953

Service Manual

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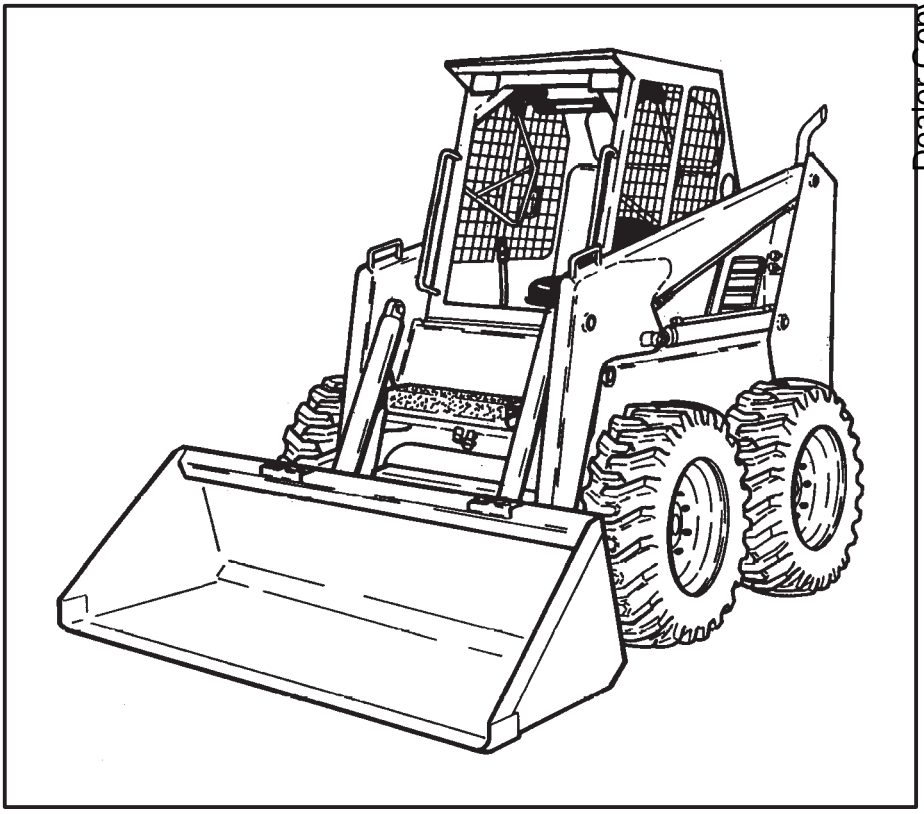


EQUIPPED WITH BOBCAT INTERLOCK CONTROL SYSTEM (BICS™)

MELROE
INGERSOLL-RAND

6724352 (02-20)

Printed in U.S.A.

bobcat

SERIAL NUMBER LOCATIONS

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

LOADER SERIAL NUMBER

The loader serial number plate is located on the inside of the left upright, above the grill **[A]**.

Explanation of loader Serial Number:

XXXX XXXXX

- **XXXXX** — Module 2. – Production Sequence (Series)
- **XXXX** — Module 1. – Model/Engine Version

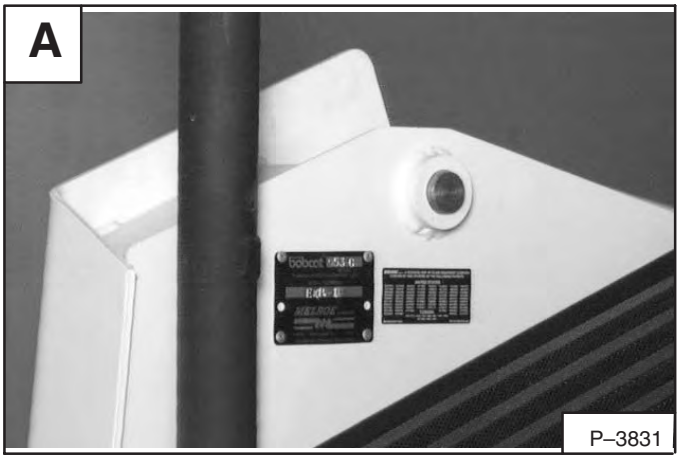
The four digit Model/Engine Combination module number identifies the model number and engine combination. This number (in parenthesis beside the model number) is used in the Service Manual to more easily identify the standard, optional and field accessory equipment included or available for each specific model.

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

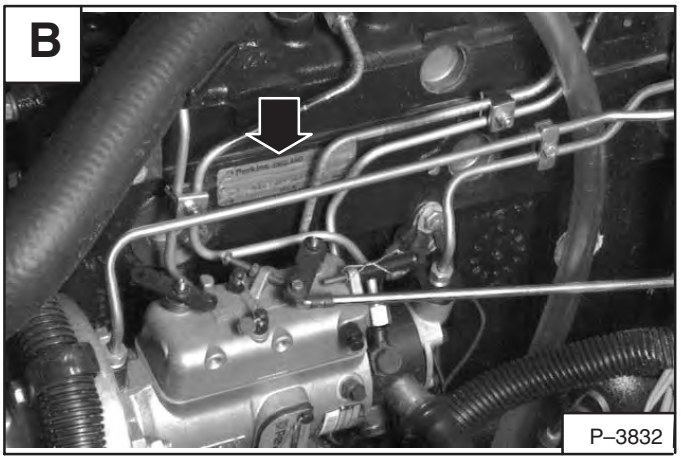
ENGINE SERIAL NUMBER

The serial number is located above the starter on the engine block **[B]**.

A



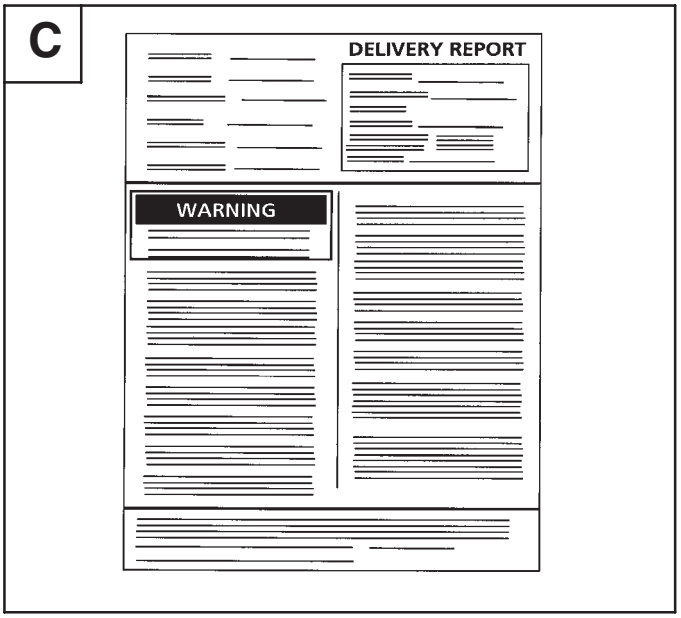
B



DELIVERY REPORT

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

C



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.

W–2069–1285

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 1–6.)

⚠ WARNING

Before the cab or the lift arms are raised for service, jackstands must be put under the rear corners of the frame. Failure to use jackstands may allow the machine totip backward causing injury or death.

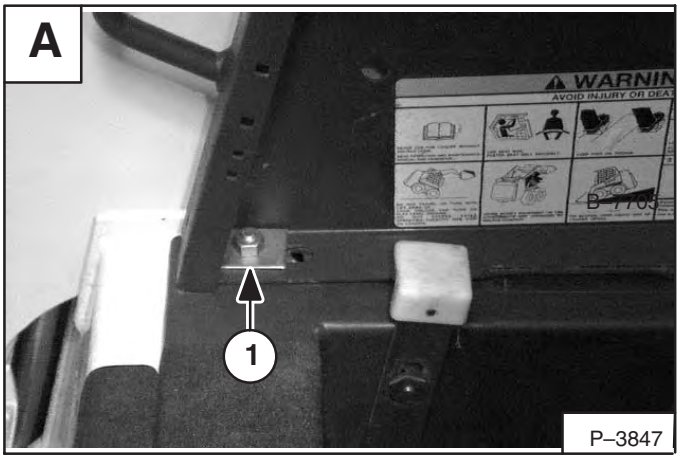
W–2014–1285

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

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

Lift on the grab handle and bottom of the operator cab slowly until the cab latching mechanism engages and the cab is all the way up **[C]**.

A



P–3847

B

P–3846

C

P–4537

Removing Coolant From the Cooling System

⚠ WARNING

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

W–2070–1285

Open the rear door. Open the rear grill.

Remove the radiator cap (Item 1) **[A]**.

Connect a hose to the engine block drain valve (Item 1) **[B]**. Open the drain valve and drain the coolant into a container.

After all the coolant is removed, close the drain valve.

NOTE: Protect the cooling system by adding premixed coolant to the system. (See Page 1–16.) This mixture will protect the cooling system to –34°F. (–36°C.)

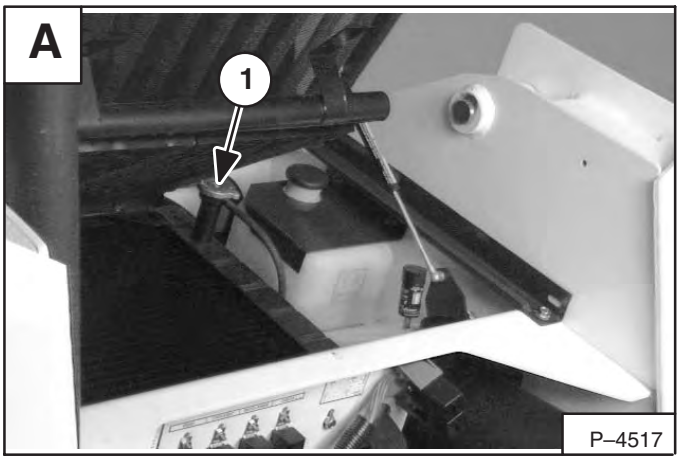
Mix the coolant in a separate container. (See Specifications for correct capacity, Page 9–1.)

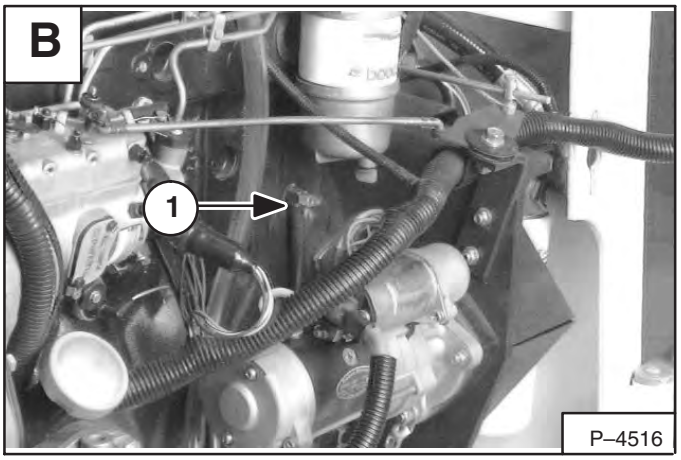
Fill the radiator with the premixed coolant. Install the radiator cap.

Fill the coolant recovery tank 1/3 full.

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

Check the coolant level in the recovery tank when cool. Add coolant to the recovery tank as needed.





REMOTE START SWITCH

Procedure

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

MEL1429 – Remote Start Switch

⚠ 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 Remote Start Switch (Item 1) **[A]** is required when the operator cab is in the raised position for service and the service technician needs to start the engine. The operator cab wire harness connectors must be separated from the engine wiring harness connector under the cab.

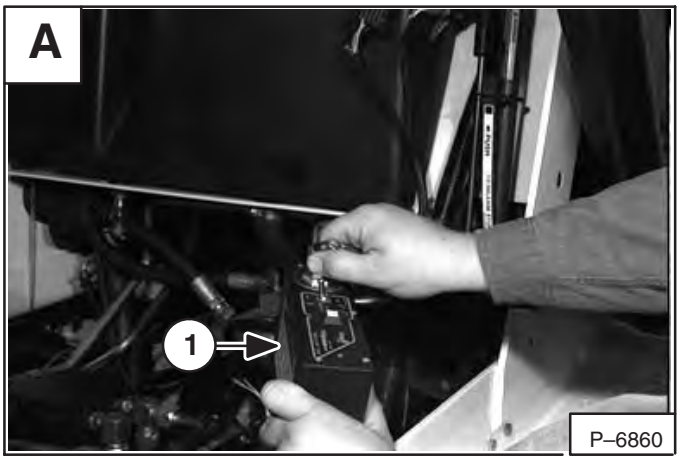
The remote start switch is required when the service technician is adjusting the steering linkage and checking the hydraulic/hydrostatic system.

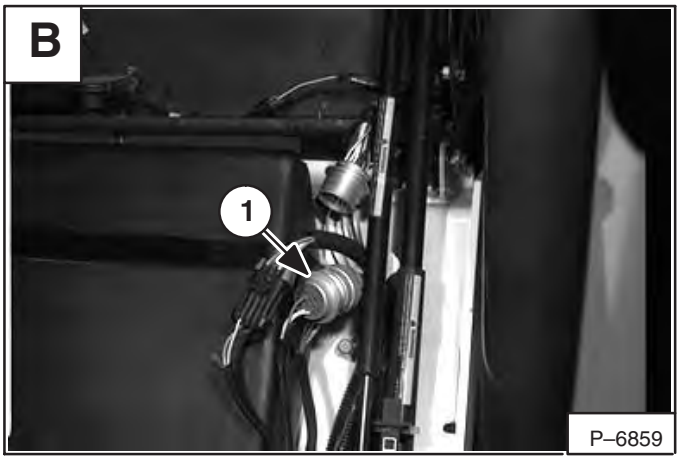
Lift and block the loader. (See Page 1–4.)

Raise the lift arms and install an approved lift arm support device. (See Page 1–6.)

Raise the operator cab. (See Page 1–7.)

Connect the remote start switch to these connectors (Item 1) **[B]**.





HYDRAULIC/HYDROSTATIC SCHEMATIC
953 BICS (S/N 513111594 - 14999)
(S/N 513115085 and Above)

(Printed February 1997)
(MC-2319)

Printable Version Click Here

25 MICRON FILTER

4 MICRON FILTER

CONTROL VALVE

FEMALE

MALE

TILT CYLINDERS

JUNCTION PORT BLOCK

TILT CYLINDERS

TILT LOCK VALVE

REAR AUXILIARY CAPPED AT VALVE

AUX. FRONT

AUX. REAR

TILT

LIFT

FAN MOTOR PORT BLOCK

3 MICRON FILTER

HYDROSTATIC PUMP 1 & 2

BUCKET POSITION VALVE

LIFT LOCK VALVE

LIFT CYLINDERS

LIFT CYLINDERS

MC 2319 (1-31-97)

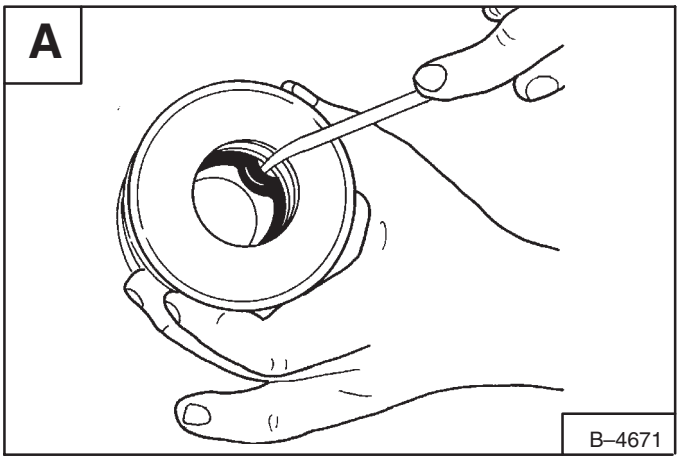
HYDRAULIC CYLINDER REPAIR (Cont'd)

Assembly

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

MEL1032 – Rod Seal Tool
MEL1009 – Seal Installation Tool (3")

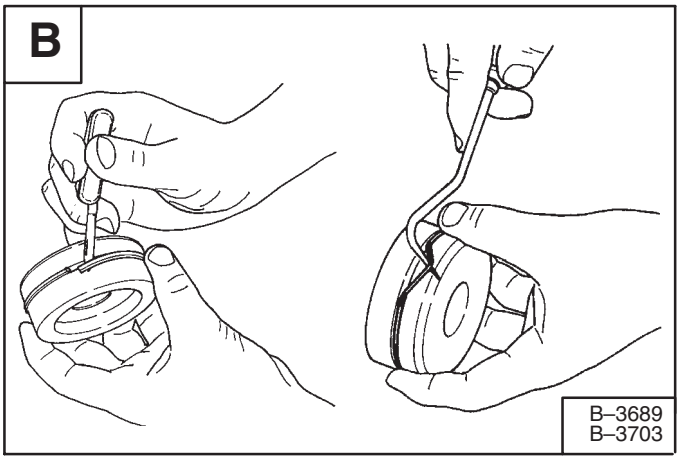
Remove the oil seal from the end cap **[A]**.



Remove the teflon seal and the O–ring from the piston **[B]**.

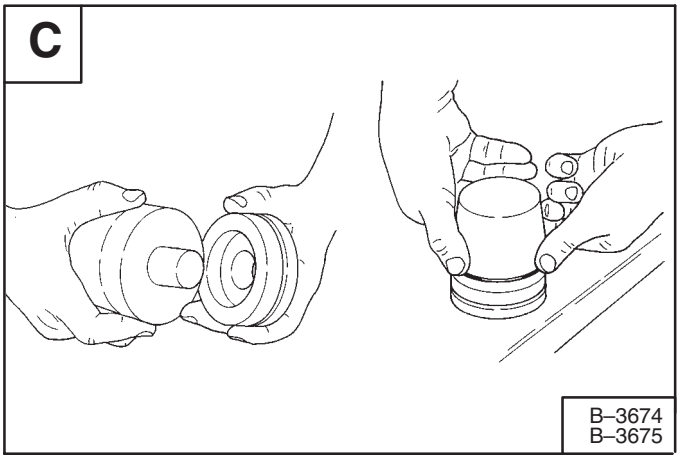
Wash all the parts in clean solvent. Dry with air only . Destroy old seals and O–rings.

Inspect the parts for scratches, nicks, bent, etc. Replace the parts as needed.



Install the piston on the tool **[C]**.

Install the O–ring on the piston using the tool **[C]**.

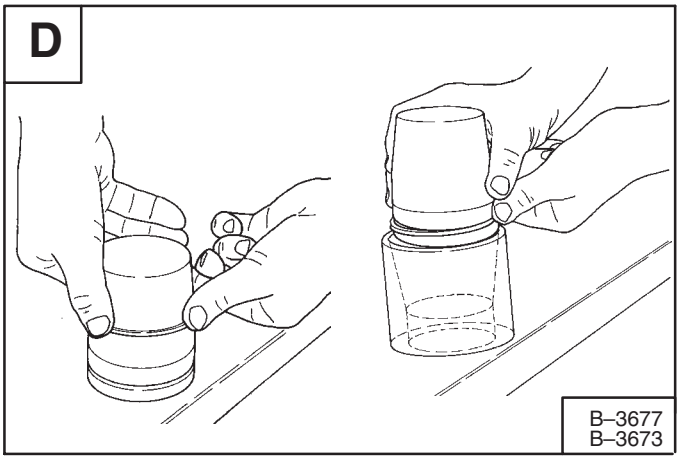


Install the Teflon seal over the tool and on the piston**[D]**.

NOTE: To prevent damage to the Teflon seal, do not turn it into the piston groove.

Install the piston into the tapered end of the tool to get the Teflon seal to the piston size diameter **[D]**.

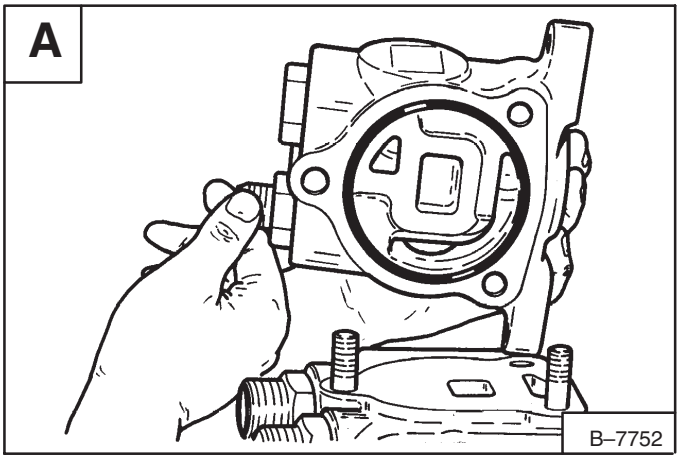
Wait 5 minutes so that the T eflon seal will become the same size as the piston.



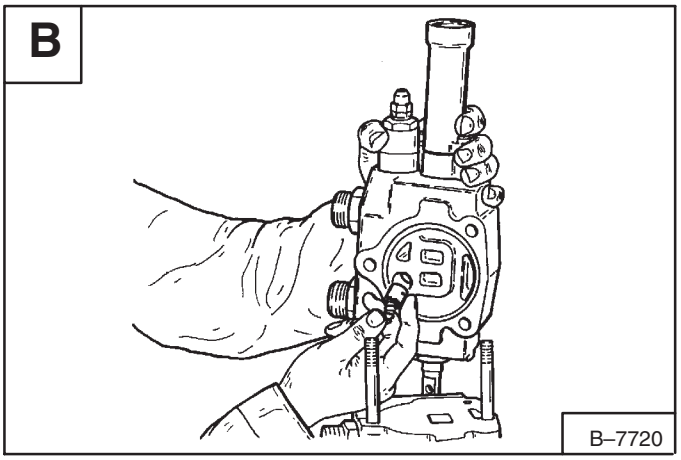
HYDRAULIC CONTROL VALVE (Cont'd)

Disassembly and Assembly (Cont'd)

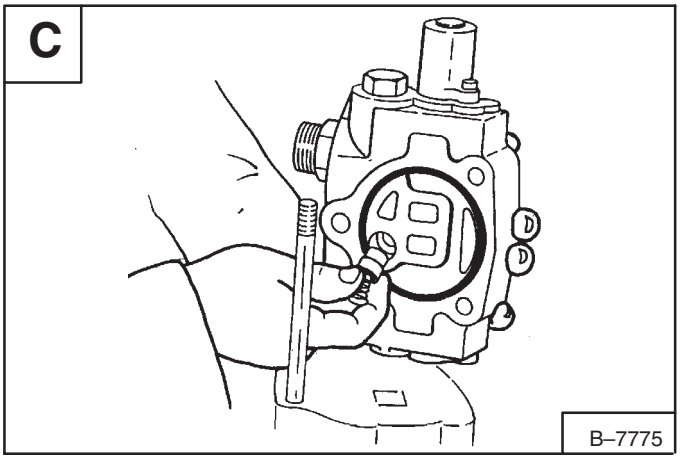
Remove the inlet section and O–ring **[A]**.



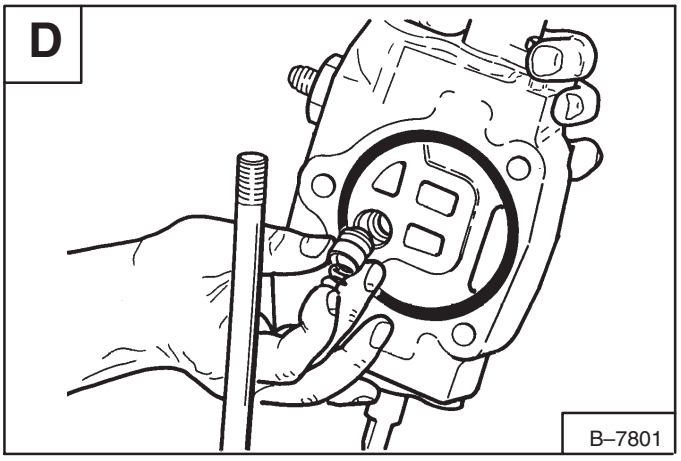
Remove the lift section, O–ring, load check poppet and spring **[B]**.



Remove the tilt section, O–ring, load check poppet and spring **[C]**.



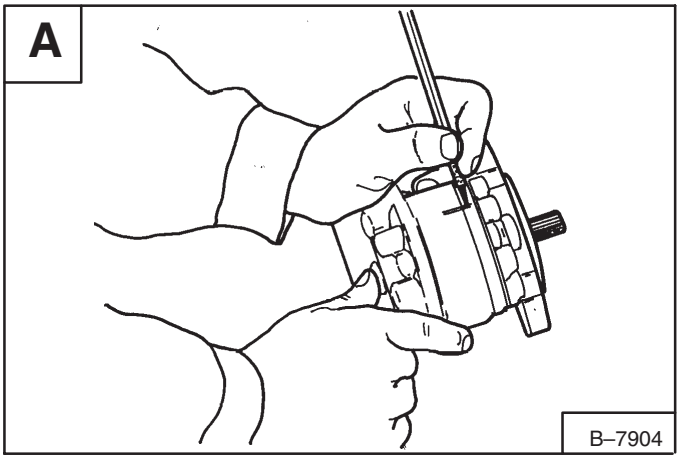
Remove the rear auxiliary section, O–ring, load check poppet and spring **[D]**.



CHARGE PUMP (Cont'd)

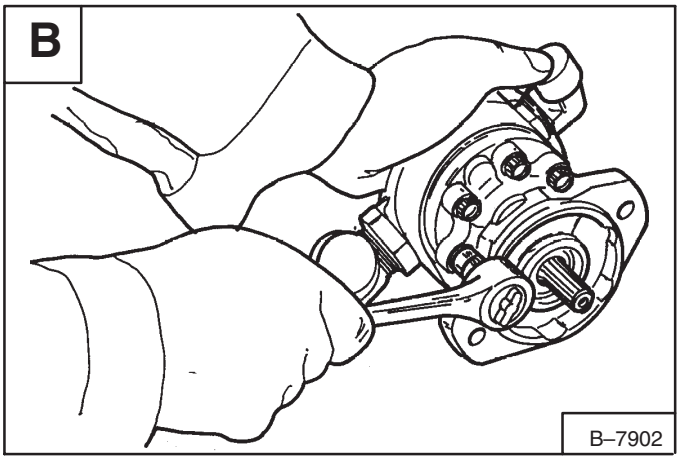
Disassembly and Assembly (Cont'd)

Mark the charge pump housing forcorrect assembly **[A]**.

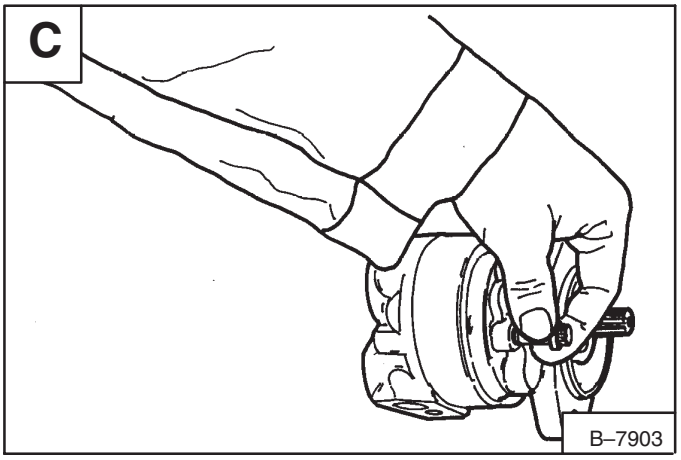


Loosen the bolts at the pump housing **[B]**.

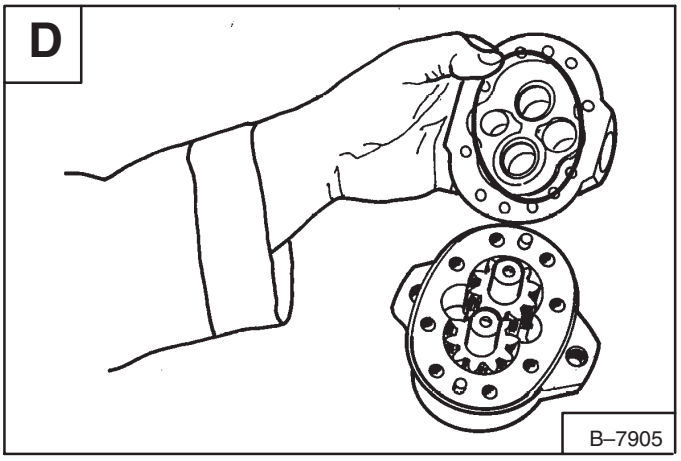
Assembly: Tighten the bolts to 22–25 ft.–lbs. (30–34 Nm) torque.



Remove the bolts from the pump **[C]**.



Remove the pump end housing and O–ring **[D]**.



HYDRAULIC FILTER

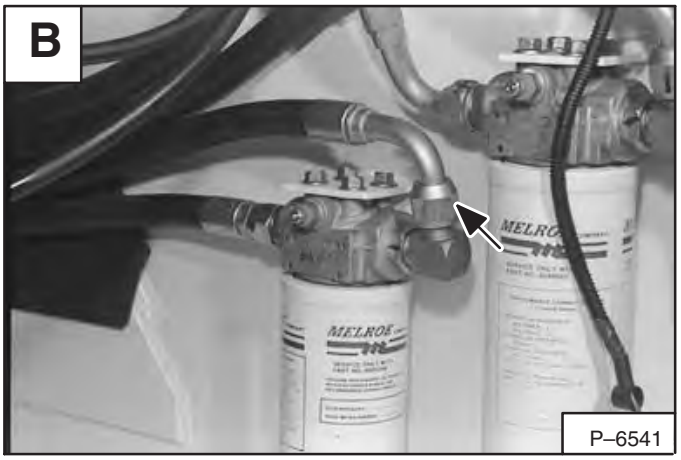
Removal and Installation

Open the rear door.

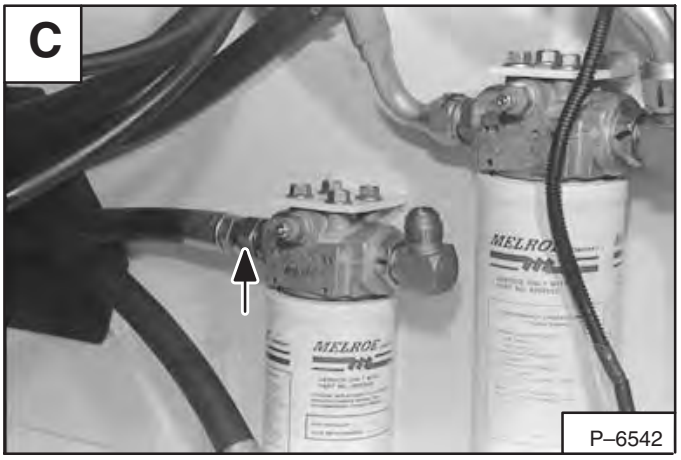
Raise the operator cab. (See Page 1–1.)

Disconnect the wire from the sending switch **[A]**.

Disconnect the hose **[B]**.



Disconnect the hose **[C]**.



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

Remove the filter housing from the loader.

FAN MOTOR

Removal and Installation

IMPORTANT

When making repairs on 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–2003–0284

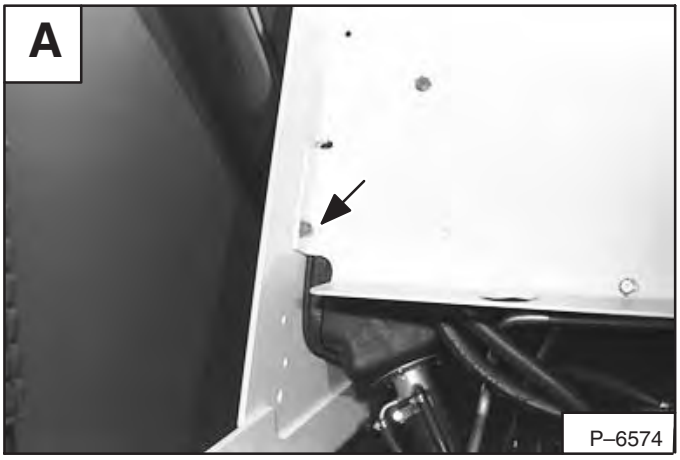
Remove the hydraulic reservoir. (See Page 2–40.)

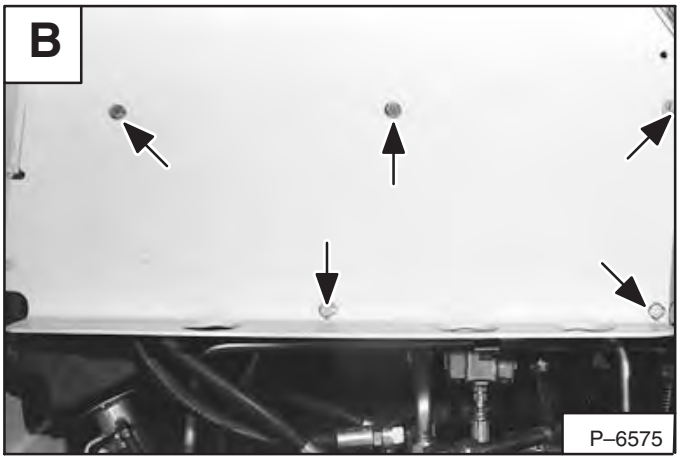
Remove the bolt and nut at the tank mounting plate (both sides) **[A]**.

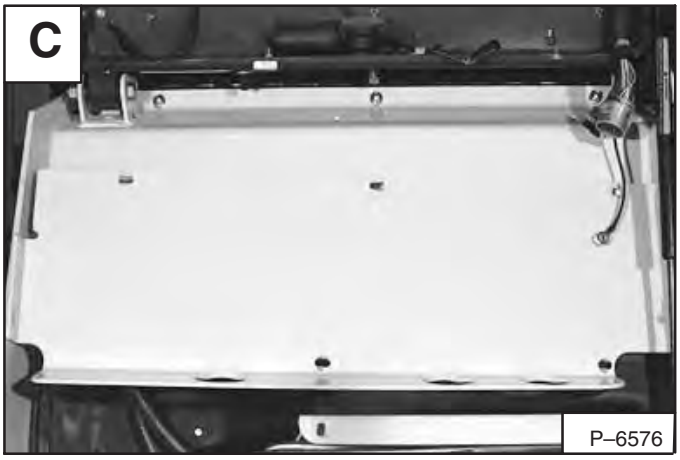
Remove all the bolts at the front of the shrouding panel **[B]**.

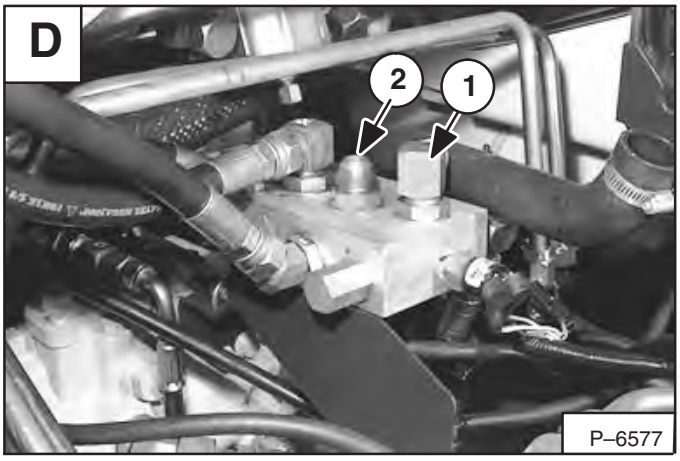
Remove the shrouding panel **[C]**.

Mark the hoses for correct installation. Disconnect the inlet and outlet hoses (Items 1 & 2) **[D]** at the fan motor.









TROUBLESHOOTING

Chart

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

⚠ WARNING

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, 3
No drive on one side in either directions.	2, 3, 5, 6, 20, 22
The loader does not move in a straight line.	2, 3, 4, 6, 7, 8, 20
The hydrostatic system is overheating.	9, 10, 11, 12, 13, 14, 17, 18, 19
The oil light comes ON.	11, 14, 15, 16, 21

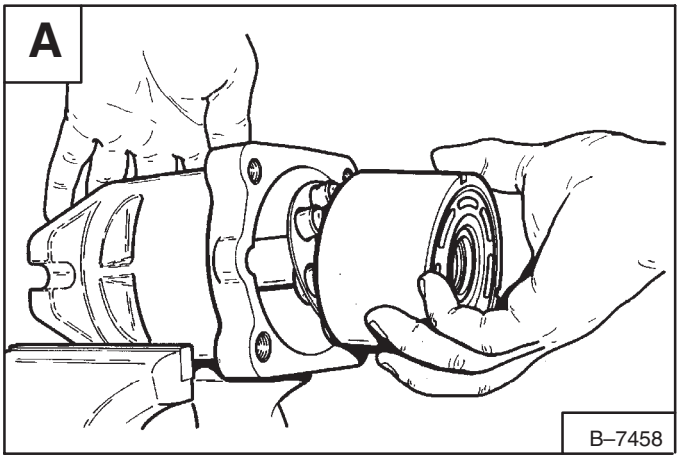
KEY TO CORRECT THE CAUSE

1. The hydrostatic system has a fluid leak.
2. The steering linkage needs adjustment.
3. The high pressure replenishing valve(s) are defective.
4. The hydrostatic pumps have a defect.
5. The final drive chain is broken.
6. The hydrostatic motor has a defect.
7. The tires do not have the correct tire pressure.
8. The tires are not the same size.
9. The hydrostatic fluid is not at the correct level.
10. The oil cooler has a restriction.
11. The temperature switch is not operating correctly.
12. The control valve is not operating correctly.
13. The loader is not being operated at the correct RPM.
14. The temperature switches have a defect.
15. There is low charge pressure.
16. Filters need replacing.
17. Fan motor by–pass valve has a defect.
18. Fan motor solenoid valve has a defect.
19. Oil cooler by–pass valve has a defect.
20. Tow valves maybe open.
21. Fluid is too hot.
22. Control sleeve orifice is plugged at hydrostatic pumps.

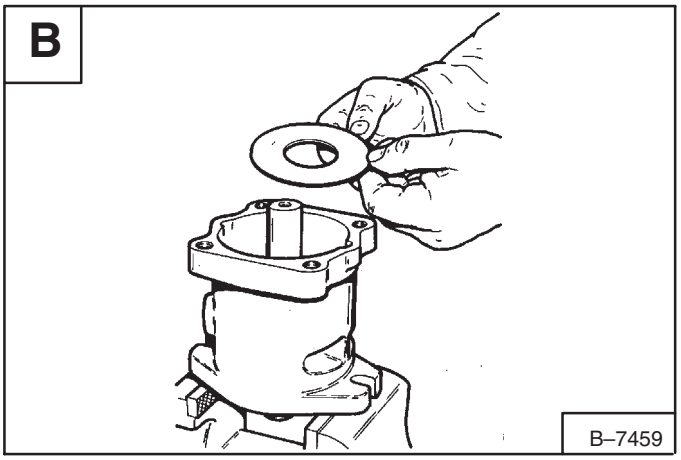
HYDROSTATIC MOTOR (Cont'd)

Disassembly and Assembly (Cont'd)

Remove the rotating group assembly **[A]**.



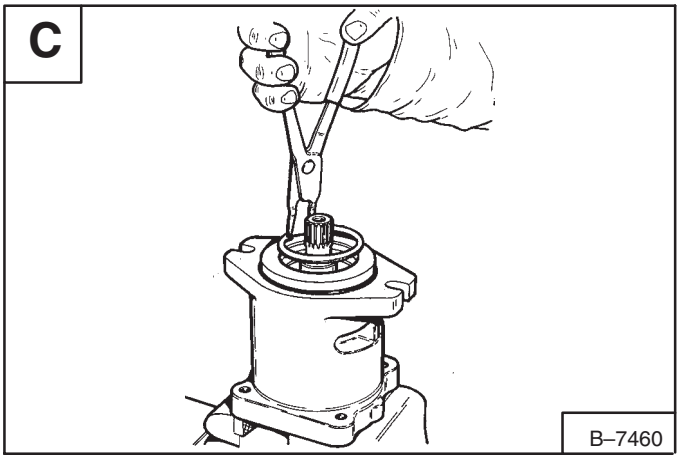
Remove the wear plate **[B]**.



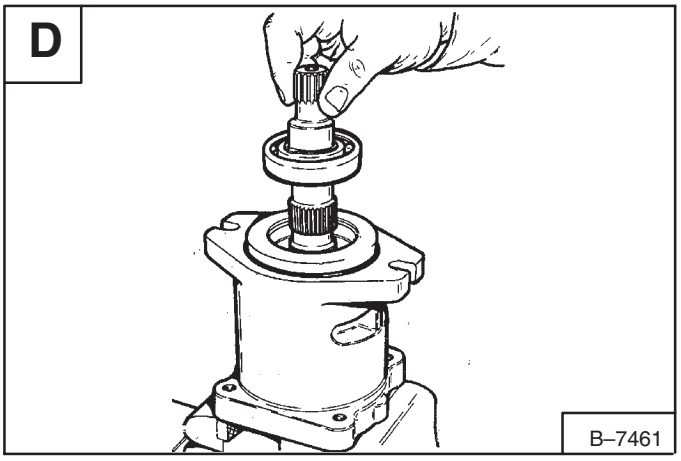
Remove the first snap ring **[C]**.

Using a seal puller, remove the seal from the housing.

Remove the second snap ring **[C]**.



Remove the shaft and bearing assembly **[D]**.

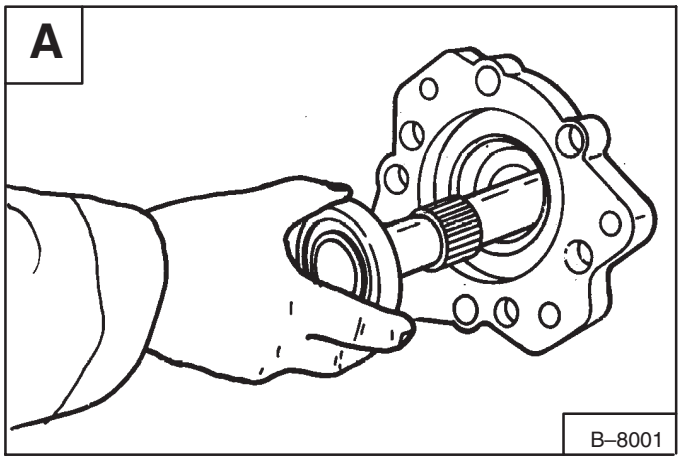


HYDROSTATIC PUMP (Cont'd)

Disassembly and Assembly (Cont'd)

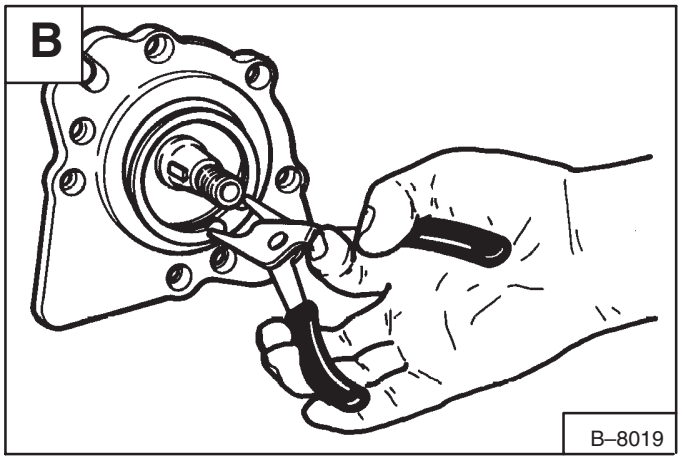
Rear Pump:

Remove the bearing and shaft assembly **[A]**.



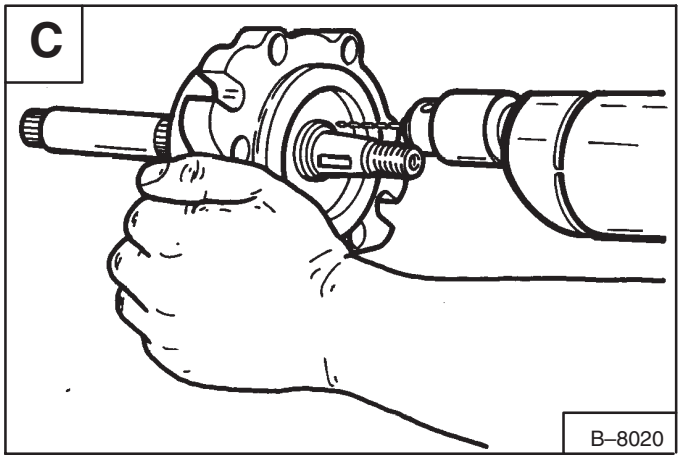
Front Pump:

Remove the snap ring at the seal **[B]**.



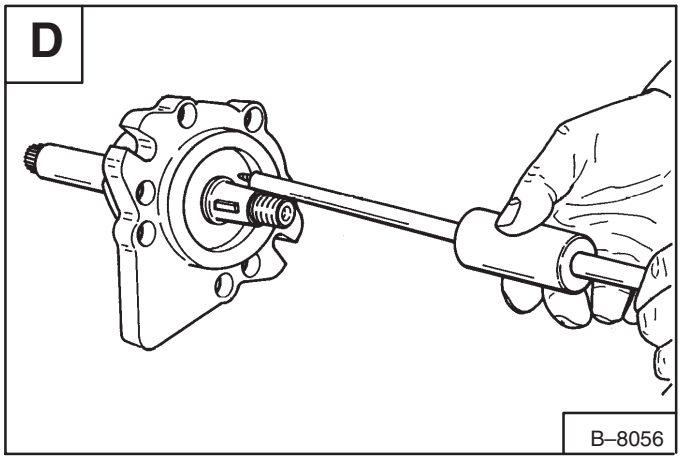
Front Pump:

Drill a hole in the seal **[C]**.



Front Pump:

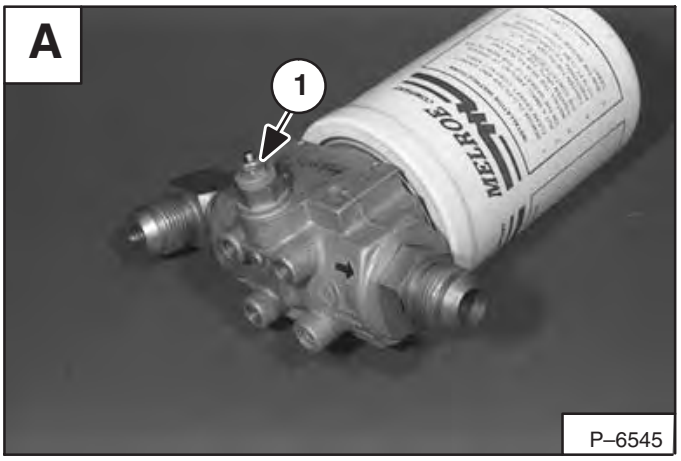
Install a seal puller and remove the seal **[D]**.



HYDROSTATIC FILTER (Cont'd)

Disassembly and Assembly

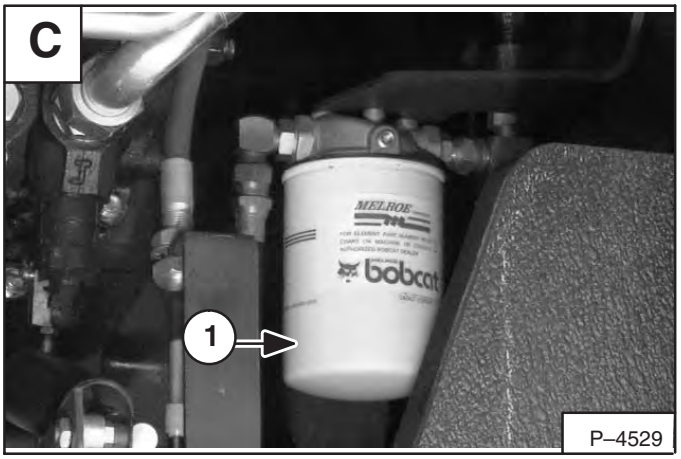
Loosen the pressure switch (Item 1) **[A]**.



Remove the pressure switch **[B]**.

Case Drain Filter

The case drain filter (Item 1) **[C]** must be replaced whenever there have been major repairs to the hydrostatic pumps or motors.



PARKING BRAKE

Removal and Installation

Raise the loader operator cab. (See Page 1–1.)

Remove the (2) mounting bolts (Item 1) **[A]** from the brake pedal mounting bracket.

Installation: Tighten the mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

Disconnect the electrical connector from the parking brake pedal sensor (Item 2) **[A]**. The connector is located behind the control panel.

Remove the parking brake assembly from the loader by moving the rubber floor mat and removing the tube clamp (Item 1) **[C]** and sliding the tube and wires out.

Reverse the removal procedure to install the parking brake assembly in the loader.

Disassembly and Assembly

Loosen and remove the mounting bolt (Item 1) **[B]** and nut from the spring mounting bracket (Item 2) **[B]**.

Remove the brake pedal spring (Item 3) **[B]** from the tension spring mounting bracket (Item 2) **[B]** and from the brake pedal mounting bracket (Item 4) **[B]**.

Remove the (2) mounting bolts, washers and nuts (Item 5) **[B]** from the brake pedal sensor.

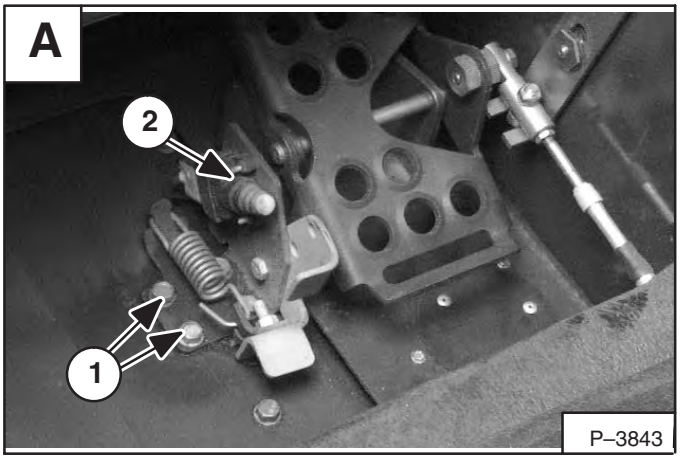
Remove the harness mounting clamp (Item 1) **[C]** from the pedal mounting bracket (Item 4) **[B]**.

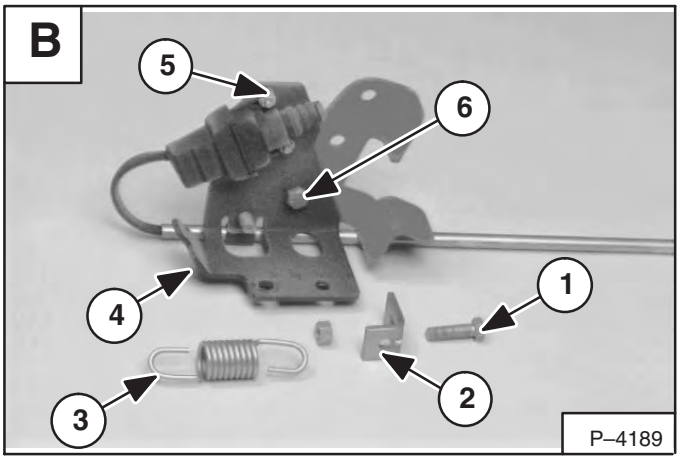
Remove the sensor harness form the pedal mounting bracket.

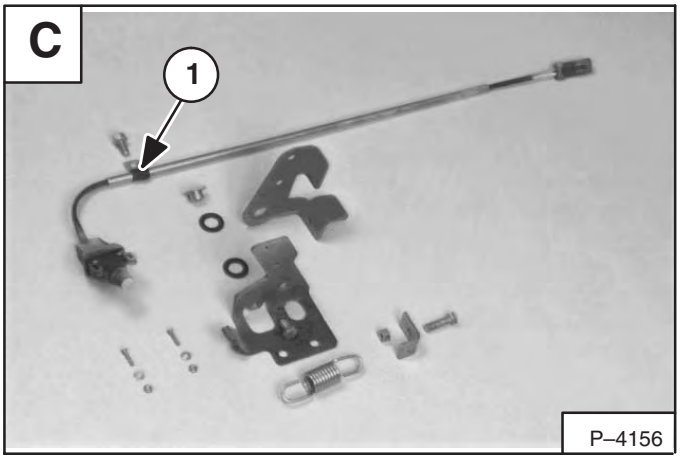
Remove the pedal Mounting bolt (Item 6) **[B]**, plastic spacers and bushing nut from the brake pedal.

Remove the pedal from the pedal mounting bracket.

Photo **[C]** shows the parking brake disassembled to identify the existing parts in the brake assembly.



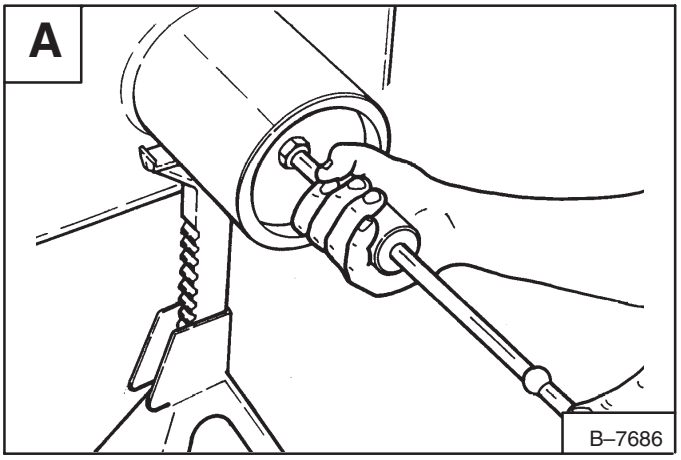




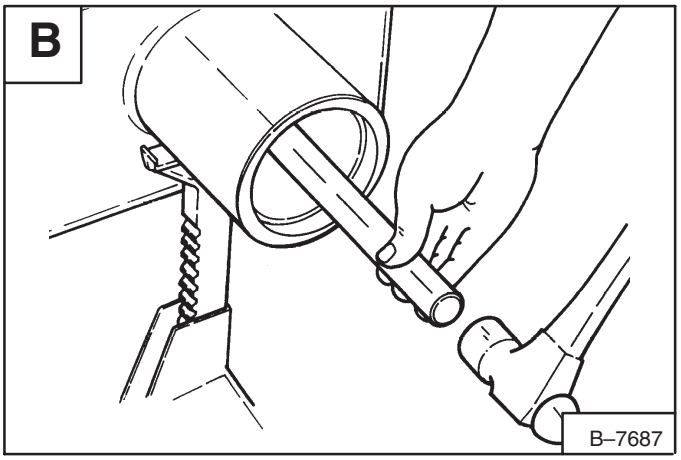
FRONT AXLE AND SPROCKET (Cont'd)

Removal (Cont'd)

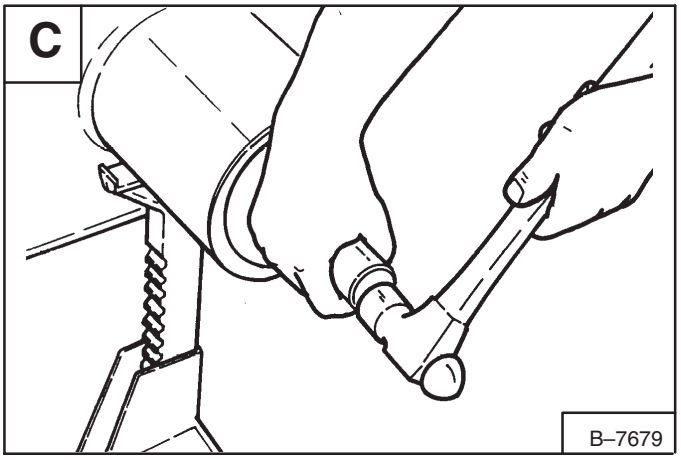
Pull the bearing cup from the axle tube **[A]**.



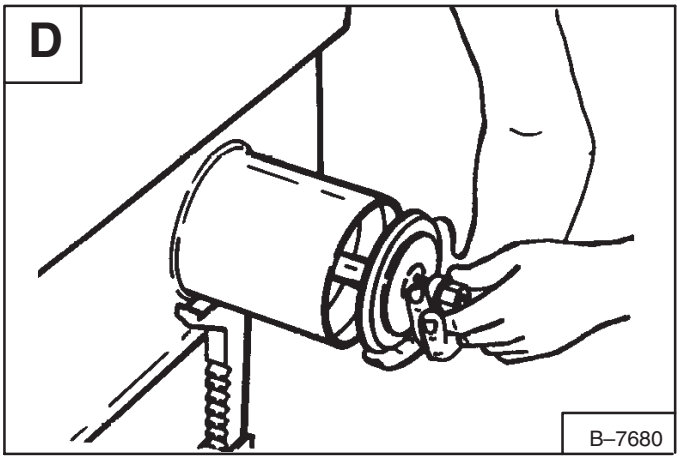
Use along rod and remove the inner bearing cup **[B]** (MEL1202–13).



Using the correct size driver, install the outer bearing cup **[C]** (MEL1202–12).



Install the long threaded bolt into the axle tube. Install the correct size bearing cup driver. Install a washer and nut **[D]** (MEL1202–11).



DRIVE CHAINS

Front Drive Chain

Removal and Installation

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

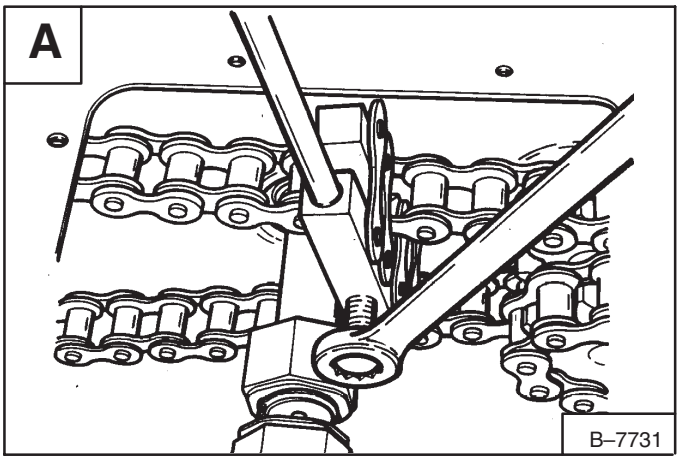
MEL1246 – Chain Link Press

Remove the control center. (See Page 3–1.)

Remove the center cover with brakes.

Remove the brake disc.

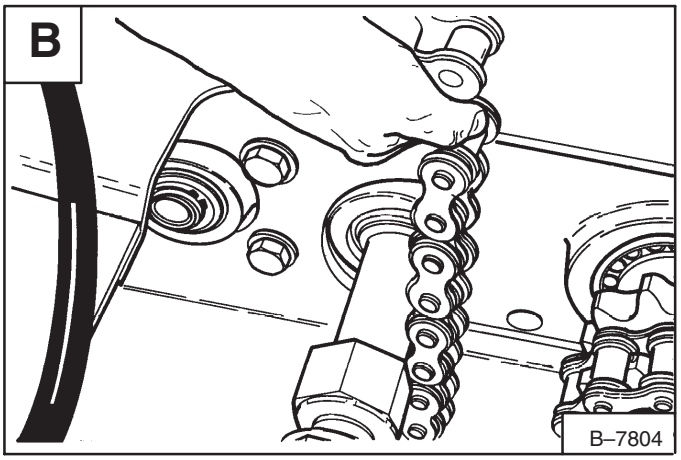
Using the chain breaker tool, separate the chain **[A]**.



NOTE: The front chains are heavy duty chains and the rear chains are regular drive chains.

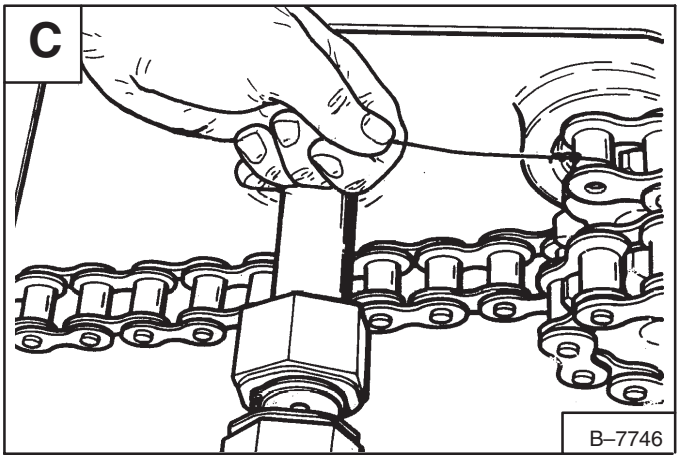
Remove the chain from the chaincase **[B]**.

Install a new chain.

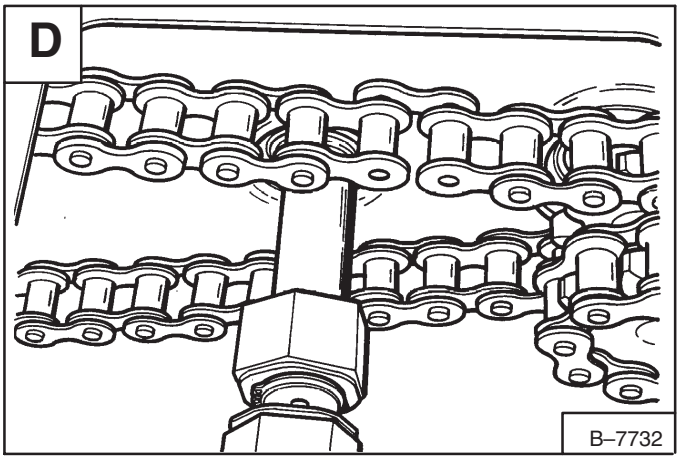


Use wire to install the chain around the reduction gearcase sprocket **[C]**.

Install the chain around the front sprocket.



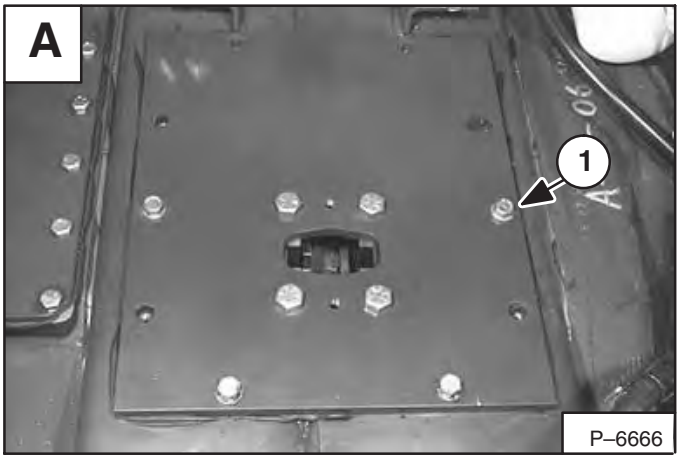
Pull the chain together and install the connector link **[D]**.



Center Chaincase Cover Removal and Installation (Cont'd)

Remove the remaining chaincase cover mounting bolts (Item 1) **[A]**.

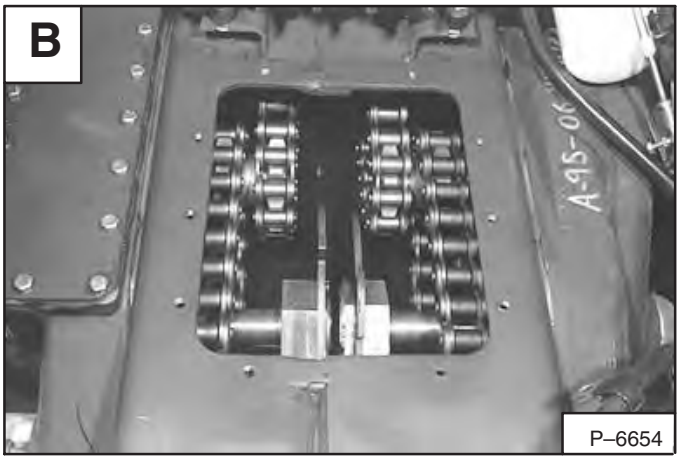
Installation: Tighten the cover mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.



Remove the center chaincase cover form the loader**[B]**.

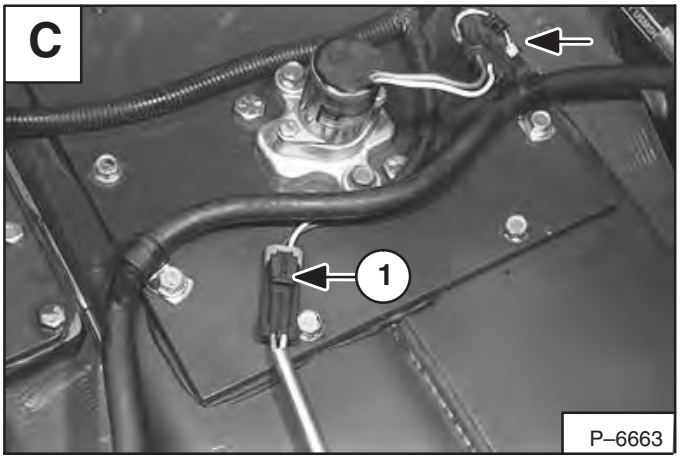
Installation: The chaincase cover is sealed by using RTV sealant (Item 1) **[B]** installed onto the chaincase. Clean the surfaces of the chaincase and cover for proper adhesion.

Reverse the removal procedure to install the chaincase cover.



Front Chaincase Cover Removal and Installation

Disconnect the electrical connector (Item 1) **[C]** from the parking brake pedal sensor.

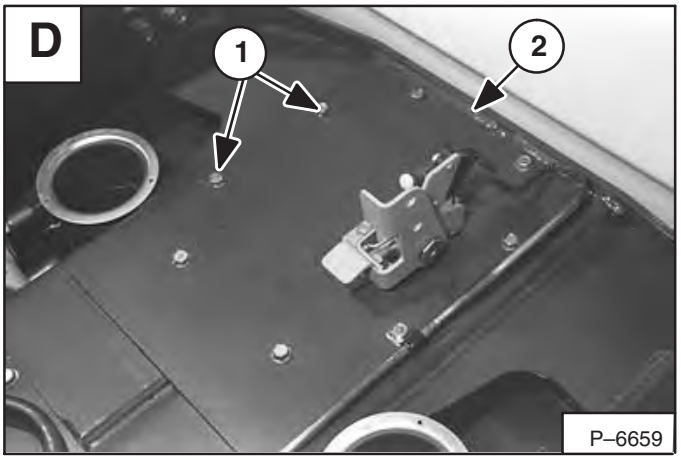


Remove the (8) front chaincase cover mounting bolts (Item 1) **[D]**.

Installation: Tighten the cover mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

Remove the front chaincase cover (Item 2) **[D]** from the loader.

Installation: The front chaincase cover (Item 2) **[D]** is sealed by using RTV installed onto the chaincase. Clean the surfaces of the chaincase and cover for proper adhesion.



SEAT BAR (Cont'd)

Assembly (Cont'd)

Assemble the parts as shown for the right side of the seat bar pivot assembly **[A]**:

Mounting Bolt (Item 1).
Pivot Bushing (Item 2).
Keyed Plastic Bushing (Item 3).
Gas Spring Mounting Bracket (Item 4).
Mounting Bolt (Item 5).

Install the right side pivot assembly as shown. Tighten the mounting bolt (Item 1)**[B]** to 180–200 in.–lbs. (21–23 Nm) torque.

NOTE: Be sure the bend in the gas spring bracket faces in toward the operator when installing the gas spring bracket. Slide the bracket all the way forward so the front edge of the bracket fits tightly against the operator cab.

Compressing the Gas Cylinder

To compress the seat bar gas spring, it is necessary to use the gas spring retainer tool MEL1426.

Use the following procedure to compress the gas spring:

⚠ WARNING

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

W–2113–0288

Open the rear door of the loader and install the gas spring (Item 1 – ball stud end**[C]** in the hole located in the loader frame.

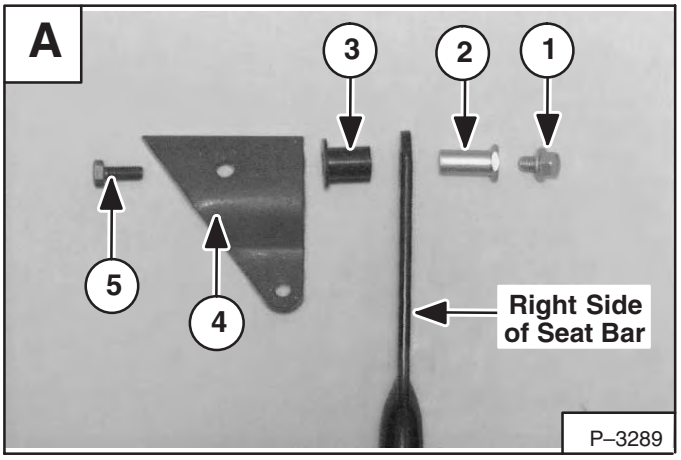
NOTE: Install the ball stud threads up through the hole and install a nut (Item 2) [C] on the ball stud.

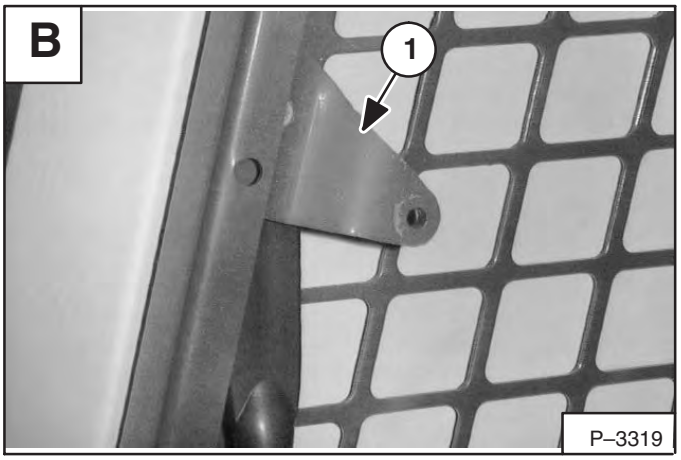
Put the clevis end of the gas cylinder on the edge of the rear door as shown **[C]** and install a locking plier (Item 3) **[C]** on the bottom edge of the door to keep the gas cylinder from sliding along the edge.

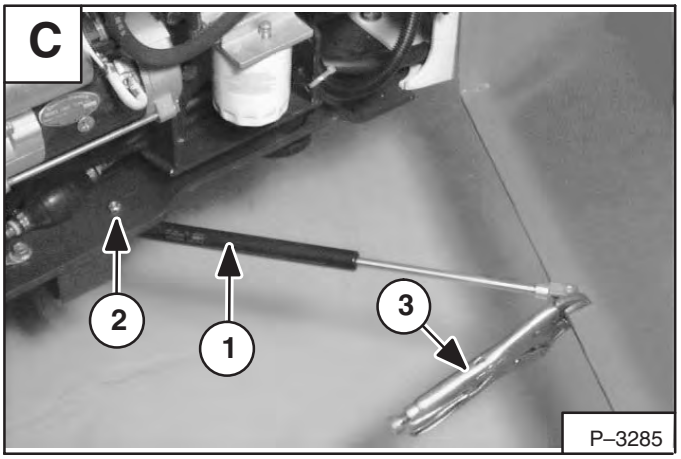
Pull the door in and compress the gas cylinder **[D]**.

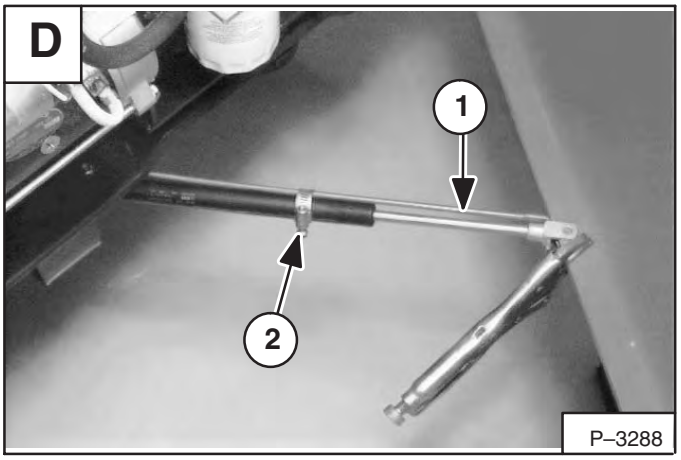
Install the retainer tool (Item 1) **[D]** with the 90° bend in the clevis of the rod end of the gas cylinder . Install the curved end of the tool around the base end of the gas spring.

Install the clamp (Item 2) **[D]** around the gas cylinder to hold the retainer tool in place. Remove the nut and remove the gas spring from the rear door.







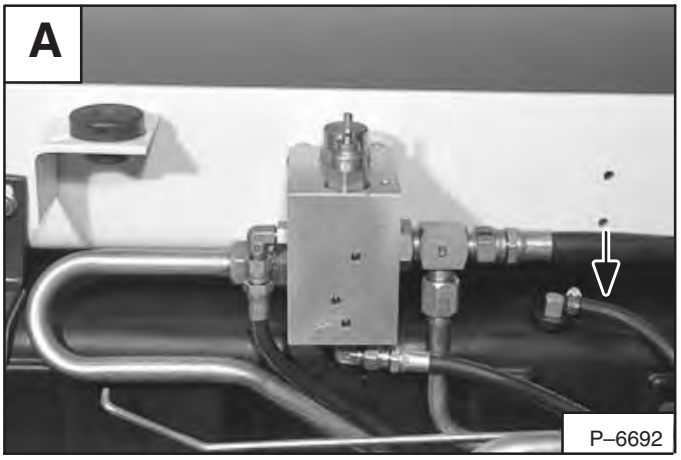


FUEL TANKS (Cont'd)

Removal and Installation, Right Side

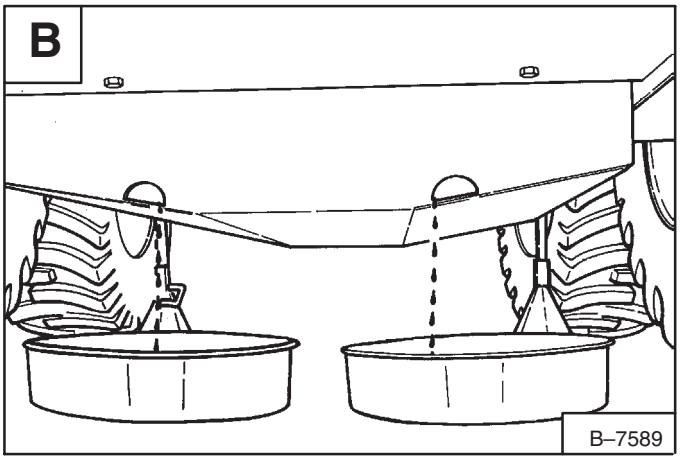
Remove the control panel. (See Page 3–1.)

Remove the air bleed hoses and fuel suction hose **[A]**.

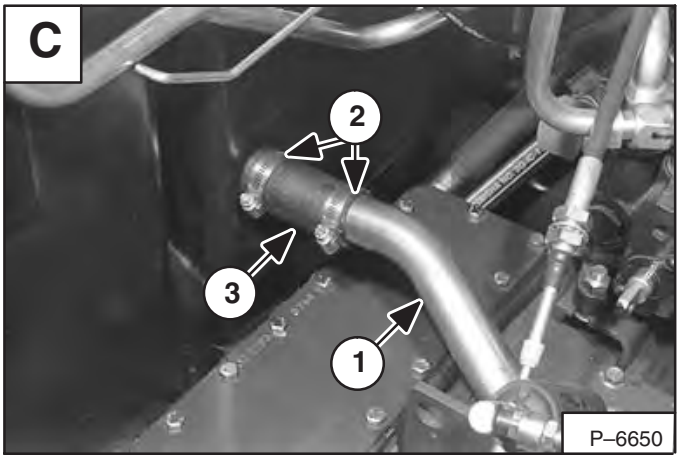


Remove the fuel from both tanks using a hand operated pump or hydraulic transfer pump.

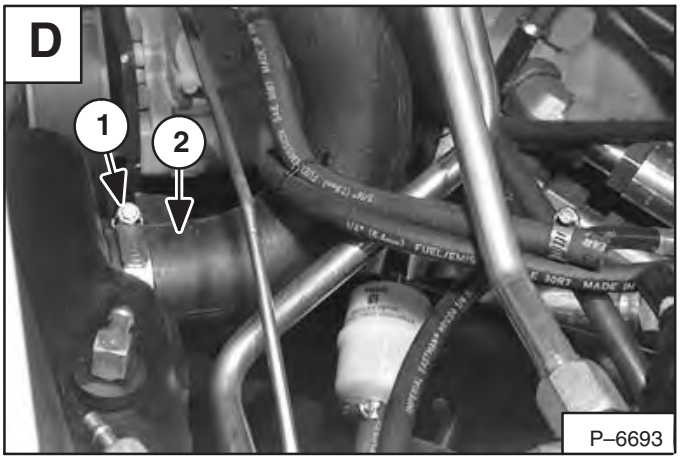
Put drain pans under the rear of the loader frame to prevent fuel from draining on the floor **[B]**.



Remove the cross–over tube (Item 1) **[C]** between the fuel tanks by removing the clamps (Item 2) **[C]** and the hose (Item 3) **[C]**.



Loosen the clamp (Item 1) **[D]** and disconnect the fuel fill hose (Item 2) **[D]** from the fuel tank.



WIRE LEGEND

NO. 's	COLOR	GAUGE
12S	Orange/White	16
46LA	Yellow	16
46RA	Green	16
46T	Brown	16
50A	Black	16
59E	Orange	16
64	Orange/Blue	16

PARTS LEGEND

(1) Left Multi-Switch Control Handle (Euro. Opt.

(2) Bucket Level Off Solenoid (Euro. Opt.)

(3) Bucket Positioning Valve

(4) Control Harness (Euro. Opt.
6596066

ALTERNATOR (Cont'd)

Disassembly

Disassemble the alternator. (See Parts Identification **[A]**.)

Remove the regulator cover and regulator.

Remove the four bolts holding halves together.

Pry the halves apart.

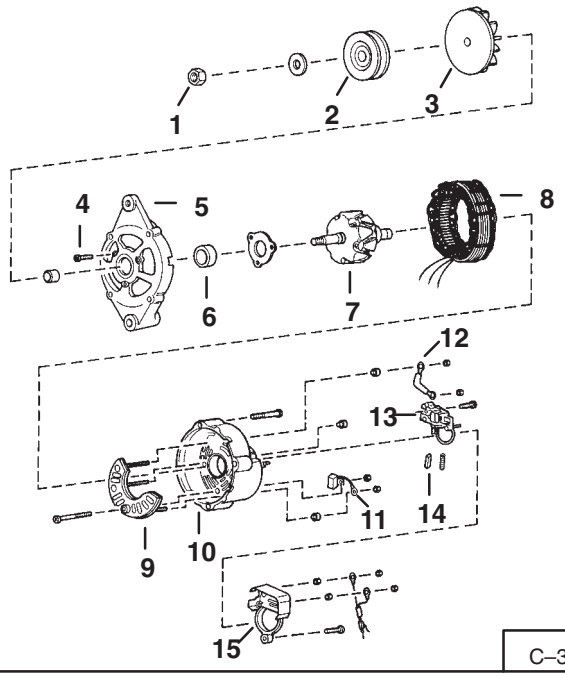
Use a soft jaw vise to hold rotor while removing pulley nut.

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

Unsolder the stator leads from the rectifier. Remove the stator.

A

1. Nut
2. Pulley
3. Fan
4. Bolt
5. Case Half (Front)
6. Bearing
7. Rotor
8. Stator
9. Rectifier (Diode)
10. Case Half (Rear)
11. Condenser Assy
12. Strap
13. Regulator
14. Brush
15. Cover



C–3312

Stator Continuity Test

Use an ohmmeter to test the stator.

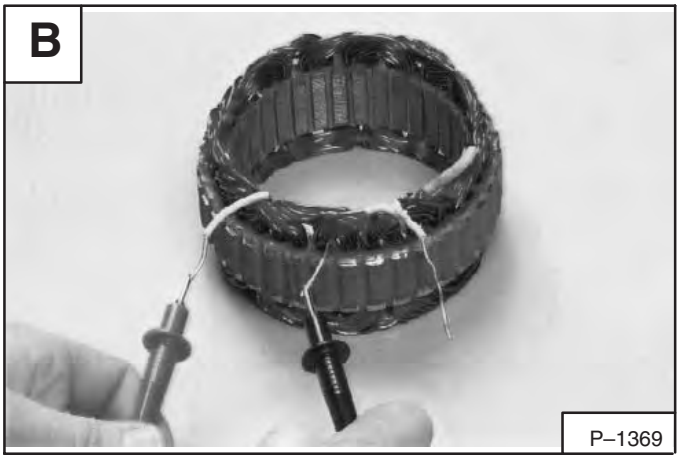
Touch the probes to two of the bare stator wires **[B]**.

Move one of the probes to the third wire.

The readings should be the same.

If there is no continuity, replace the stator.

B



P–1369

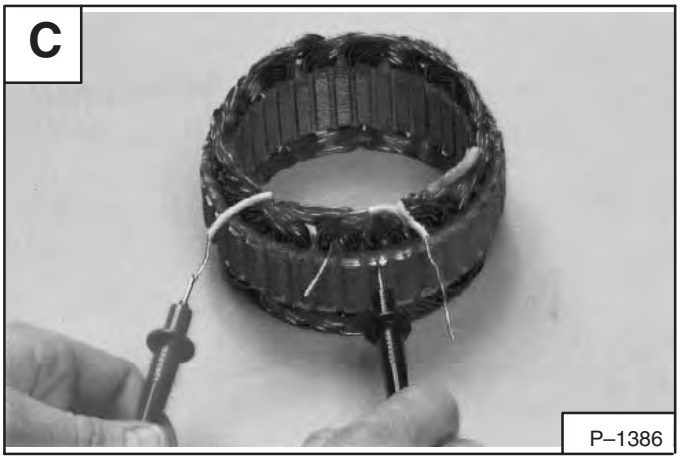
Stator Ground Test

Touch one probe to a bare stator lead and the other probe to the bare metal surface of the stator **[C]**.

There should be no continuity.

Replace the stator if there is continuity.

C



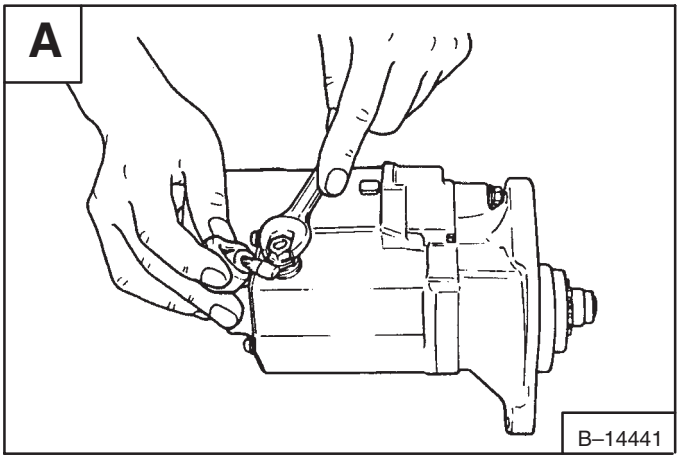
P–1386

STARTER (S/N 11376 & Above) (Cont'd)

Disassembly and Assembly

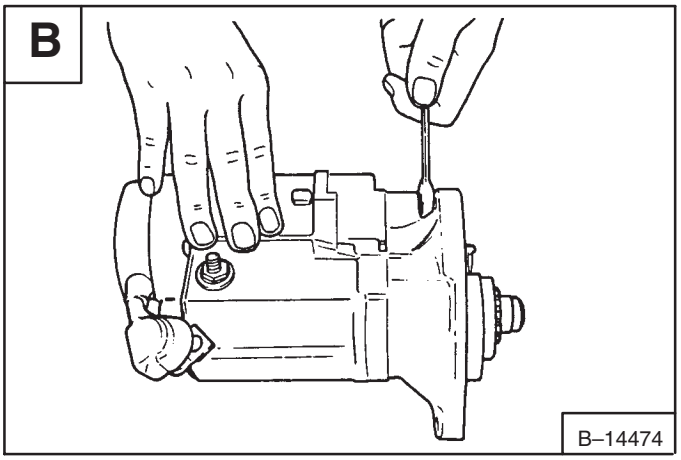
Disconnect the wire from the magnetic switch **[A]**.

Assembly: Tighten the nut to 52–86 in. lbs. (5,9–9,7 Nm) torque. Securely put the rubber boot over the terminal.

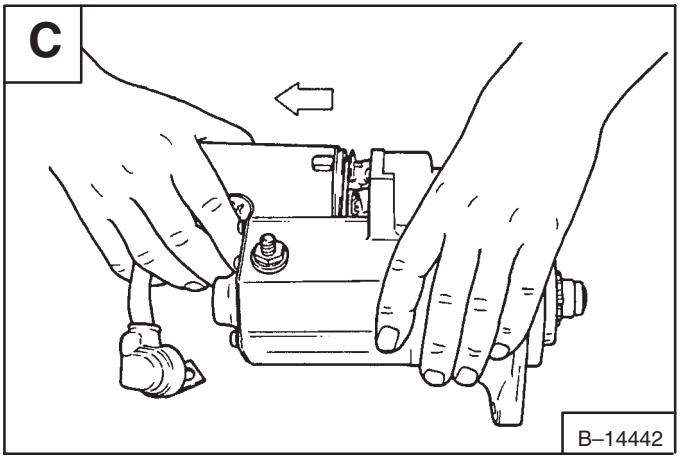


Remove the through bolts from the drive end frame **[B]**.

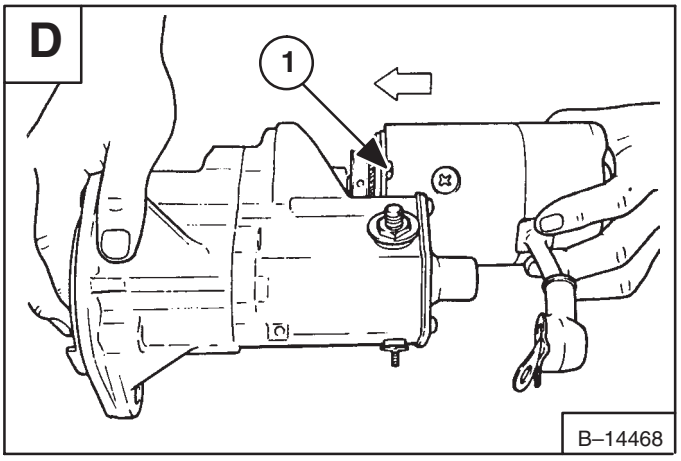
Assembly: Tighten the through bolts to 60–104 in. lbs. (6,8–11,8 Nm) torque.



Remove the field windings housing from the magnetic switch **[C]**.



Assembly: When installing the field windings housing to the magnetic switch, engage the tab (Item 1) **[D]** on the field windings housing with the notch in the magnetic switch.

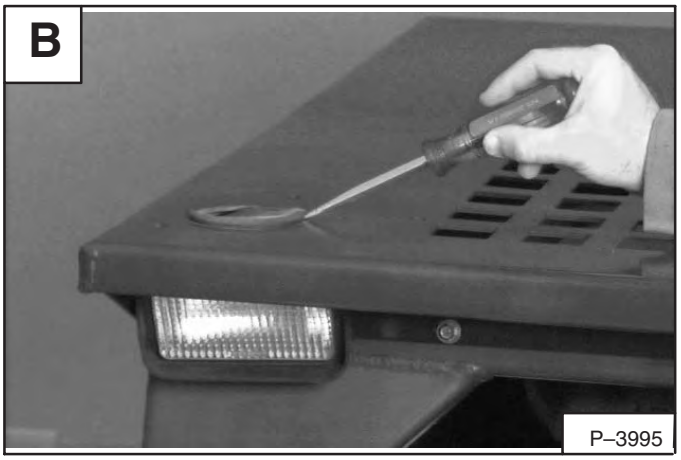


FRONT LIGHTS

Removal and Installation

The front lights are mounted in the upper corners of the operator cab **[A]**.

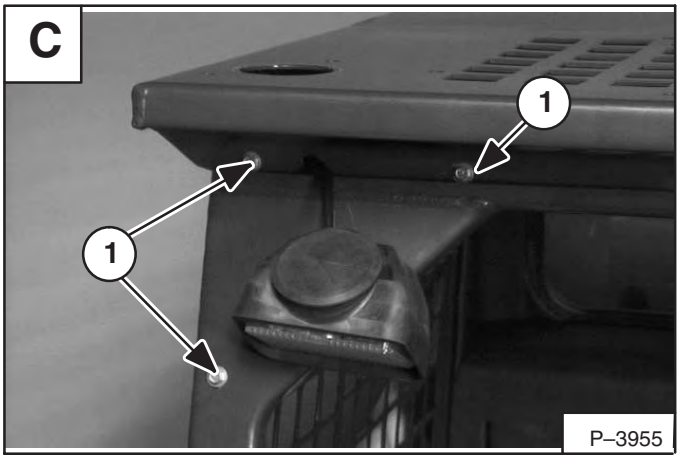
Pry the rubber light mount free from the operator cab **[B]**.



Pull the light down and remove the three mounting bolts (Item 1) **[C]** from the instrument panel.

Disconnect the front light connector from the instrument panel. Remove the front light from the operator cab.

Reverse the removal procedure to install the front light.



FUEL INJECTION PUMP

The injection pump contains parts which have a very close tolerance and its operations has a direct effect on the performance of the engine.

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I–2028–0289

Removal and Installation

Disconnect the throttle linkage (Item 1) **[A]**.

Disconnect the wires (Item 2) **[A]** from the fuel shut–off solenoid.

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

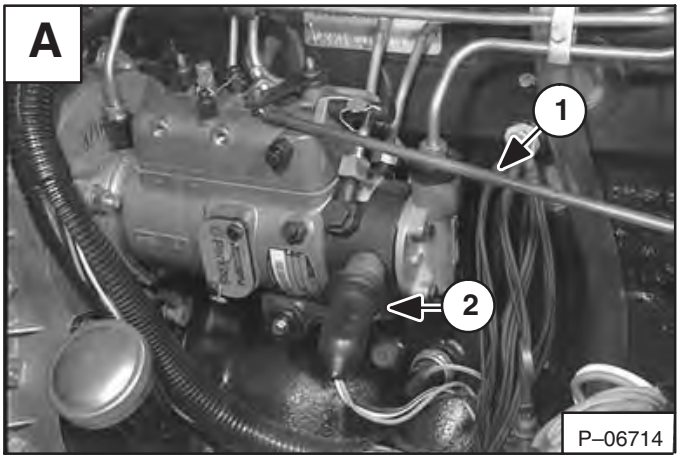
I–2029–0289

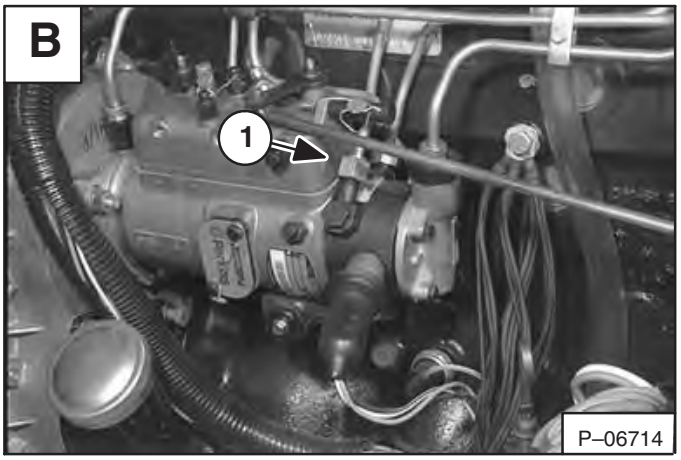
Disconnect the high pressure tubelines (Item 1) **[B]** at the fuel injectors.

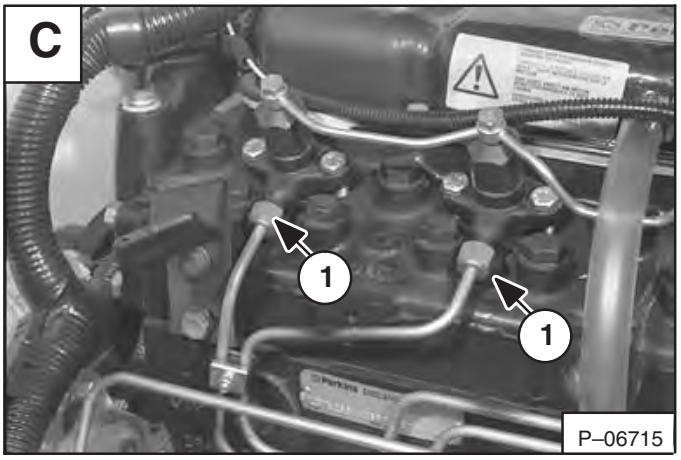
Installation: Tighten the high pressure tubeline fittings to 15 ft.–lbs. (20 Nm) torque when installing them.

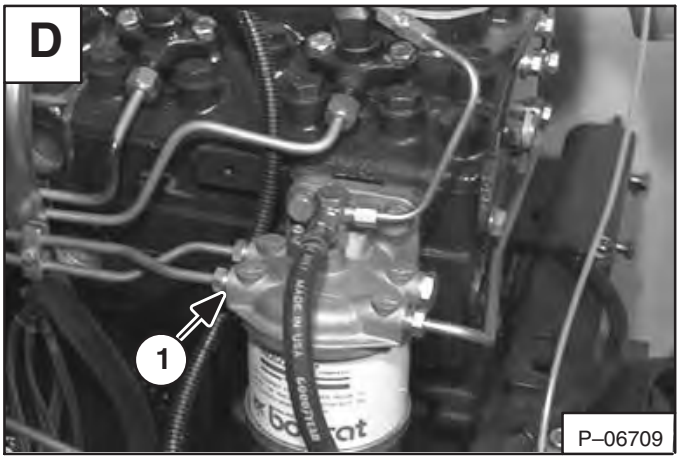
Remove all the high pressure tubelines (Item 1) **[B]** & **[C]** from the engine.

Disconnect the low pressure tubelines (Item 1) **[D]** at the fuel filter and injection pump.





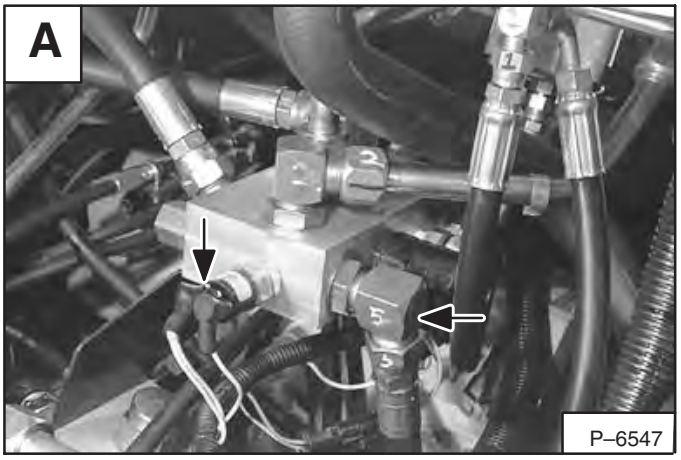




ENGINE (Cont'd)

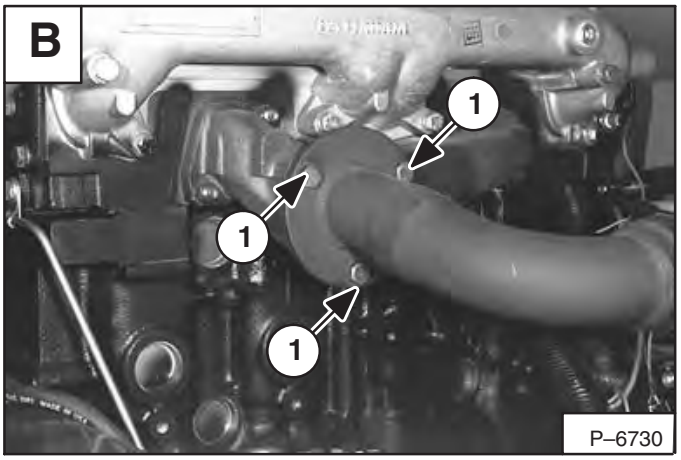
Removal and Installation (Cont'd)

Disconnect the wiring harness from the port block valve **[A]**.



Remove the (3) three bolts (Item 1) **[B]** at the exhaust manifold and remove the exhaust pipe.

NOTE: When disconnecting any hoses or tubelines, always install caps and plug in the ends.



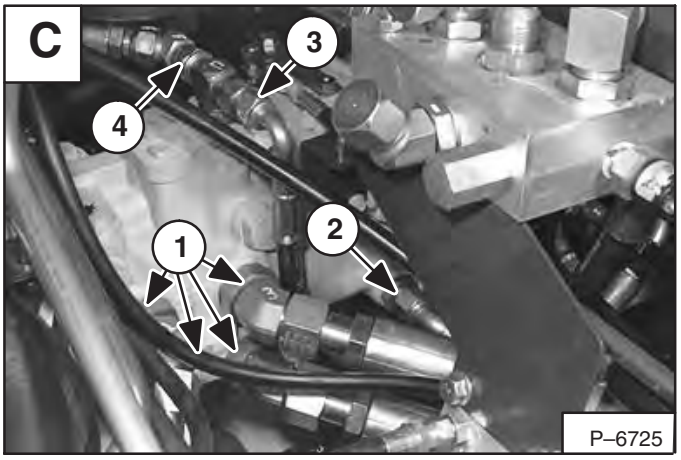
Mark the (4) drive motor hoses (Item 1) **[C]** for the correct installation.

Disconnect the (4) drive motor hoses (Item 1) **[C]** from the hydrostatic pump.

Disconnect the motor case drain hose (Item 2) **[C]** from the hydrostatic pump.

Disconnect the hose (Item 3) **[C]** from the return filter.

Disconnect the hose (Item 4) **[C]** going to the hydrostatic filter.



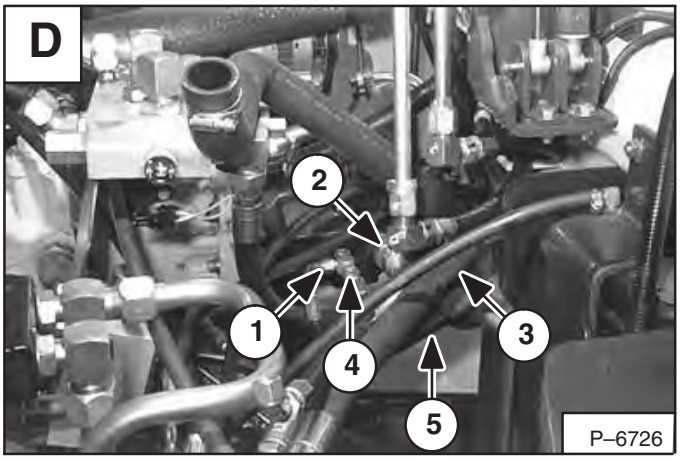
Disconnect the pilot pressure hose (Item 1) **[D]** to the tilt lock valve, from the fitting on the hydraulic pump.

Disconnect the outlet tube/hose (Item 2) **[D]** to the main control valve, from the fitting on the hydraulic pump.

Disconnect the hose at the pre–charge port block (Item 3) **[D]**.

Disconnect the hose going to the oil reservoir (Item 4) **[D]**.

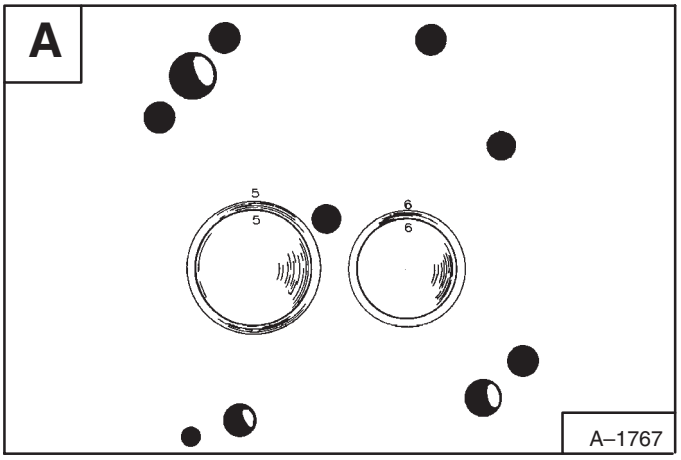
Disconnect the hose (Item 5) **[D]** going to the hydraulic filter.



VALVES

Removal of the Valves

Mark the valves so they are put in the original position on assembly **[A]**.



Use a valve spring compressor and remove the valve spring locks **[B]**.

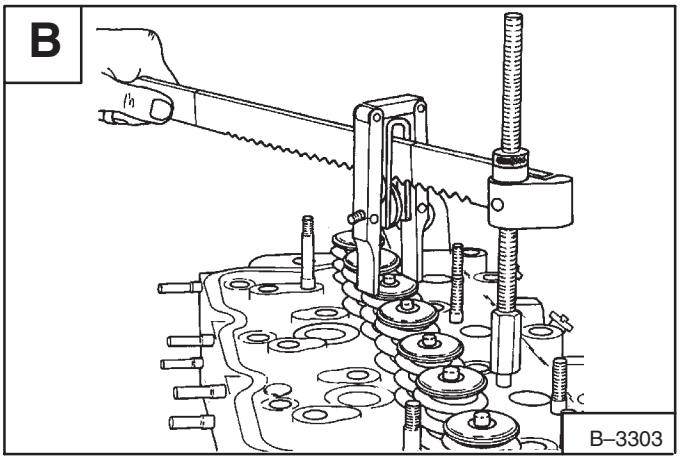
Repeat this procedure for each valve.

Installing the Valves

Make sure the cylinder head is clean.

Put oil on the valve guides and valve stems.

Put each valve in its correct location.

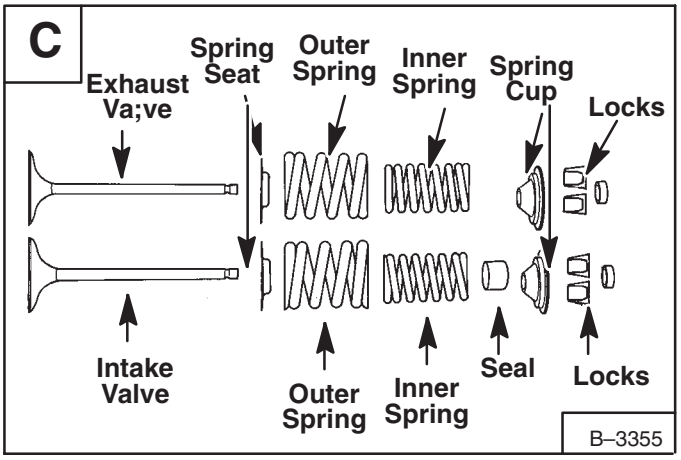


Assemble the valve springs and cups **[C]**.

The intake valve is fitted with a rubber seal.

Use a valve spring compressor and install the valve springs and valve stem locks.

Tap the valve stem with a hammer a small amount to seat the valve stem locks.



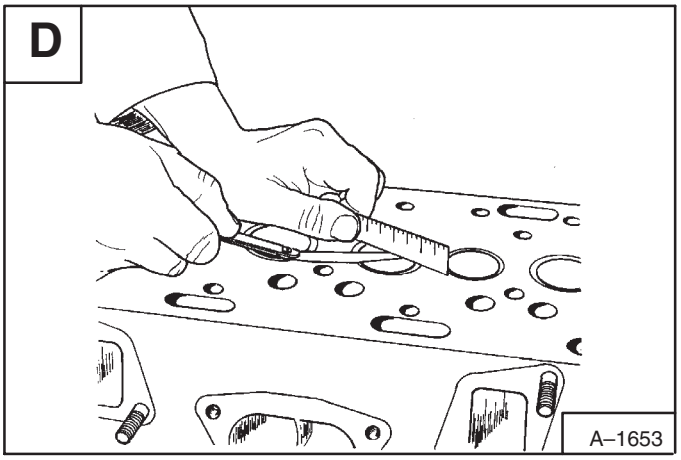
Reconditioning the Valves and Valve Seats

Use the correct equipment to grind the valve and valve seat.

The angle of the intake and exhaust valve is 45°.

Check the valve head depth in the cylinder head after grinding **[D]**. The correct specifications are as follows:

Intake – 0.035/0.045” (0,89/1,14 mm)
Exhaust – 0.047/0.057;; (1,19/1,45 mm)



MAIN BEARINGS (Cont'd)

Installation

Check the crankshaft journals before installing the main bearings. (See Page 7–38.)

Lubricate the new bearings. Install them by putting the end without the tab into the block and rotating the engine crankshaft until the tab is on its seat.

Install the other bearing half in the main bearing cap. Lubricate the bearing and install it on the engine block.

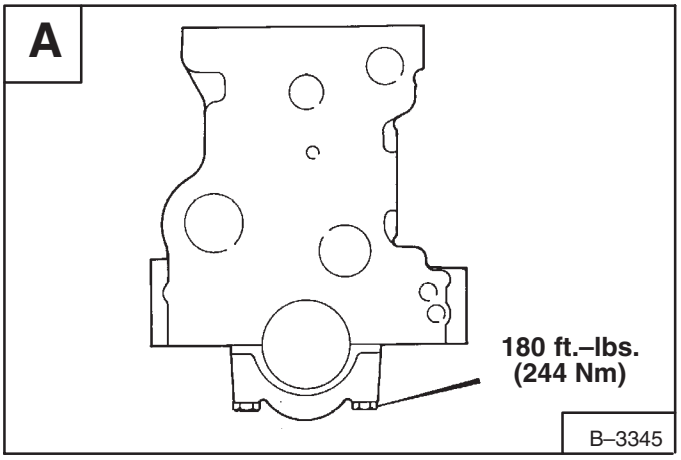
Install the bolts and tighten to position the cap, then loosen them.

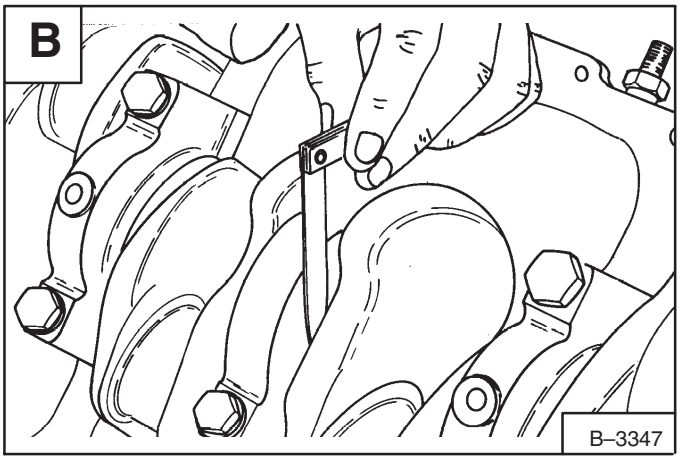
Install the center main bearing and thrust washers.

Install the center main bearing into the cap. Install the bolts and tighten to position the cap, then loosen them.

Repeat the procedure until all the main bearings are installed.

Then tighten the bolts to the correct torque **[A]**.

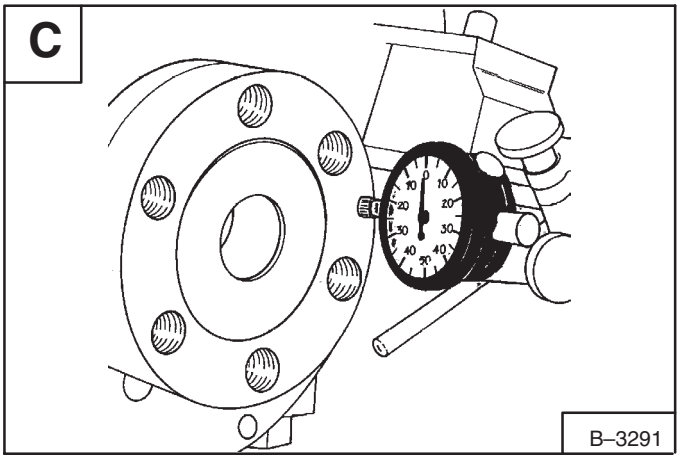


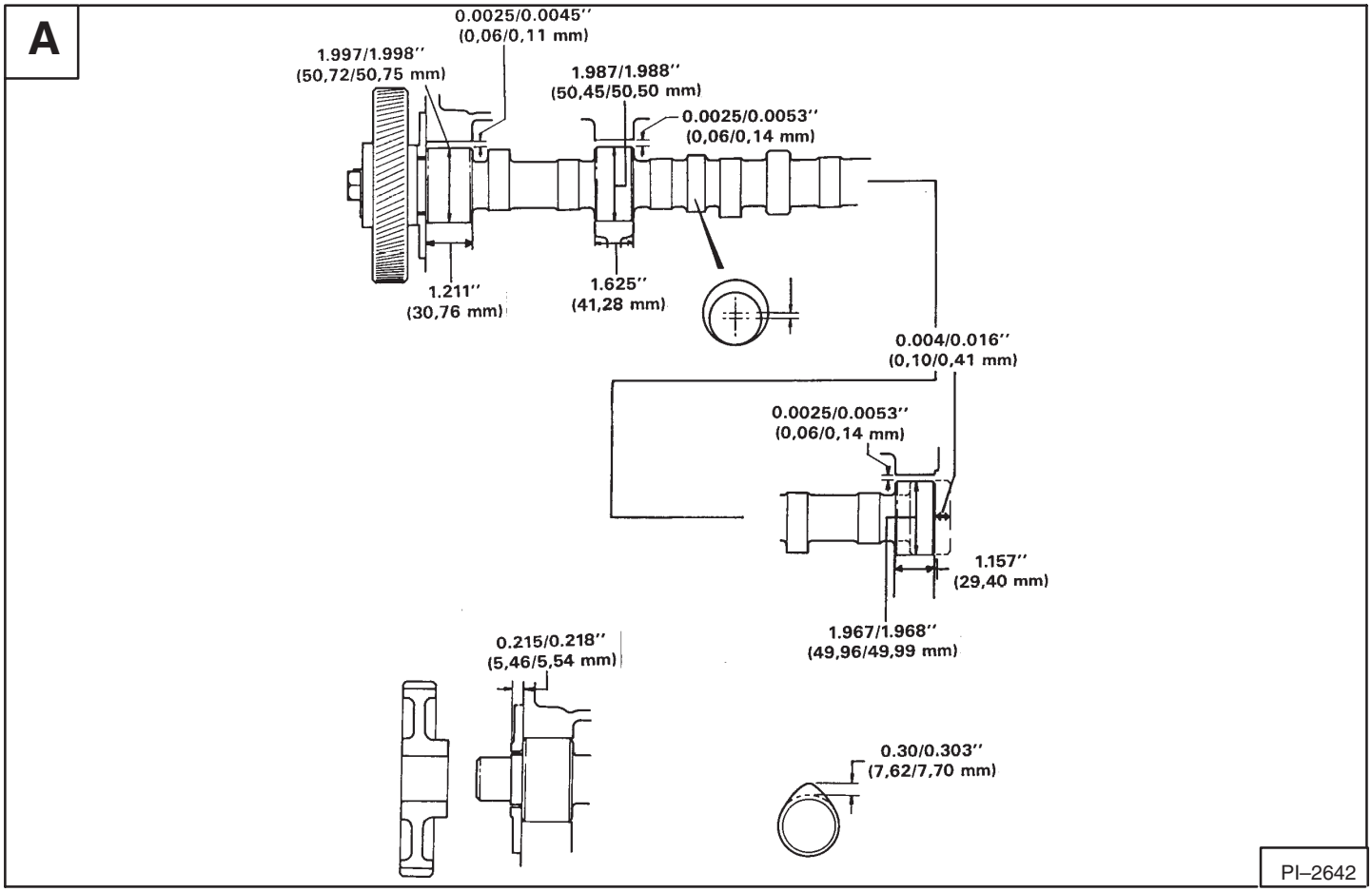


Crankshaft End Play

The end play can be checked by either a feeler gauge **[B]** or a dial indicator **[C]**.

The maximum end play is 0.014'' (0,35 mm). The fitting of oversize thrust washers can be used to correct the end play if it is over the specifications.





Inspection

Check the camshaft and the bearings **[A]**.

Use the correct tools for removal and installation of the camshaft bearings.

Installation

Lubricate the tappets before installation.

Lubricate the camshaft and install. Be careful not to damage the camshaft bearings.

After the rocker arms are installed, make sure to set the valve clearance. (See Page 7–4.)

Page Number

BICS™ SYSTEM CONTROLLER (Cont'd)

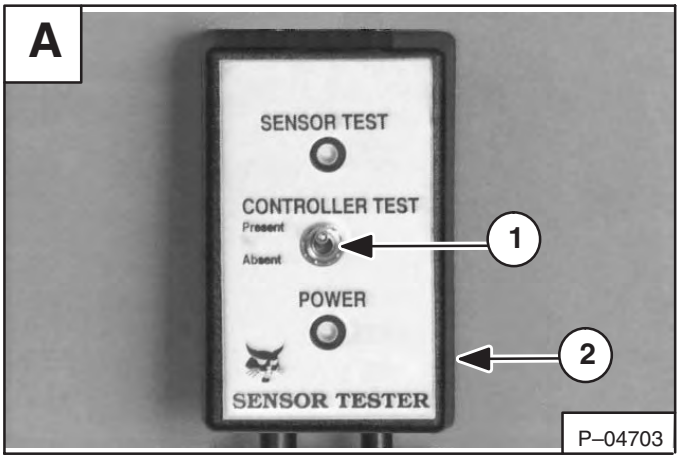
Controller Test

MEL1428 Sensor Tester is necessary for the following procedure:

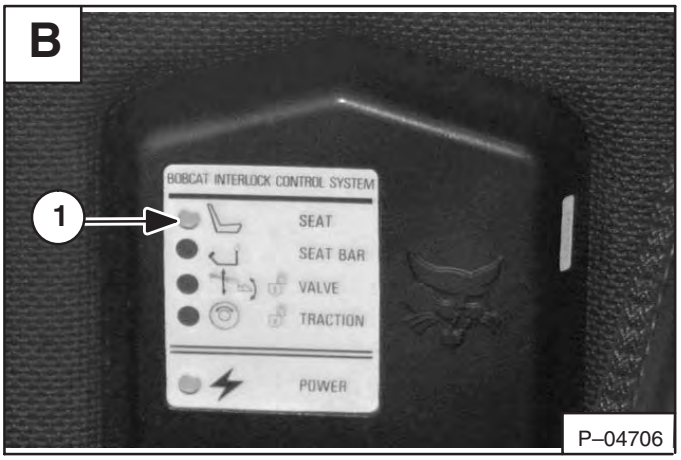
Turn the key to the ON position. **DO NOT START THE ENGINE**.

After completing the procedure for the Seat sensor test or the Seat Bar sensor test, do the Controller test. Refer to Page 8–3 for correct procedures to do the Seat Bar sensor test or the Seat sensor test.

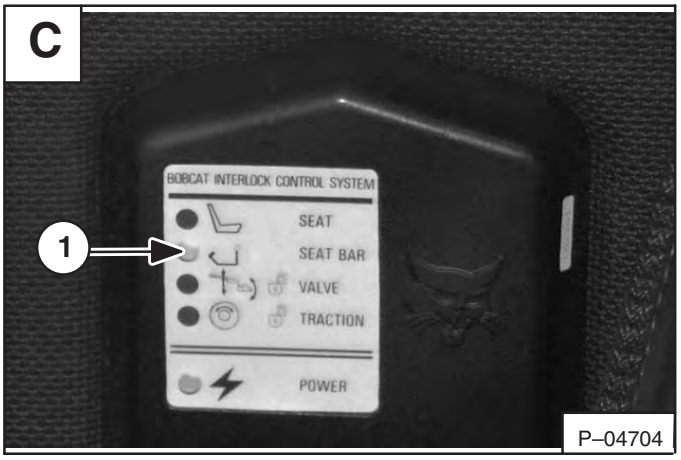
Move the toggle switch (Item 1) **[A]** on the sensor tester (Item 2) **[A]** to the **Present** position.



If the controller is working correctly, the Seat light (Item 1) **[B]** on the controller will illuminate when the tester is connected to the Seat sensor.



When the tester is connected to Seat Bar sensor, the Seat Bar light (Item 1) **[C]** will illuminate if the controller is working correctly.

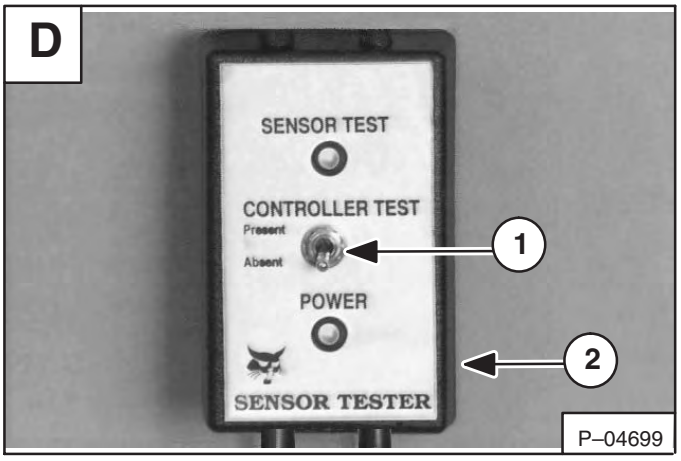


Move the toggle switch (Item 1) **[D]** on the sensor tester (Item 2) **[D]** to the **Absent** position.

The Seat light (Item 1) **[B]** or 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.

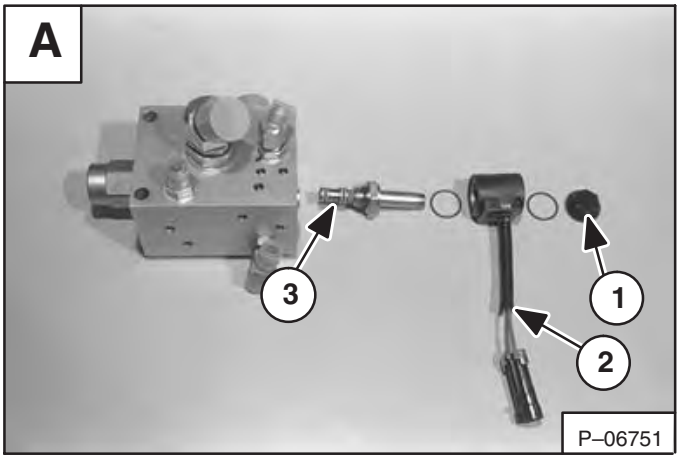
Refer to Page 8–3 for the correct procedure to inspect the BICS System Controller.



TILT LOCK VALVE (Cont'd)

Disassembly and Assembly

Remove the solenoid mounting nut (Item 1)**[A]**, solenoid (Item 2) **[A]** and solenoid valve (Item 3) **[A]** from the tilt lock valve.

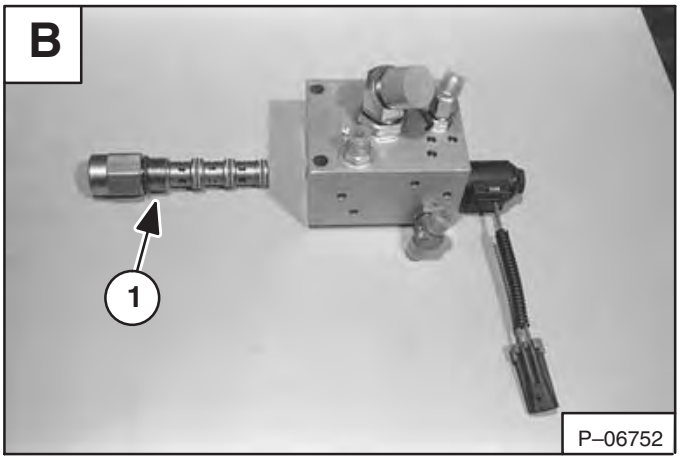


Remove the check valve (Item 1) **[B]** from the lift lock valve.

Assembly: Tighten the solenoid mounting nut to 80–90 in.–lbs. (9–10 Nm) torque.

Inspect the solenoid valve, check valve and hydraulic fittings for damage or wear. Replace if necessary.

Refer to Page 8–1 for lift arm by–pass control inspection procedure.



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

Camshaft & Thrust Washer (Cont'd)

No. 2 Journal Length	1.625 (41,27)
No. 2 Journal Diameter	1.987/1.988 (50,46/50,48)
No. 2 Block Camshaft Bore Diameter	1.990/1.992 (50,55/50,60)
No. 3 Journal Length	1.156 (29,40)
No. 3 Journal Diameter	1.967/1.968 (49,95/49,98)
No. 3 Block Camshaft Bore Diameter	1.970/1.972 (50,04/50,09)
No. 2 & 3 Running Clearance	0.0025/0.0053 (0,06/0,14)
Cam Lift	0.300/0.303 (7,62/7,70)
Passage for Rocker Arm Shaft Lubrication	No. 2 Journal
Camshaft Thrust Washer Type	360°
Thrust Washer O.D.	2.872/2.874 (72,95/73,00)
Block Recess Diameter for Thrust Washer	2.875/2.885 (73,03/73,28)
Clearance Fit of Thrust Washer in Recess	0.001/0.013 (0,03/0,33)
Thrust Washer I.D.	1.75 (44,45)
Thrust Washer Thickness	0.216/0.218 (5,47/5,54)
Block Recess Depth for Thrust Washer	0.187/0.190 (4,75/4,83)
Thrust Washer Extended Beyond Block Face	0.026/0.031 (0,66/0,79)
Camshaft End Play	0.004/0.016 (0,10/0,41)

Timing Case & Timing Gears

Camshaft Gear No. of Teeth	56
Camshaft Gear I.D. of Gear Boss	1.375/1.376 (34,93/34,96)
Camshaft Gear O.D. of Gear	1.374/1.375 (34,90/34,91)
Fit of Camshaft Gear on Camshaft Hub	–0.0009/+0.0013 (–0,02/+0,03)
Fuel Pump Gear No. of Teeth	56
Fuel Pump Gear I.D. of Bore	1.750/1.751 (44,45/44,47)
Fuel Pump Gear Hub Diameter	1.748/1.749 (44,40/44,42)
Idler Gear No. of Teeth	63
Idler Gear Bore Diameter of Gear Bushing	1.999/2.001 (50,79/50,82)
Idler Gear O.D. of Hub	1.996/1.998 (50,70/50,74)
Idler Gear Running Clearance on Hub	0.0016/0.0039 (0,04/0,10)
Idler Gear Width with Bushings	1.865/1.875 (30,14/30,16)
Idler Gear Hub Width	1.192/1.195 (30,26/30,33)
Idler Gear End Play	0.004/0.008 (0,10/0,20)
Crankshaft Gear No. of Teeth	28
Crankshaft Gear Bore	1.875/1.876 (47,63/47,65)
Crankshaft Diameter for Gear	1.875/1.876 (47,63/47,64)
All Gears – Timing Backlash	0.003 (0,08 Minimum)

Oil Pump, Gear & Relief Valve

Type of Oil Pump	Rotor Type
No. of Lobes – Inner Rotor (Concentric)	Six
No. of Lobes – Outer Rotor (Concentric)	Seven
Drive Position on Block	By the Idler Gear from Crankshaft Gear
Clearance of Inner to Outer Rotor	0.01/0.003 (0,025/0,076)
Inner Rotor End Clearance	0.0015/0.003 (0,038/0,076)
Outer Rotor End Clearance	0.005/0.0025 (0,013/0,063)
Outer Rotor to Pump Body	0.011/0.013 (0,28/0,33)
Oil Pump Drive Gear No. of Teeth	19
I.D. of Oil Pump Gear Bore	0.497/0.4978 (12,62/12,64)
O.D. of Oil Pump Shaft	0.499/0.4995 (12,67/12,69
Interference Fit of Gear on Shaft	0.0012/0.0025 (0,03/0,06)
Clearance Between Drive and Pump Body	0.003/0.007 (0,08/0,18)
Oil Pump Idler Gear No. of Teeth	20
Oil Pump Idler Gear I.D. of Bore	1.00/1.001 (25,40/25,43)
Oil Pump Idler Gear O.D. of Bushing	1.000/1.0008 (25,40/25,42)
I.D. of Oil Pump Idler Gear Bushing	0.875/0.8763 (22,23/22,26)
O.D. of Idler Gear Shaft	0.8737/0.8742 (22,19/22,20