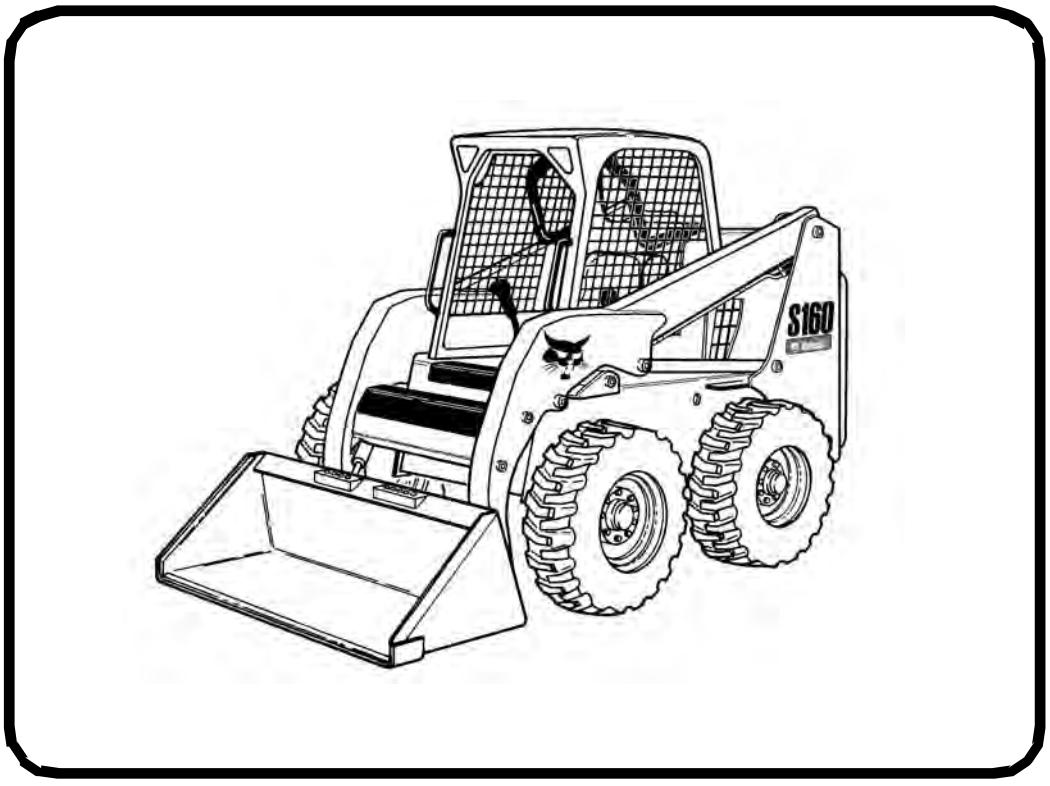
Bobcat®

Service Manual
S160 Skid-Steer Loader

S/N A3L311001 & Above
S/N A3L411001 & Above
S/N AEYN11001 & Above



EQUIPPED WITH
BOBCAT INTERLOCK
CONTROL SYSTEM (BICS™)

6987048enUS (01-15) (U)

Printed in U.S.A.

iT4

SAFETY INSTRUCTIONS

Safety Alert Symbol

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

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

SI SSL-0913 SM

Special Applications Kit

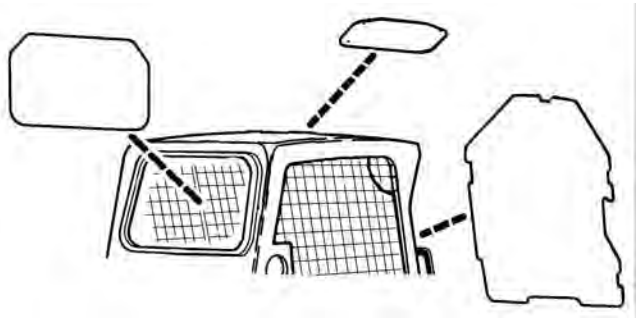
WARNING

AVOID INJURY OR DEATH

Some attachment applications can cause flying debris or objects to enter front, top or rear cab openings. Install the Special Applications Kit to provide added operator protection in these applications.

W-2737-0508

Figure 10-30-9



B-25286A

Available for special applications to restrict material from entering cab openings. Kit includes 12,7 mm (0.50 in) poly carbonate front door, top and rear windows **[Figure 10-30-9]**.

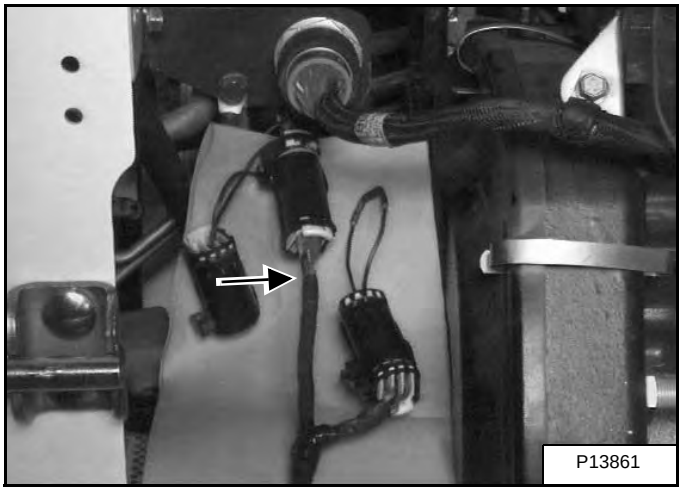
See your dealer for availability.

Special Applications Kit Inspection And Maintenance

- Inspect for cracks or damage. Replace if required.
- Pre-rinse with water to remove gritty materials.
- Wash with a mild household detergent and warm water.
- Use a sponge or soft cloth. Rinse well with water and dry with a clean soft cloth or rubber squeegee.
- Do not use abrasive or highly alkaline cleaners.
- Do not clean with metal blades or scrapers.

Remote Start Procedure (Cont'd)

Figure 10-60-12



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

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

⚠ WARNING

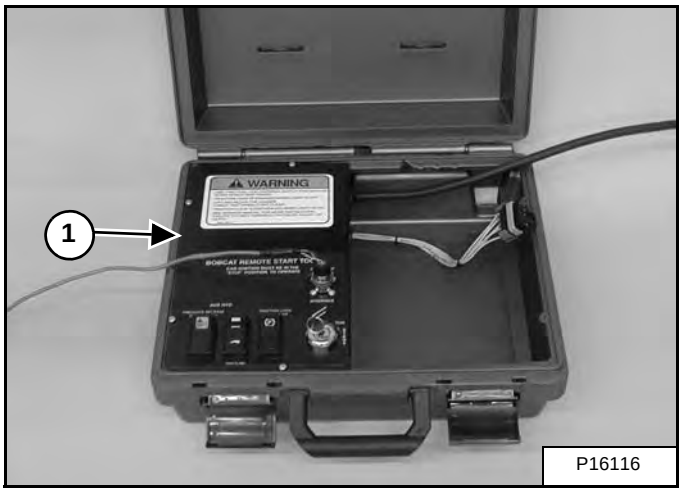
UNAUTHORIZED AND UNEXPECTED ENGINE START-UP CAN CAUSE SERIOUS INJURY OR DEATH

With the 7-pin connector plugged into the machine and Remote Start Tool Key Switch in the OFF position, the engine can be started from the operator panel inside the cab.

- **Place the key switch of the Remote Start Tool in the RUN position to disconnect the operator panel from the start circuit.**
- **Remove the operator panel key (key switch), lock the keypad with a unique password (keyless) or otherwise disable the starter before working in the engine area.**

W-2457-1110

Figure 10-60-13



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

SERVICE SCHEDULE

Chart

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

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death. W-2003-0807

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

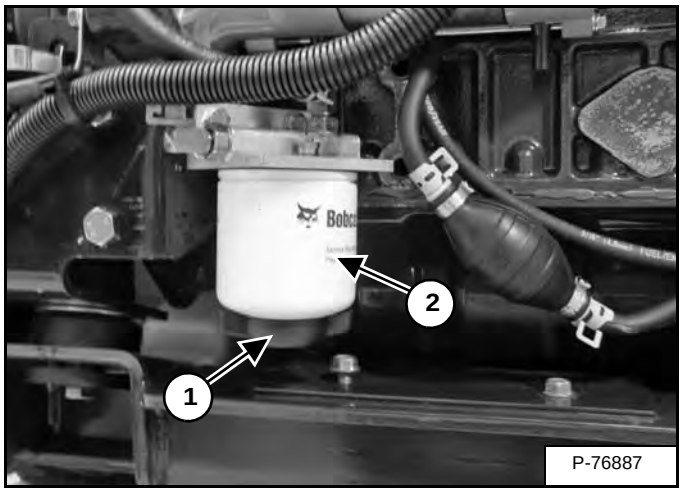
■ **Or every 12 months.**
▲ **Perform at first 50 hours, then as scheduled.**
❑ **Check every 8 - 10 hours for the first 24 hours, then at 50 hour intervals.**
● **Replace the hydraulic / hydrostatic filter element after the first 50 hours, then when service code [M0217] is displayed or as scheduled.**
✶ **Change oil and filter every 100 hours when operating under severe conditions.**
❍ **Perform at first 500 hours, then as scheduled.**

Fuel Filter

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

Removing Water

Figure 10-100-3



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

Replacing Element

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

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

Remove air from the fuel system. (See Removing Air From The Fuel System below.)

WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Removing Air From The Fuel System

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

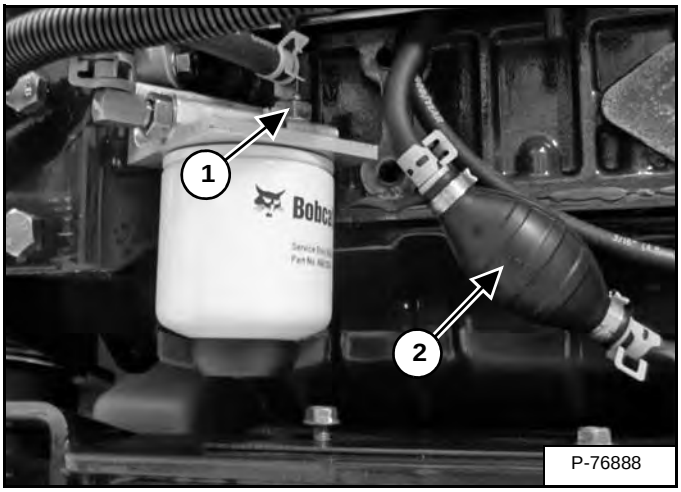
WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

Figure 10-100-4



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

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

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

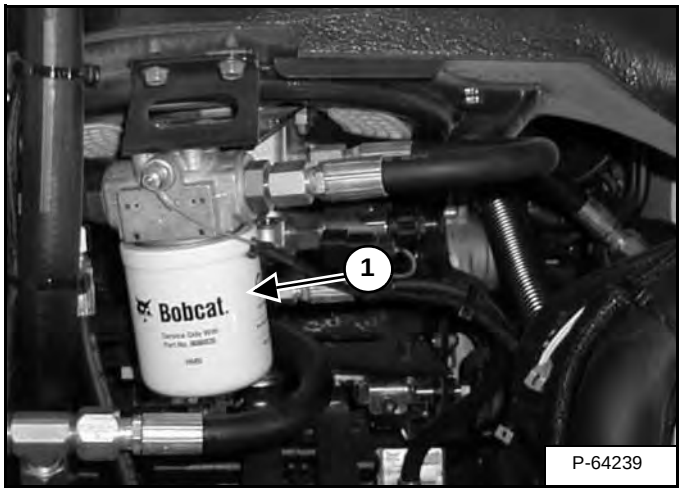
Removing And Replacing Hydraulic Charge Filter

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

Raise the operator cab. (See Raising on Page 10-30-2.)

Earlier Models

Figure 10-120-12



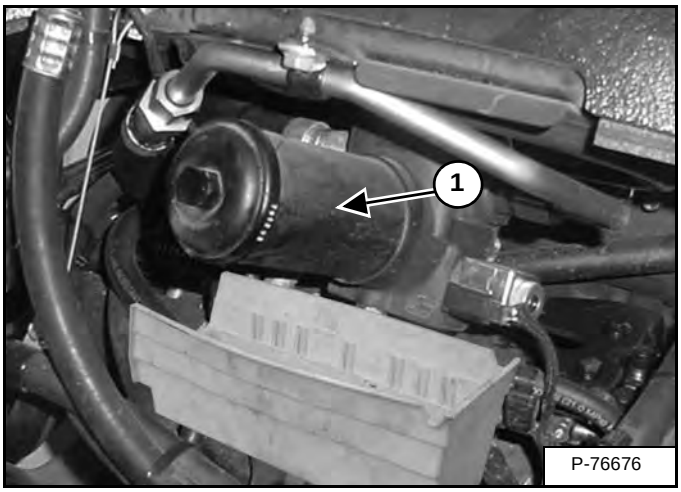
Remove the filter (Item 1) **[Figure 10-120-12]**.

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

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

Later Models

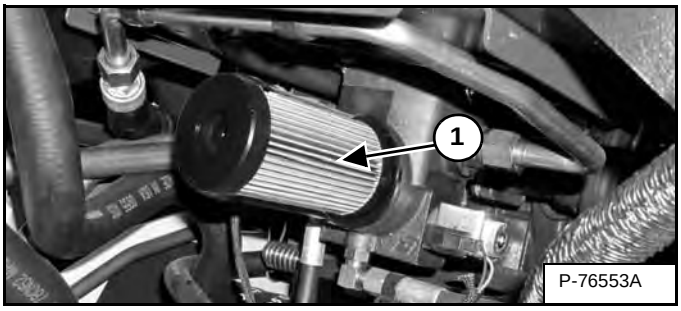
Figure 10-120-13



Place a suitable container below the filter housing and remove the filter housing (Item 1) **[Figure 10-120-13]**.

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

Figure 10-120-14



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

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

Put clean oil on the seal of the new filter element. Install the element on the filter base. Install and hand tighten the filter housing to 65 - 71 N•m (45 - 52 ft-lb) torque.

TIRE MAINTENANCE

Wheel Nuts

Figure 10-160-1

See the SERVICE SCHEDULE for the service interval to check the wheel nuts **[Figure 10-160-1]**. (See SERVICE SCHEDULE on Page 10-70-1.)

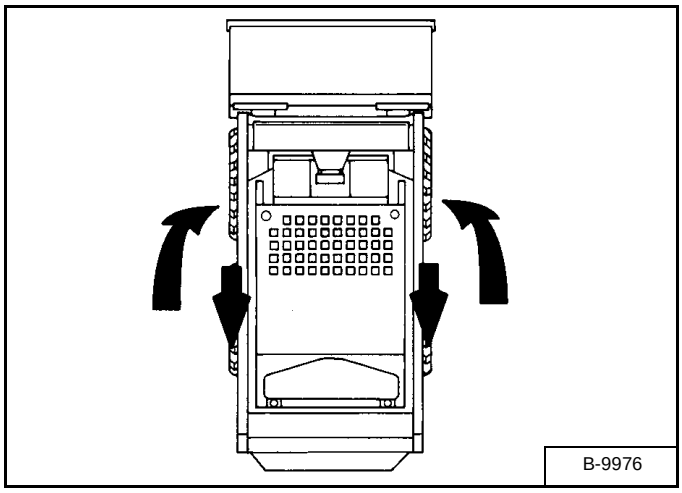
When installing wheel nuts, tighten to 217 N•m (160 ft-lb) torque.

When checking wheel nut torque, set the torque wrench to 190 N•m (140 ft-lb) to prevent over-tightening.

Rotating

Check the tires regularly for wear, damage and pressure.

Figure 10-160-2



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

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

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

Mounting

Tires are to be repaired only by an authorized person using the proper procedures and safe equipment.

Tires and rims must always be checked for correct size before mounting. Check rim and tire bead for damage.

The rim flange must be cleaned and free of rust.

The tire bead and rim flange must be lubricated with a rubber lubricant before mounting the tire.

Avoid excessive pressure which can rupture the tire and cause serious injury or death.

During inflation of the tire, check the tire pressure frequently to avoid over inflation.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2078-1007

IMPORTANT

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

I-2057-1010

EMERGENCY EXIT

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

Rear Window

Figure 10-210-1

Pull on the tag on the top of the rear window to remove the rubber cord **[Figure 10-210-1]**.

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

Figure 10-210-2

Exit through the rear of the operator cab **[Figure 10-210-2]**.

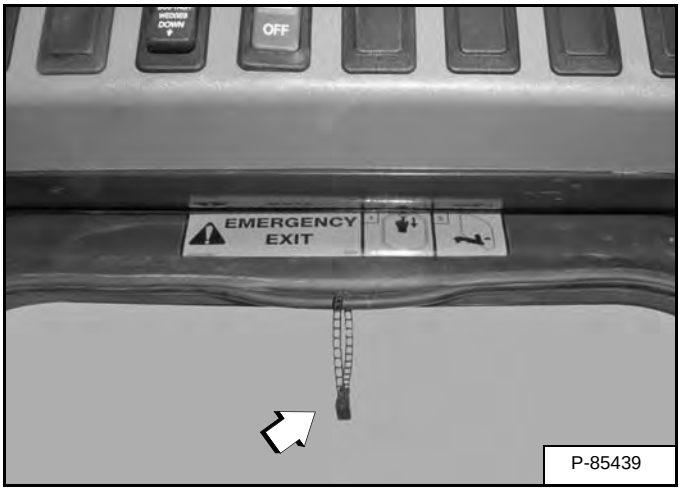
Front Door

This machine may be equipped with a front door.

NOTE: When an Operator Cab Enclosure Kit is installed, the window of the front door can be used as an emergency exit. [Figure 10-210-3]

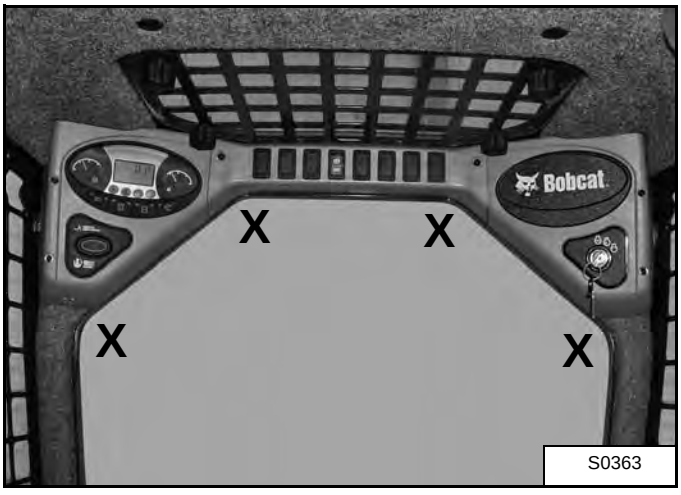
NOTE: If the loader has a Special Application Door Kit installed, the window of the front door is NOT an emergency exit.

Figure 10-210-3



Pull the plastic loop at the top of the window in the front door to remove the rubber cord **[Figure 10-210-3]**.

Figure 10-210-4



Push the window out with your foot at any corner of the window **[Figure 10-210-4]**.

Exit through the front door.

HYDRAULIC/HYDROSTATIC SCHEMATIC
S160 (S/N A3L311001 AND ABOVE)
(S/N A3L411001 AND ABOVE)
(S/N AEYN11001 AND ABOVE)

(PRINTED JANUARY 2009)

V-1114legend

Printable Version Click Here

LEGEND

1. RESERVOIR:
   Capacity . . . . . 19.2 Qts. (18,2 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 Bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 Bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5000 PSI (345 Bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 Bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   16.9 GPM (64 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 Bar)
   at Front Quick Couplers
10. RELIEF/ANTICAVITATION VALVE - PORT 3500 PSI (241,3 Bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. RELIEF/ANTICAVITATION VALVE - PORT (OPTIONAL) 3500 PSI (241,3 Bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.140 inch (3,6 mm)
29. RESTRICTOR - 0.031 inch (0,8 mm)
30. RELIEF VALVE: 3300 PSI (228 Bar)
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BIDIRECTIONAL HYDROSTATIC PUMP
37. SHUTTLE RELIEF VALVE
    (Not Adjustable - Factory Set)
    65 PSI (4,5 Bar)
38. FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDROSTATIC MOTOR
39. CHECK VALVE - With 80 PSI (5,5 Bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. CHARGE PUMP -
    12.8 GPM (48,5 L/min) at High Engine Idle
43. CHECK VALVE - With 300 PSI (20,7 Bar) Spring And With 0.016 inch (0,40 mm) Orifice
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 Bar)
48. RELIEF VALVE - 1200 PSI (83 Bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR - FAN
51. ANTICAVITATION VALVE
52. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
53. FILTER - BOB-TACH VALVE
54. RESTRICTION - 0.343 inch (8,73 mm)
55. SENSOR – CHARGE PRESSURE – Fan Filter
56. SENSOR – HYD. TEMP. – Hyd. Filter

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

Printed in U.S.A.

HYDRAULIC/HYDROSTATIC SCHEMATIC
WITH SJC & 2 SPEED OPTION
S160 (S/N A3L311001 AND ABOVE)
(S/N A3L411001 AND ABOVE)
(S/N AEYN11001 AND ABOVE)

(PRINTED JANUARY 2009)

V-1119legend Printable Version Click Here

LEGEND

1. RESERVOIR:
   Capacity . . . . . 19.2 qt. (18,2 L)
2. SPRING LOADED FILTER BY-PASS VALVE: 45-55 PSI (3,1-3,8 bar)
3. DIFFERENTIAL PRESSURE SWITCH:
   36-44 PSI (2,5-3,0 bar)
   Normally Closed
4. DRIVE MOTOR SHUTTLE VALVE
5. RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 5075 PSI (350 bar)
6. RELIEF VALVE - CHARGE INLET:
   360 PSI (24,8 bar)
   at High Engine Idle
   With 140 degrees F. (60 degrees C.) Fluid
7. FRONT AUXILIARY MANUAL PRESSURE BLEED-OFF VALVE
8. HYDRAULIC PUMP . . . . . Gear Type
   16.9 GPM (64 L/min.) at High Engine Idle
9. RELIEF VALVE - MAIN:
   3250-3350 PSI (224-231 bar)
   at Front Quick Couplers
10. PORT RELIEF/ANTICAVITATION VALVE
    3500 PSI (241,3 bar)
11. ANTICAVITATION VALVE
12. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - AUXILIARY
13. PORT RELIEF/ANTICAVITATION VALVE:
    . . . . . (Optional)
    3500 PSI (241,3 bar)
14. LOAD CHECK VALVE
15. LIFT CYLINDER SPOOL - MADE TO RESTRICT FLOW DURING BOOM DOWN BUT NOT DURING BOOM UP
16. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BICS CONTROL
17. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL
18. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL
19. PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY-PASS
20. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL
21. PILOTED ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL
22. FLOW DIVIDER ADJUSTMENT VALVE
23. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BASE
24. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - ROD
25. LOAD SHUTTLE VALVE - BLEED OFF
26. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - TWO COIL
27. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - REAR AUXILIARY
28. RESTRICTOR - 0.140 inch (3,6 mm)
29. RESTRICTOR - 0.031 inch (0,8 mm)
30. RELIEF VALVE: 3300 PSI (228 bar)
31. FILTER - HYDRAULIC (CANISTER)
32. FILTER - CASE DRAIN (SINTERED BRONZE)
33. FILTER - BICS CONTROL VALVE (SCREEN)
34. CHECK VALVE - BUCKET POSITION VALVE
35. RESTRICTION
36. VARIABLE CAPACITY DISPLACEMENT BI-DIRECTIONAL HYDROSTATIC PUMP
37. CHECK VALVE - With 5 PSI (0,34 Bar) Spring
38. BI-DIRECTIONAL HYDROSTATIC MOTOR – 2 SPEED
39. CHECK VALVE - With 80 PSI (5,5 bar) Spring
40. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - BUCKET POSITION VALVE (ON/OFF)
41. CHECK VALVE - BICS CONTROL VALVE
42. RESTRICTION - 0.343 inch (8,7 mm)
43. FILTER - Bob-Tach Valve
44. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - HYDRAULIC POWERED BOB-TACH
45. RESTRICTION - 0.089 inch (2,26 mm)
46. RESTRICTION - 0.025 inch (0,6 mm)
47. RELIEF VALVE - 2000 PSI (137 bar)
48. RELIEF VALVE - 1200 PSI (83 bar)
49. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
50. FIXED CAPACITY DISPLACEMENT HYDRAULIC MOTOR - FAN
51. ANTICAVITATION VALVE
52. PROPORTIONAL RELIEF VALVE – (Fan Speed Regulator):
    1566 - 1784 PSI (108 - 123 bar)
53. CHARGE PUMP -
    12.8 GPM (48,5 L/min) at High Engine Idle
54. CHECK VALVE - With 300 PSI (20,7 bar) Spring with 0.016 inch (0,40 mm) orifice
55. SOLENOID ACTIVATED CONTROL VALVE - FORWARD/REVERSE
56. SERVO PISTON -Swash Plate
57. POSITION SENSOR -Swash Plate
58. CHARGE PRESSURE SENSOR
59. SENSOR – CHARGE PRESSURE – Fan Filter
60. SENSOR – HYD. TEMP. – Hyd. Filter
61. HIGH PRESSURE SHUTTLE
62. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – WARM-UP
63. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE – 2 SPEED
64. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE – HIGH / LOW SPEED
65. RELIEF VALVE – With 125 PSI (8,6 bar) Spring

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

Printed in U.S.A.

V-1119legend (1-13-09)

Troubleshooting

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

If a service code appears in the left instrument panel (See DIAGNOSTIC SERVICE CODES on Page 60-90-1.)

WARNING

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

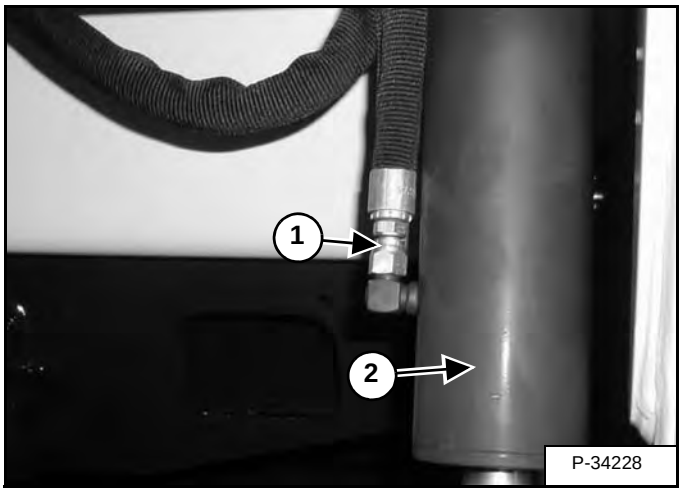
W-2004-1285

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

KEY TO CORRECT CAUSE	
	1. The fluid level is not correct.
	2. The pedal linkage is disconnected.
	3. The hydraulic pump has damage.
	4. The pedal linkage is not adjusted correctly.
	5. Relief valve is not at the correct pressure.
	6. Suction leak on the inlet side of the hydraulic pump.
	7. Fluid is cold. Wrong viscosity fluid. (See HYDRAULIC / HYDROSTATIC FLUID SPECIFICATIONS on Page SPEC-40-1.)
	8. Using the loader for more than its rated capacity. Exceeding the loaders rated operating capacity.
	9. Internal leak in the lift cylinder(s).
	10. External leak from the cylinder(s).
	11. Damaged lift spool.
	12. Rotate shaft.
	13. Replace lift arm bypass control valve assembly.

Removal And Installation (Cont'd)

Figure 20-21-6



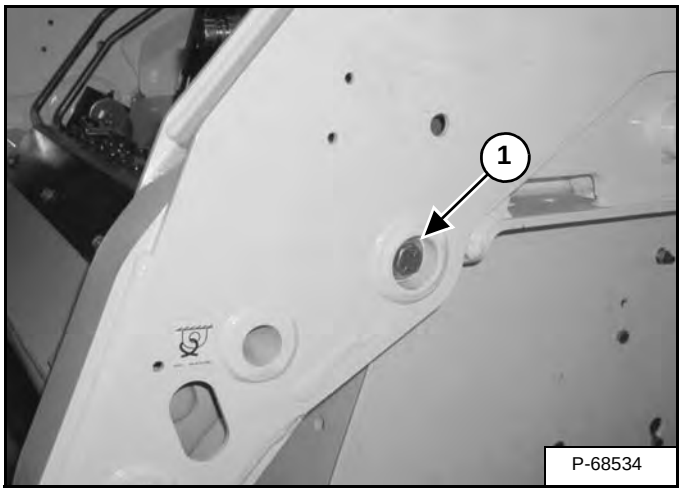
Disconnect the hose (Item 1) **[Figure 20-21-6]** from the cylinder.

Remove the cylinder (Item 2) **[Figure 20-21-6]** from the rod end pivot pin.

Remove the cylinder from the loader.

Base End Pivot Pin Removal And Installation

Figure 20-21-7



Remove the tilt cylinder from the Bob-Tach®. (See Removal And Installation on Page 20-21-2.)

Loosen the retainer bolt (Item 1) **[Figure 20-21-7]** from the tilt cylinder rod base end pin.

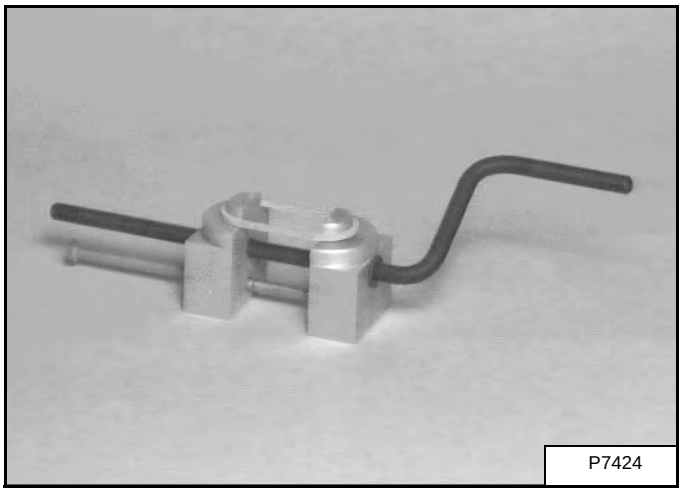
Installation: Tighten the retainer bolt to 240 - 260 N•m (175 - 190 ft-lb) torque.

Strike the head of the bolt (Item 1) **[Figure 20-21-7]** to push the pivot pin out.

Reverse the removal procedure to install the pivot pin.

Disassembly And Assembly (Cont'd)

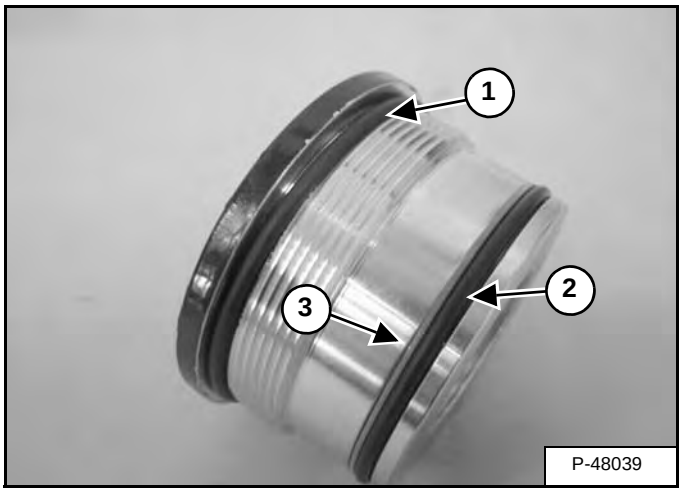
Figure 20-22-9



Assembly: Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-9]**. Allow the seal to stretch for 30 seconds before installing it on the piston.

Once the seal is installed on the piston, a piston ring compressor can be used on the piston for 3 minutes to compress the seal into place.

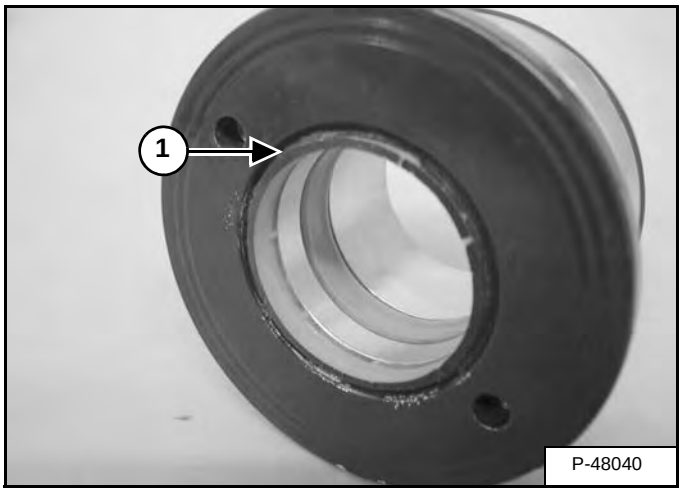
Figure 20-22-10



Remove the O-ring (Item 1). Remove the O-ring (Item 2) and the back-up ring (Item 3) **[Figure 20-22-10]** from the cylinder head.

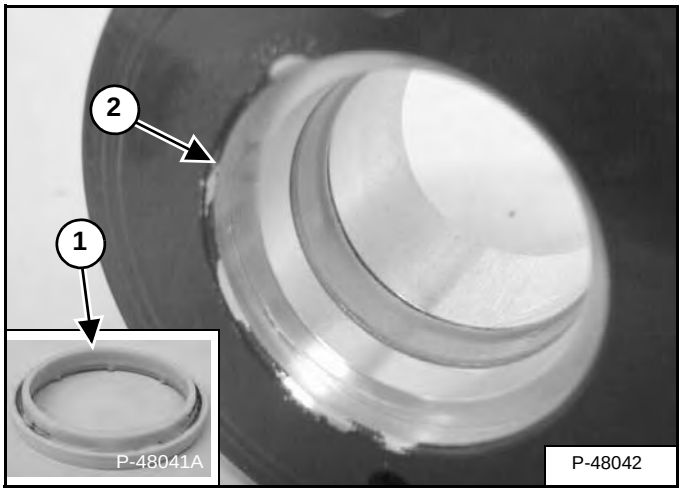
NOTE: The O-ring (Item 2) and back-up ring (Item 3) [Figure 20-22-10] are no longer available parts. The seal kit will contain a one piece seal that is used in place of the O-ring and back-up ring.

Figure 20-22-11



Remove the wiper seal (Item 1) **[Figure 20-22-11]** from the cylinder head.

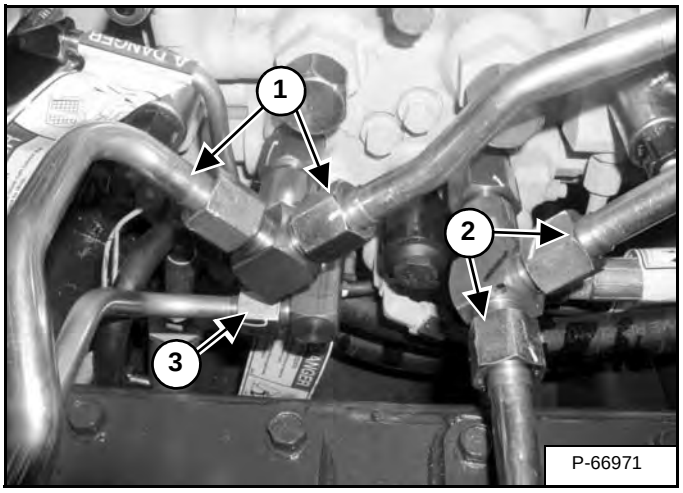
Figure 20-22-12



Install the wiper seal, with the wiper side of the seal (Item 1), toward the outside of the head (Item 2) **[Figure 20-22-12]**.

Removal And Installation (Cont'd)

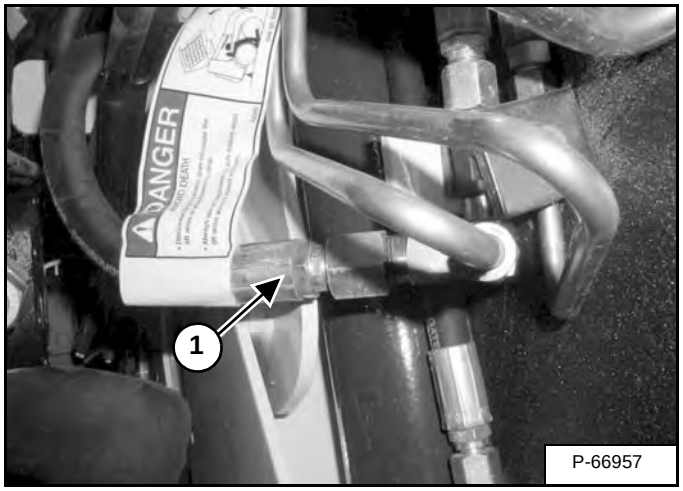
Figure 20-40-13



Disconnect and cap the tubelines (Item 1) and (Item 2) **[Figure 20-40-13]** from the tilt section of the control valve.

Disconnect and cap the tubeline (Item 3) **[Figure 20-40-13]** from the lift section of the control valve.

Figure 20-40-14

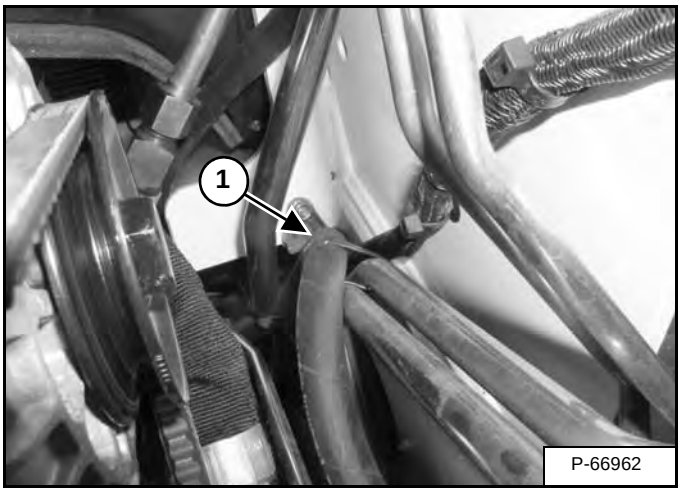


Mark all tubelines and hoses for correct installation.

The fixed end main valve hose (Item 1) **[Figure 20-40-14]** is connected to a fixed end fitting on the control valve. The hose is routed to the back upright where the hose is connected to a tee fitting that feeds the base end of both lift cylinders. The hose must be removed at the back tee fitting, located in the right side upright.

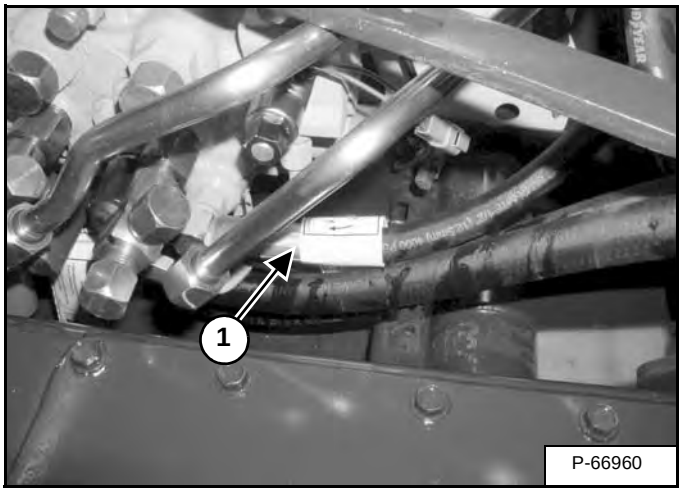
NOTE: Remember the hose routing for ease of control valve installation.

Figure 20-40-15



Remove any tie-straps (Item 1) **[Figure 20-40-15]** securing the fixed end main valve hose.

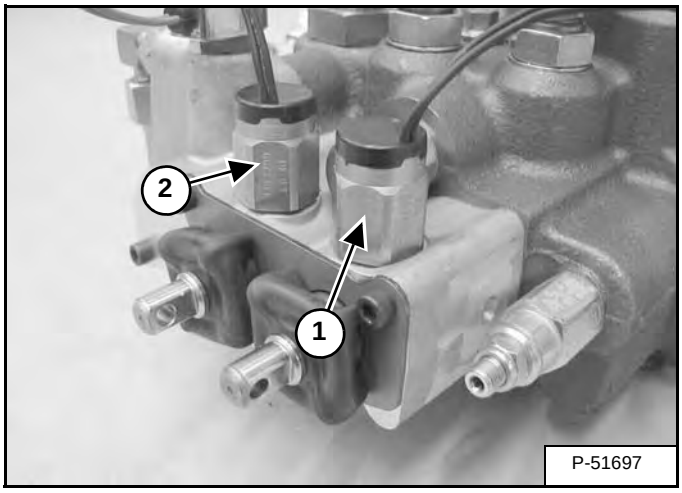
Figure 20-40-16



Remove the fixed-end main valve hose (Item 1) **[Figure 20-40-16]** from the main control valve fitting.

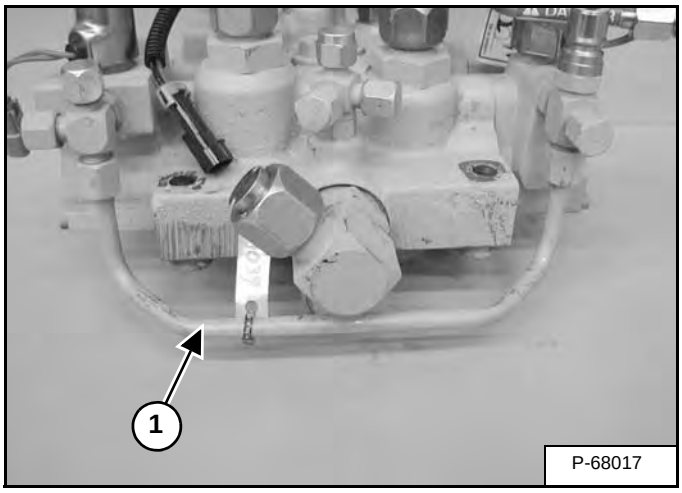
End Cap / Spool Lock Block Removal And Installation

Figure 20-40-46



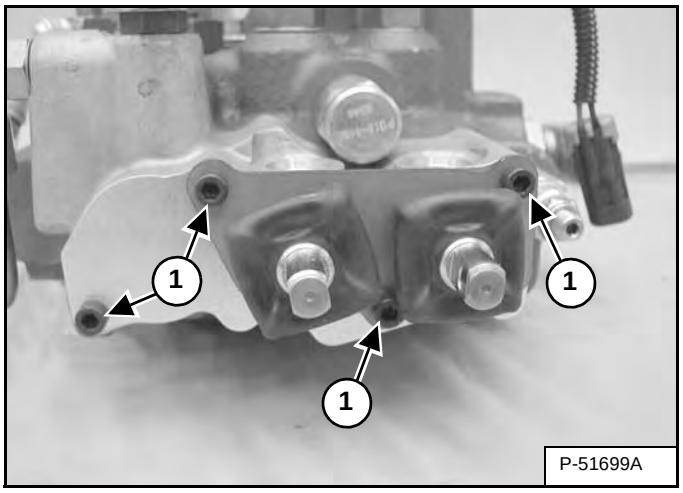
Remove the lift spool lock solenoid (Item 1) and the tilt spool lock solenoid (Item 2) **[Figure 20-40-46]** from the end cap / spool lock block.

Figure 20-40-47



Disconnect the tube line (Item 1) **[Figure 20-40-47]** from the end cap / spool lock block.

Figure 20-40-48

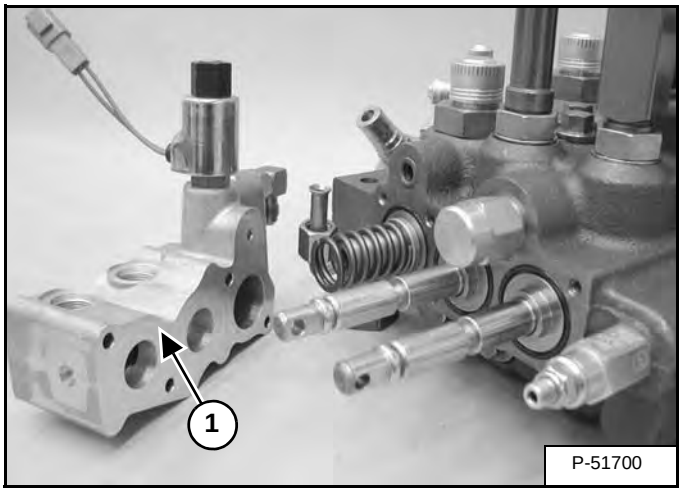


Remove the four end cap / spool lock block mount screws (Item 1) **[Figure 20-40-48]**.

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

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

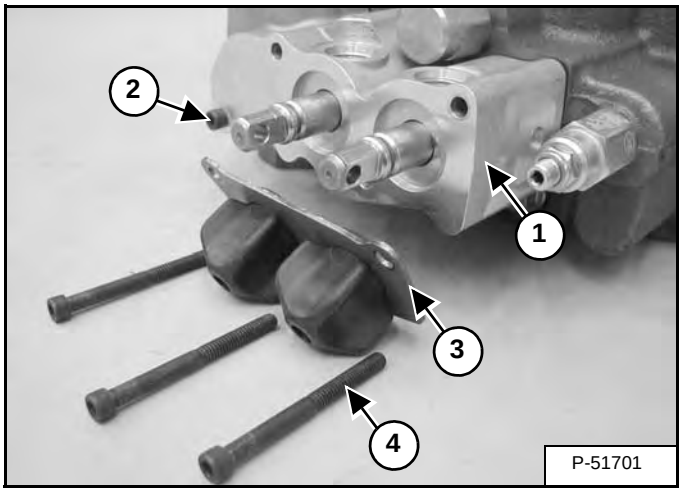
Figure 20-40-49



Remove the end cap / spool lock block (Item 1) **[Figure 20-40-49]** from the control valve.

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

Figure 20-40-85

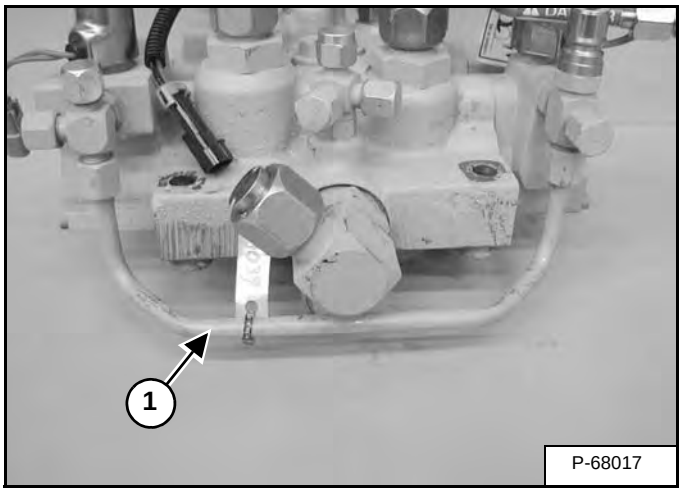


Install the end cap / spool lock block (Item 1) and the mount bolt (Item 2) **[Figure 20-40-85]**.

Install the lift and tilt spool rubber boots and mount plate (Item 3) and install the three mounting screws (Item 4) **[Figure 20-40-85]**.

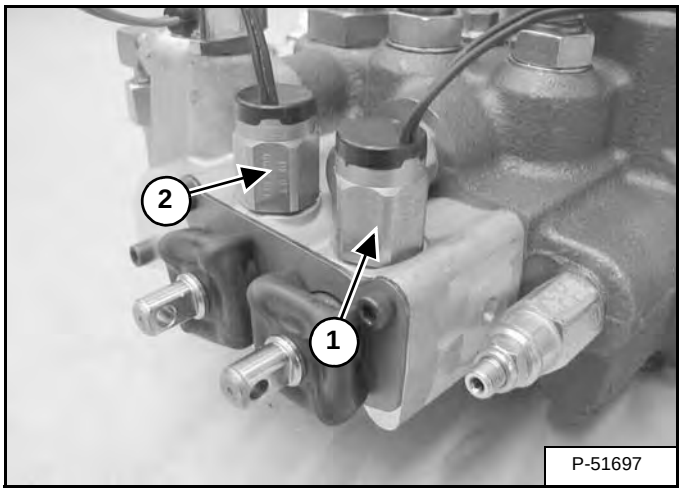
Installation: Tighten the screws to 10 - 11,3 N•m (90 - 100 in-lb) torque.

Figure 20-40-86



Connect the tubeline (Item 1) **[Figure 20-40-86]**.

Figure 20-40-87



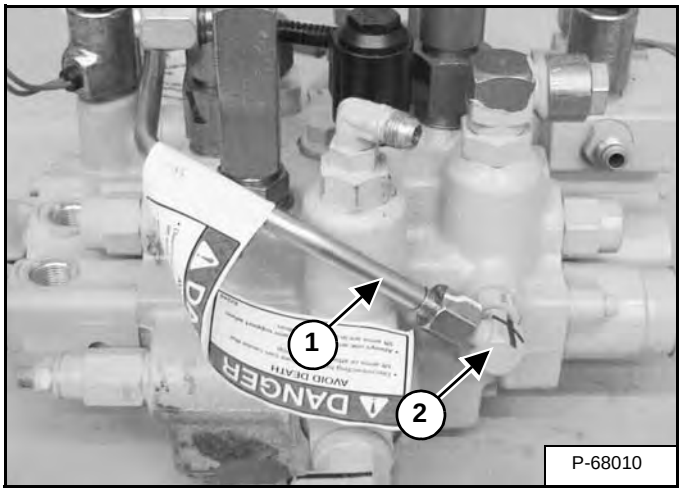
Use an ohmmeter to measure the lock solenoid coils resistance.

The correct resistance for the coil is 5.5 ± 0.28 ohm.

Installation: Install the lift spool (Item 1) and tilt spool (Item 2) **[Figure 20-40-87]** lock solenoids and tighten to 52 - 61 N•m (35 - 45 ft-lb) torque.

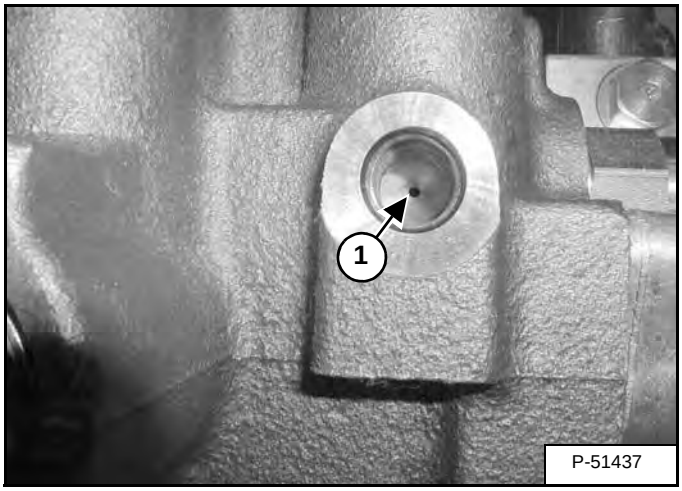
Lift Arm Bypass Orifice Removal And Installation

Figure 20-40-119



Remove the tubeline (Item 1) and fitting (Item 2) **[Figure 20-40-119]** from the valve.

Figure 20-40-120

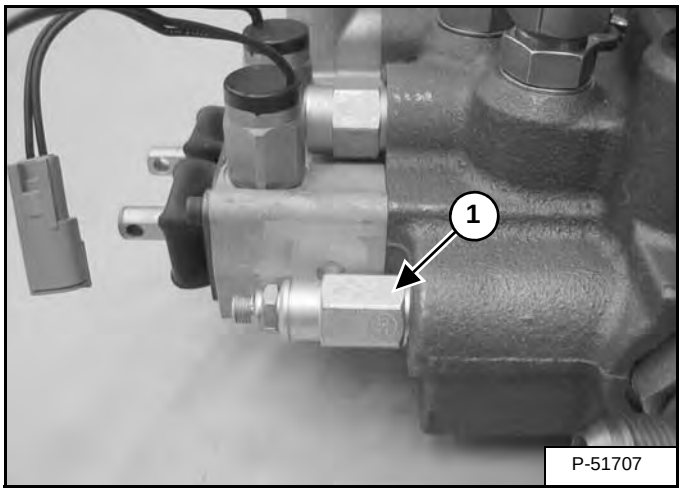


Check the lift arm bypass orifice (Item 1) **[Figure 20-40-120]**.

NOTE: This orifice is not removable from the valve casting.

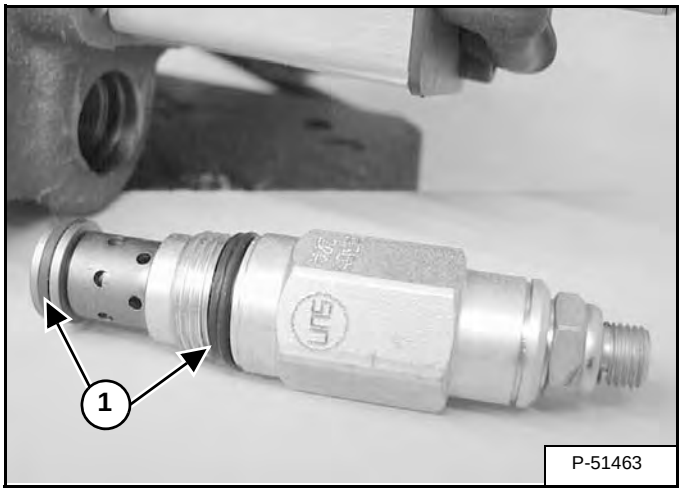
Main Relief Valve Removal And Installation

Figure 20-40-121



Remove the main relief valve (Item 1) **[Figure 20-40-121]**.

Figure 20-40-122

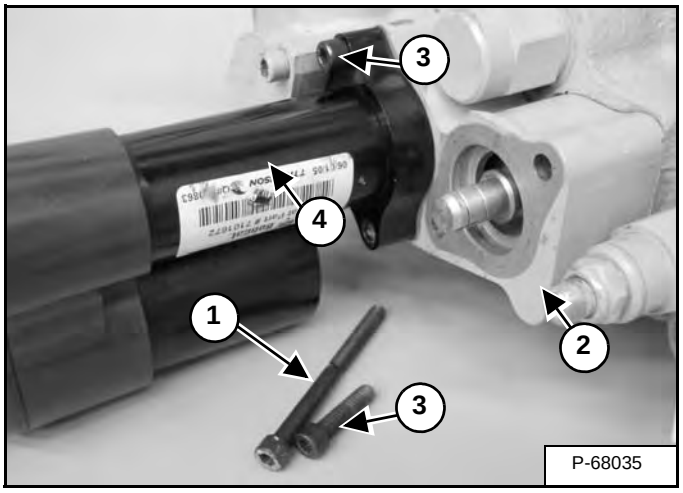


Remove the O-rings (Item 1) **[Figure 20-40-122]** from the main relief valve.

Installation: Always use new O-rings. Tighten main relief valve to 52 - 61 N•m (38 - 45 ft-lb) torque.

Actuator Removal And Installation (Out of Loader) (Cont'd)

Figure 20-41-26

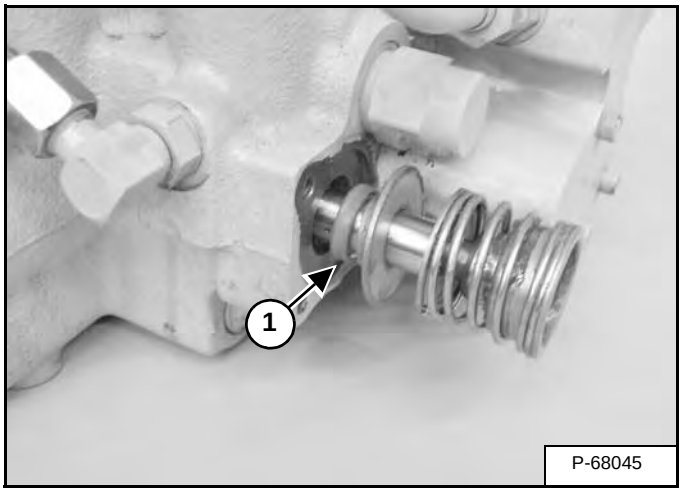


NOTE: The two longer bolts (Item 1) are used to mount the lift actuator and end cap (Item 2) to the control valve.
The two shorter mount bolts (Item 3) are used to mount the tilt actuator (Item 4) [Figure 20-41-26] to the end cap.

Installation: Tighten the mounting bolts to 10,2 - 11,3 N•m (90 - 100 in-lb) torque (Item 1) **[Figure 20-41-26]**

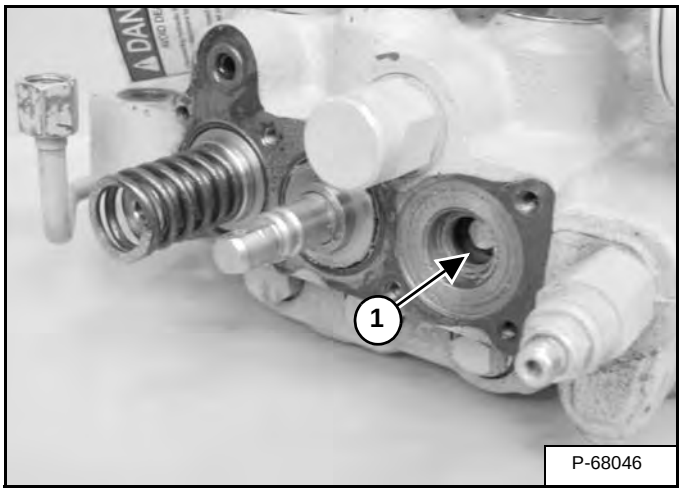
Lift Spool And Detent Removal And Installation (Cont'd)

Figure 20-41-58



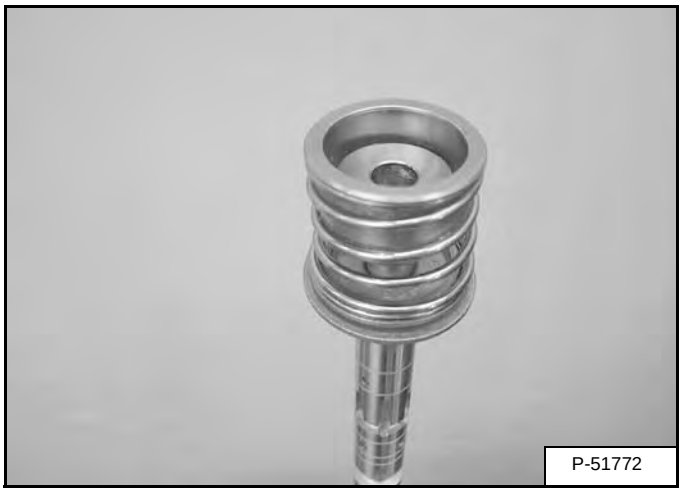
Remove the lift spool assembly and seal (Item 1) **[Figure 20-41-58]** from the control valve.

Figure 20-41-59



Remove the lift spool seal (Item 1) **[Figure 20-41-59]** from the linkage end of the valve.

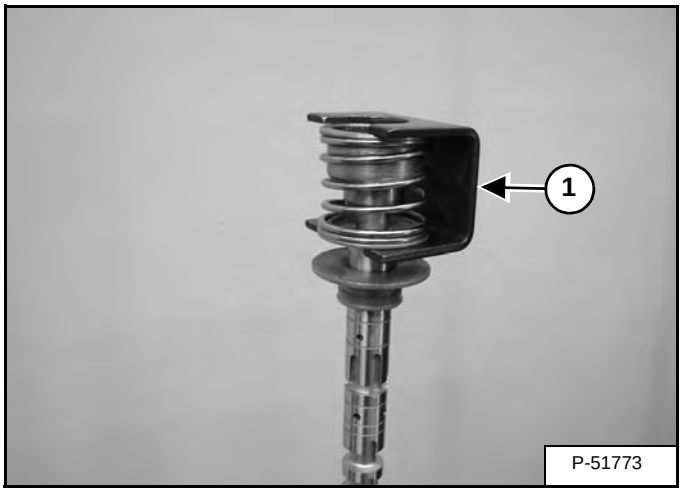
Figure 20-41-60



Clamp the linkage end of the spool in a vise **[Figure 20-41-60]**.

NOTE: Protect spool before clamping in vise.

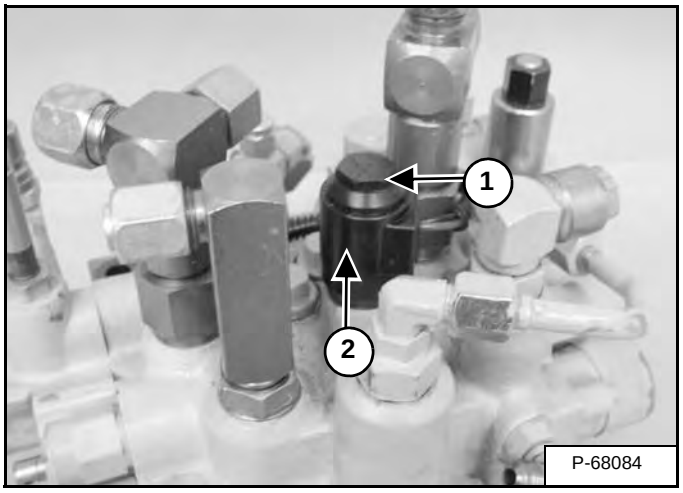
Figure 20-41-61



Install the spring tool (Item 1) **[Figure 20-41-61]** over the centering spring.

Solenoid Removal And Installation

Figure 20-41-93

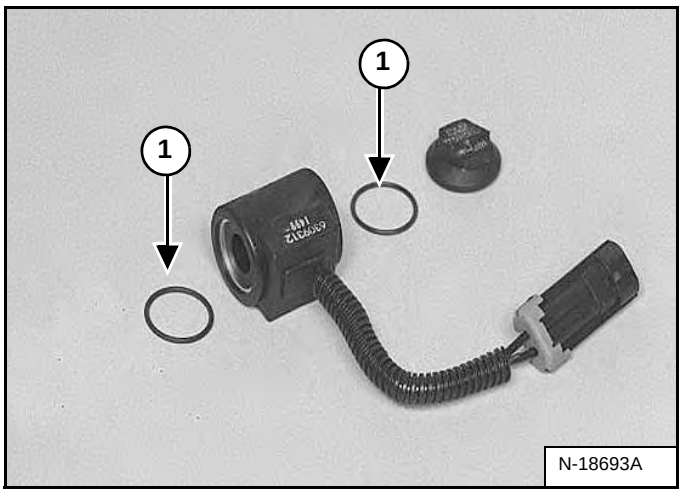


Remove the nut (Item 1) **[Figure 20-41-93]** from the solenoid stem.

Installation: Tighten the nut to 6 N•m (53 in-lb) torque.

Remove the solenoid coil (Item 2) **[Figure 20-41-93]**.

Figure 20-41-94

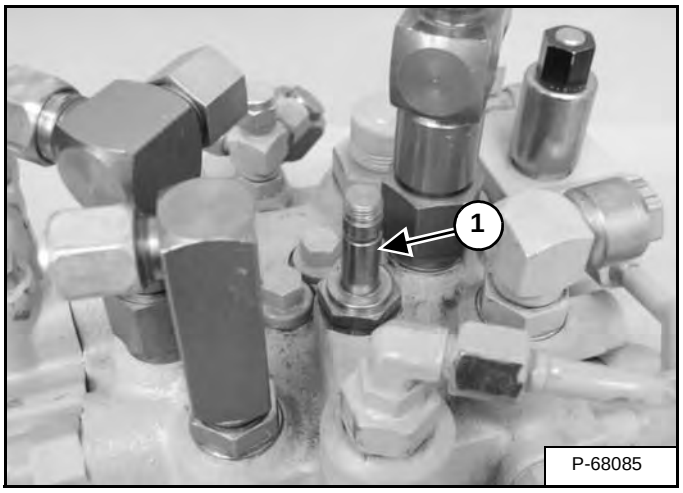


Remove the O-rings (Item 1) **[Figure 20-41-94]** from both ends of the solenoid coil.

Use an ohmmeter to measure the solenoid coil resistance.

The correct resistance for the coil is 9.79 ± 0.29 ohm.

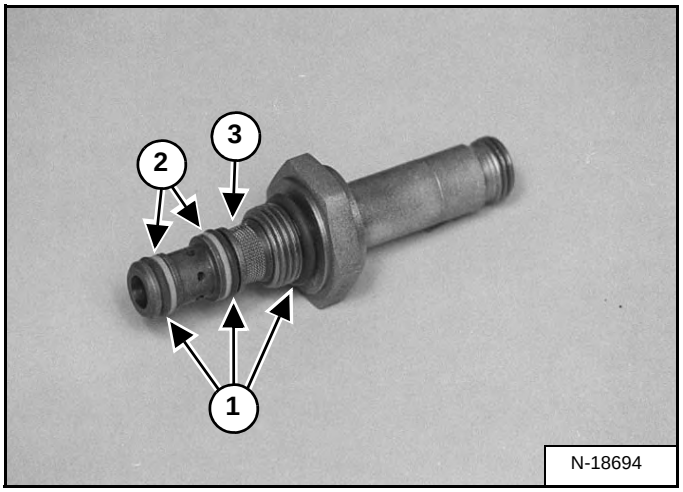
Figure 20-41-95



Remove the solenoid stem (Item 1) **[Figure 20-41-95]**.

Installation: Lubricate the O-rings and tighten the stem to 27 - 33 N•m (20 - 24 ft-lb) torque.

Figure 20-41-96



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-41-96]** from the stem.

Clean all parts in solvent and dry with compressed air.

Inspect all parts for wear and replace any showing excessive wear.

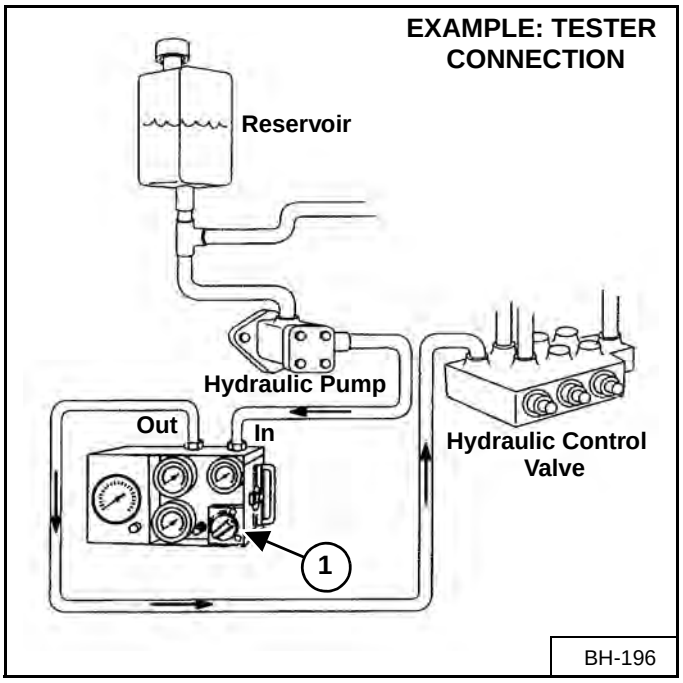
NOTE: The screen (Item 3) [Figure 20-41-96] may be cleaned with solvent. If it is torn or worn it needs to be replaced.

Use only new O-rings and apply oil to all O-rings and back-up rings before installation.

Install new O-rings (Item 1) **[Figure 20-41-94]** and **[Figure 20-41-96]** and new back-up rings (Item 2) **[Figure 20-41-96]** on the solenoid stem.

Direct Pump Test (Standard Section) (Cont'd)

Figure 20-60-4



Sample tester connection shown **[Figure 20-60-4]**.

Start the engine and run at low idle rpm. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full rpm*.

Warm the fluid to 60°C (140°F) by turning the restrictor control (Item 1) **[Figure 20-60-4]** on the tester to about 6895 kPa (69 bar) (1000 psi). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (U.S. gpm) at full rpm*.

Push the maximum / variable flow switch (on the remote start tool) to engage the front auxiliary hydraulics, the light will come ON. Push the button (on the right control lever) for fluid flow to the quick coupler (fluid pressure will go over main relief). Record the highest pressure (psi) and flow (U.S. gpm). The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (U.S. gpm)}}{\text{FREE FLOW (U.S. gpm)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full rpm.

Disassembly And Assembly (Cont'd)

Figure 20-60-27

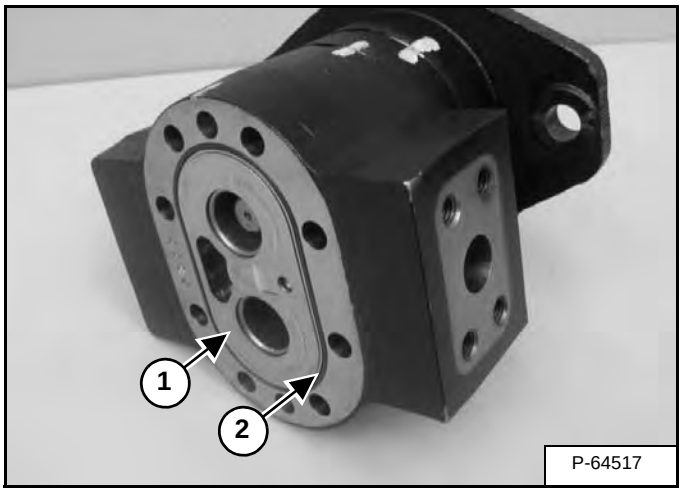
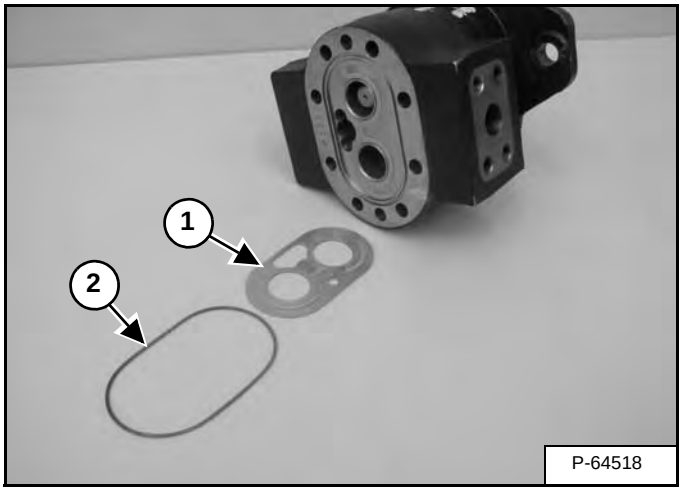


Figure 20-60-28



Remove the wear plate (Item 1) and O-ring (Item 2) **[Figure 20-60-27]** and **[Figure 20-60-28]** from the pump center section. Inspect for damage and replace as needed.

NOTE: Position wear plate (Item 1) [Figure 20-60-28] inlets and traps as shown with bronze side toward gears.

Figure 20-60-29

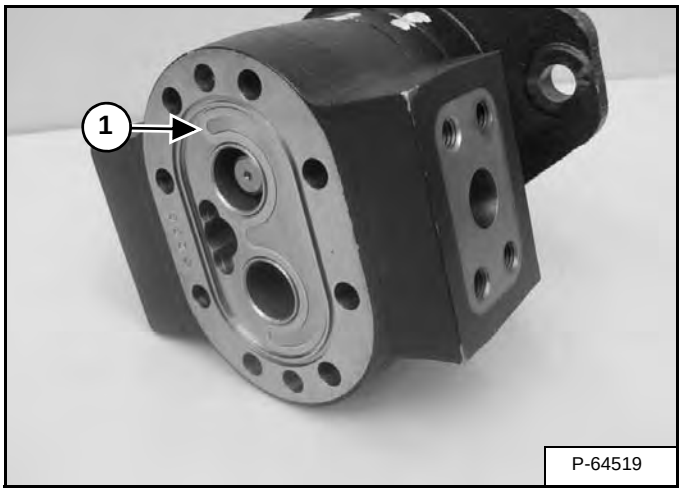
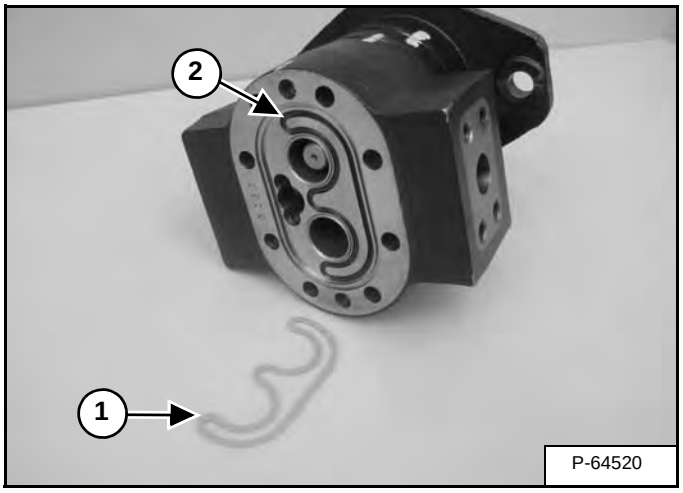


Figure 20-60-30

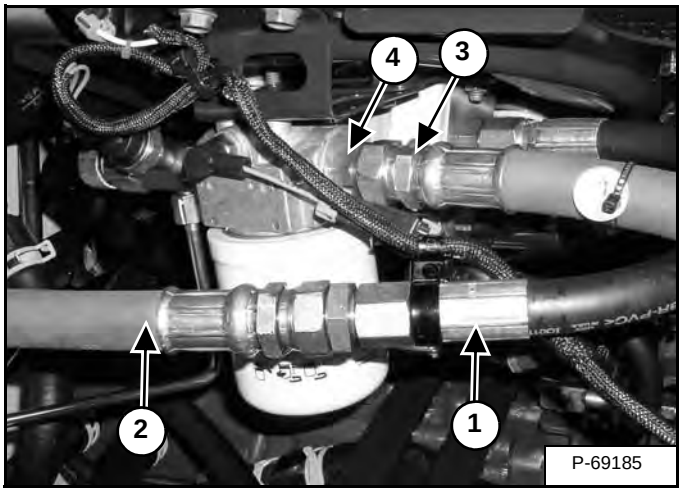


Remove the load seal (Item 1) **[Figure 20-60-29]** and **[Figure 20-60-30]**. Inspect for damage and replace as needed.

Remove the pre-load seal (Item 2) **[Figure 20-60-30]**.

Direct Pump Test (Charge Section) (Cont'd)

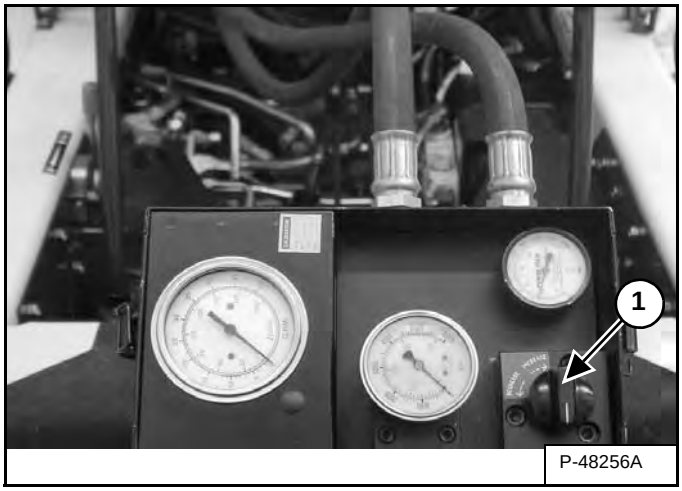
Figure 20-61-7



Connect the filter inlet hose (Item 1) to the inlet side of the tester (Item 2) **[Figure 20-61-7]**.

Connect the OUTLET hose (Item 3) from the hydraulic tester to the inlet fitting (Item 4) of the charge filter **[Figure 20-61-7]**.

Figure 20-61-8



Be sure all connections are tight and that the hoses are not touching any moving parts before starting the loader **[Figure 20-61-8]**.

IMPORTANT

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

I-2024-0284

Start the engine and run at low idle rpm. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full rpm*.

Warm the fluid to 60°C (140°F) by turning the restrictor control (Item 1) **[Figure 20-61-8]** on the tester to about 4137 kPa (41 bar) (600 psi). DO NOT exceed 8274 kPa (83 bar) (1200 psi). Open the restrictor control and record the free flow (U.S. gpm) at full rpm*.

Turn the restrictor down to system operating pressure approximately 6895 kPa (69 bar) (1000 psi). DO NOT EXCEED 8274 kPa (83 bar) (1200 psi). Refer to Hydraulic Schematics for flow. The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (U.S. gpm)}}{\text{FREE FLOW (U.S. gpm)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to the Hydraulic Schematics for pump flow and rpm.

Disassembly And Assembly (Cont'd)

Figure 20-61-31

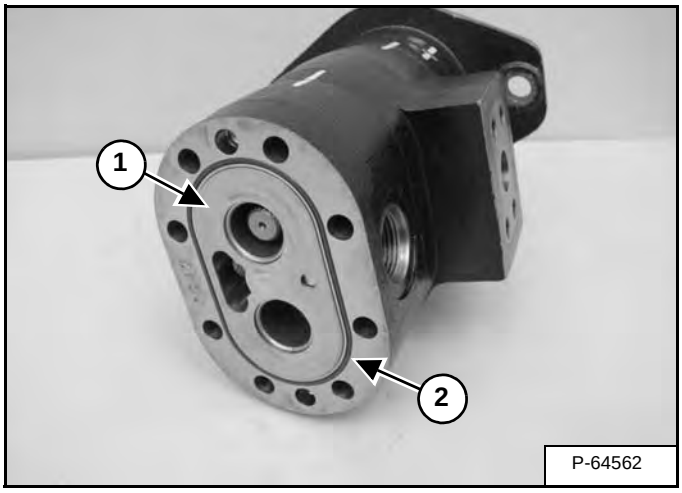
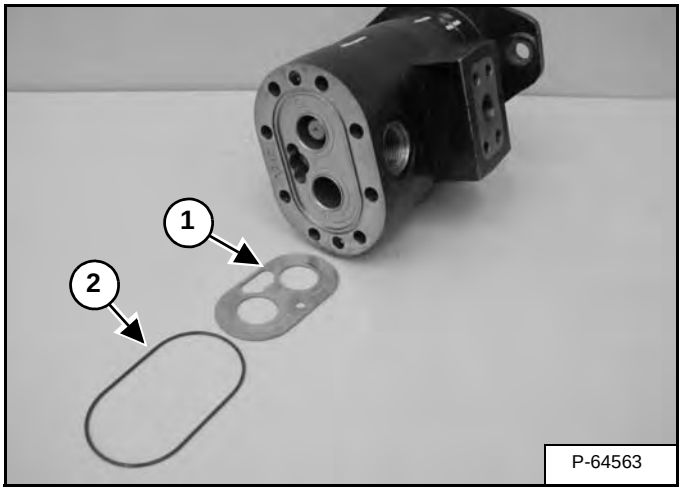


Figure 20-61-32



Remove the wear plate (Item 1) and O-ring (Item 2) **[Figure 20-61-31]** and **[Figure 20-61-32]** from the charge center section. Inspect for damage and replace as needed.

NOTE: Position wear plate (Item 1) [Figure 20-61-32] inlets and traps as shown with bronze side toward gears.

Figure 20-61-33

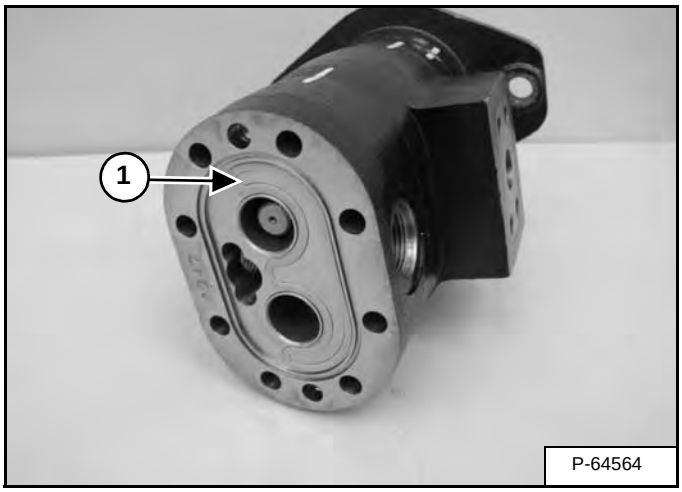
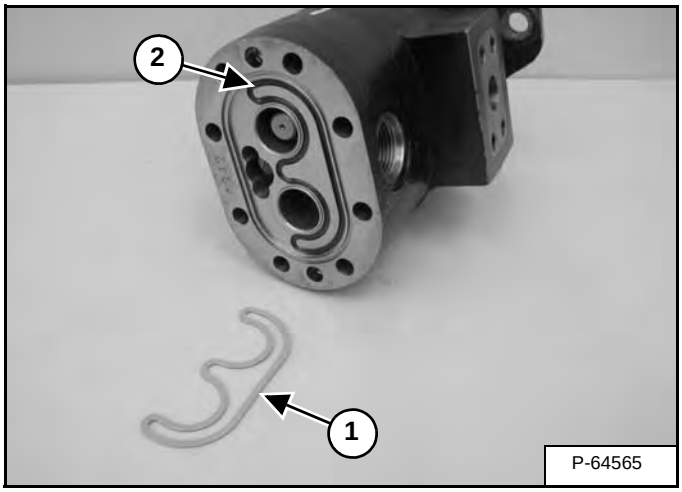


Figure 20-61-34



Remove the load seal (Item 1) **[Figure 20-61-33]** and **[Figure 20-61-34]**. Inspect for damage and replace as needed.

Remove the pre-load seal (Item 2) **[Figure 20-61-34]**.

HYDRAULIC PUMP (SJC)

Description

The hydraulic gear pump is attached to the end of the hydrostatic pumps and is located on the right side of the loader between the hydraulic control valve and the engine.

The hydraulic gear pump is a combination of gear pumps that provide hydraulic flow to several hydraulic systems.

The hydraulic gear pump has a dedicated charge pump. This supplies flow to the hydraulic fan motor and charge pressure to the hydrostatic pump.

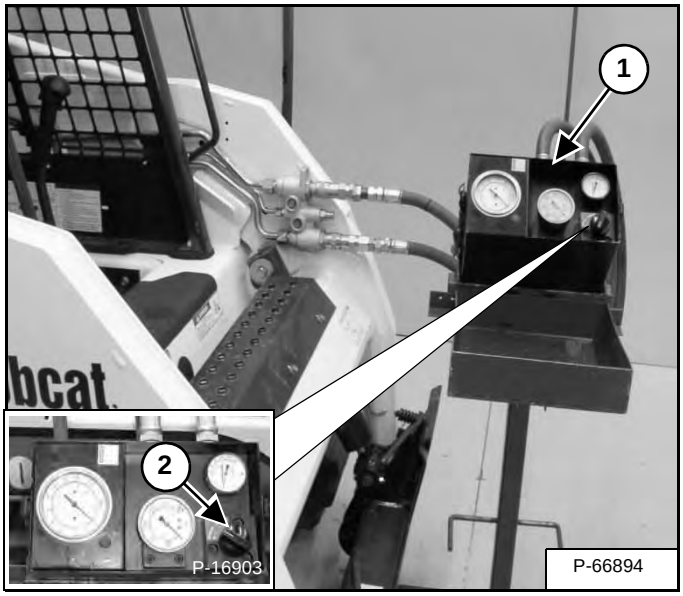
A seal kit is available to service the hydraulic pump. If any of the main components of the pump are damaged, the entire pump must be replaced.

Pump Test At Quick Couplers

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

MEL10003 - In-Line Hydraulic Tester
MEL10006 - Flow Meter Fitting Kit

Figure 20-70-1



NOTE: When testing the hydraulic flow of a machine, hoses must be at least 19,05 mm (0.75 in) in diameter and connected directly to the hydraulic tester without using any type of "quick coupler" on the connection to the tester. Also make sure your hydraulic tester is capable of at least 189 L/min (50 U.S. gpm).

Install a hydraulic tester (Item 1) **[Figure 20-70-1]** onto the front auxiliary quick couplers.

This procedure will require a operator in the cab and one operator running the tester.

Start the engine and run at low idle rpm. Press the Front Auxiliary button. Engage the front auxiliary with the trigger on the right handle. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full rpm*.

Warm the fluid to 60°C (140°F) by turning the restrictor control clockwise on the tester so it reads about a 6895 kPa (69 bar) (1000 psi).

NOTE: DO NOT EXCEED 22753 kPa (228 bar) (3300 psi).

Turn the restrictor control (Item 2) **[Figure 20-70-1]** on the tester counterclockwise to obtain free flow, the flow should be approximately 61 - 64 L/min (16 - 17 U.S. gpm). Start turning the restrictor clockwise, causing more restriction on the flow. The U.S. gpm should drop off slightly until the pressure reaches approximately 19305 kPa (193 bar) (2800 psi). At approximately 19305 kPa (193 bar) (2800 psi) the flow should start decreasing rapidly until the pressure reaches 22408 - 22753 kPa (224 - 228 bar) (3250 - 3300 psi). At 22408 - 22753 kPa (224 - 228 bar) (3250 - 3300 psi) the flow should be at 0 L/min (0 U.S. gpm). Turn the restrictor (Item 2) **[Figure 20-70-1]** counterclockwise to free flow. Shut the front auxiliary hydraulics off.

If flow and pressure specs are not obtained, go to Direct Pump Testing. (See Direct Pump Test (Standard Section) on Page 20-70-2.)

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full rpm.

Disassembly And Assembly (Cont'd)

Figure 20-70-19

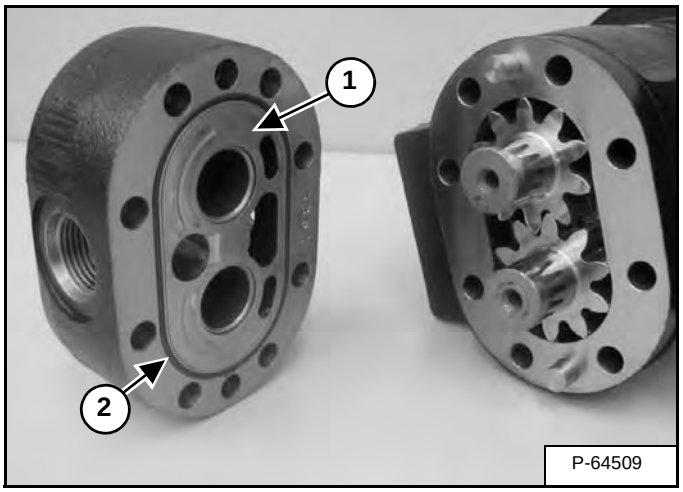
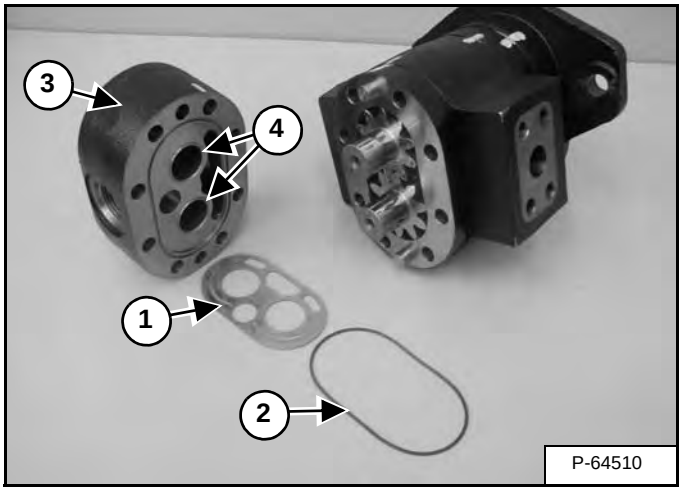


Figure 20-70-20



Remove the wear plate (Item 1) and section seal (Item 2) **[Figure 20-70-19]** and **[Figure 20-70-20]** from the pump end section.

NOTE: Position wear plate (Item 1) [Figure 20-70-20] inlets and traps as shown with bronze side toward gears.

NOTE: Inspect the pump end section (Item 3) [Figure 20-70-20] and bushings (Item 4) [Figure 20-70-20]. If excessive wear or damage is visible, the pump must be replaced.

Figure 20-70-21

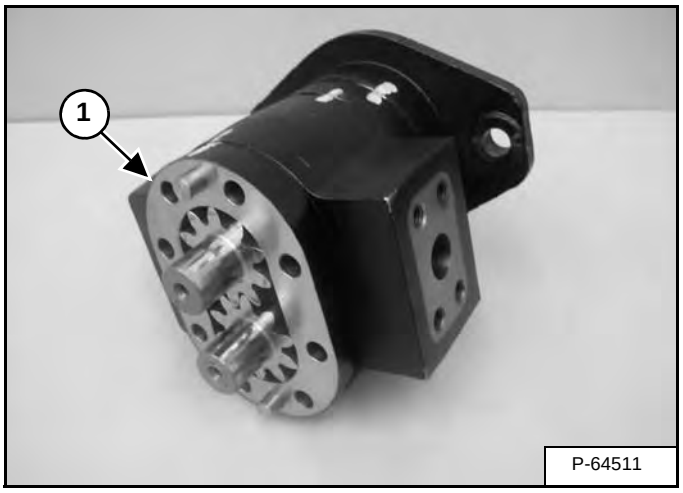
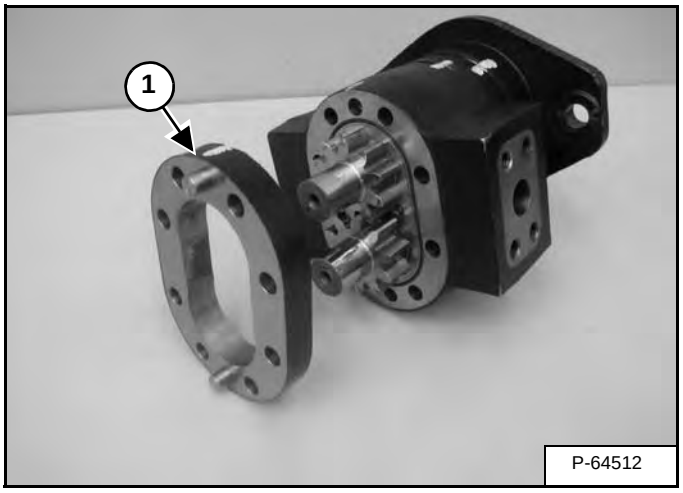


Figure 20-70-22

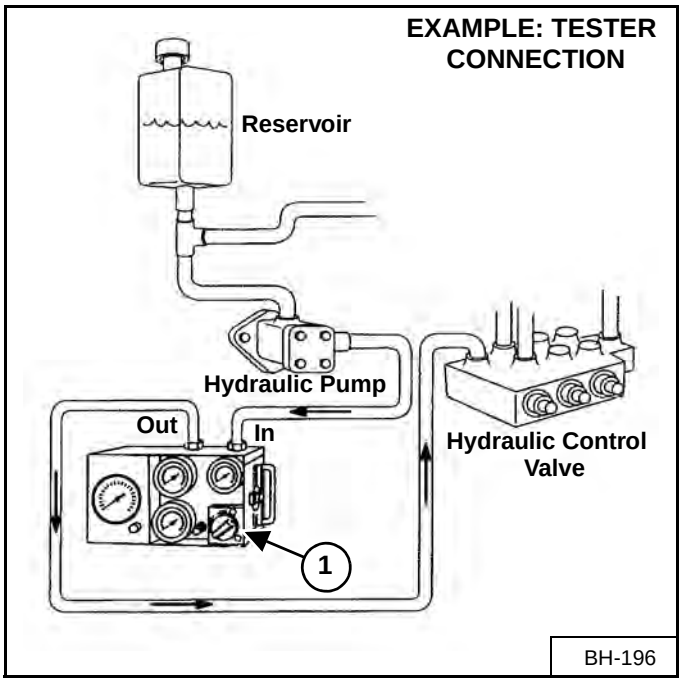


Remove the charge pump section (Item 1) **[Figure 20-70-21]** and **[Figure 20-70-22]** from the pump center section.

NOTE: Inspect the pump section (Item 1) [Figure 20-70-22]. If excessive wear or damage is visible, the pump must be replaced.

Direct Pump Test (Standard Section) (Cont'd)

Figure 20-71-4



Sample tester connection shown **[Figure 20-71-4]**.

Start the engine and run at low idle rpm. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full rpm*.

Warm the fluid to 60°C (140°F) by turning the restrictor control (Item 1) **[Figure 20-71-4]** on the tester to about 6895 kPa (69 bar) (1000 psi). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (U.S. gpm) at full rpm*.

Push the maximum / variable flow switch (on the remote start tool) to engage the front auxiliary hydraulics, the light will come ON. Push the button (on the right control lever) for fluid flow to the quick coupler (fluid pressure will go over main relief). Record the highest pressure (psi) and flow (U.S. gpm). The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (U.S. gpm)}}{\text{FREE FLOW (U.S. gpm)}} \times 100$$

A low percentage may indicate a failed pump.

*Refer to (See Hydraulic System on Page SPEC-10-3.) for system relief pressure and full rpm.

Disassembly And Assembly (Cont'd)

Figure 20-71-24

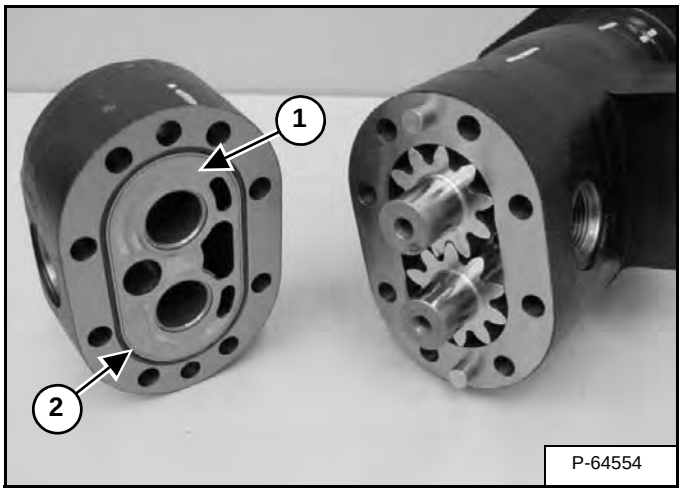
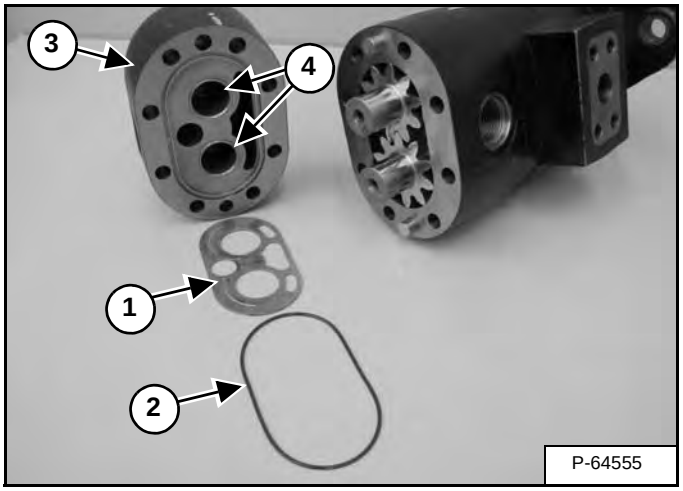


Figure 20-71-25



Remove the wear plate (Item 1) and O-ring (Item 2) **[Figure 20-71-24]** and **[Figure 20-71-25]** from the high flow end section.

NOTE: Position wear plate (Item 1) [Figure 20-71-25] inlets and traps as shown with bronze side toward gears.

NOTE: Inspect the high flow end section (Item 3) and bushings (Item 4) [Figure 20-71-25]. If excessive wear or damage is visible, the pump must be replaced.

Figure 20-71-26

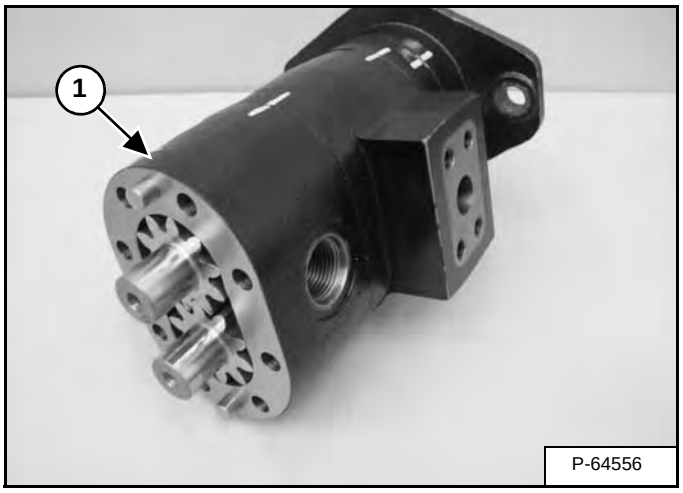
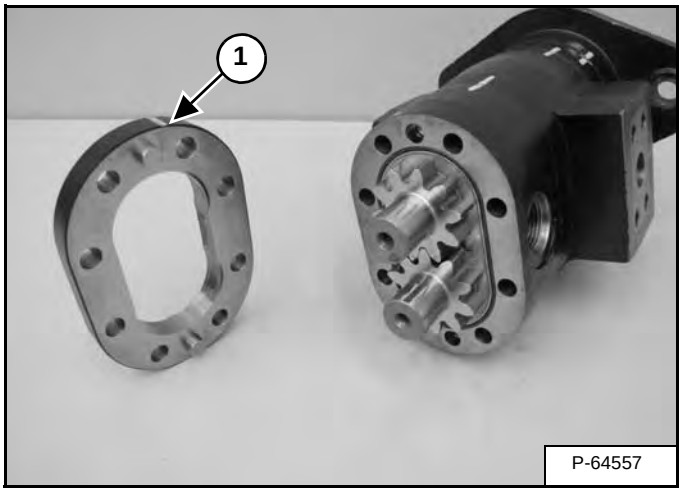


Figure 20-71-27

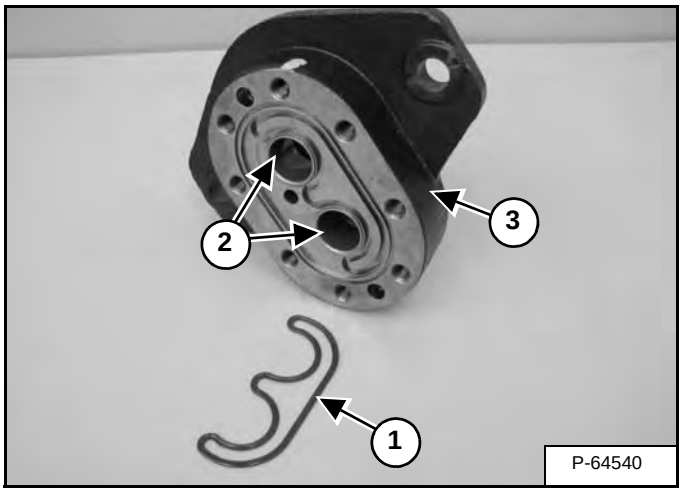


Remove the high flow pump section (Item 1) **[Figure 20-71-26]** and **[Figure 20-71-27]** from the charge center section.

NOTE: Inspect the high flow pump section (Item 1) [Figure 20-71-27]. If excessive wear or damage is visible, the pump must be replaced.

Disassembly And Assembly (Cont'd)

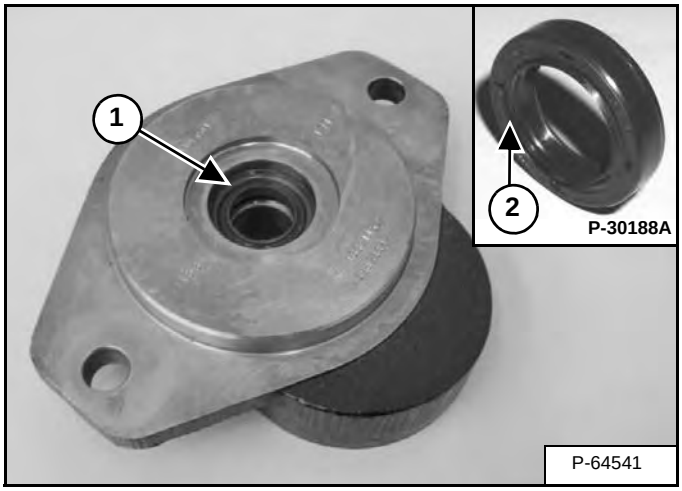
Figure 20-71-64



Inspect the pre-load seal (Item 1) **[Figure 20-71-64]** for damage and replace as needed.

NOTE: Inspect the pump flange section (Item 2) and bushings (Item 3) [Figure 20-71-64]. If excessive wear or damage is visible, the pump must be replaced.

Figure 20-71-65



Remove the shaft seal (Item 1) **[Figure 20-71-65]** from the pump flange section.

Installation: The shaft seal flush surface (Item 2) **[Figure 20-71-65]** must be facing out away from the pump.

OIL COOLER

Description

The oil cooler is used to cool the loaders hydraulic and hydrostatic oil. Oil passages are coiled into a heat exchanger. Air is forced, with the cooling fan, around the passages cooling the oil.

The oil cooler is located underneath the rear grille between the A/C condenser (if so equipped) and the radiator.

REAR AUXILIARY DIVERTER VALVE

Description

The rear auxiliary diverter valve is an optional valve that diverts oil from the front auxiliary circuit to two sets of rear auxiliary couplers or the right side auxiliaries. The couplers are used for rear mounted attachments.The right side auxiliaries are used for older attachments.

The rear couplers are located, one set on each side of the rear frame uprights.

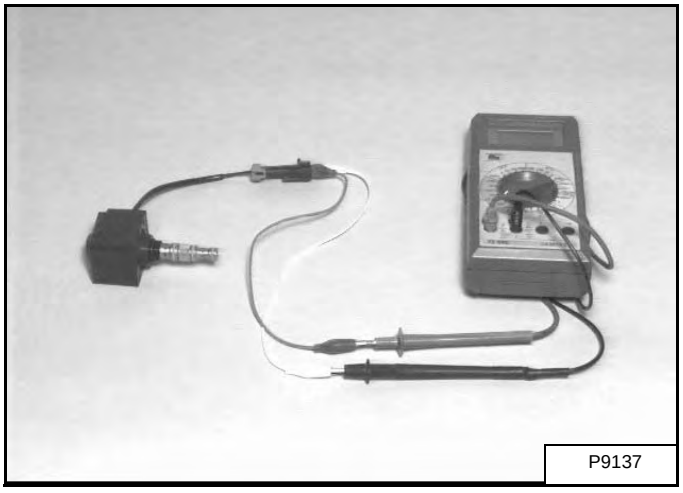
The right side auxiliaries are located on the inside of the right side lift arm at the front of the machine.

The rear auxiliary valve is located on the right side of the machine behind the blower housing. The valve is accessed by remove a panel on the right side of the machine.

See Hydraulic Schematic for more circuit information. (See HYDRAULIC SYSTEM INFORMATION on Page 20-10-1.)

Solenoid Testing

Figure 20-120-1



Use a test meter to measure coil resistance **[Figure 20-120-1]**. Coil wires do not have polarity. Correct resistance is 8.6 - 9.5 ohm @ 68 degrees Fahrenheit.

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

BOB-TACH® (POWER) BLOCK

Description

The power Bob-Tach® block is an option that allows the operator to hydraulically control the Bob-Tach® levers for mounting and dismounting the attachments.

The power Bob-Tach® is operated by a switch on the front console.

The power Bob-Tach® block is mounted on the right side of the machine in front of the engine on the backside of the hydraulic gear pump.

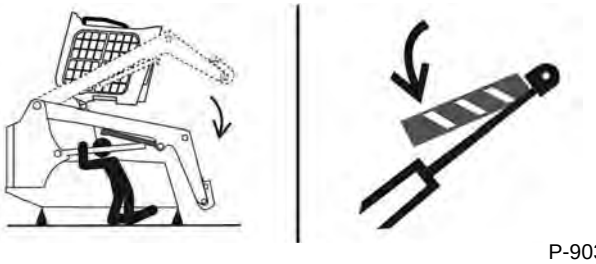
Removal And Installation

WARNING

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

W-2059-0598

DANGER



P-90328

AVOID DEATH

- **Disconnecting or loosening any hydraulic tubeline, hose, fitting, component or a part failure can cause lift arms to drop.**
- **Keep out of this area when lift arms are raised unless supported by an approved lift arm support. Replace if damaged.**

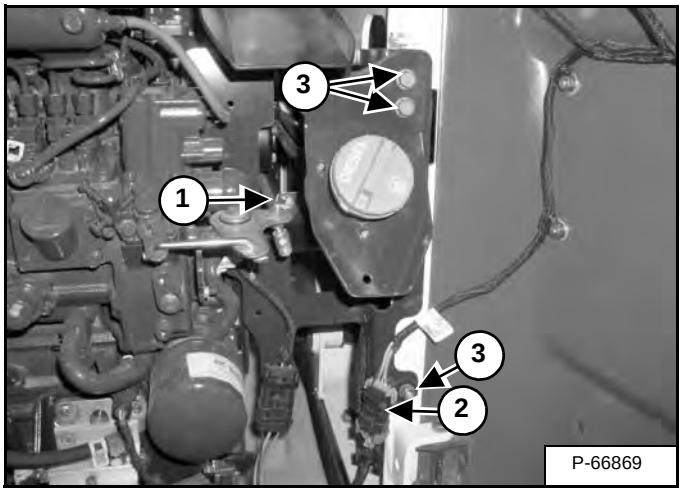
D-1009-0409

IMPORTANT

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

I-2003-0888

Figure 20-130-1



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

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Open the rear door.

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

Remove the nut from the speed control linkage (Item 1) and unplug the rear lights electrical connector (Item 2) **[Figure 20-130-1]**.

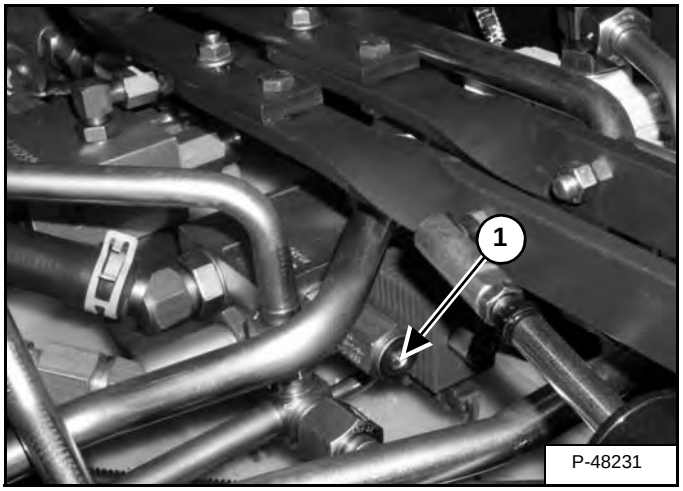
Remove the fuel fill bracket mounting bolts (Item 3) **[Figure 20-130-1]**.

HIGH FLOW VALVE (CONT'D)

High Flow Relief Valve Adjustment

NOTE: The high flow relief valve is located between the control valve and the hydraulic reservoir.

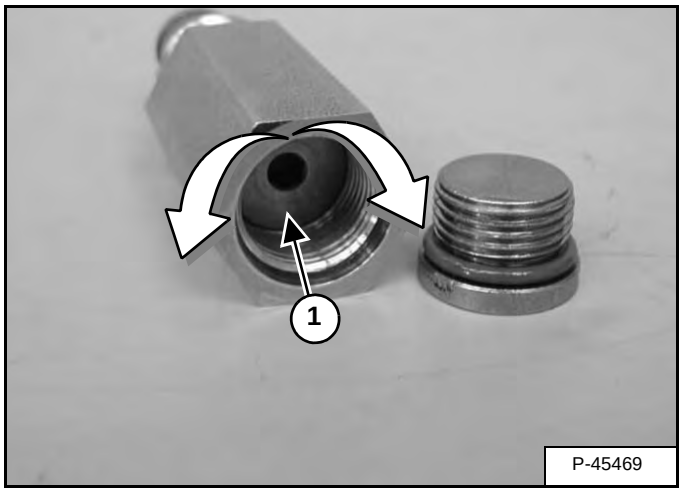
Figure 20-150-4



If the relief pressure is not correct, stop the engine and raise the operator cab. (See Raising on Page 10-30-2.)

Remove the high flow relief valve adjustment plug (Item 1) **[Figure 20-150-4]**.

Figure 20-150-5



To increase the high flow relief valve psi turn the screw (Item 1) **[Figure 20-150-5]** 90° clockwise and recheck the high flow relief valve. (1/4 turn equals approximately 1379 kPa (14 bar) (200 psi).)

To decrease the high flow relief valve psi turn the screw (Item 1) **[Figure 20-150-5]** 90° counterclockwise and recheck the high flow relief valve. (1/4 turn equals approximately 1379 kPa (14 bar) (200 psi).)

NOTE: If the relief screw (Item 1) [Figure 20-150-5] has been turned in 1/4 turn and the pressure remains the same, remove and inspect the high flow relief valve, replace as needed.

Install the plug into the high flow relief valve.

Solenoid Testing

Figure 20-150-6

Use a test meter to measure coil resistance **[Figure 20-150-6]**. Coil terminals do not have polarity. Correct resistance for the pressure relief coil is 7.5 ohm.

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

HYDROSTATIC DRIVE MOTOR

Description

The hydrostatic motors are driven by high pressure from the hydrostatic pumps.

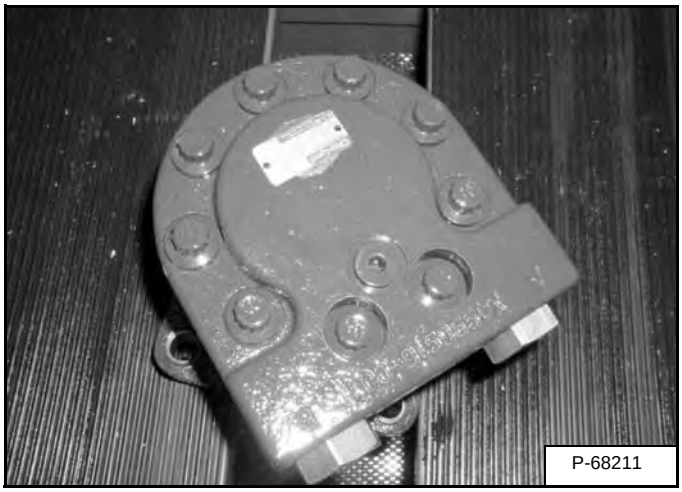
In this system there is a case drain filter for each motor to filter the excess low pressure oil before the oil enters the hydraulic reservoir.

There are two hydrostatic motors mounted to motor carriers. The motor carriers are mounted to the transmission tub which houses the drive chains.

The hydrostatic motors do not have an internal brake.

Inside the endcap of the hydrostatic motor, there is a shuttle valve. The shuttle valve helps to keep the motor cool by mixing case drain oil with cooled low pressure oil from the charge circuit. The shuttle valve is shifted by the high pressure oil coming from the hydrostatic pumps. If the shuttle valve sticks, a delay or lack of drive may or may not be felt in the controls and / or an overheated hydrostatic motor will result.

Figure 30-20-1



HYDROSTATIC DRIVE MOTOR (TWO-SPEED)

Description

The hydrostatic motors are driven by high pressure from the hydrostatic pumps.

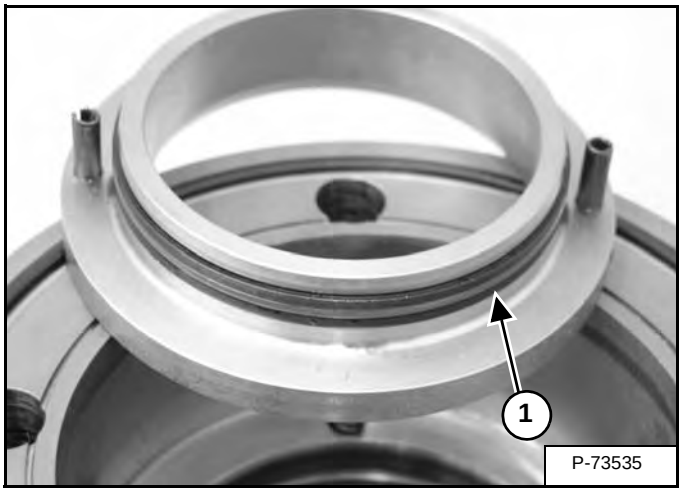
In this system there is a case drain filter for filtering the excess low pressure oil before the oil enters the hydraulic reservoir.

The hydrostatic motor contains a shuttle valve. The shuttle valve helps to keep the motor cool by mixing drive loop return oil with cooled low pressure oil from the charge circuit. The shuttle valve is shifted by the high pressure oil coming from the hydrostatic pumps. If the shuttle valve sticks, a delay or lack of drive may or may not be felt in the controls and / or an overheated hydrostatic motor will result.

There are two hydrostatic motors mounted to motor carriers. The motor carriers are mounted to the transmission chaincase which houses the drive chains.

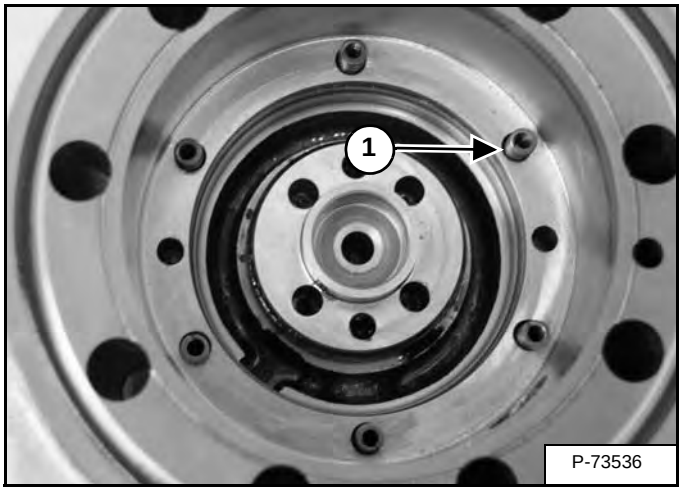
Disassembly (Cont'd)

Figure 30-21-26



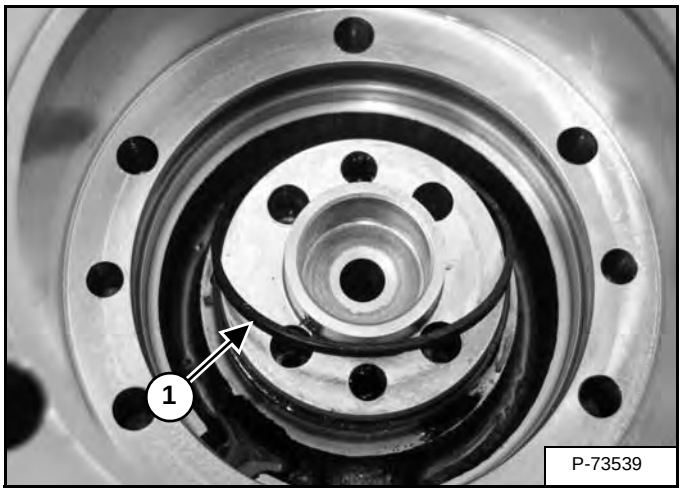
Remove and discard the O-ring and two back-up rings (Item 1) **[Figure 30-21-26]** from the outer balance ring.

Figure 30-21-27



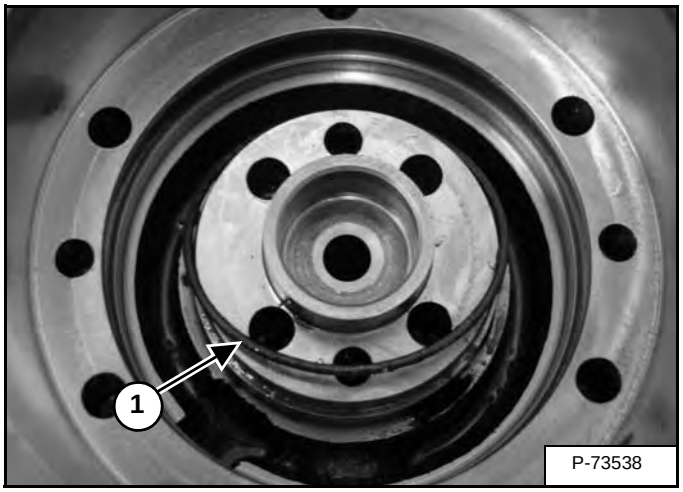
Remove the six compression springs (Item 1) **[Figure 30-21-27]** and inspect for damage.

Figure 30-21-28



Remove and discard the back-up ring (Item 1) **[Figure 30-21-28]** from the valve housing.

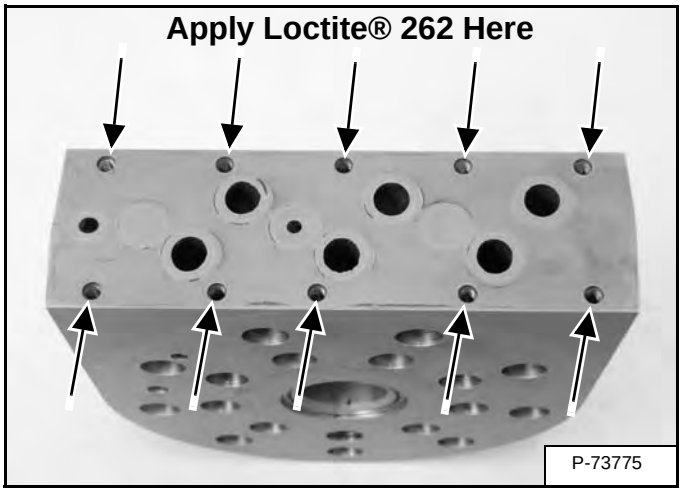
Figure 30-21-29



Remove and discard the O-ring (Item 1) **[Figure 30-21-29]** from the valve housing.

Assembly (Cont'd)

Figure 30-21-64



NOTE: Before assembling the new gasket, the spool housing, or the screws, remove any old thread sealer from the threaded holes.

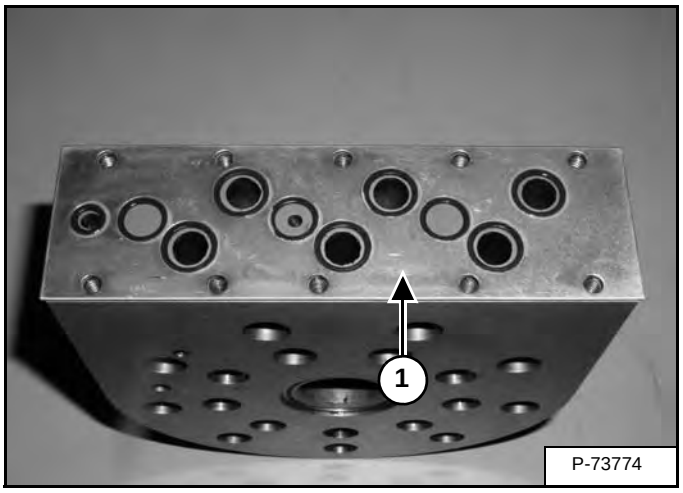
Put a VERY SMALL amount of Loctite® 262 into each of the ten threaded holes of the selector plate. DO NOT put Loctite® on the screw threads **[Figure 30-21-64]**.

Remove any trapped air from below the Loctite®. Wipe any excess Loctite® from the selector plate surface.

NOTE: If too much Loctite® is applied and any trapped air is not removed, it can pool in the bottom of the threaded holes. This can prevent the screws from reaching full thread contact and the correct torque may not be reached.

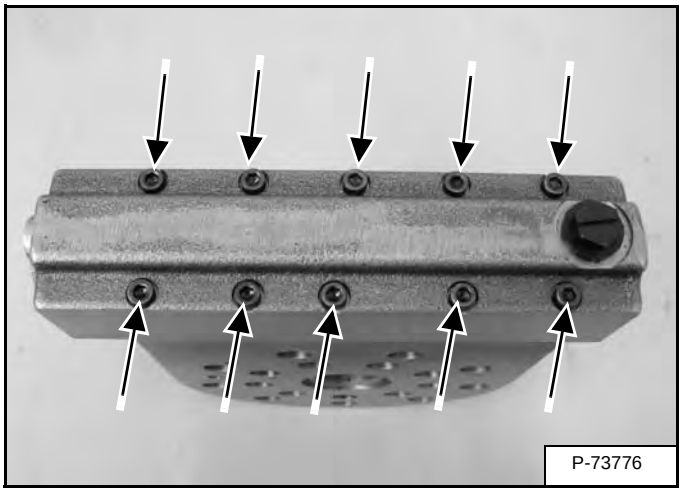
NOTE: Installing the screws can force some of the Loctite® out of the holes and onto the selector plate surface. If any Loctite® gets between the new gasket and the selector plate it will create a poor seal. Be sure to wipe excess Loctite® from the surface.

Figure 30-21-65



Install the new gasket (Item 1) **[Figure 30-21-65]** onto the selector plate.

Figure 30-21-66



Install the ten screws **[Figure 30-21-66]** through the spool housing and into the selector plate.

HYDROSTATIC MOTOR CARRIER (SINGLE AND TWO-SPEED WITH MANUAL CONTROLS)

Description

The hydrostatic motor carrier is the mating connection from the hydrostatic drive motor to the transmission case.

The hydrostatic motor carrier contains a shaft that rotates on two tapered roller bearings. the shaft has two sprockets that turn the drive chains.

The hydrostatic motor carrier has a seal which isolates the chain case oil from the hydrostatic motor case drain oil.

A brake disk is installed on each hydrostatic motor carrier. The brake disk is mounted to the shaft in the motor carrier.

The hydrostatic motor carriers are made to fit on both the right or left hand side of the loader. There are two sets of mounting holes on each hydrostatic motor carrier to fasten the hydrostatic motors. One set for the left hand side and another set for the right hand side of the loader.

Figure 30-30-1

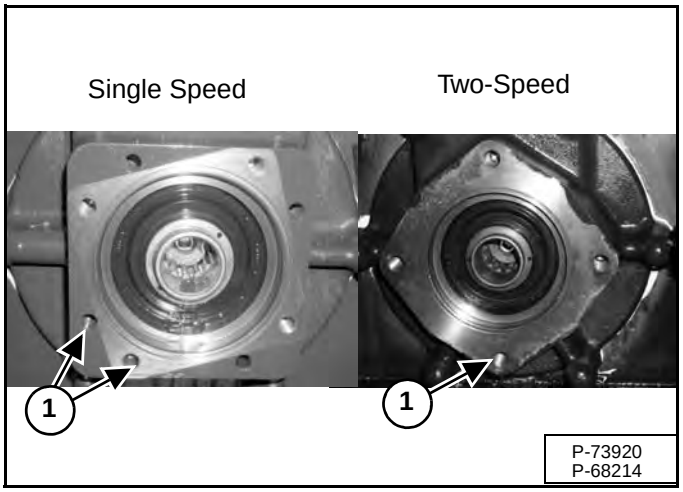
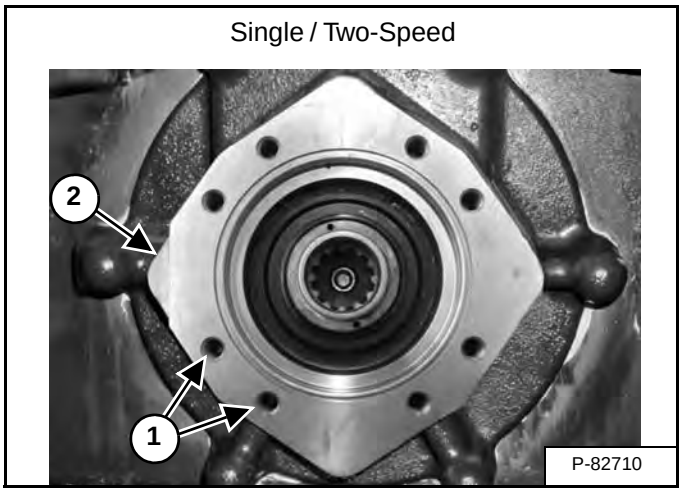


Figure 30-30-2

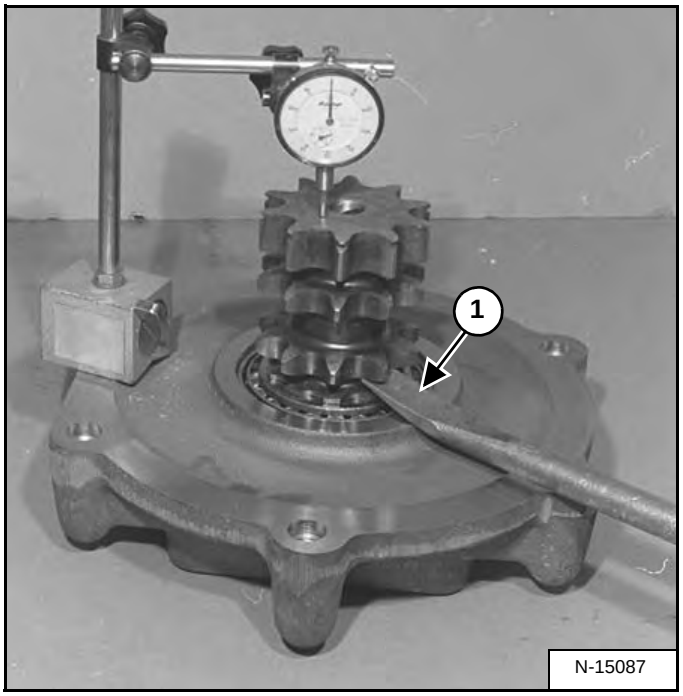


The motor carrier hydrostatic motor mounting holes (Item 1) **[Figure 30-30-1]** and **[Figure 30-30-2]** are the only difference between the single, two-speed and single / two-speed motor carriers with manual controls. The disassembly and assembly procedures are the same.

The single / two-speed motor carrier has a notch (Item 2) **[Figure 30-30-2]** removed from one side of the carrier.

Disassembly And Assembly (Cont'd)

Figure 30-30-27



Install a dial indicator as shown in Photo **[Figure 30-30-27]**.

Use a pry bar (Item 1) **[Figure 30-30-27]** to lift the carrier shaft and read the end play on the dial indicator.

The carrier shaft must turn freely with end play not to exceed 0,17 mm (0.007 in).

Disassembly And Assembly (Cont'd)

Figure 30-31-21

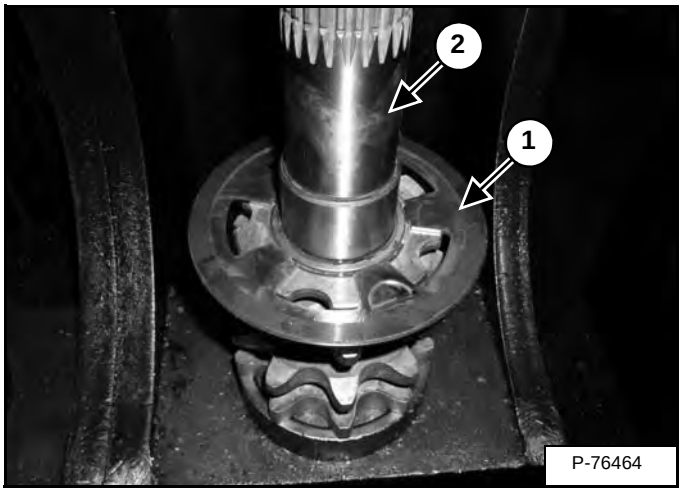
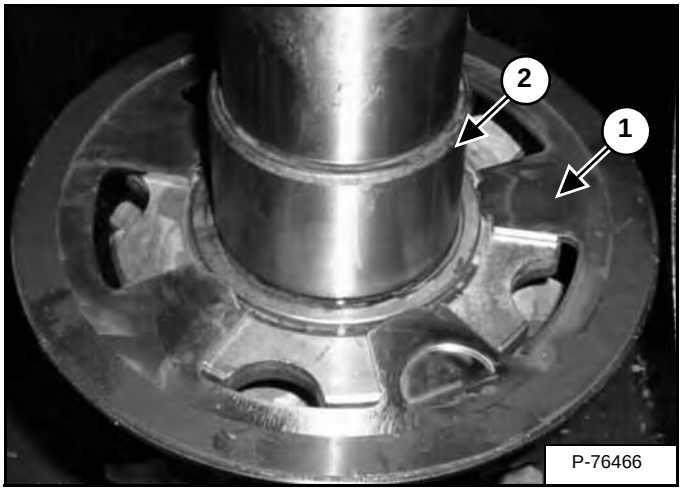


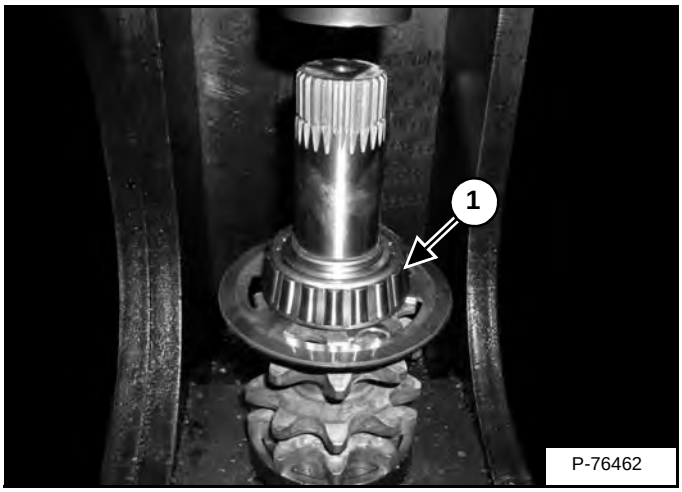
Figure 30-31-22



Install the sensor disc (Item 1) on the shaft (Item 2) **[Figure 30-31-21]** and **[Figure 30-31-22]**.

NOTE: Protrusion on disc to be aligned with pin area on sprocket.

Figure 30-31-23



Use the fabricated press tool and 76,2 mm (3.0 in) driver tool, install the new inner bearing (Item 1) **[Figure 30-31-23]** on the sprocket shaft as shown.

Remove the press and drive tools from the sprocket shaft.

Adjusting (Cont'd)

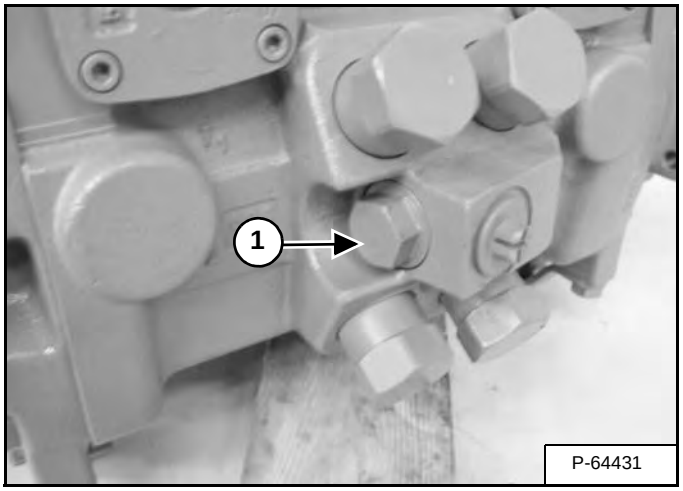
SJC Machines

IMPORTANT

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

I-2003-0888

Figure 30-40-14

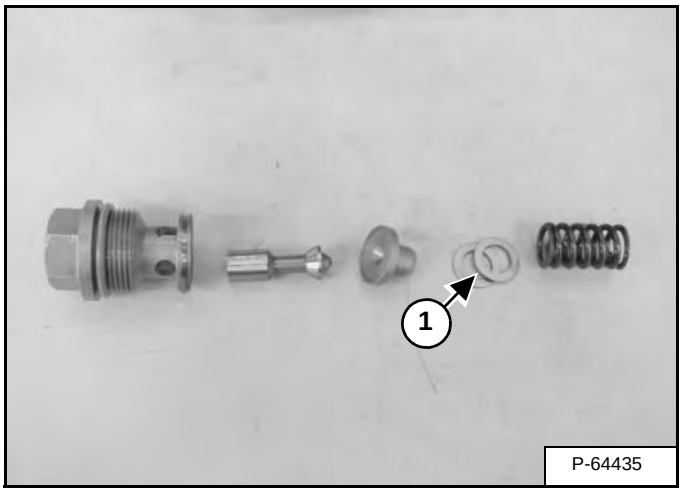


If the charge pressure is not correct remove the charge relief valve (Item 1) **[Figure 30-40-14]**.

NOTE: The pump has been removed for photo clarity. The charge pressure relief valve is located on the engine side of the hydrostatic pump when installed in the loader.

Assembly: Always use a new O-ring. Tighten the plug to 41 - 68 N•m (30 - 50 ft-lb) torque.

Figure 30-40-15



Check the poppet and spring for wear or damage.

Inspect the seat inside the hydrostatic pump case for wear or damage.

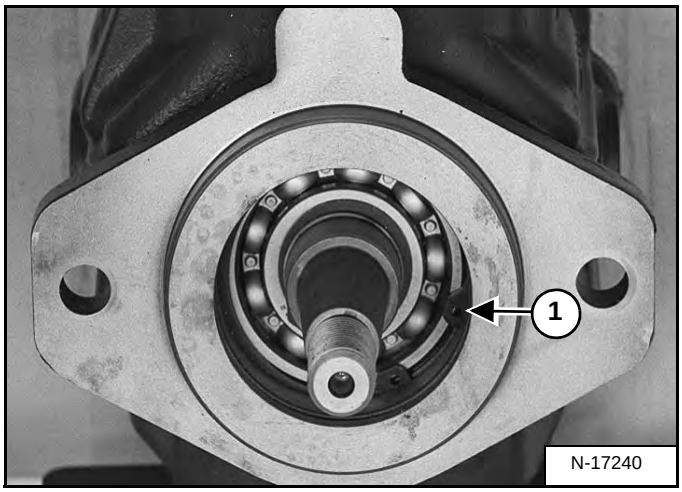
There are several different thickness of shims (Item 1) **[Figure 30-40-15]** used to adjust the charge pressure.

NOTE: 1,0 mm shim (Item 1) [Figure 30-40-15] = 300 kPa (3 bar) (43.5 psi) in pressure change. Adding shims increases charge pressure. Removing shims decreases charge pressure.

The charge pressure should be set at 2310 - 2654 kPa (23 - 27 bar) (335 - 385 psi).

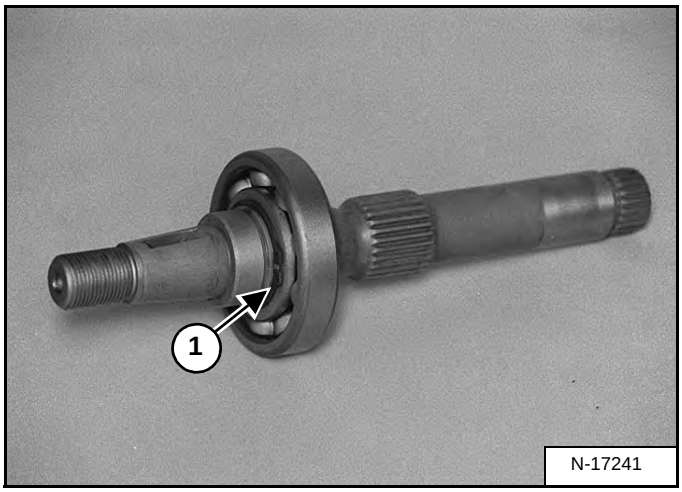
Disassembly (Cont'd)

Figure 30-50-19



Remove the snap ring (Item 1) **[Figure 30-50-19]** from the pump housing and remove the driveshaft and bearing from the housing.

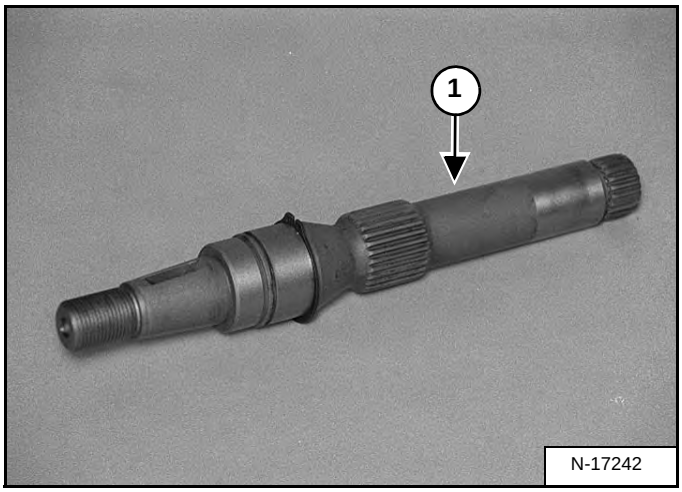
Figure 30-50-20



Remove the snap ring (Item 1) **[Figure 30-50-20]** from the driveshaft and remove the bearing.

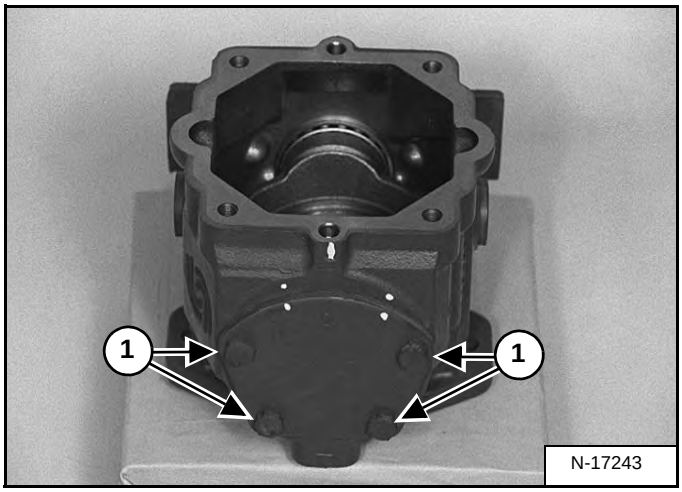
Check the bearing for wear and replace if worn.

Figure 30-50-21



Check the pump shaft (Item 1) **[Figure 30-50-21]** for wear and replace if needed.

Figure 30-50-22



Remove the four mount bolts (Item 1) **[Figure 30-50-22]** from the lower trunnion cover. Remove the cover.

HYDROSTATIC PUMP (SJC)

Description

The SJC hydrostatic pump is a fully proportional dual piston pump in one pump casing. The endcaps are removable to gain access to the rotating assemblies.

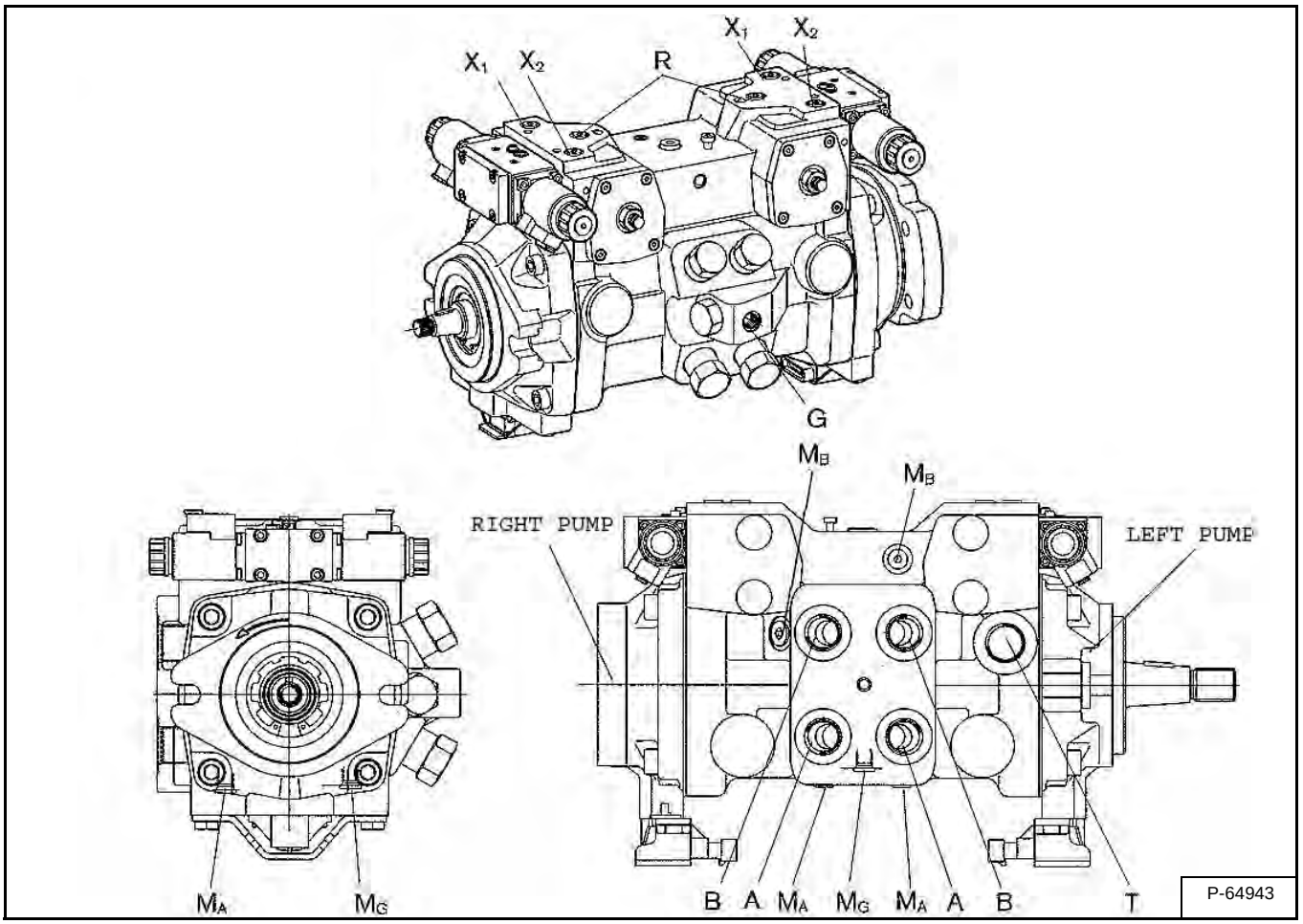
The hydraulic controllers are fed charge pressure from an external charge pump. 12 volt electrical solenoids shift a spool in the hydraulic controller that directs flow to a servo piston.

The servo piston strokes the swash plate in the rotating group. The rotating group generates flow to the A or B ports on the hydrostatic pump. The flow from the A and B ports is sent to the hydrostatic drive motors where forward or reverse drive motor rotation is obtained.

There are swash plate angle sensors on the bottom of the pump that monitor swash plate movement.

Ports are labeled on the hydrostatic pump casting.

Figure 30-51-1



A,B Service Line Ports (High Pressure Outlet Ports to Drive Motors)

T_1 Case Drain Port

M_A Operating Pressure of “A” Port

M_B Operating Pressure of “B” Port

R Air Bleed Port

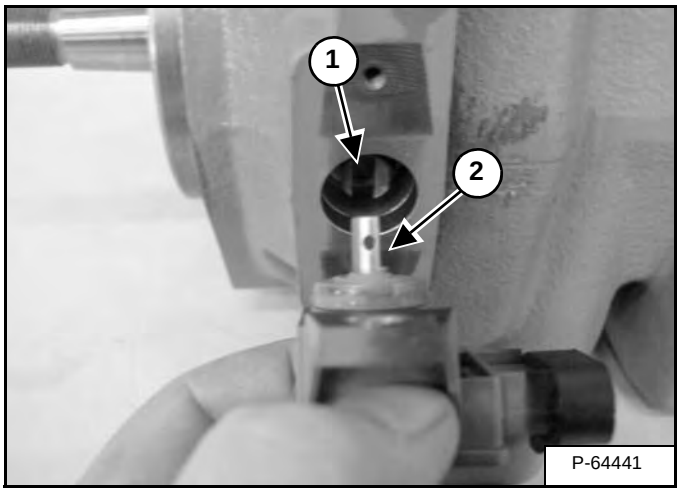
X_1,X_2 Control Pressure Gauge Port

G Charge Pressure Inlet Port

M_G Gauge Port For Charge Pressure

Disassembly And Assembly (Cont'd)

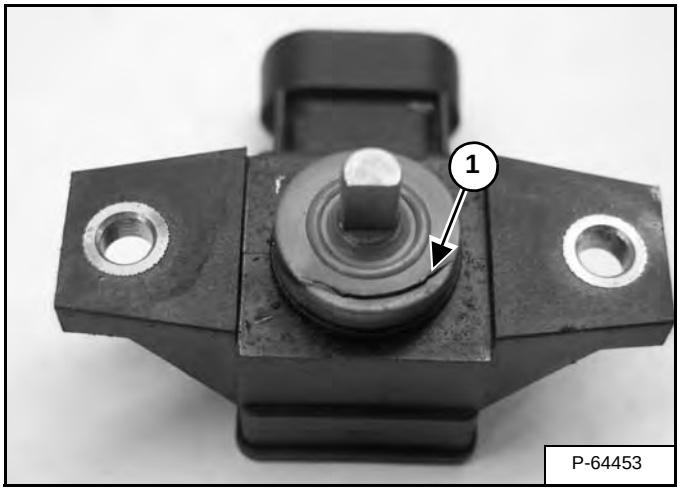
Figure 30-51-26



Assembly: Note the slotted portion (Item 1) of the positioning pin tightly fits the machined section on the swash plate angle sensor shaft (Item 2) **[Figure 30-51-26]**.

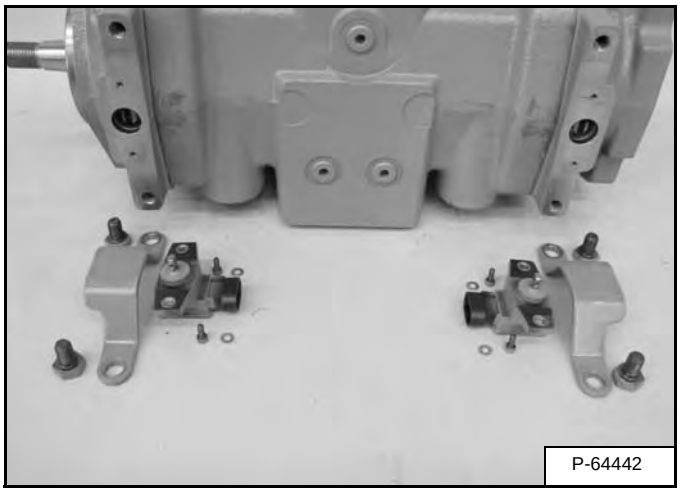
Note the machined section of the swash plate angle sensor shaft faces the center of the hydrostatic pump.

Figure 30-51-27



NOTE: Improperly installing the swash plate angle sensor, with the shaft facing toward the outside of the hydrostatic pump, will make it hard to install the sensor mounting bolts and also destroy the seal (Item 1) [Figure 30-51-27].

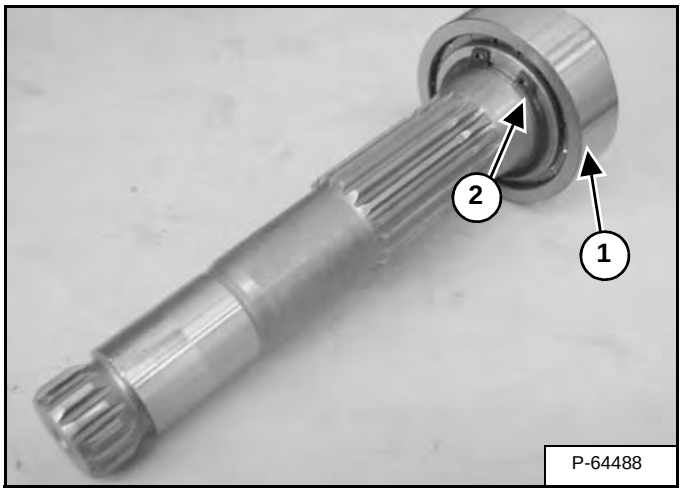
Figure 30-51-28



Both swash plate angle sensors and associated hardware removed from the hydrostatic pump. **[Figure 30-51-28]**.

Disassembly And Assembly (Cont'd)

Figure 30-51-61

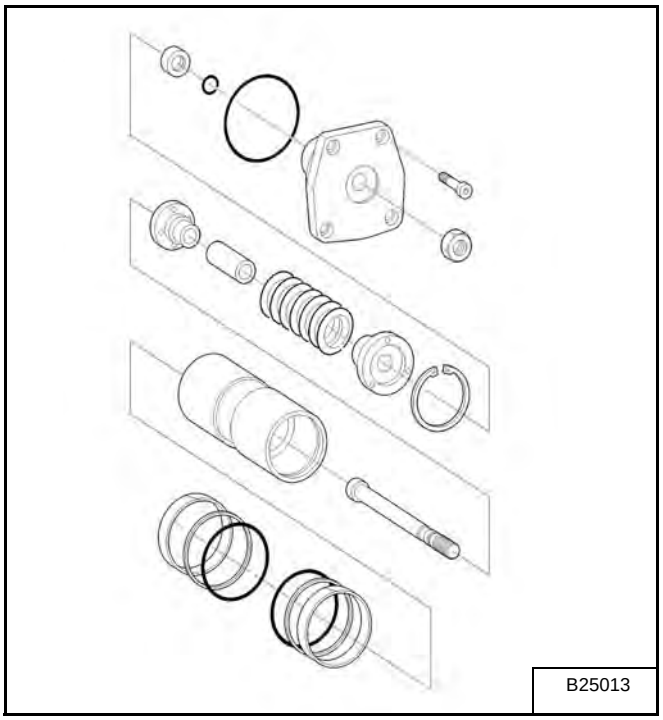


The drive shaft can be tapped out of the end housing with a rubber mallet.

Inspect wear surfaces for scratches, and inspect splines for excessive wear.

Inspect bearing (Item 1); if bearing needs replacement, remove snap ring (Item 2) **[Figure 30-51-61]** and remove bearing.

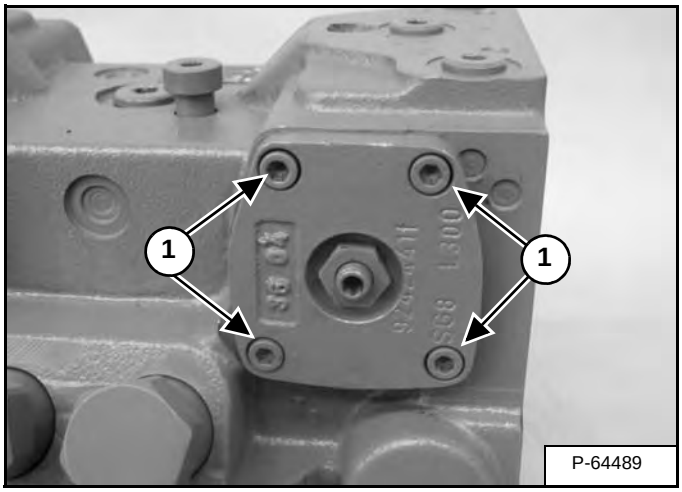
Figure 30-51-62



Servo Piston Assembly **[Figure 30-51-62]**.

The Servo Piston Assembly **[Figure 30-51-62]** cannot be removed unless the hydraulic controller and rotating group is removed first.

Figure 30-51-63

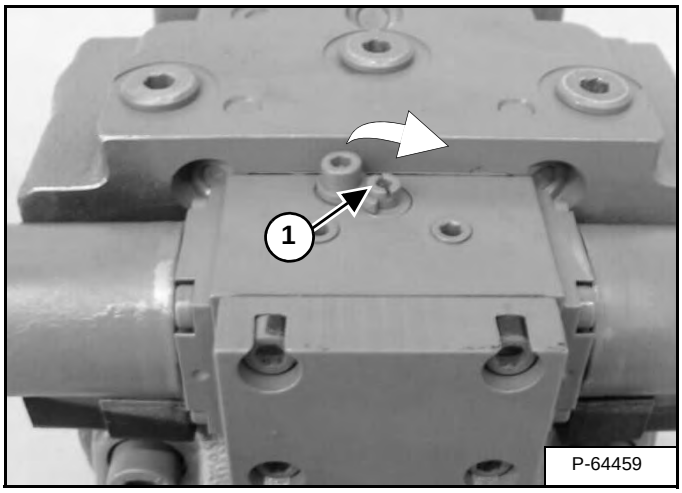


Remove servo piston mounting bolts (Item 1) **[Figure 30-51-63]**.

Installation: Tighten bolts to 10,4 N•m (7.7 ft-lb) torque.

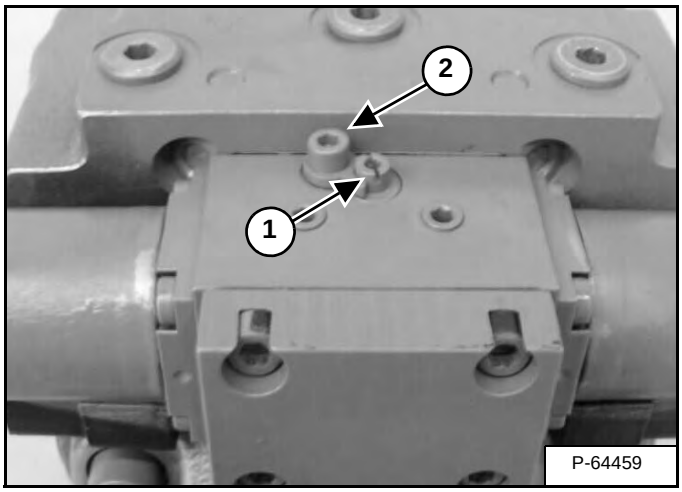
Hydraulic Controller Neutral Adjustment (Cont'd)

Figure 30-51-94



Turn the adjustment screw (Item 1) **[Figure 30-51-94]** clockwise, to a position halfway between the recorded positions. The pressure gauge should read equal pressures.

Figure 30-51-95



While holding the adjustment screw (Item 1) in position, tighten the locking screw (Item 2) **[Figure 30-51-95]** to 6,1 N•m (4.5 ft-lb) torque.

Shut loader OFF.

Remove the pressure gauges from the X1 and X2 ports on the pump. Install the plugs and tighten to 25 N•m (18 ft-lb) torque.

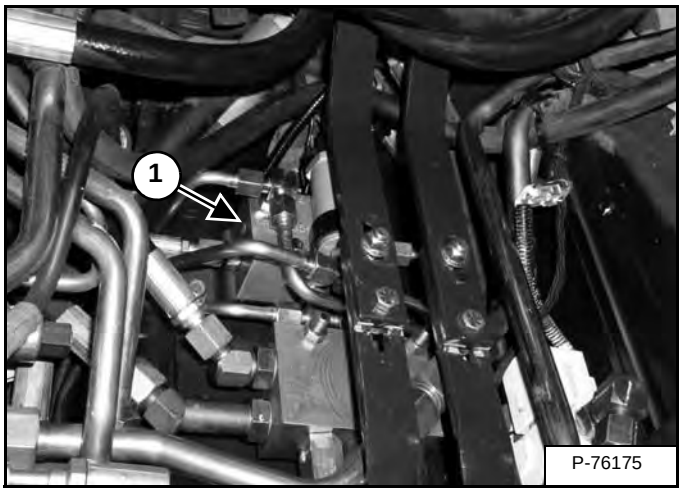
Connect the hydraulic controller wire connectors to the loader wiring harness.

Perform a controller calibration procedure. (See CALIBRATION on Page 60-160-1.)

TWO-SPEED VALVE

Description

Figure 30-70-1



The two-speed valve (Item 1) **[Figure 30-70-1]** is located on top of the chaincase in front of the hydrostatic pump. The high range is selected by a switch located on the right handle for manual loaders and on the left joystick for SJC loaders.

When the high range is selected, the two-speed solenoid is energized by the Bobcat Controller. The valve shifts and directs charge pressure oil to the shift spool in each motor. The charge pressure hydraulic oil shifts the spools allowing the motors to move into high range. When low range is selected, the solenoid is de-energized and the shift spools are spring returned to low range.

The two-speed valve also contains a two-speed pre-warming solenoid, which provides warm hydraulic oil to preheat the drive motors preventing damage in cold conditions. When the hydraulic oil reaches a pre-determined temperature, the pre-warming solenoid is turned off and the two-speed is engaged.

The case drain filter for the drive motors is mounted to the top of the two-speed valve.

BRAKE (SINGLE SPEED)

Description

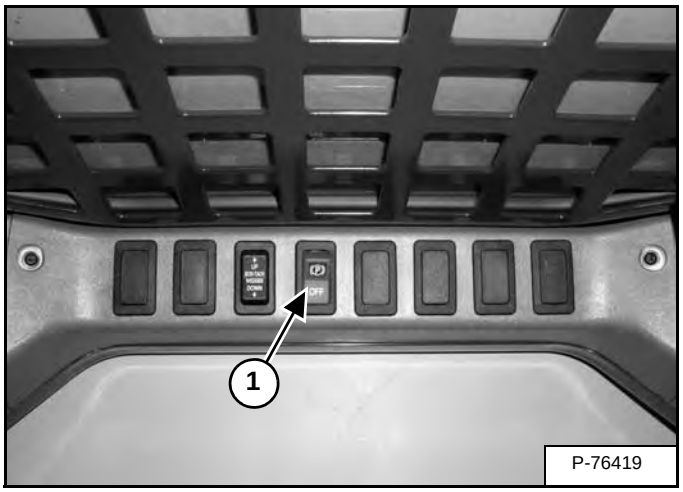
The brake is used to hold the machine in place. The brake is operated by a switch (Item 1) **[Figure 40-10-1]** located on the front accessory panel.

The brake is applied by a spring-loaded wedge that drops into two notched brake discs attached to the motor carrier shafts. An electric solenoid is sent power from a relay to pull the wedge away from the discs. A signal from the main Bobcat controller holds the wedge away from the discs.

The hold signal will be interrupted and the wedge will drop if the engine rpm drops below 700 rpm, the seat bar sensor fails or if there is a break in the wires for the brake solenoid.

For more information on the brake. (See TRACTION LOCK on Page 60-120-1.)

Figure 40-10-1



Disc Removal And Installation

Raise the loader lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

⚠ WARNING

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

W-2059-0598

Raise the loader operator cab. (See Raising on Page 10-30-2.)

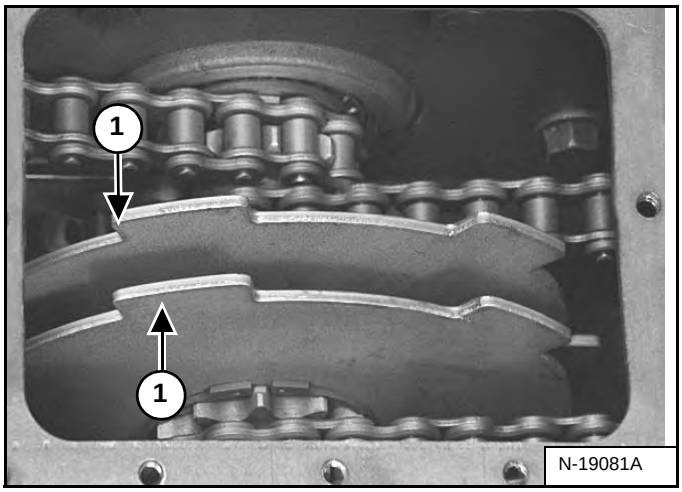
Disconnect and remove the engine speed control. (See Removal And Installation on Page 70-20-1.)

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

Remove the center chaincase cover. (See Center Cover Removal And Installation on Page 40-30-2.)

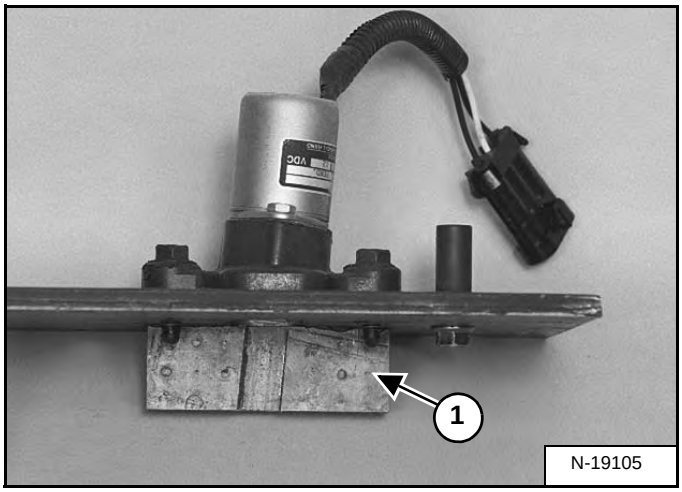
Remove the traction lock assembly. (See Removal And Installation on Page 60-120-2.)

Figure 40-10-2



The parking brake discs (Item 1) **[Figure 40-10-2]** are located beneath the center chaincase cover.

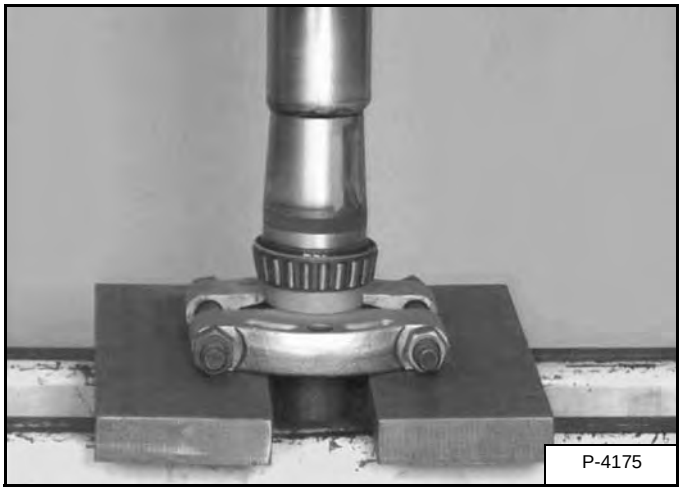
Figure 40-10-3



Inspect the traction lock guides (Item 1) **[Figure 40-10-3]** and the brake disc for damage or wear and replace as necessary. (See Inspecting on Page 60-120-6.)

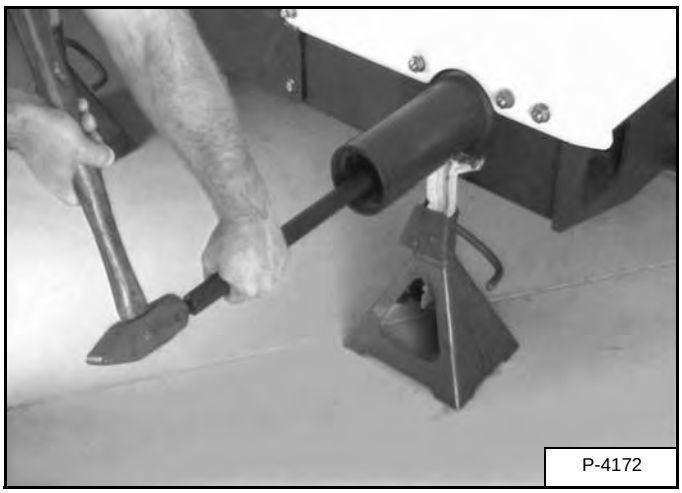
Axle Sprocket And Bearings Removal And Installation (Cont'd)

Figure 40-20-13



When the bearing reaches the bearing mounting surface, continue the installation until the bearing is fully seated **[Figure 40-20-13]**.

Figure 40-20-14

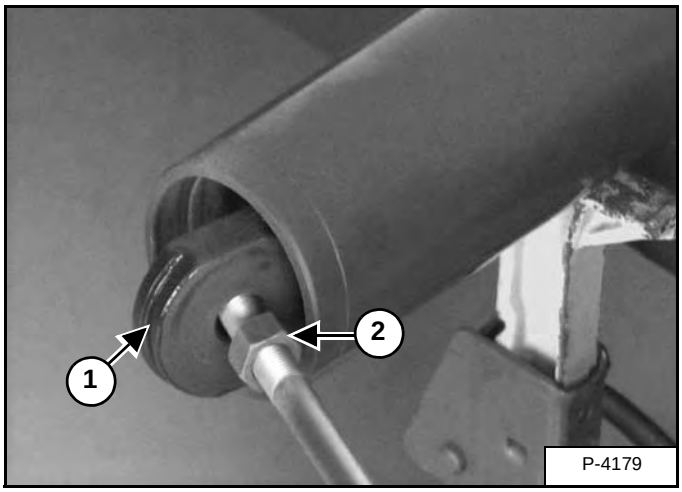


Use the tools provided in the MEL1202 Axle Bearing Service Set for bearing cup removal and installation. A slide hammer is also necessary for this procedure.

Use the long rod and bearing cup tool to remove the inner bearing cup **[Figure 40-20-14]**.

Hit the long rod with a hammer to remove the bearing cup from the axle tube **[Figure 40-20-14]**.

Figure 40-20-15

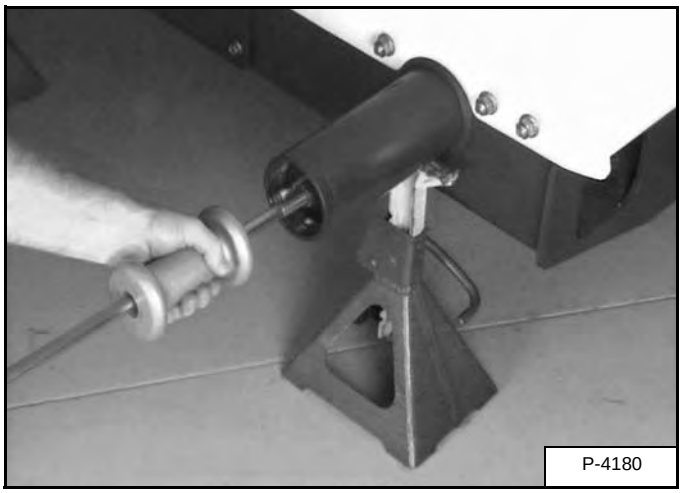


To remove the outer bearing cup, place the bearing cup tool (Item 1) **[Figure 40-20-15]** on the slide hammer.

Leave the bearing cup tool loose until the tool is installed inside the tube **[Figure 40-20-15]**.

After the bearing cup tool is inside the axle tube, pull the tool against the bearing cup and tighten the nut (Item 2) **[Figure 40-20-15]** on the tool.

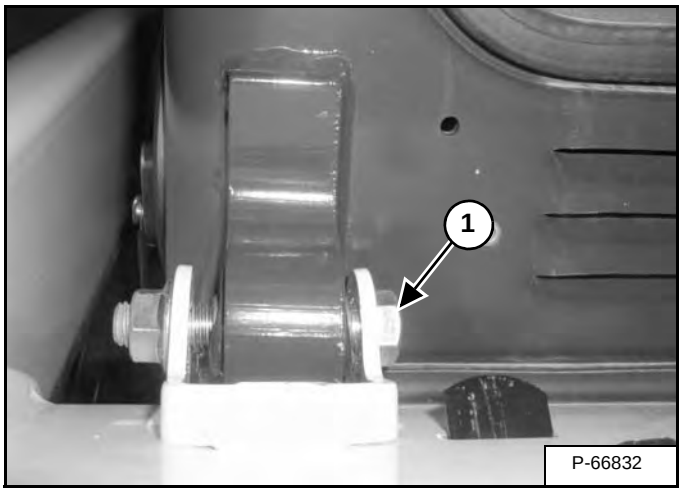
Figure 40-20-16



Use the slide hammer and remove the bearing cup from the axle tube **[Figure 40-20-16]**.

Removal And Installation (Cont'd)

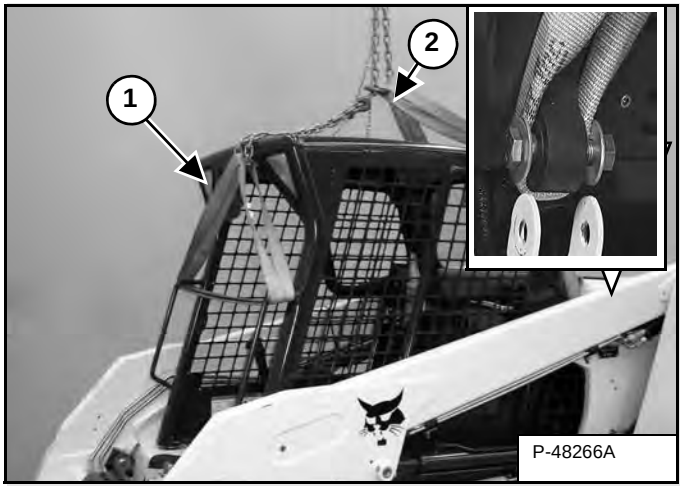
Figure 50-20-14



Remove the rear mounting bolt (Item 1) **[Figure 50-20-14]** (both sides) and nut from the operator cab.

Installation: Tighten the bolt and nut to 34 - 47 N•m (25 - 35 ft-lb) torque.

Figure 50-20-15



Connect the slings (Items 1 and 2) **[Figure 50-20-15]** to a chain hoist.

Lift the operator cab up and forward.

Remove the operator cab from the loader.

Reverse the above procedure to install the operator cab.

BOB-TACH® (HAND LEVER)

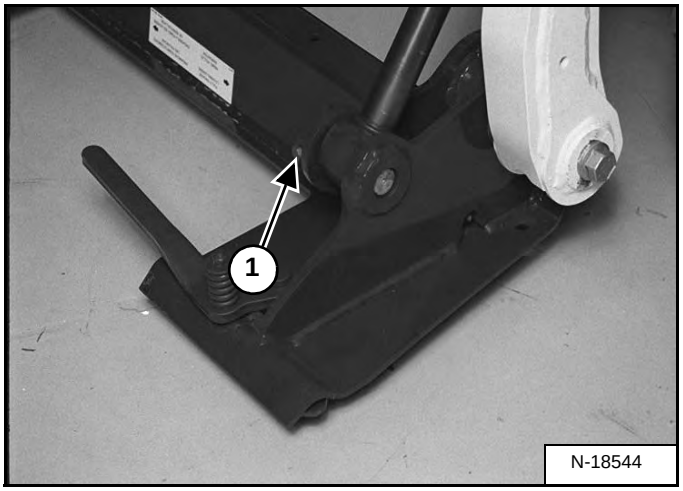
Description

The Bob-Tach® is the section of the loader lift arm that attachments mount to. The Power Bob-Tach® uses two manually operated, spring assisted, locking wedge and lever assemblies to secure the attachment the Bob-Tach®.

The Bob-Tach® is located on the front of the loader connected to the loader lift arms.

Removal And Installation

Figure 50-40-1



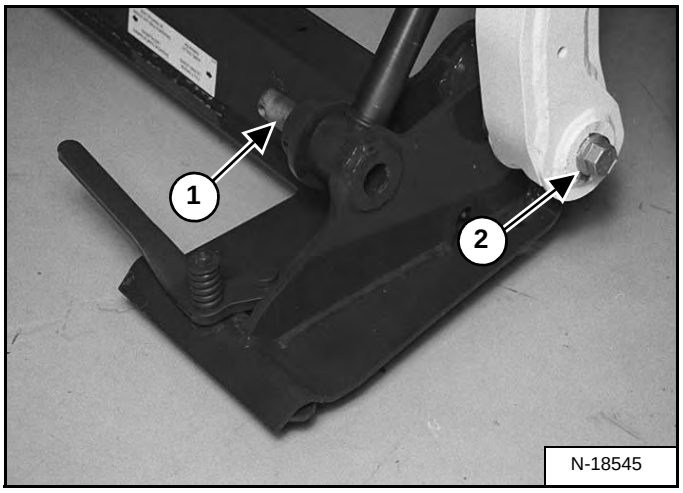
Tilt the Bob-Tach® forward, so it is parallel to the floor. Put blocks (approximately 76,2 mm [3 in]) under each side of the Bob-Tach® **[Figure 50-40-1]**.

Lower the Bob-Tach® onto the blocks.

Remove the retainer bolt (Item 1) **[Figure 50-40-1]** and nut from the tilt cylinder rod end pin (both sides).

Installation: Tighten the retainer bolt and nut to 34 - 38 N•m (25 - 30 ft-lb) torque.

Figure 50-40-2



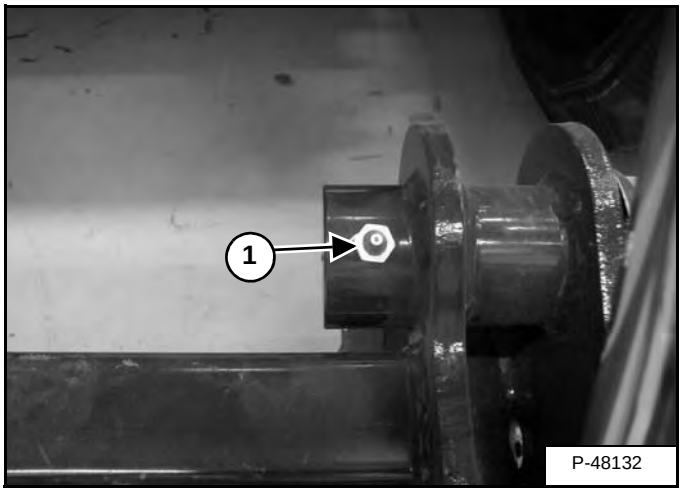
Remove the pivot pin (Item 1) **[Figure 50-40-2]** from the tilt cylinder rod end (both sides).

Remove the tilt cylinder rod end from the Bob-Tach® (both sides).

Loosen the bolt (Item 2) **[Figure 50-40-2]** at the Bob-Tach® pivot pin.

Installation: Tighten the bolt to 240 - 260 N•m (175 - 190 ft-lb) torque.

Figure 50-40-3



Remove the grease fitting (Item 1) (both sides) **[Figure 50-40-3]** out of the Bob-Tach® frame. This allows grease to escape when driving the pivot pins into the Bob-Tach® frame.

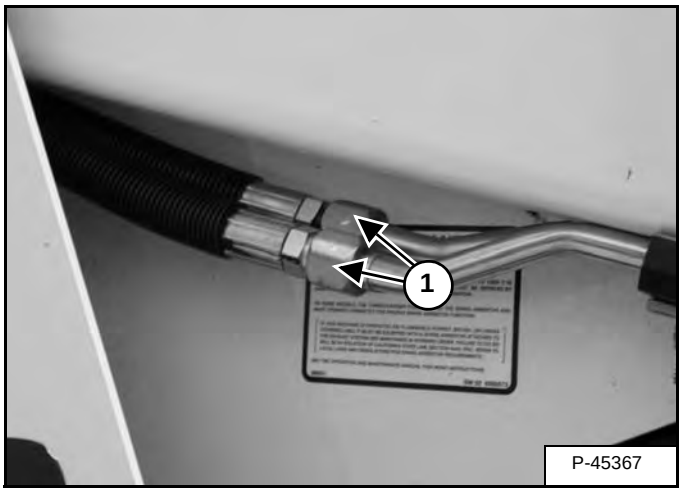
LIFT ARMS

Removal And Installation

NOTE: When installing new lift arms, It may be necessary to spread the lift arms apart or pull them closer together to get all of the pivot pins in place.

Roll the Bob-Tach® fully forward. Stop the engine.

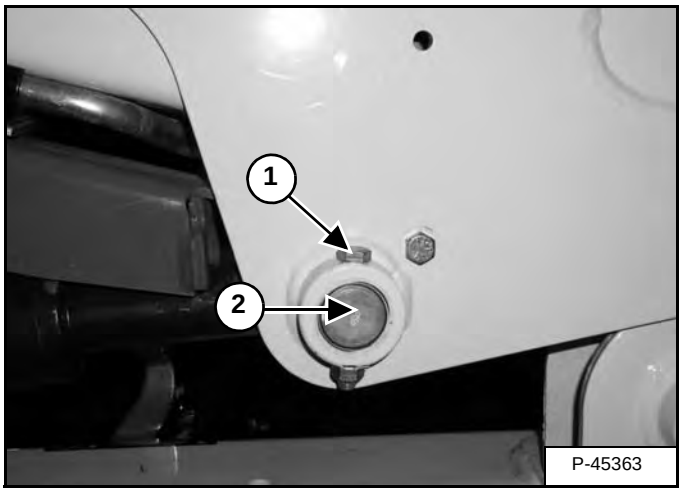
Figure 50-50-1



At the right side of the loader, mark the two tilt hoses for proper installation.

Disconnect and cap the two tilt hoses (Item 1) **[Figure 50-50-1]** from the tubelines (right side of machine).

Figure 50-50-2

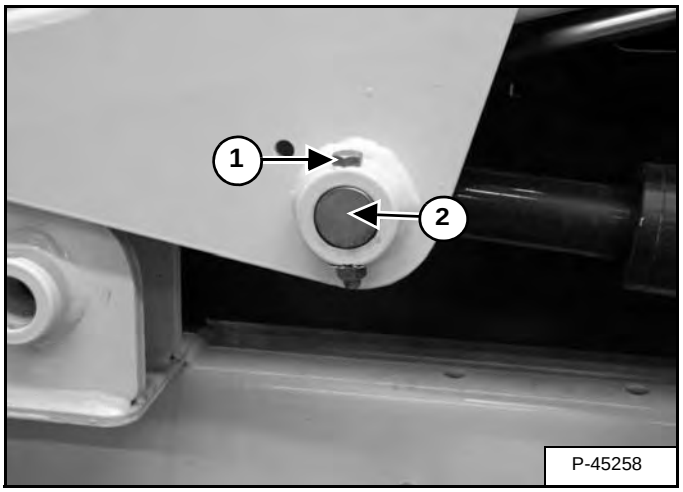


Remove the retainer bolt and nut (Item 1) **[Figure 50-50-2]** from the right side, rod end lift cylinder.

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

Remove the lift cylinder rod pin (Item 2) **[Figure 50-50-2]**.

Figure 50-50-3

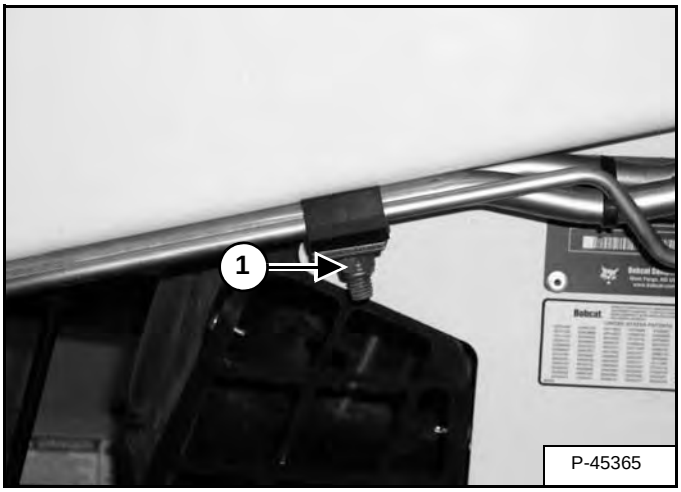


Remove the retainer bolt and nut (Item 1) **[Figure 50-50-3]** from the left side, rod end, lift cylinder pin.

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

Remove the lift cylinder rod pin (Item 2) **[Figure 50-50-3]**.

Figure 50-50-4

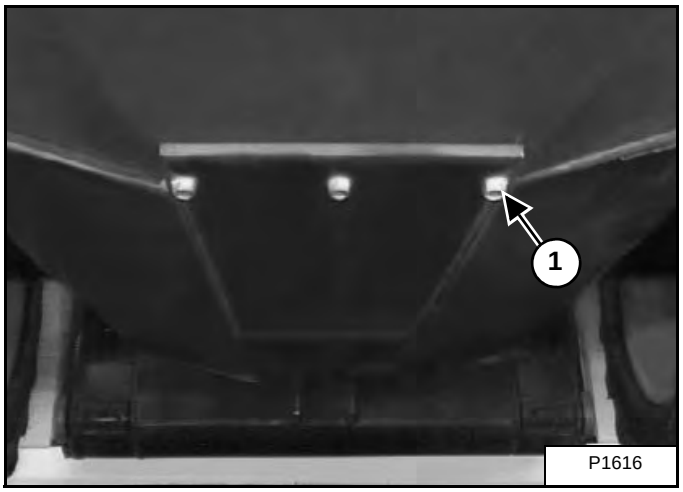


Remove the tubeline clamp (Item 1) **[Figure 50-50-4]**.

FUEL TANK

Removal And Installation

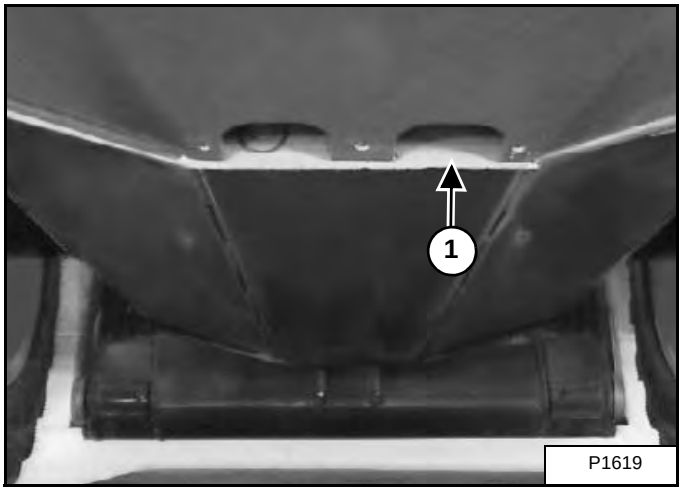
Figure 50-80-1



Remove the cover (Item 1) **[Figure 50-80-1]** which is installed over the fuel drain near the rear of the chaincase.

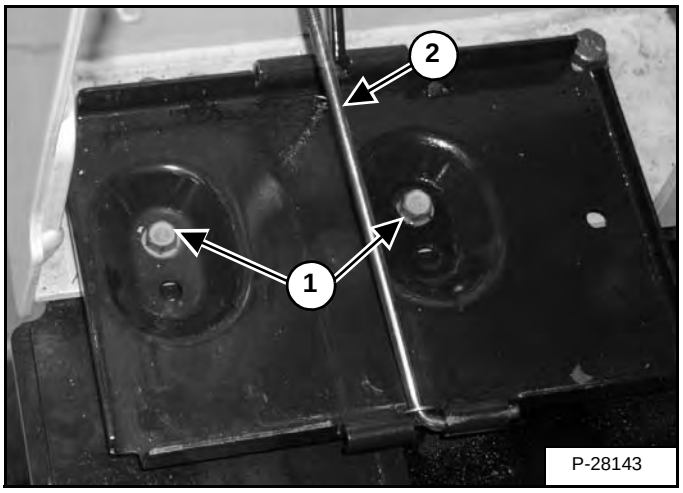
Installation: Tighten the cover mounting bolts to 21,5 - 27 N•m (190 - 240 in-lb) torque.

Figure 50-80-2



Drain the fuel from the tank through the fuel drain (Item 1) **[Figure 50-80-2]**.

Figure 50-80-3



Open the rear door of the loader.

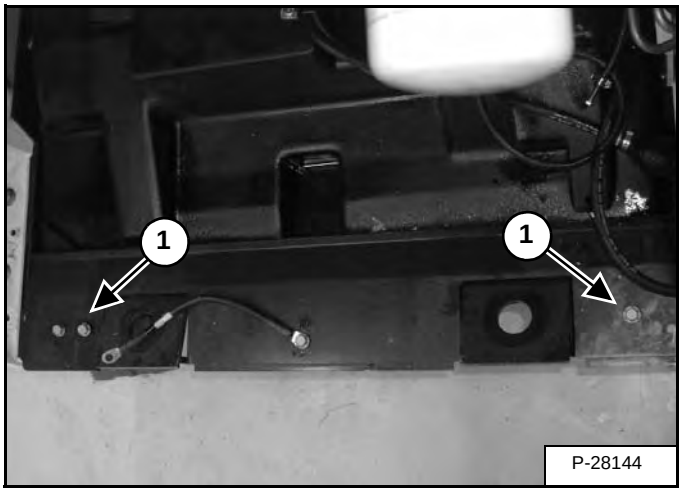
Remove the engine / hydrostatic pump assembly from the loader. (See Engine Removal And Installation on Page 70-10-8.)

Remove the two mounting bolts (Item 1) **[Figure 50-80-3]** from the battery holder.

Installation: Tighten the battery holder mounting bolts to 21,5 - 27 N•m (190 - 240 in-lb) torque.

Remove the battery holder (Item 2) **[Figure 50-80-3]** from the loader.

Figure 50-80-4

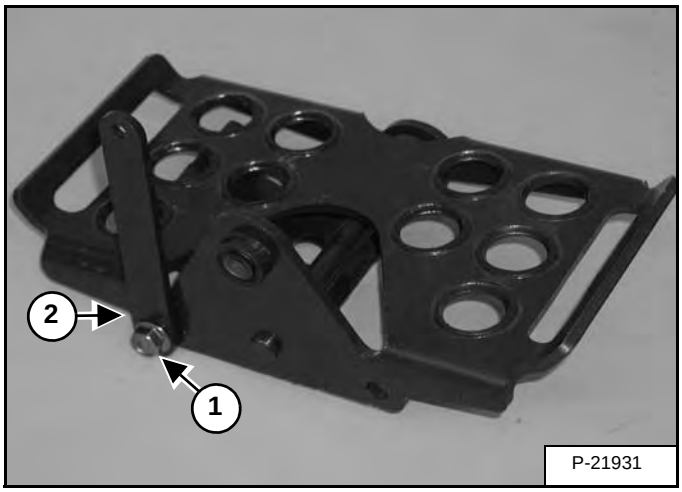


Remove the mounting bolts (Item 1) **[Figure 50-80-4]** from the fuel tank retainer bracket.

Installation: Tighten the mounting bolts to 21,5 - 27 N•m (190 - 240 in-lb) torque.

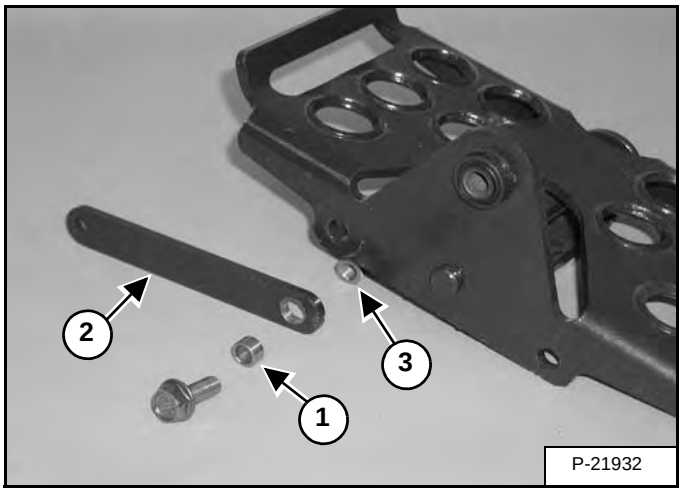
Foot Pedal Linkage Disassembly And Assembly

Figure 50-91-7



Remove the bolt (Item 1) holding the linkage (Item 2) to the side of the foot pedal **[Figure 50-91-7]**.

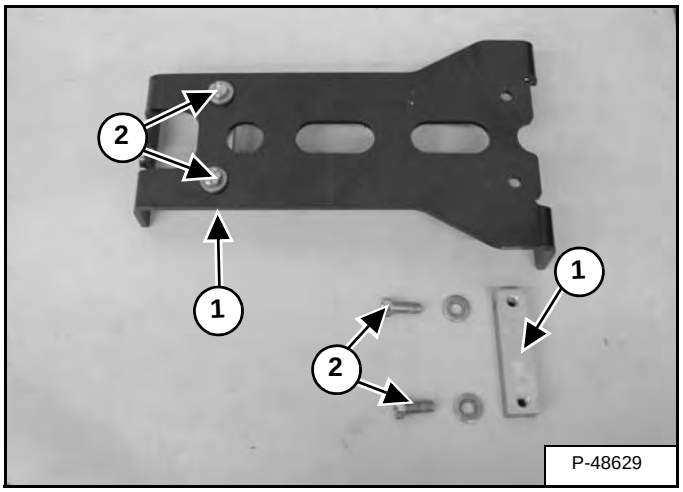
Figure 50-91-8



Remove the spacer (Item 1), linkage (Item 2), and nut (Item 3) from the foot pedal **[Figure 50-91-8]**.

Linkage Removal And Installation (Cont'd)

Figure 50-100-18



Check the wear on the centering blocks (Item 1) **[Figure 50-100-18]**.

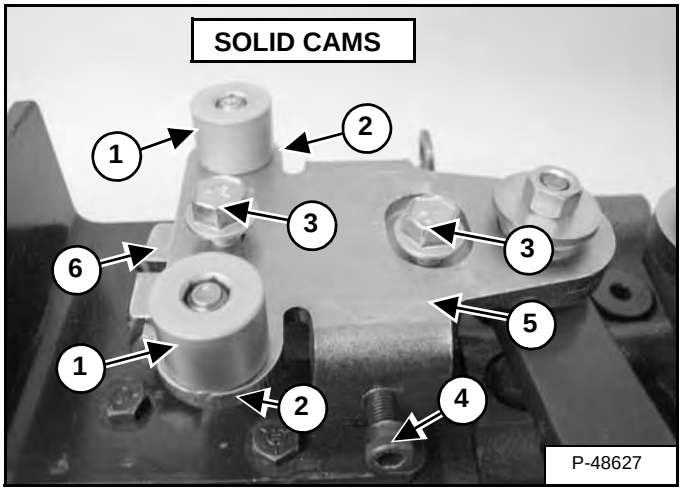
If the centering blocks need replacement, remove the bolts (Item 2) **[Figure 50-100-18]**. Remove the centering blocks.

Installation: Tighten the centering block bolts to 47,5 - 54,2 N•m (35 - 40 ft-lb) torque.

NOTE: The washers go between the bolts and the centering plate.

NOTE: If the centering blocks are worn, they can be removed and rotated 180 degrees and reinstalled. If the solid cams are worn, they can be loosened and rotated 90 degrees and reinstalled.

Figure 50-100-19



If the surface of any of the four solid pintle cams (Item 1) are worn, loosen the bolt (Item 2) and rotate the cams 1/4 turn **[Figure 50-100-19]**.

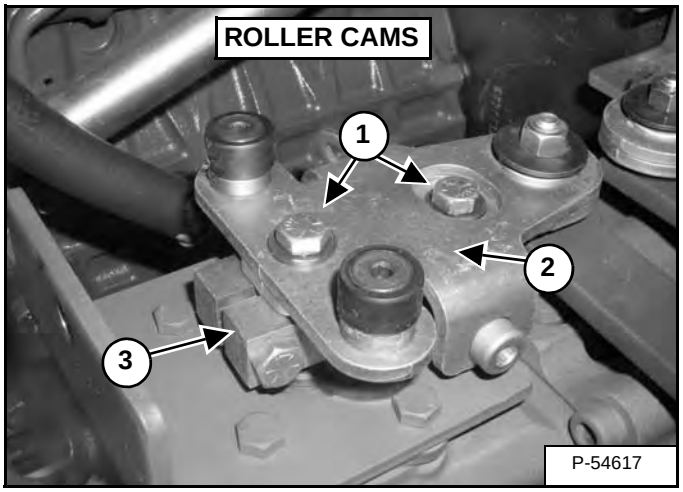
Remove the bolts and washers (Item 3) **[Figure 50-100-19]** from the pintle.

Installation: Tighten the bolts to 47,5 - 54,2 N•m (35 - 40 ft-lb) torque.

Loosen the creep adjustment bolt (Item 4) **[Figure 50-100-19]**.

Remove the pintle arm (Item 5) from the pintle base (Item 6) **[Figure 50-100-19]**.

Figure 50-100-20



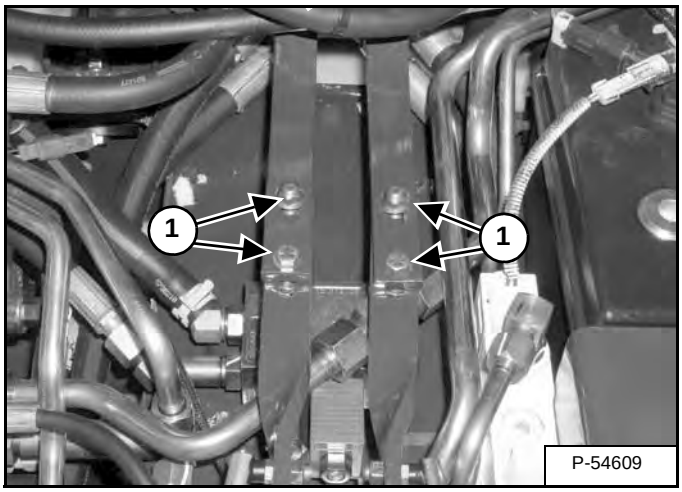
Remove the bolts and washers (Item 1) **[Figure 50-100-20]** from the pintle.

Installation: Tighten the bolts to 47,5 - 54,2 N•m (35 - 40 ft-lb) torque.

Remove the pintle arm (Item 2) from the pintle base (Item 3) **[Figure 50-100-20]**.

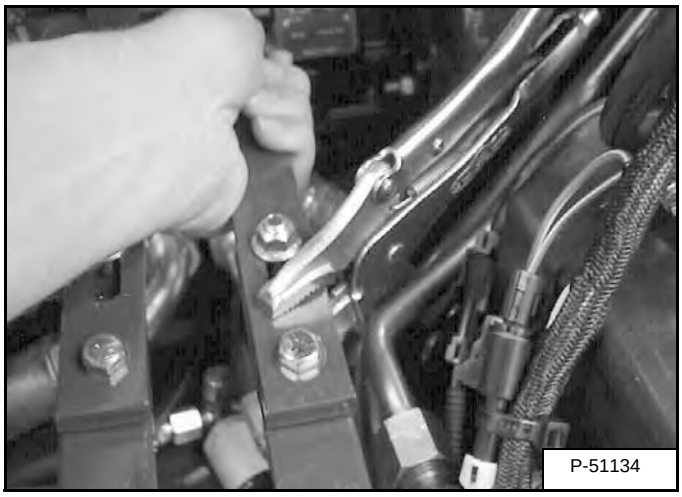
Linkage Travel (Adjusting) (Cont'd)

Figure 50-100-43



Loosen the two bolts and nuts (Item 1) **[Figure 50-100-43]** on each steering linkage bar.

Figure 50-100-44



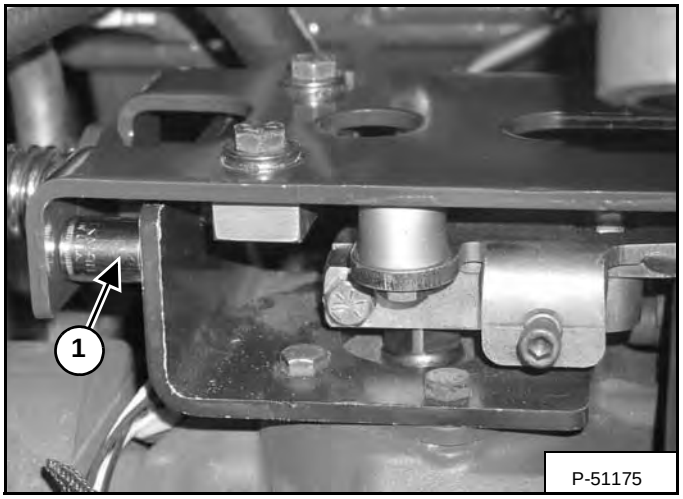
Move the left control lever to the full forward position, then pull forward on the left rear linkage bar until the pintle arm is rotated to the front as far as possible **[Figure 50-100-44]**. Use a locking plier, clamp the two linkage bars together.

Installation: Tighten the nuts and bolts to 47,5 - 54,2 N•m (35 - 40 ft-lb) torque.

Check the lever movement to make sure that the pintle arm and the control lever are both at full stroke at the same time. This will allow for maximum forward speed.

Repeat the linkage travel adjustment procedure for the right side linkage.

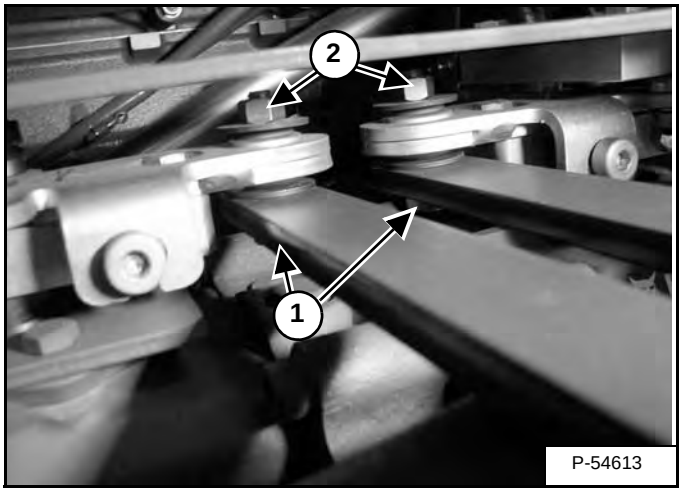
Figure 50-100-45



Remove the spacer (Item 1) **[Figure 50-100-45]**.

Disconnect the remote start tool.

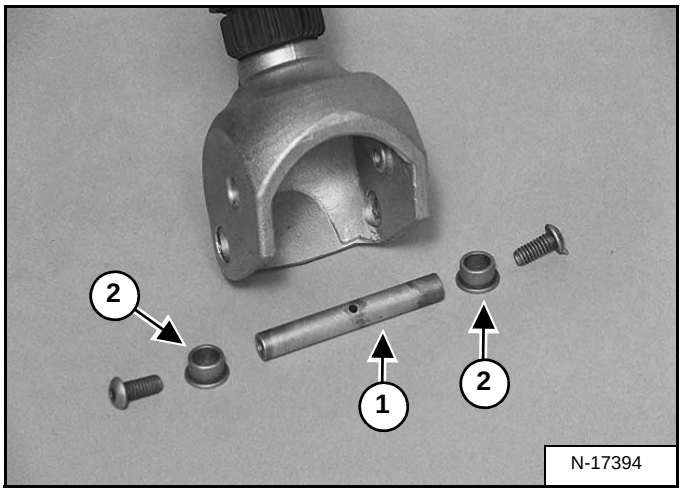
Figure 50-100-46



Tighten the two bolts (Item 1) and nuts (Item 2) to 47,5 - 54,2 N•m (35 - 40 ft-lb) **[Figure 50-100-46]**.

Handle Disassembly And Assembly

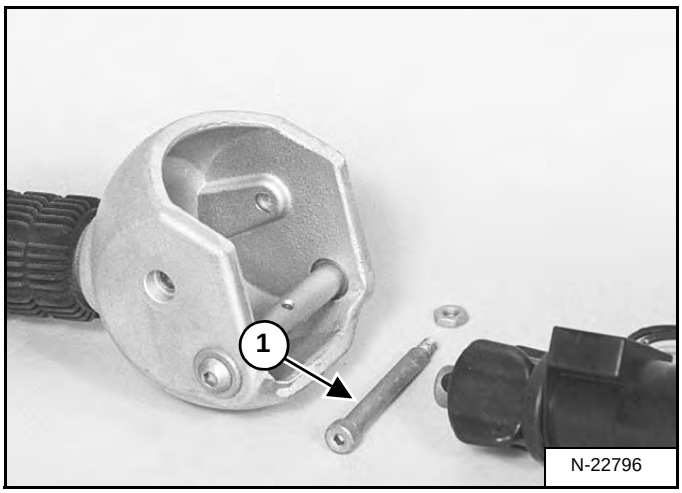
Figure 50-111-16



Remove the handle sleeve (Item 1) and bushings (Item 2) from the handle **[Figure 50-111-16]**.

Check all parts for wear and replace as needed.

Figure 50-111-17



Check the mounting bolt (Item 1) **[Figure 50-111-17]** that connects the handle to the handle sensor for wear, replace as needed.

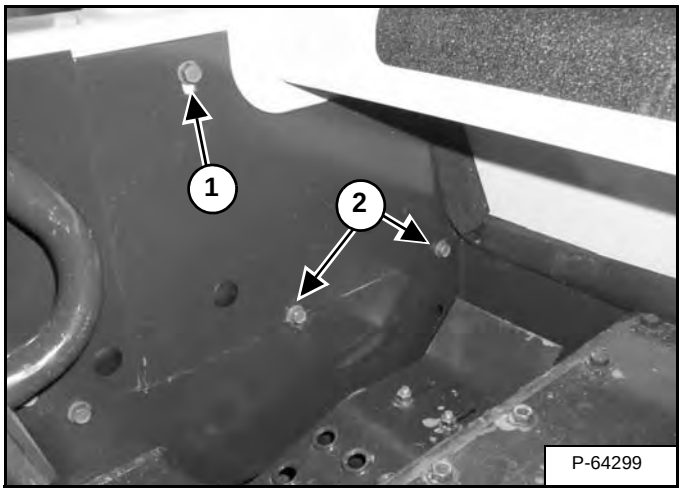
ACCESS PANEL (INSIDE) (SJC)

Removal And Installation (Left)

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Figure 50-121-1

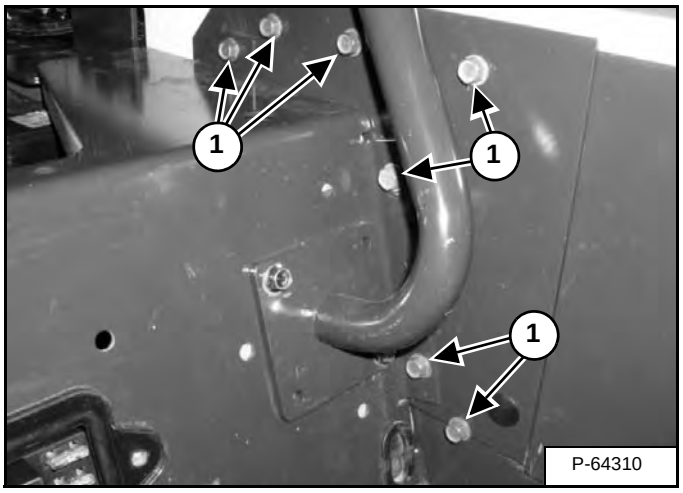


Remove the top mounting screw (Item 1) and loosen the two bottom screws (Item 2) **[Figure 50-121-1]**.

Installation: Tighten the screws to 20 - 27 N•m (15 - 20 ft-lb) torque.

Remove the inside front access panel from the loader.

Figure 50-121-2



Remove the seven mount screws (Item 1) **[Figure 50-121-2]**

Installation: Tighten the screws to 20 - 27 N•m (15 - 20 ft-lb) torque.

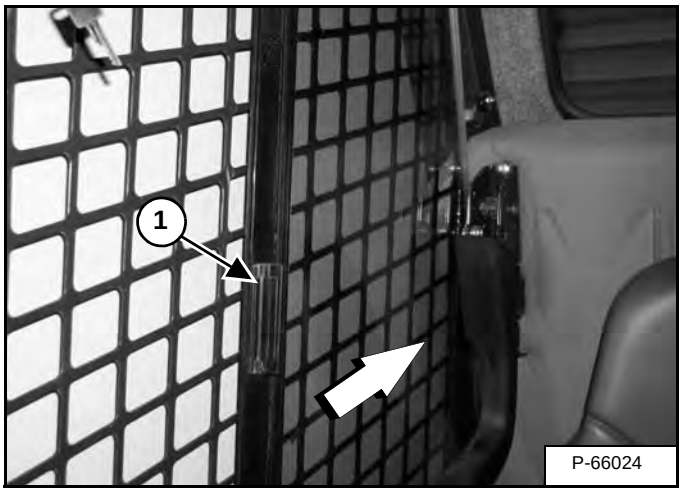
Move the lever assembly a slight amount toward the center of the loader, to allow clearance for the panel to be removed.

Remove the inside rear access panel from the loader.

WINDOW (SIDE)

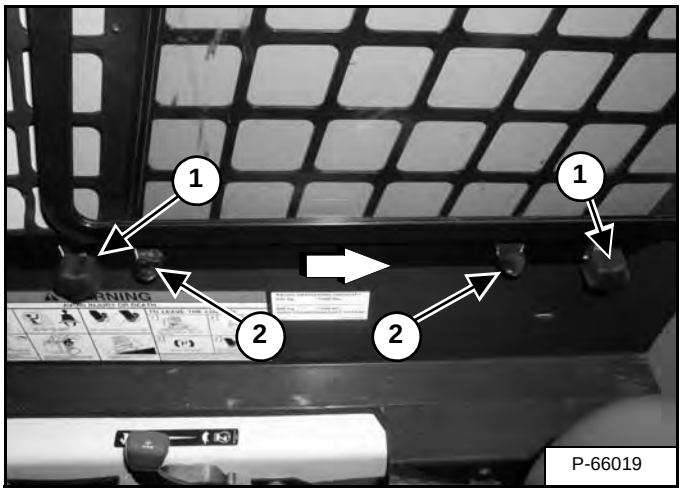
Removal And Installation

Figure 50-132-1



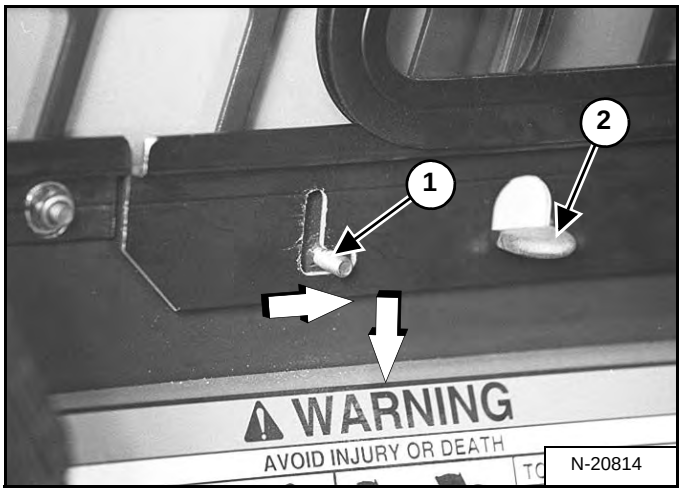
Release the latch (Item 1) **[Figure 50-132-1]** and slide the front window back towards the rear of the operator cab.

Figure 50-132-2



From inside the operator cab, loosen the knobs (Item 1) **[Figure 50-132-2]** and **[Figure 50-132-3]** on the window slide rail bolts.

Figure 50-132-3



NOTE: [Figure 50-132-3] is shown with the washer and knob removed to illustrate the direction of movement.

Move the window slide rail using the two thumb pads (Item 2) **[Figure 50-132-2]** and **[Figure 50-132-3]** towards the rear of the operator cab and then down towards the bottom of the operator cab.

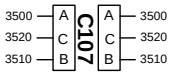
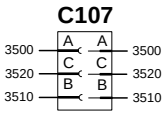
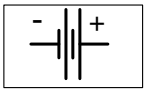
NOTE: The top of the window should come out of the top slide rail at this time. Make sure the window is secure and does not fall. Make sure the slide rails are in alignment and the window is positioned in the top track during installation.

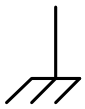
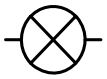
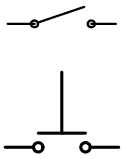
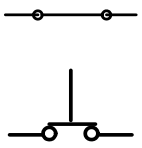
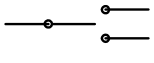
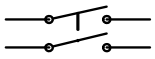
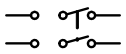
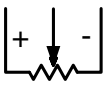
Remove the front side window from the operator cab.

ELECTRICAL SYSTEM AND ANALYSIS

ELECTRICAL SYSTEM INFORMATION

Glossary Of Electrical Symbols

SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 etc.). The harness wires numbers are called out next to the connector (Example: 3500).
	The connector number is called out next to the connector (Example: C107). These connector numbers are used for schematic identification only and do not appear on the harness or connector.
	COMPONENTS
	BATTERY - Used for supplying and storing electrical power for the machine.
+	POSITIVE ELECTRICAL CIRCUIT - Indicates positive battery circuit.
-	NEGATIVE ELECTRICAL CIRCUIT - Indicates battery ground circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	GROUND - Used to represent an external ground connection.

SYMBOL	DESCRIPTION
	COMPONENTS
	GROUND - Frame - Used to represent an component that is internally grounded.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

BATTERY

Removal And Installation

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

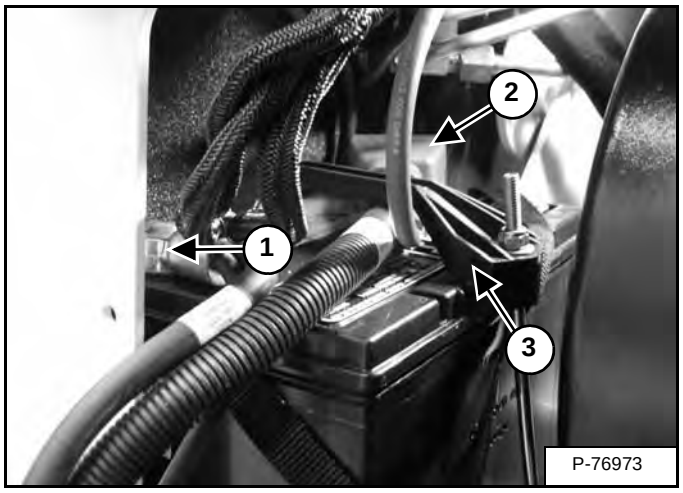
In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

Open the rear door.

Figure 60-20-1



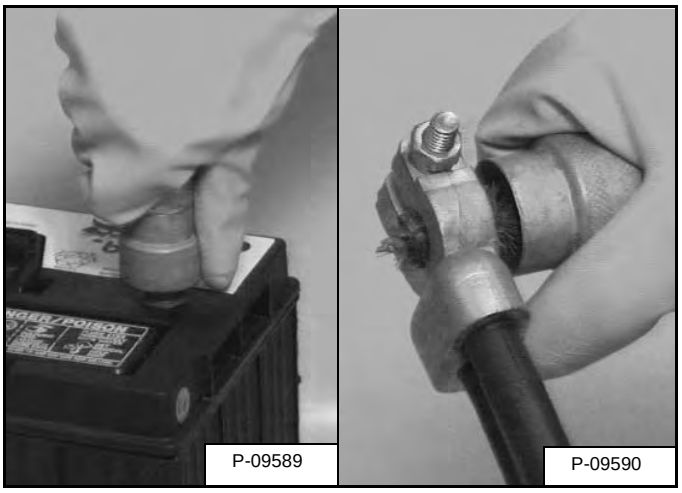
Disconnect the negative (-) battery cable (Item 1) **[Figure 60-20-1]**.

Remove the battery hold down clamp (Item 2) **[Figure 60-20-1]**.

Disconnect the positive (+) cable (Item 3) **[Figure 60-20-1]** from the battery.

Remove the battery from the loader.

Figure 60-20-2



Always clean the battery terminals and cable ends when installing a new or used battery **[Figure 60-20-2]**.

When installing the battery in the loader, do not touch any metal parts with the battery terminals.

Connect the negative (-) cable last to prevent sparks.

Connect and tighten the battery cables.

Install and tighten the battery hold down.

WARNING

BATTERY GAS CAN EXPLODE AND CAUSE SERIOUS INJURY OR DEATH

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

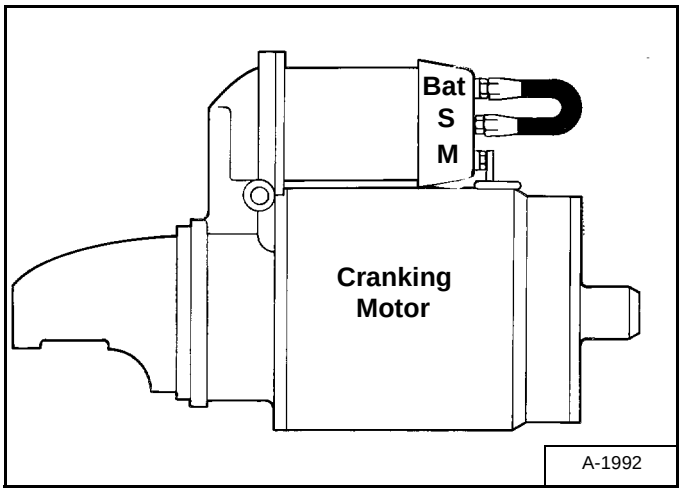
Do not jump start or charge a frozen or damaged battery. Warm battery to 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

W-2066-0910

STARTER

Testing

Figure 60-40-1



The key switch must be in the OFF position.

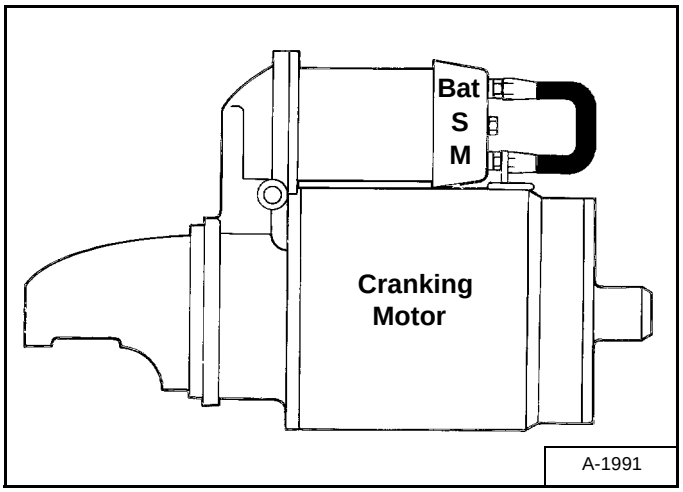
The battery must be at full charge.

The cable connections on the battery must be clean and tight.

Connect a jumper wire between S terminal and BAT terminal **[Figure 60-40-1]**.

If the starter turns but does not turn the engine, the starter drive has a defect.

Figure 60-40-2



Connect a jumper wire (of at least 4 gauge in size) between the M terminal and the BAT terminal **[Figure 60-40-2]**.

If the starter turns, the defect is in the solenoid.

If the starter does not turn, the starter is defective.

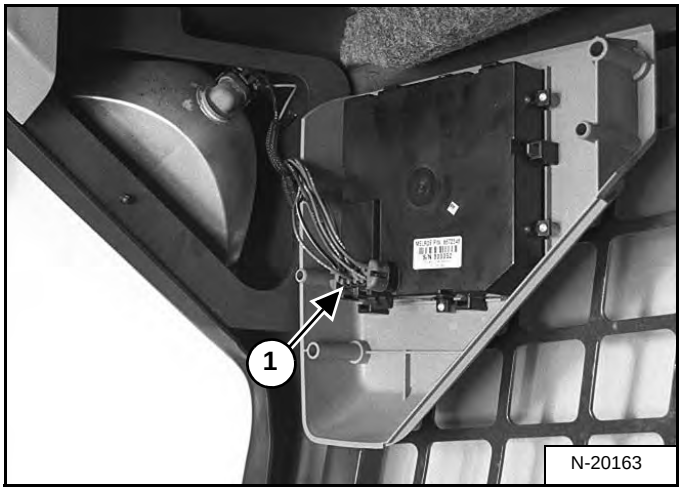
Removal And Installation (Left And Right) (Cont'd)

Figure 60-50-12

Remove the two mounting bolts (Item 1) **[Figure 60-50-12]**.

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

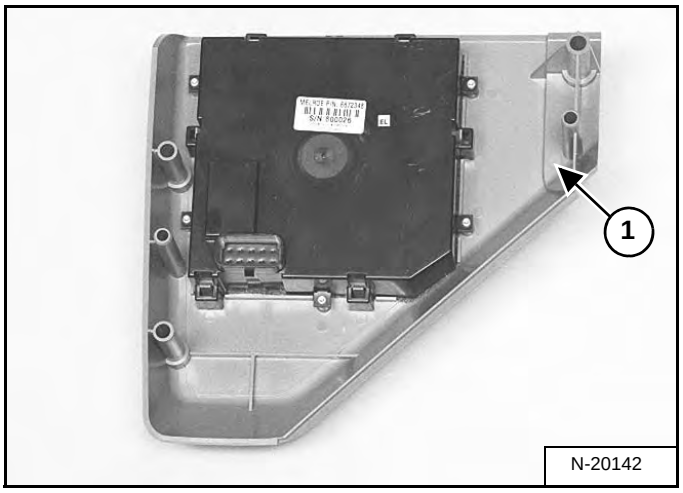
Figure 60-50-13



Pull the right instrument panel down and disconnect the wire harness connector (Item 1) **[Figure 60-50-13]** from the panel.

Remove the panel from the loader cab.

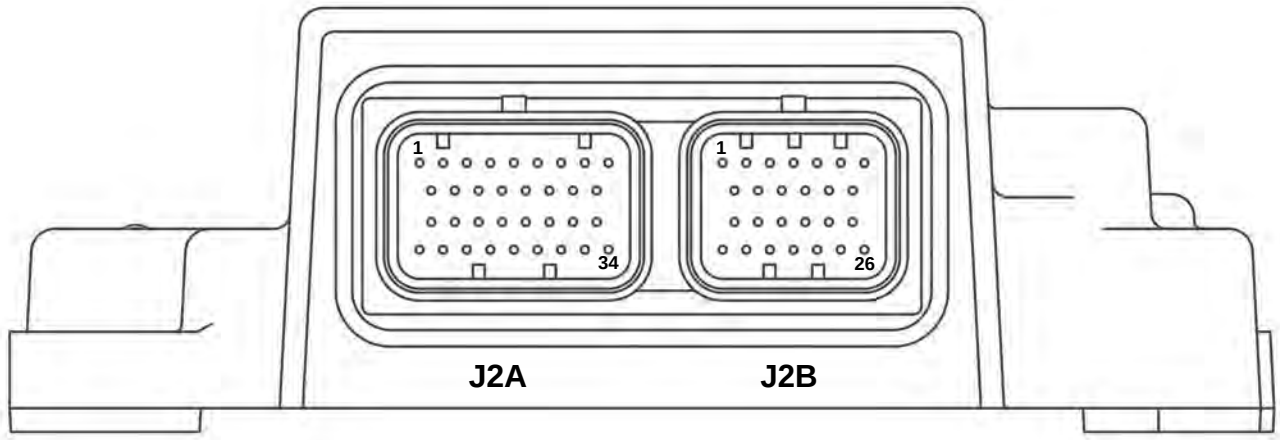
Figure 60-50-14



NOTE: The instrument panel (Item 1) [Figure 60-50-14] must be replaced as a complete unit.

Connector Identification (Cont'd)

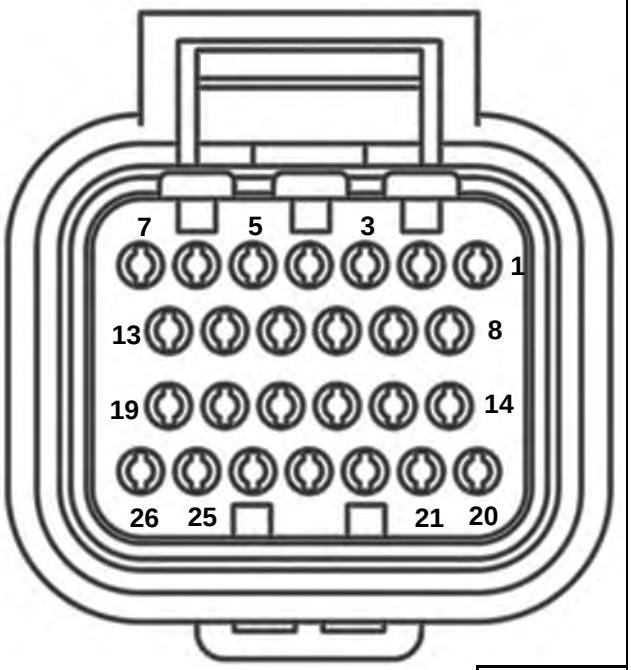
Auxiliary Controller



Harness Connector View

J2A

Harness Connector View



J2B

P-76647
P-76646
P-76645

BOBCAT CONTROLLER (SJC) (DRIVE)

Description

The drive controller is only on loaders equipped with the SJC option. This controller processes information for the drive functions.

The drive controller is located behind the right side access panel near the operators right foot.

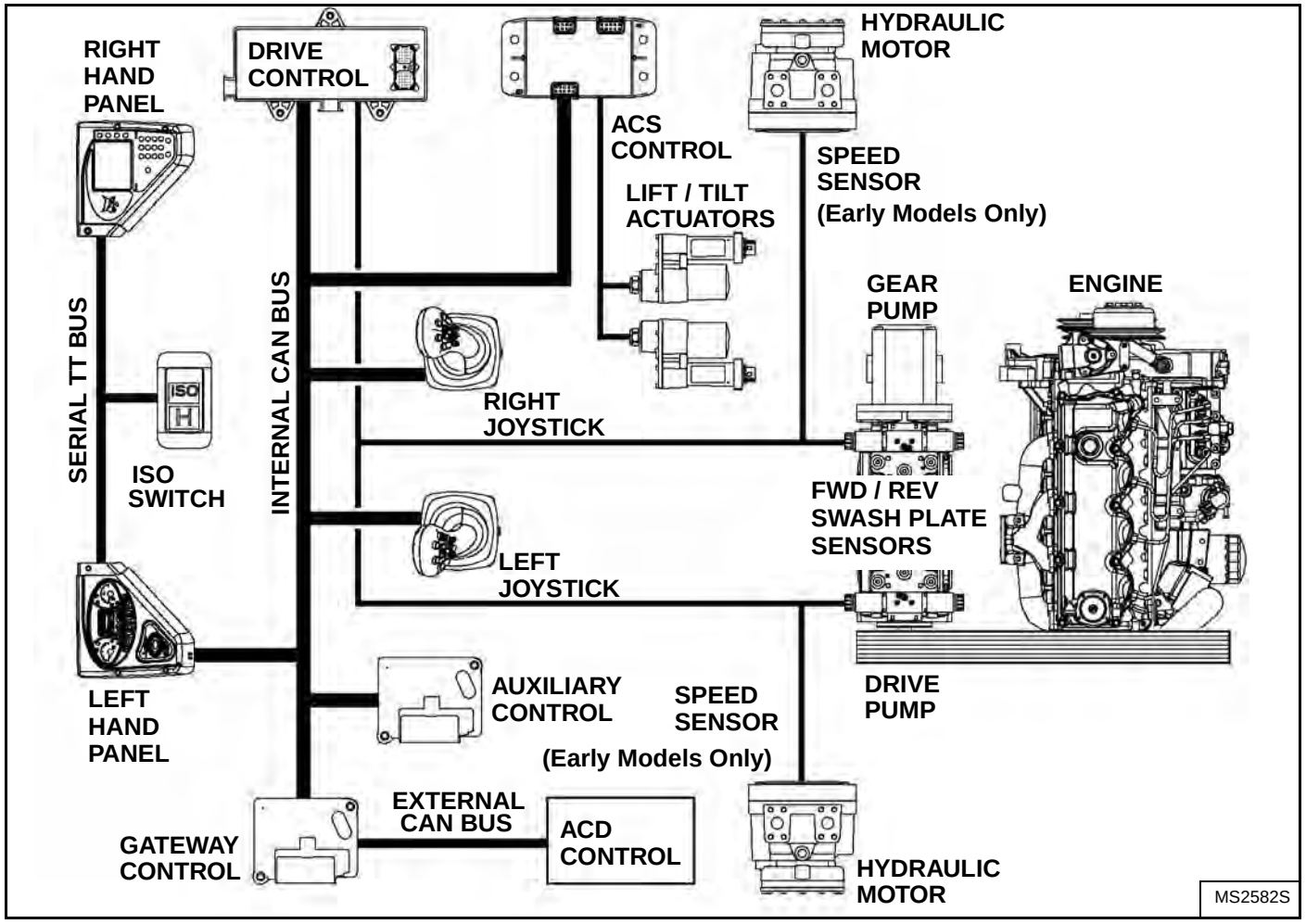
The drive controller monitors the position of the left joystick, pump swash plate angles and the output of the wheel speed sensors (If equipped).

The drive controller works along with the ACS controller and communicates with the Gateway controller in an SJC system. All these controllers are capable of software upgrades.

The SJC system uses electronic joysticks to control both of the workgroups (lift and tilt) and the drive functions of the loader. The control can be switched from ISO and H-Pattern drive control layouts.

The workgroup actuators are the same used on the ACS system.

The hydrostatic drive pump is a Rexroth A22 unit. It has two electromagnetic coils on each of the two pumps to control the drive of the loader. The coils will direct the forward and reverse outputs of the pump to the drive motors. The Rexroth pump is equipped with position sensors mounted to the bottom of the swash plates to provide feedback to the controllers to sense uncommanded swash plate movement.



DIAGNOSTIC SERVICE CODES (CONT'D)

Service Codes List (Cont'd)

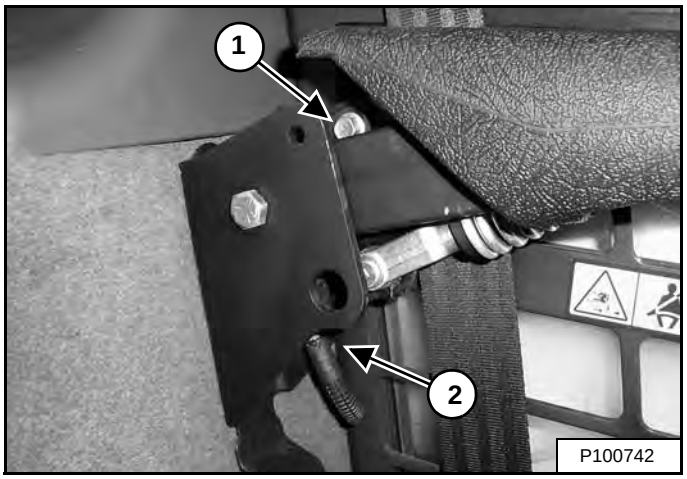
CODE	DESCRIPTION	CODE	DESCRIPTION
D7512	Right speed sensor not connected	D7564	Left rear steer retract short to ground
D7513	Right front wheel angle sensor stuck	D7565	Steer pressure short to ground
D7514	Left front wheel angle sensor stuck	D7566	Back-up alarm error OFF
D7515	Right rear wheel angle sensor stuck	D7567	No communication from Gateway controller
D7516	Left rear wheel angle sensor stuck	D7568	Angle sensors not calibrated
D7517	Left swash plate not in neutral	D7569	Battery voltage out of range high
D7518	Right swash plate not in neutral	D7570	Interrupted power (also occurs after software update)
D7519	Left joystick X-axis out of range high	D7571	Battery voltage out of range low
D7521	Left joystick Y-axis out of range high	D7572	Drive pump not calibrated
D7522	Right joystick Y-axis out of range high	D7573	Operating mode switch flipped while operating
D7523	Right front wheel angle sensor out of range high	D7574	Right wheel speed uncommanded motion
D7524	Left front wheel angle sensor out of range high	D7575	Left wheel speed uncommanded motion
D7525	Right rear wheel angle sensor out of range high	D7576	No communication from ACS controller
D7526	Left rear wheel angle sensor out of range high	D7577	Left speed sensor out of range high
D7527	Left swash plate out of position	D7578	Right speed sensor out of range high
D7528	Right swash plate out of position	D7579	Left speed sensor out of range low
D7529	Left joystick X-axis out of range low	D7580	Right speed sensor out of range low
D7531	Left joystick Y-axis out of range low	D7581	Right front steer retract short to battery
D7532	Right joystick Y-axis out of range low	D7582	Left front steer retract short to battery
D7533	Right front wheel angle sensor out of range low	D7583	Right rear steer retract short to battery
D7534	Left front wheel angle sensor out of range low	D7584	Left rear steer retract short to battery
D7535	Right rear wheel angle sensor out of range low	D7585	Sensor supply 1 out of range high
D7536	Left rear wheel angle sensor out of range low	D7586	Sensor supply 2 out of range high
D7537	Sensor supply 1 out of range low	D7587	Software update required
D7538	Sensor supply 2 out of range low	D7588	Switched power stuck ON
D7539	Left swash plate sensor out of range high	D7589	Switched power error OFF
D7540	Left swash plate sensor out of range low	D7590	Drive calibration performed
D7541	Right swash plate sensor out of range high	D7591	Left swash plate sensor reversed
D7542	Right swash plate sensor out of range low	D7592	Right swash plate sensor reversed
D7543	Left forward drive solenoid error ON	D7593	Right speed sensor unresponsive
D7544	Left reverse drive solenoid error ON	D7594	Left speed sensor unresponsive
D7545	Right forward drive solenoid error ON	D7595	Left speed sensor reversed
D7546	Right reverse drive solenoid error ON	D7596	Right speed sensor reversed
D7547	Right front steer extend short to battery	D7597	Controller programmed
D7548	Left front steer extend short to battery	D7598	In drive calibration mode
D7549	Right rear steer extend short to battery	D7599	In angle calibration mode
D7550	Left rear steer extend short to battery		
D7551	Steer pressure short to battery	H1121	Boost Sensor out of range high
D7552	Back-up alarm error ON	H1122	Boost Sensor out of range low
D7553	Left forward drive solenoid error OFF	H1221	Right Primary out of range high
D7554	Left reverse drive solenoid error OFF	H1222	Right Primary out of range low
D7555	Right forward drive solenoid error OFF	H1224	Right Primary not in neutral
D7556	Right reverse drive solenoid error OFF	H1321	Left Primary out of range high
D7557	Right front steer extend short to ground	H1322	Left Primary out of range low
D7558	Right front steer retract short to ground	H1324	Left Primary not in neutral
D7559	Left front steer extend short to ground	H2005	Boost solenoid short to battery
D7560	Left front steer retract short to ground	H2006	Boost solenoid short to ground
D7561	Right rear steer extend short to ground	H2007	Boost solenoid open circuit
D7562	Right rear steer retract short to ground	H2032	Boost solenoid overcurrent
D7563	Left rear steer extend short to ground	H2205	Pressure control solenoid short to battery

SEAT BAR SENSOR (CONT'D)

Removal And Installation

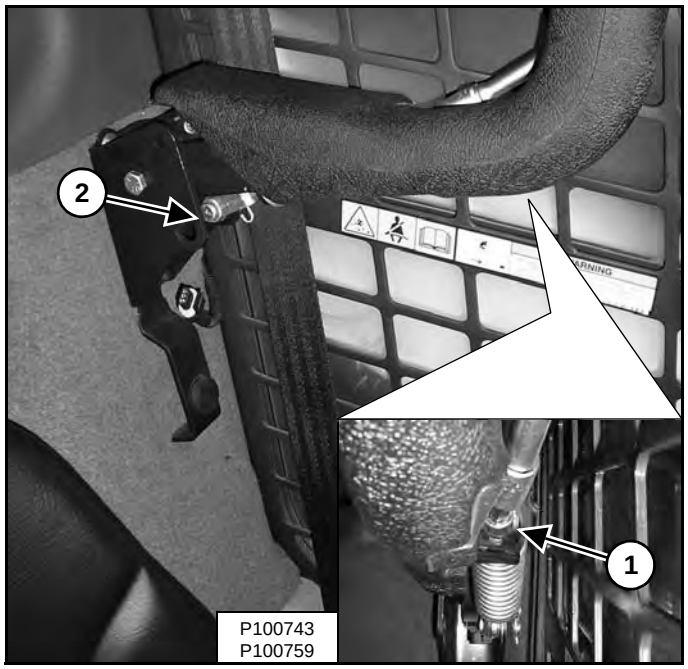
NOTE: This procedure is performed with the seat bar in the raised position and the technician in the operators seat.

Figure 60-110-5



Remove the sensor mounting bolt and nut (Item 1) **[Figure 60-110-5]**. Disconnect the sensor wiring connector (Item 2) **[Figure 60-110-5]**.

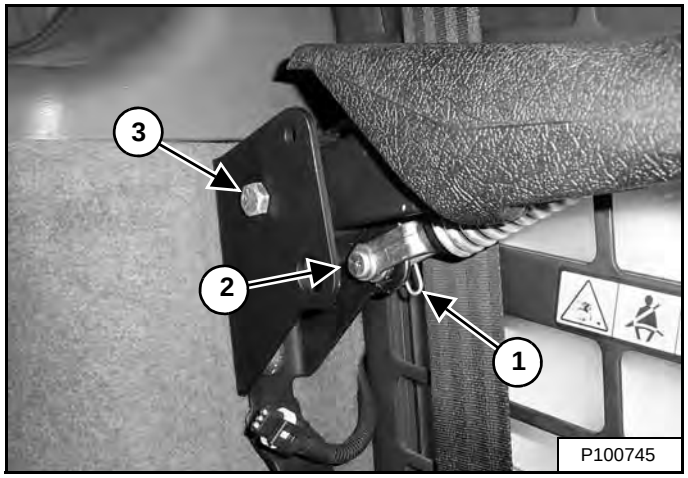
Figure 60-110-6



Tighten the clevis bolt (Item 1) until spring tension is released from the clevis pin (Item 2) **[Figure 60-110-6]**.

NOTE: Approximately 4 turns of the clevis bolt should be adequate to release the spring tension. When tension is released, the clevis pin can easily be rotated using the retaining pin.

Figure 60-110-7



Remove the retaining pin (Item 1) and clevis pin (Item 2) **[Figure 60-110-7]**. Remove the seat bar mounting bolt and nut (Item 3) **[Figure 60-110-7]**.

CONTROL SYSTEM (ACS)

Description

The (ACS) Actuator Control System system is an option that allows the operator to quickly switch between foot and hand control modes.

The ACS control uses the electric actuators on the main hydraulic control valve to control the lift and tilt spools in the hydraulic control valve, foot sensors, handle sensors and a specially designed control handle.

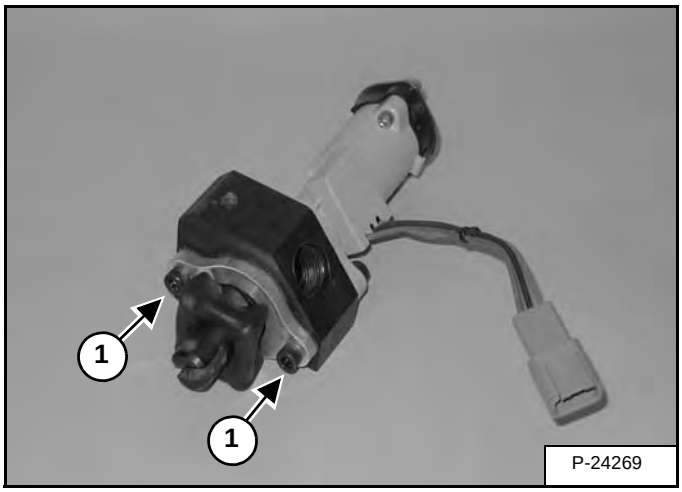
Hand controls contain a locking solenoid which lock when the switch on the center control panel is switched to foot mode.

Foot controls also contain solenoids which lock when the switch on the center control panel is switched to hand mode.

Both the hand and foot controls contain sensors that relay information to the ACS controller as to which function should be activated and how far the spool should be moved.

Foot Sensor Disassembly And Assembly

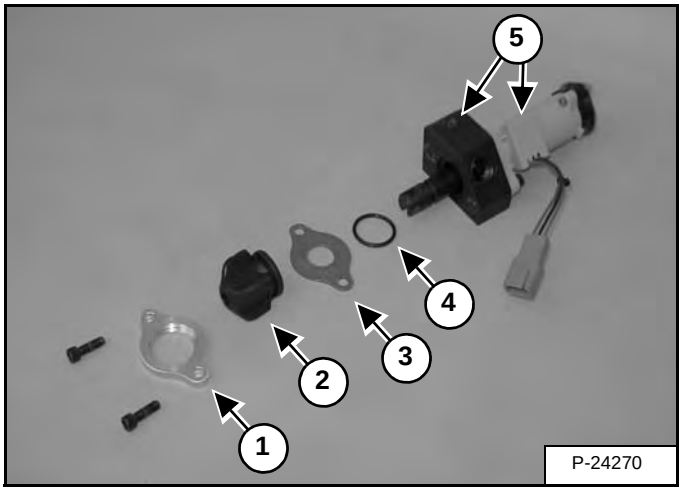
Figure 60-130-28



Remove the two bolts (Item 1) **[Figure 60-130-28]** from the end of the foot sensor.

Installation: Tighten the bolts to 10,2 N•m (90 in-lb) torque. Apply Loctite® 242 to the threads.

Figure 60-130-29



Remove the boot retainer (Item 1), boot (Item 2), spool stop plate (Item 3), O-ring (Item 4) **[Figure 60-130-29]**.

NOTE: Do not disassemble the sensor assembly (Item 5) [Figure 60-130-29]. The sensor assembly is a calibrated assembly and cannot be serviced. Order through Bobcat Parts.

Identification Chart ACD Group 0

Left side Control Handle Switches	Switch Number	Solenoid Number Activated				Attachment Harness Terminal Activated	Attachment Harness Connector	RIght Side Control Handle Switches
		STD	RH	HFH	RH / HFH		Fourteen Pin Connector Viewed from front (pin side of connector) of loader.	
	1	1	1	1, 7	1,7	K		
	2	2	2	2	2	K		
	3	1	1	1, 7	1,7	K		
	4	2	3,5,6	2	3,5,6	K,A,D		
	5	1	4,5,6	1	4,5,6	K,A,C		
	6	1	4,5,6	1	4,5,6	K,E		
	7	1	4,5,6	1	4,5,6	K,F		
	8	1	4,5,6	1	4,5,6	K,G		
	9	1	4,5,6	1	4,5,6	K,H		
P-90898 P-90900	10, 11, 12, 13, 14	-	--	--		K	No Jumpers	P-90899 P-90900A

RH - Loaders with Rear Hydraulics Option.
HFH - Loaders with High Flow Hydraulics Option.
RH / HFH - Loaders with Rear Hydraulics and High Flow Hydraulics Option.
Terminal K is activated with Key switch ON.

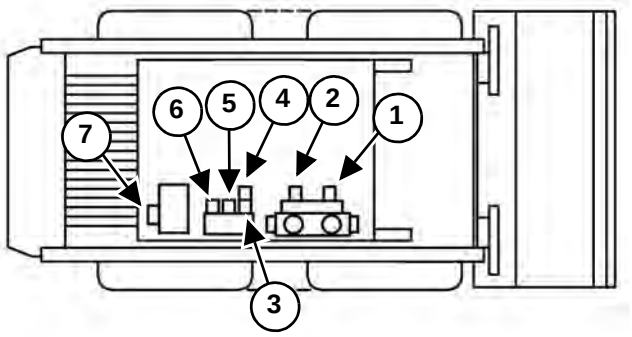
NOTE: For diagnostics and troubleshooting connect the Service PC (See SERVICE PC (LAPTOP COMPUTER) on Page 60-150-1.)

The ACD (Attachment Control Device) automatically recognizes the use of the seven or fourteen pin connector when connected.

Pressing the auxiliary hydraulics button and moving the rear auxiliary hydraulic switch to the right and left several times activates solenoid numbers 3, 4, 5, and 6 at the diverter valve.

Front Auxiliary Pressure Release is accomplished by manually pushing the male and female couplers in at the front auxiliary block.

The High Flow Button in the left side instrument panel must be pushed ON to activate solenoid number seven at the gear pump.



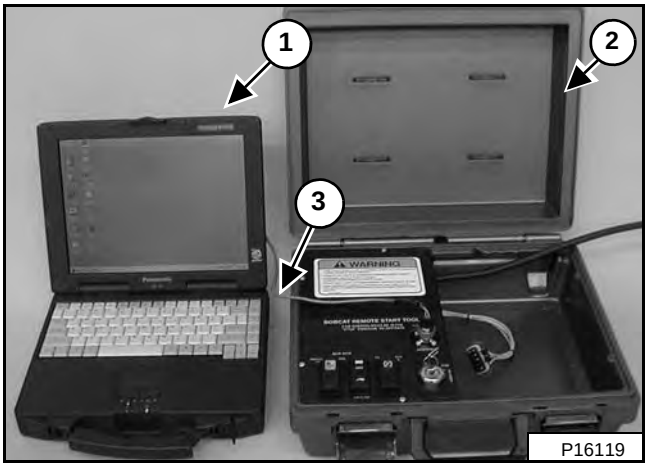
NA1891

Solenoid Number	Hydraulic Coupler	Wiring Number
1	Front Male (Rod)	4330
2	Front Female (Base)	4340
3	Diverter Rear (Rod)	4430
4	Diverter Rear (Base)	4440
5	Bleed / Lock Valve (Base)	4480
6	Bleed / Lock Valve (Rod)	4450
7	High Flow on Pump	4460

SERVICE PC (LAPTOP COMPUTER)

Connecting Remote Start Tool

Figure 60-150-1



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

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

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

The Service PC (Item 1) with the Remote Start Tool (Item 2) **[Figure 60-150-1]**. When connected to the loader, the Service PC is used to monitor, conduct diagnostics, and upgrade software.

Connect the Service Tool Harness Communicator (MEL1566) (Item 3) **[Figure 60-150-1]** to the designated serial port on the Service PC.

NOTE: The recommended serial cable length should not exceed 4,6 m (15 ft). A serial cable longer than 4,6 m (15 ft) will create a degraded signal causing communication errors.

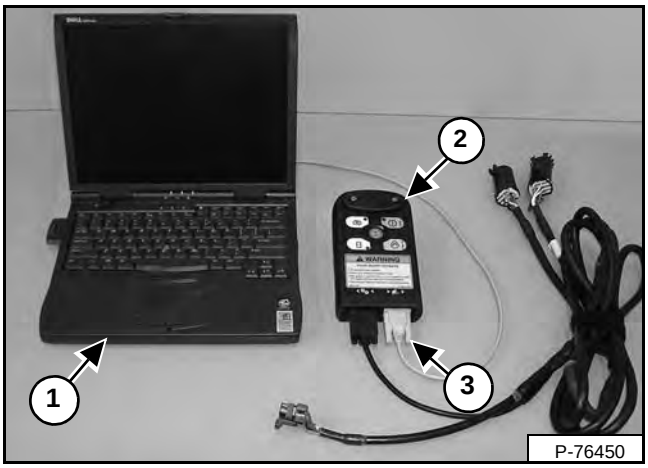
Connect the other end to the connector on the Remote Start Tool.

Connect the Remote Start Tool to the loader. (See REMOTE START TOOL KIT - MEL1563 on Page 10-60-1.)

NOTE: Refer to BobcatNET for PC requirements and the latest Service Analyzer software.

Connecting Remote Start Tool (Service Tool)

Figure 60-150-2



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

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

Kit Includes:

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

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

The Service PC (Item 1) with the Remote Start Tool (Service Tool) (Item 2) **[Figure 60-150-2]**. When connected to the loader, the Service PC is used to monitor, conduct diagnostics, and upgrade software.

Connect the Remote Start Tool (Service Tool) Computer Service Tool Harness (Item 3) **[Figure 60-150-2]** to the designated serial port on the Service PC.

NOTE: The recommended serial cable length should not exceed 4,6 m (15 ft). A serial cable longer than 4,6 m (15 ft) will create a degraded signal causing communication errors.

Connect the other end to the connector on the Remote Start Tool (Service Tool).

Connect the Remote Start Tool (Service Tool) to the loader. (See REMOTE START TOOL (SERVICE TOOL) KIT - 7217666 on Page 10-61-1.)

NOTE: Refer to BobcatNET for PC requirements and the latest Service Analyzer software.

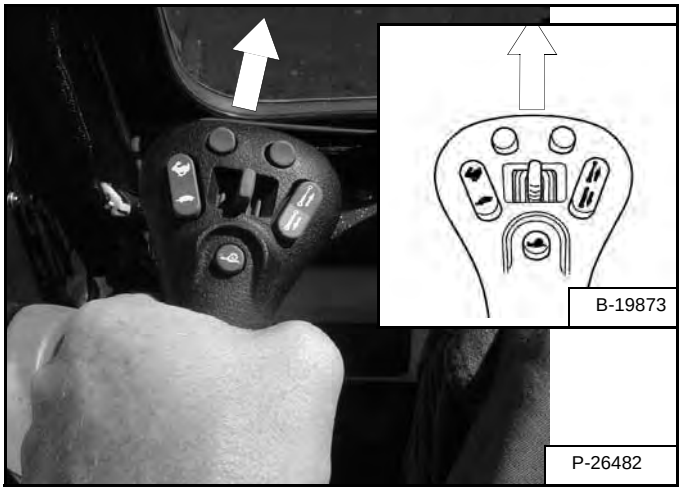
Hydrostatic Pump Calibration (SJC) (Cont'd)

⚠ WARNING

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

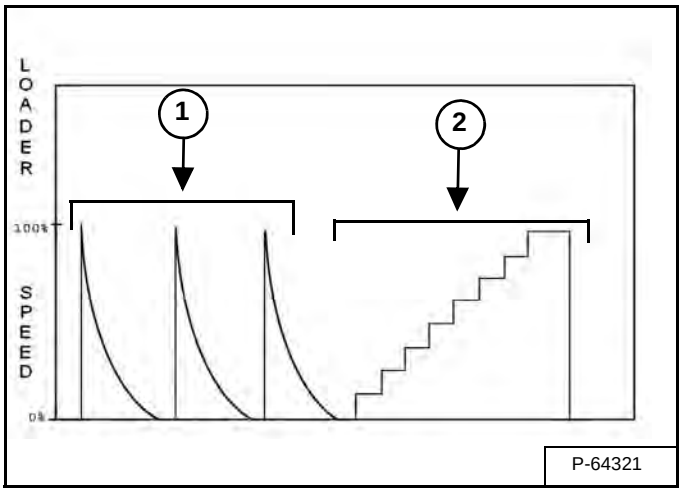
W-2017-0286

Figure 60-160-18



Move and hold the left joystick to the forward position **[Figure 60-160-18]** until the forward calibration is completed.

Figure 60-160-19



The loader speed will “ramp up” quickly (Item 1) **[Figure 60-160-19]** and slow down 3 times in a row.

The loader will then “stair step” the speed (Item 2) **[Figure 60-160-19]** until it reaches full speed and then come to a stop.

Loaders with software version (79.7 or newer). The loader tires or tracks will **momentarily reverse** then continue to rotate in reverse and “stair step” the speed (Item 2) **[Figure 60-160-19]** until it reaches full speed and then “stair step” down and come to a stop.

Continue to hold the left joystick in the forward position until the loader wheels or tracks come to a stop and an audible beep is heard.

Forward calibration is complete.

NOTE: If the wheels or tracks do not stop moving in Full Speed Forward in 2 minutes or less, there was an error in the calibration procedure. The operator must shut the loader OFF, and start the calibration procedure from the beginning.

PASSWORD SETUP (DELUXE INSTRUMENTATION PANEL)

Password Setup is available on machines with a Deluxe Instrumentation Panel.

Password Description

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

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

Master Password:

A permanent, randomly selected password set at the factory which cannot be changed. This password is used for service by the Bobcat dealer if the owner password is not known; or to change the owner password.

Owner Password:

Allows for full use of the loader and to setup the Deluxe Instrumentation Panel. There is only one owner password. It must be used to change the owner or user passwords. Owner should change the password as soon as possible for security of the loader.

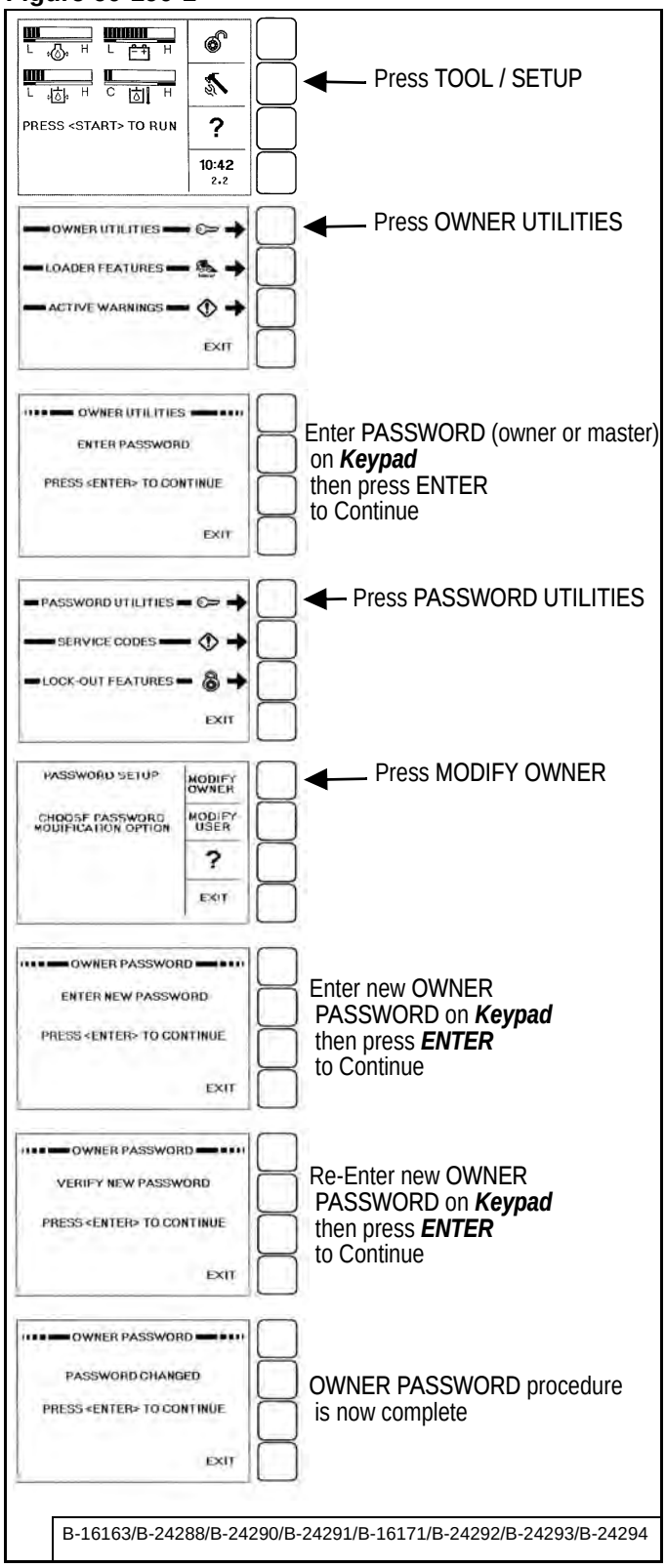
User Password:

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

For the procedures to change passwords (See Changing The Owner Password on Page 60-190-1.) (See Changing The User Passwords on Page 60-190-2.)

Changing The Owner Password

Figure 60-190-1



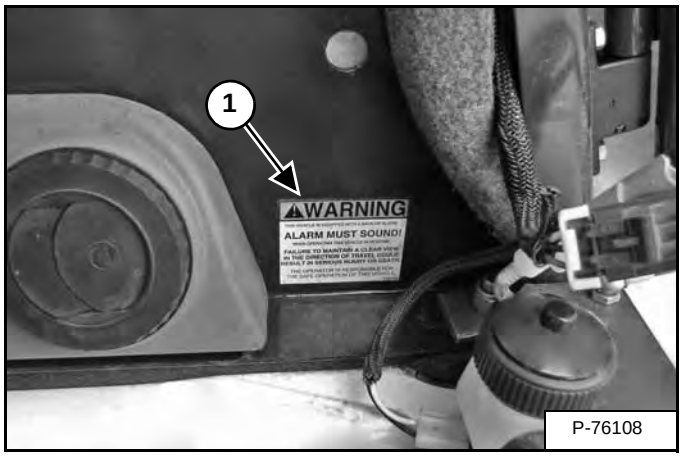
BACK-UP ALARM SYSTEM

Description

This machine may be equipped with a back-up alarm system. The back-up alarm will sound when the operator moves both steering levers or joystick(s) into the reverse position. Slight movement of the steering levers into the reverse position is required with hydrostatic transmissions, before the back-up alarm will sound.

Inspecting

Figure 60-210-1



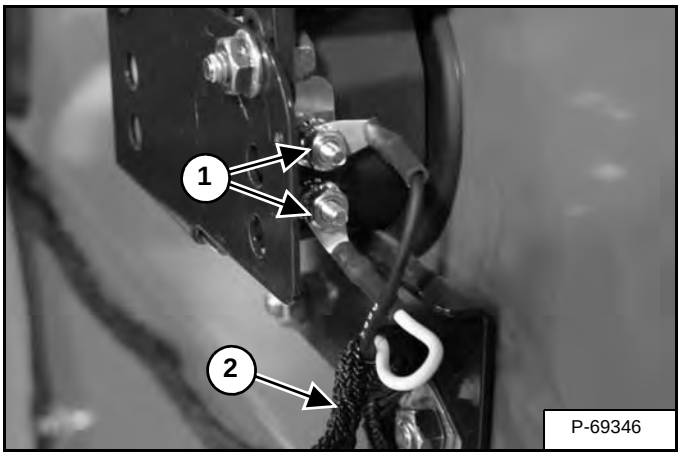
Inspect for damaged or missing back-up alarm decal (Item 1) **[Figure 60-210-1]**. Replace if required.

Sit in the seat and fasten the seat belt. Engage the parking brake. Pull the seat bar all the way down. Start the engine. Press the PRESS TO OPERATE LOADER button. Disengage the parking brake.

Move both steering levers or joystick(s) into the reverse position. The back-up alarm must sound when all wheels or both tracks are moving in reverse.

The back-up alarm is located on the inside of the rear door.

Figure 60-210-2



Inspect the back-up alarm electrical connections (Item 1) **[Figure 60-210-2]**, wire harness (Item 2) **[Figure 60-210-2]** and back-up alarm switches (if equipped) (Item 2) **[Figure 60-210-3]** for tightness and damage. Repair or replace any damaged components.

If the back-up alarm switches require adjustment, (See Adjusting Switch Position on Page 60-210-2.)

ENGINE INFORMATION

Description

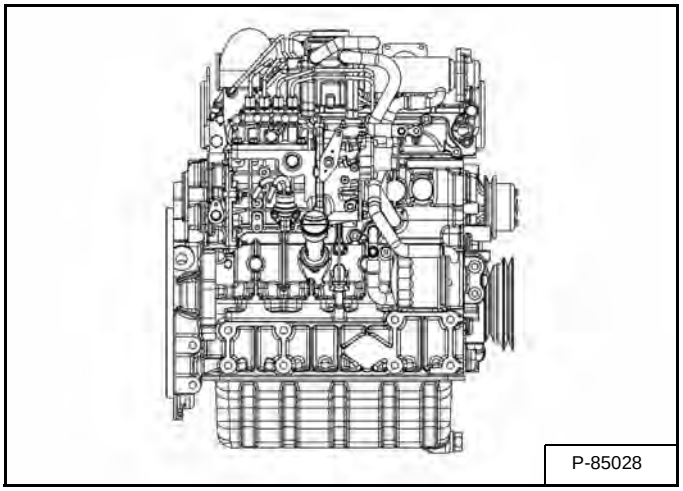
The S160 has a Kubota direct injected V2607-DI-T turbo diesel engine with a displacement of 2,6 L (158.7 in^3). The engine is rated at an SAE Net 43,3 kW (58 hp) and has a closed crankcase ventilation system **[Figure 70-10-1]**.

The engine has 4 cylinders and the rotation is counter-clockwise (viewed from the flywheel side). It is equipped with glow plugs for assisting in cold starts. Engine block heaters are also available from Bobcat Parts. To meet emission regulations it is also equipped with an Exhaust Gas Recirculation (EGR) system to reduce Nitrogen Oxide (NOx).

The engine serial number is stamped on the engine and is located near the injection pump. The model number is located on the valve cover. Use these numbers to obtain the correct service parts.

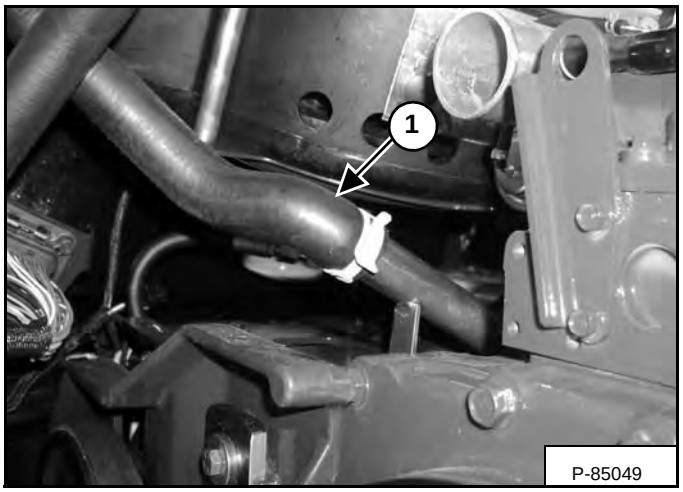
The engine is liquid cooled with a propylene glycol / water mixture in a radiator. Coolant flow is controlled by a thermostat. The cooling fan is driven by a hydraulic motor. The speed of the fan is determined by the engine coolant temperature sensor and the hydraulic / hydrostatic fluid temperature sensor.

Figure 70-10-1



Engine Removal And Installation (Cont'd)

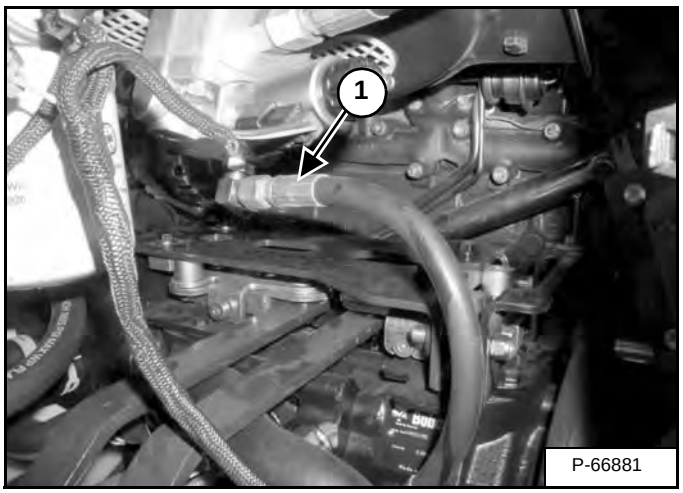
Figure 70-10-12



Disconnect engine coolant hose (Item 1) **[Figure 70-10-12]**.

Cap or plug all hoses and fittings.

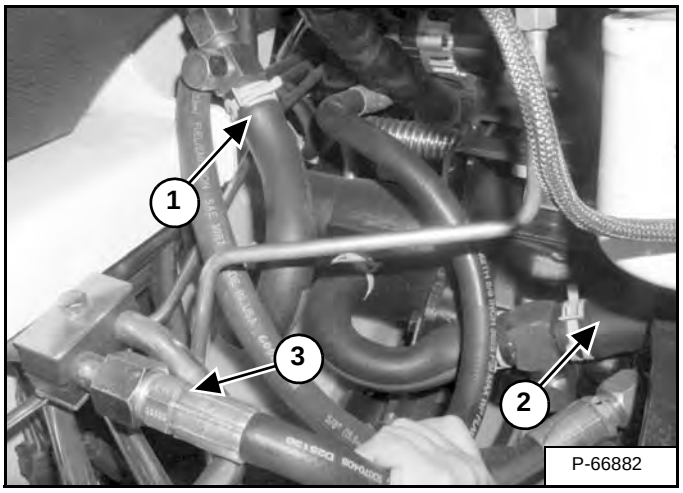
Figure 70-10-13



Disconnect drain hose (Item 1) **[Figure 70-10-13]** from the hydraulic cooling fan.

Cap or plug all hoses and fittings.

Figure 70-10-14



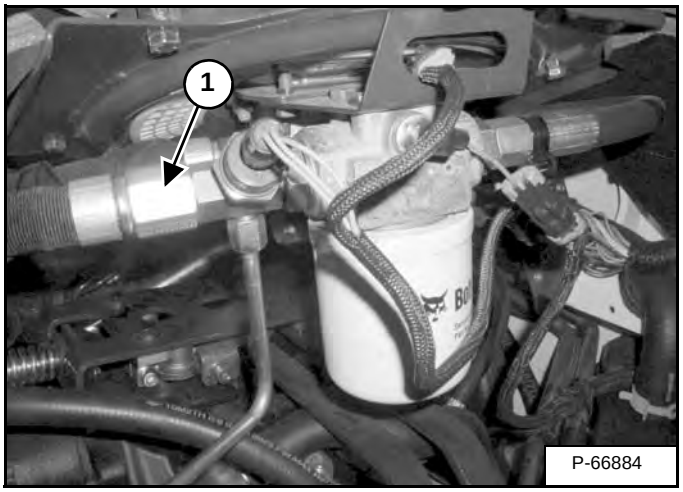
Disconnect gear pump inlet hose (Item 1) **[Figure 70-10-14]**.

Disconnect supply hose (Item 2) **[Figure 70-10-14]** from hydraulic fluid reservoir.

Disconnect gear pump outlet hose (Item 3) **[Figure 70-10-14]**.

Cap or plug all hoses and fittings.

Figure 70-10-15

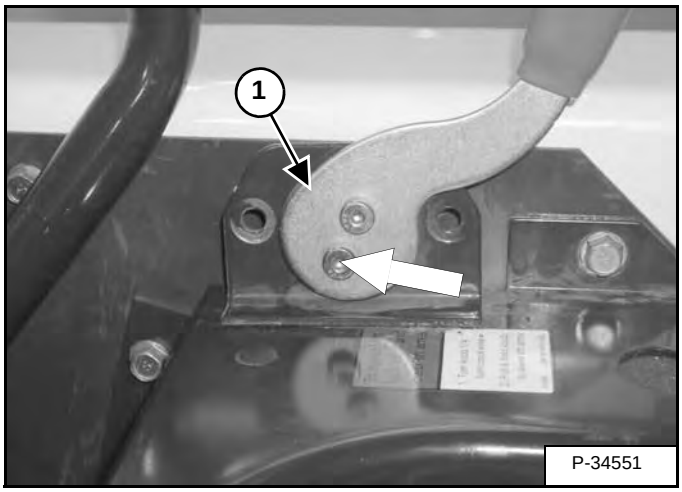


Mark and disconnect the charge pump / fan filter outlet hose (Item 1) **[Figure 70-10-15]**.

Cap or plug all hoses and fittings.

Removal And Installation (Cont'd)

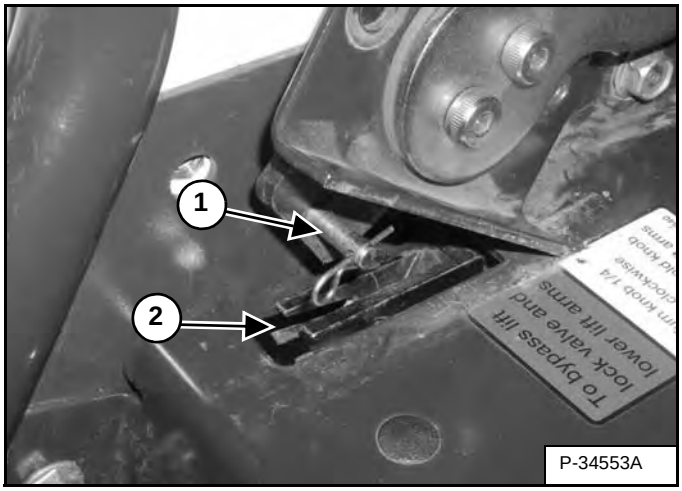
Figure 70-21-8



At the bottom side of the control panel, move the speed control linkage toward the rear of the loader.

Slide the hand speed control lever (Item 1) **[Figure 70-21-8]** forward and lift, and disconnect the assembly from the speed control cable.

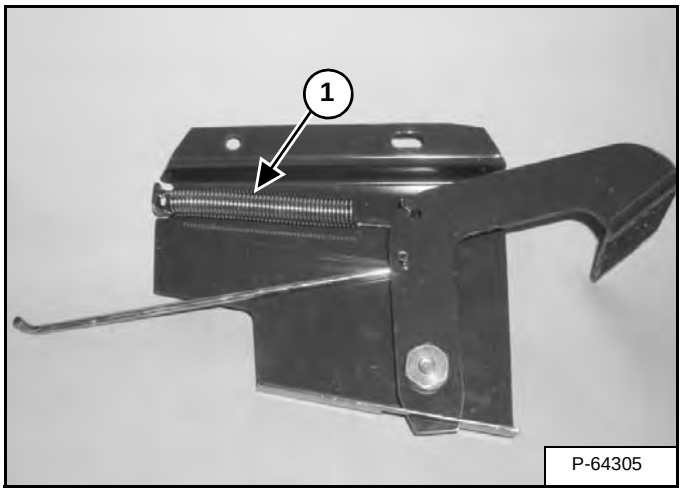
Figure 70-21-9



Installation: When installing the hand speed control to the speed control cable, be sure the speed control lever (Item 1) fits in the notch (Item 2) **[Figure 70-21-9]** of the speed control rod clevis.

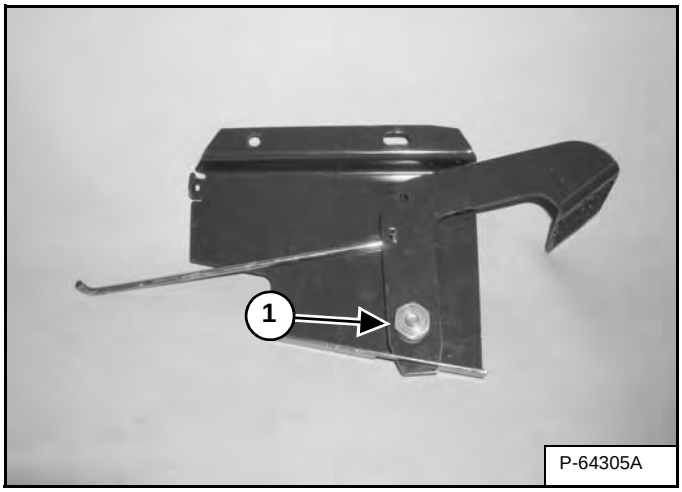
Disassembly And Assembly

Figure 70-21-10



Remove the spring (Item 1) **[Figure 70-21-10]** from the foot speed control assembly.

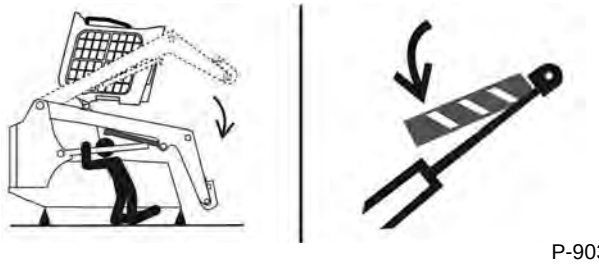
Figure 70-21-11



Remove the bushing / nut (Item 1) **[Figure 70-21-11]** from the pedal lever.

Blower Housing Removal And Installation (S/N A3L329999 & Below And A3L429999 & Below)

DANGER



P-90328

AVOID DEATH

- **Disconnecting or loosening any hydraulic tubeline, hose, fitting, component or a part failure can cause lift arms to drop.**
- **Keep out of this area when lift arms are raised unless supported by an approved lift arm support. Replace if damaged.**

D-1009-0409

WARNING

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

W-2059-0598

IMPORTANT

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

I-2003-0888

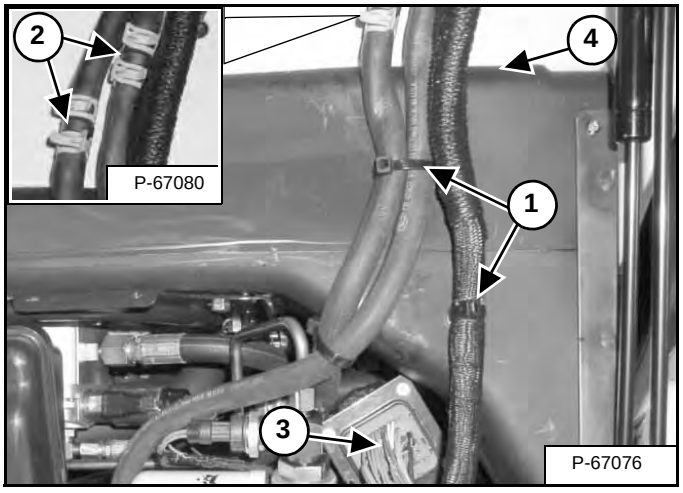
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Remove the fan motor / charge pump filter housing. (See Charge Filter Housing Removal And Installation on Page 20-80-3.)

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

Figure 70-50-10



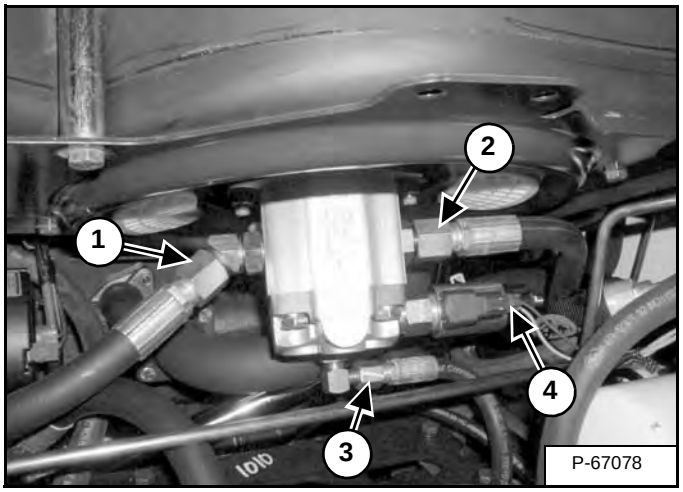
Remove cable ties (Item 1) **[Figure 70-50-10]** attached to blower housing.

Disconnect and plug the heater hoses (Item 2) **[Figure 70-50-10]**.

Disconnect the cab harness connector (Item 3) **[Figure 70-50-10]**.

Remove the sealant between the blower housing and the loader frame (Item 4) **[Figure 70-50-10]**.

Figure 70-50-11



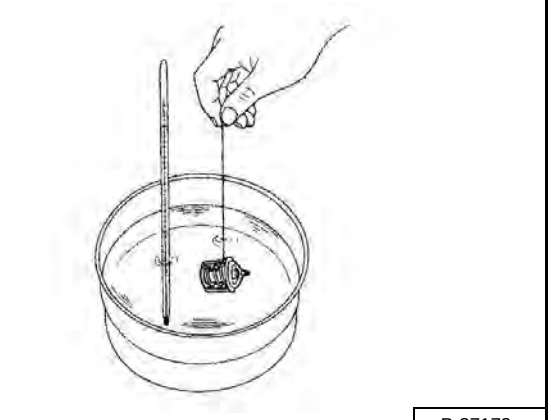
Remove the fan motor inlet hose (Item 1) and outlet hose (Item 2) **[Figure 70-50-11]**.

Remove the fan motor case drain hose (Item 3) **[Figure 70-50-11]**.

Disconnect the electrical connector (Item 4) **[Figure 70-50-11]**.

Thermostat - Checking

Figure 70-50-36



Push down the thermostat valve and insert a string between the valve and the valve seat.

Place the thermostat and a thermometer in a container with water and gradually heat the water **[Figure 70-50-36]**.

Hold the string to suspend the thermostat in the water. When the water temperature rises, the thermostat valve will open, allowing it to fall down from the string.

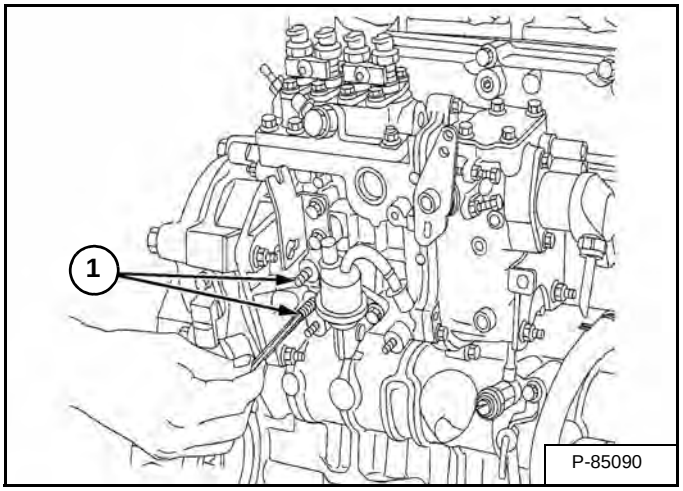
Continue heating the water and read the temperature when the valve has risen by about 8 mm (0.315 in).

If the measurement is not acceptable, replace the thermostat.

Thermostat's valve opening temperature	Factory spec.	74.5 - 78.5°C (166.1 - 173.3°F)
Temperature at which thermostat completely opens	Factory spec.	90°C (194°F)

Fuel Injection Pump Assembly Removal And Installation (Cont'd)

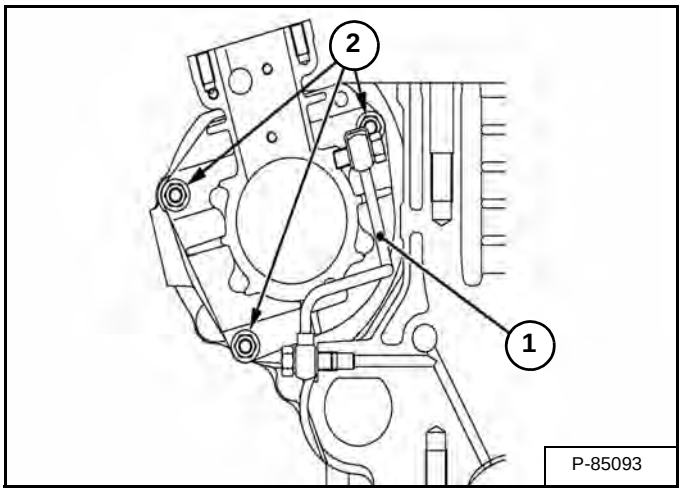
Figure 70-70-13



Install one lock tool in the upper plug opening (Item 1) and tighten until it comes in contact with the fuel camshaft. Make sure the fuel camshaft is not moving. Install second lock tool in lower opening (Item 1) **[Figure 70-70-13]** and repeat the process.

NOTE: Do not over tighten the lock screws after they have contacted the fuel camshaft. Otherwise the injection pump may become damaged.

Figure 70-70-14



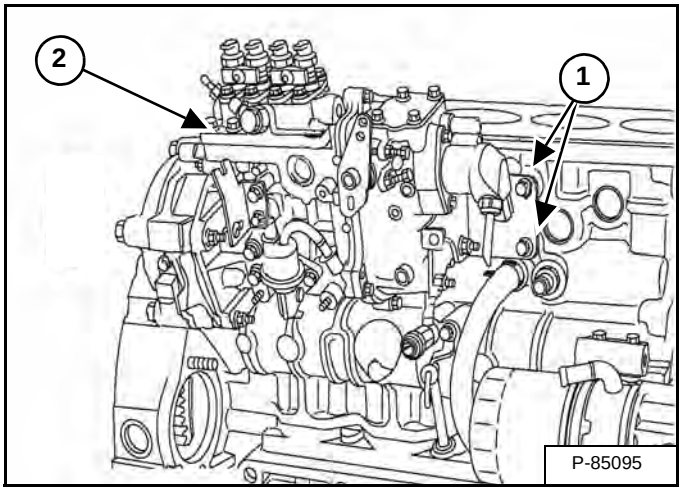
Remove the lubricating oil pipe (Item 1) **[Figure 70-70-14]**.

Remove the three injection pump mounting nuts (Item 2) **[Figure 70-70-14]**

Installation: Tighten the lubricating oil pipe to 16 - 19 N•m (12 - 14 ft-lb) torque.

Installation: Tighten the injection pump mounting nuts to 18 - 20 N•m (13 - 15 ft-lb) torque.

Figure 70-70-15



Remove injection pump support (Item 1) **[Figure 70-70-15]**.

Remove injection pump assembly (Item 2) **[Figure 70-70-15]**.

Installation: Reverse procedure to install.

Fuel Injection Pump - Timing

IMPORTANT

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

I-2028-0289

Remove the drive belt cover.

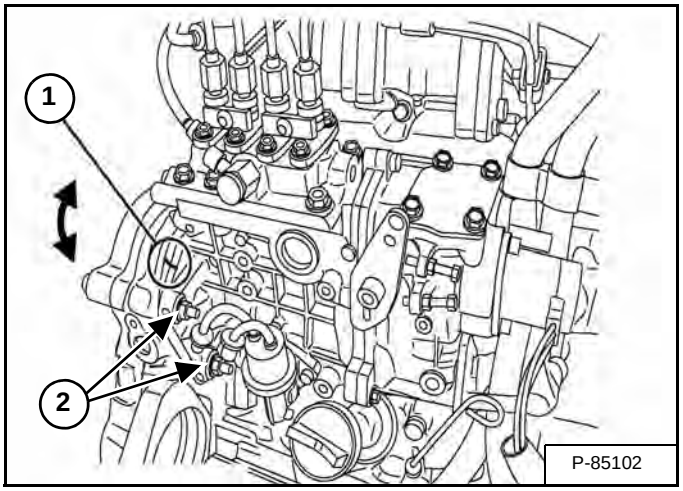
Remove the engine speed sensor.

Remove the fuel injection high pressure lines.

Installation: Tighten the fuel injection high pressure lines to 28 N•m (21 ft-lb) torque.

Remove the fuel shutoff solenoid. (See Fuel Shutoff Solenoid Removal And Installation on Page 70-70-1.)

Figure 70-70-39

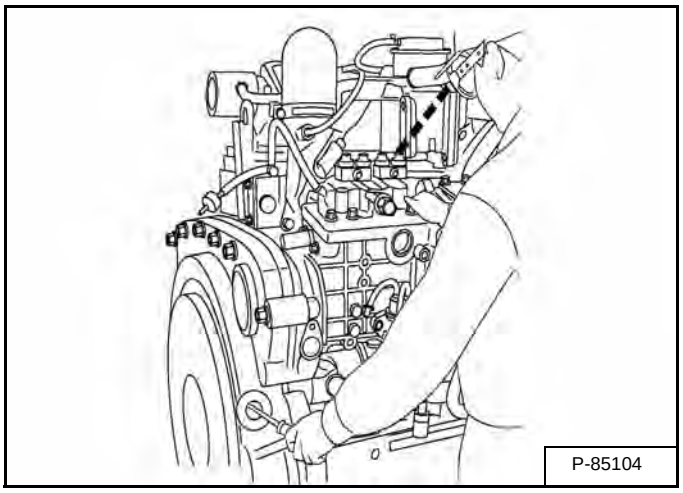


A timing mark (Item 1) **[Figure 70-70-39]** is stamped at the injection pump and flywheel housing parting line during engine manufacture. Verify the mark is aligned before proceeding. If necessary, loosen the three injection pump mounting bolts (Item 2) **[Figure 70-70-39]** and align the mark.

NOTE: The third injection pump mounting bolt is located behind the pump.

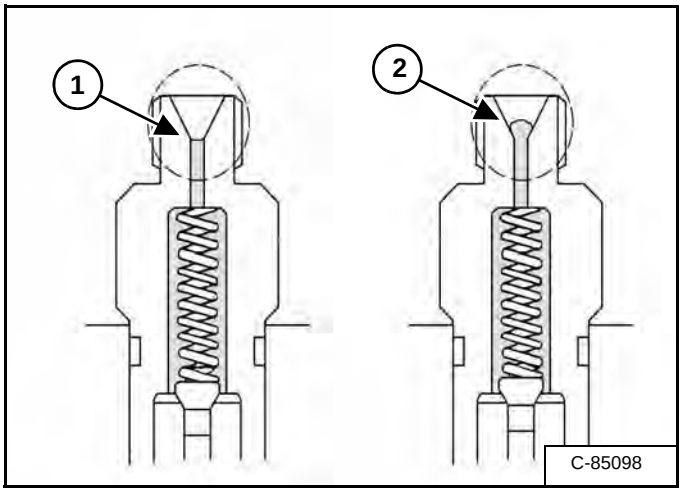
NOTE: Timing the injection pump is done by rotating the injection pump assembly upward for advance, downward for retard.

Figure 70-70-40



Rotate the flywheel counterclockwise (viewed from the flywheel side) **[Figure 70-70-40]** until fuel fills up to the hole of the number one cylinder delivery valve holder (Item 1) **[Figure 70-70-41]**.

Figure 70-70-41

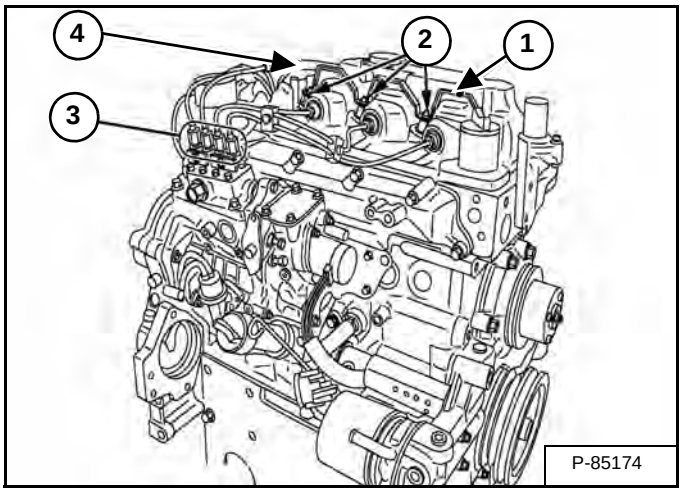


After fuel fills up the hole of the number one cylinder delivery valve holder (Item 1) **[Figure 70-70-41]**, turn back the flywheel clockwise approximately 1,6 rad (90 degrees).

NOTE: A small clear clean plastic tube that fits securely in holder port can be inserted and marked to provide an easier visual indicator of the fuel level and when it changes.

Cylinder Head Removal And Installation

Figure 70-80-10



Remove the glow plug connecting strap (Item 1), glow plugs (Item 2), and injection pipes (Item 3) **[Figure 70-80-10]**.

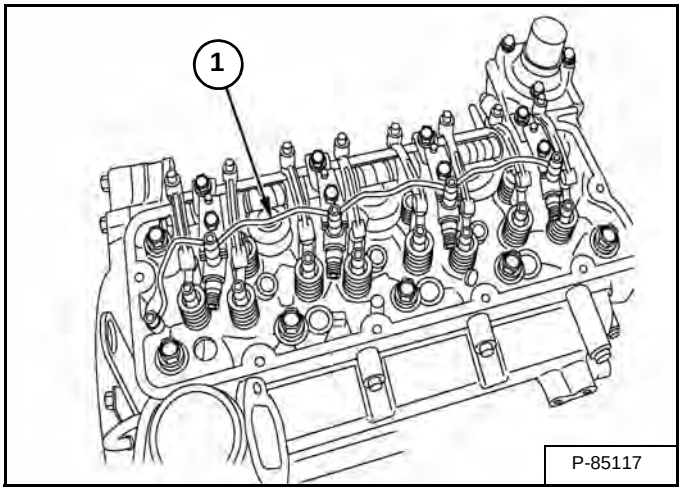
Remove the valve cover (Item 4) **[Figure 70-80-10]** and gasket.

Installation: Gradually tighten the valve cover bolts to 9,81 - 11,2 N•m (7 - 8 ft-lb) torque. Tighten center bolts first, then work your way to the front and back of the valve cover.

Installation: Tighten injection pipe retaining nuts to 23 - 36 N•m (17 - 26 ft-lb) torque.

Installation: Tighten glow plugs to 7,7 - 9,3 N•m (5.7 - 6.8 ft-lb) torque.

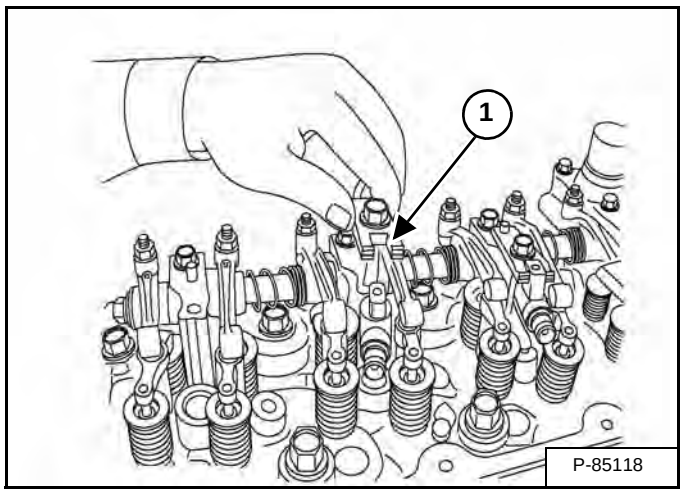
Figure 70-80-11



Remove the overflow pipe (Item 1) **[Figure 70-80-11]**.

Installation: Tighten overflow pipe to 9,81 - 11,2 N•m (7 - 8 ft-lb) torque.

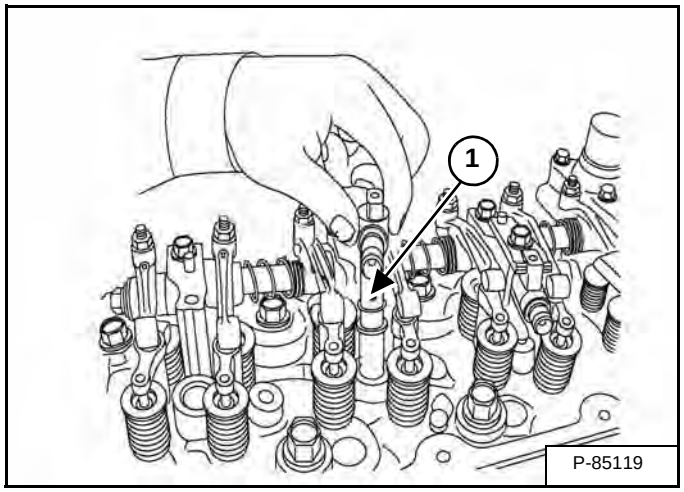
Figure 70-80-12



Remove the nozzle holder clamps (Item 1) **[Figure 70-80-12]**.

Installation: Tighten the nozzle holder clamp bolts to 24 - 27 N•m (18 - 20 ft-lb) torque.

Figure 70-80-13

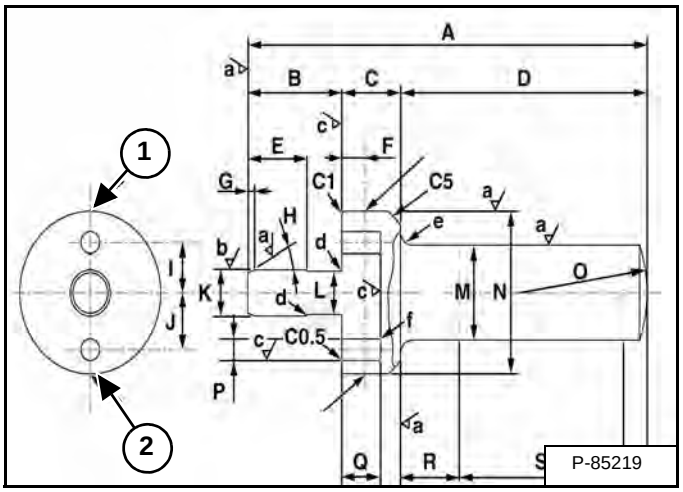


Remove the nozzle holder assembles and nozzle gaskets (Item 1) **[Figure 70-80-12]**.

Installation: Tighten the nozzle holder clamp bolts to 24 - 27 N•m (18 - 20 ft-lb) torque.

Bridge Arm Shaft Removal And Installation

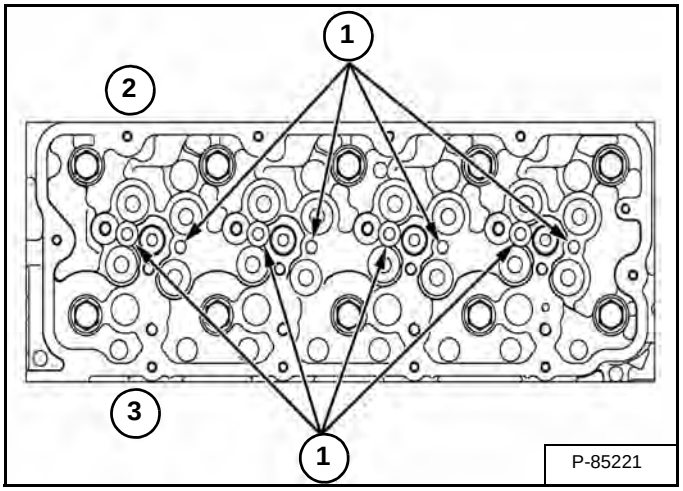
Figure 70-80-45



Make bridge arm shaft replacement tool as shown above (Item 1) intake side and (Item 2) is exhaust side **[Figure 70-80-45]**.

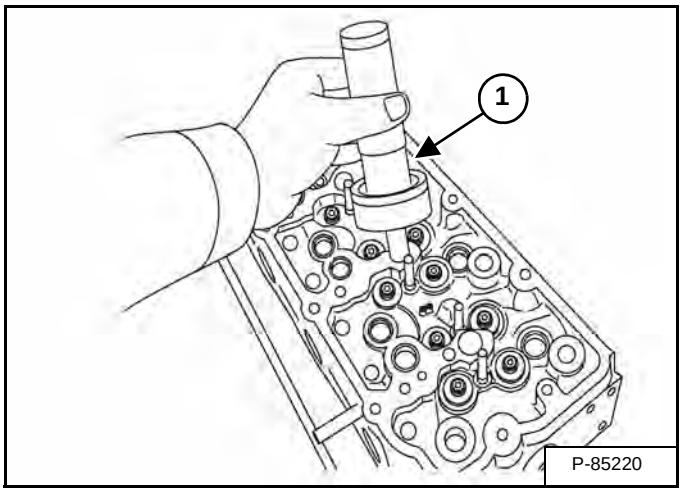
A	170 mm (6.69 in)
B	40,0 mm (1.57 in)
C	25,0 mm (0.984 in)
D	105 mm (4.13 in)
E	25,0 mm (0.984 in)
F	10,0 mm (0.394 in)
G	3,0 mm (0.12 in)
H	0,35 rad. (20°)
I	18,45 - 18,55 mm (0.7264 - 0.7303 in)
J	20,95 - 21,05 mm (0.8248 - 0.8287 in)
K	17,057 - 17,084 mm dia. (0.67154 - 0.67259 in dia.)
L	16,0 mm dia. (0.630 india)
M	35,0 mm dia. (1.38 in dia.)
N	60,0 mm dia. (2.36 in dia.)
O	SR 50,0 mm (1.97 in)
P	8,10 - 8,15 mm dia. (0.319 - 0.320 in dia.)
Q	16,4 - 16,6 mm (0.646 - 0.653 in)
R	25,0 mm (0.984 in)
S	70,0 mm (2.76 in) Knurled
T	10,0 mm (0.394 in)
a	Ra = 6.3 a
b	Ra = 1.6 a
c	Ra = 3.2 a
d	0,50 mm radius (0.020 in radius)
e	5,0 mm radius (0.20 in radius)
f	under 0,30 mm radius (0.012 in radius)
C0.5	Chamfer 0,50 mm (0.020 in)
C1	Chamfer 1,0 mm (0.039 in)
C5	Chamfer 5,0 mm (0.20 in)

Figure 70-80-46



Remove the used bridge arm shaft (Item 1), then clean bridge arm shaft mounting hole. Apply an anaerobic sealant to the tip of the bridge arm shaft. Intake side (Item 2) and exhaust side (Item 3) **[Figure 70-80-46]**.

Figure 70-80-47



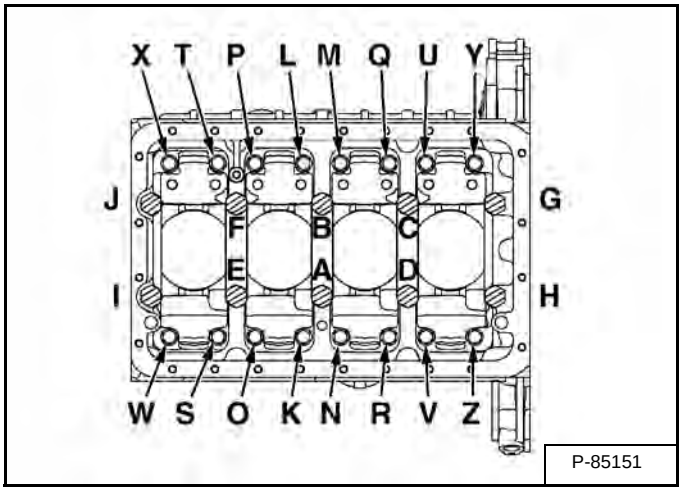
Install bridge arm shaft using the tool (Item 1) **[Figure 70-80-47]** to the proper depth in **[Figure 70-80-48]**.

CRANKSHAFT AND PISTONS (CONT'D)

Crankshaft And Bearings Removal And Installation

Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 70-90-1.)

Figure 70-90-21

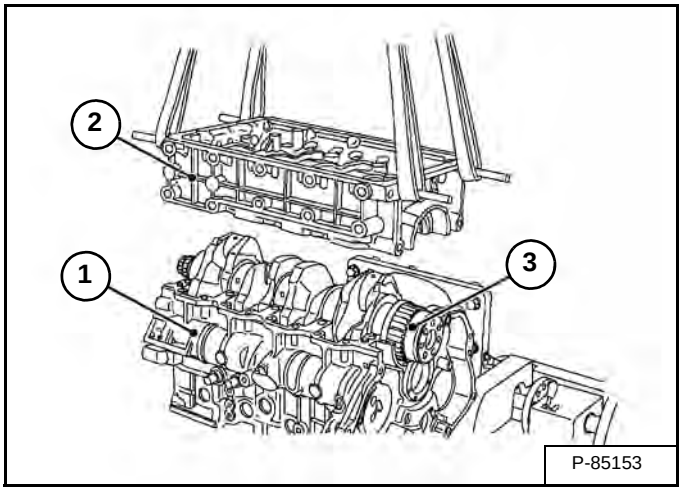


Remove the crankcase mounting screws in order from Z to A **[Figure 70-90-21]**.

Installation: Tighten the crankcase mounting bolts from A to J to 128 - 137 N•m (94.1 - 101 ft-lb)

Installation: Tighten the crankcase mounting bolts from K to Z to 49 - 55 N•m (37 - 41 ft-lb).

Figure 70-90-22

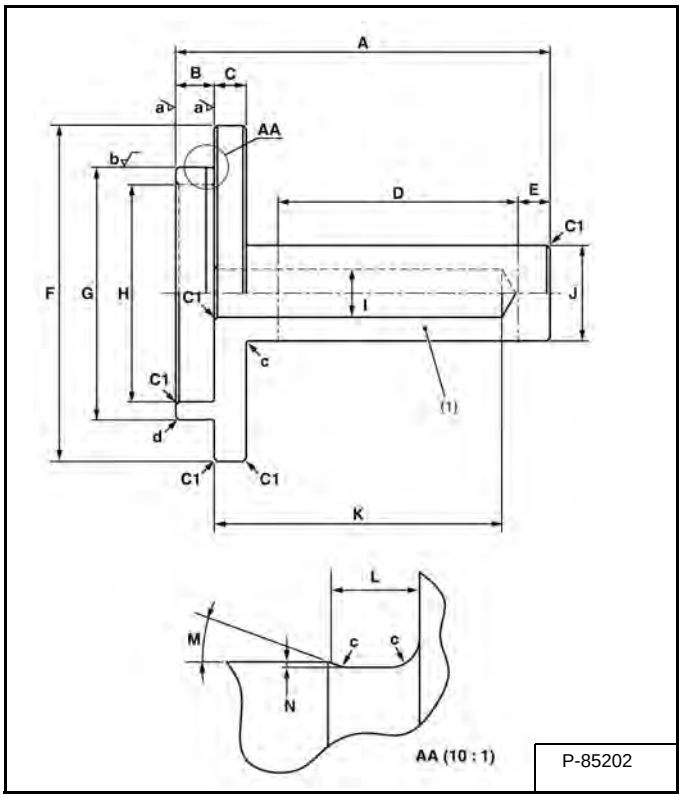


Remove crankcase 2 (Item 2) from crankcase 1 (Item 1) **[Figure 70-90-22]**.

Remove the crankshaft (Item 3) **[Figure 70-90-22]**.

Timing Gearcase Cover Installation (Cont'd)

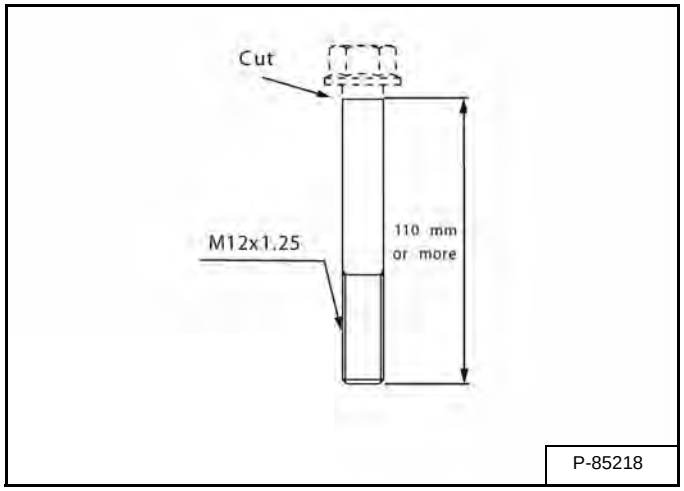
Figure 70-100-3



A	117 mm (4.61 in)
B	12,0 mm (0.472 in)
C	10,0 mm (0.394 in)
D	75,0 mm (2.95 in)
E	10,0 mm (0.394 in)
F	105 mm dia. (4.13 in dia.)
G	78,9971 - 78,9990 mm dia. (3.11013 - 3.11019 in dia.)
H	68,0 mm dia. (2.68 in dia.)
I	15,0 mm dia. (0.591 in dia.)
J	30,0 mm dia. (1.18 in dia.)
K	90,0 mm (3.54 in)
L	2,5 mm (0.098 in)
M	0,35 rad (20 °)
N	0,15 - 0,25 mm (0.0059 - 0.0098 in)
a	Ra = 3.2 a
b	Ra = 1.6 a
c	0,80 mm radius (0.031 in radius)
d	1,5 mm radius (0.059 in radius)
C1	Chamfer 1,0 mm (0.039 in)

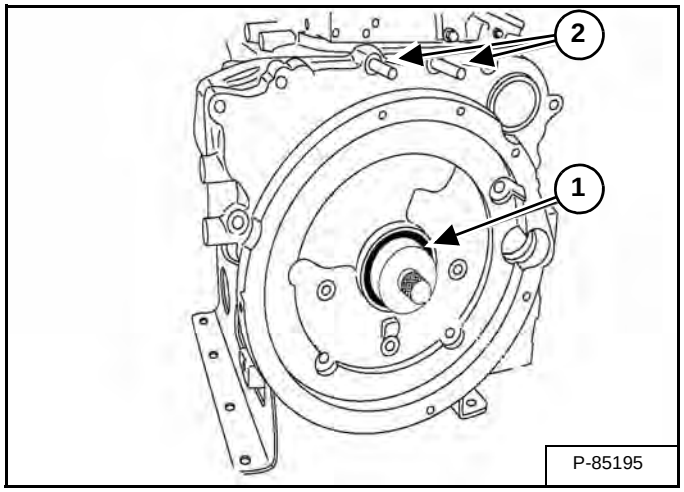
Make timing gearcase oil seal replacing tool **[Figure 70-100-3]**.

Figure 70-100-4



Make timing gearcase guide screws as shown above **[Figure 70-100-4]**.

Figure 70-100-5



Apply engine oil to the timing gearcase oil seal (Item 1) **[Figure 70-100-5]**.

Install timing gearcase guide screws (Item 2) **[Figure 70-100-5]**.

Housing Removal And Installation

Remove the engine / hydrostatic pump package from the loader. (See Engine Removal And Installation on Page 70-10-8.)

Remove the drive belt shield. (See Shield Removal And Installation on Page 30-60-1.)

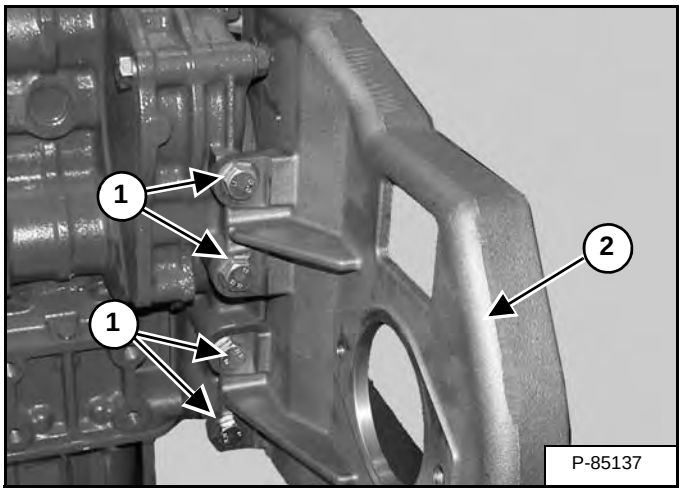
Remove the drive belt tension pulley. (See Tensioner Pulley Removal And Installation on Page 30-60-4.)

Remove the drive belt. (See Belt Removal And Installation on Page 30-60-3.)

Remove the starter. (See Removal And Installation on Page 60-40-2.)

Remove the flywheel. (See Flywheel Removal And Installation on Page 70-120-1.)

Figure 70-120-7



Remove the four mounting bolts (Item 1) and the housing (Item 2) **[Figure 70-120-7]**.

Installation: Tighten the mounting bolts to 80 - 84 N•m (56 - 62 ft-lb) torque.

AIR CONDITIONING SYSTEM FLOW

Description

In an air conditioning system the refrigerant is circulated under pressure through five major components in a closed circuit. At these five points in the system the refrigerant goes through pressure and temperature changes.

The compressor (Item 1) (See Chart on Page 80-10-2.) takes in heated, low pressure refrigerant gas through the suction valve (low pressure side) and as the name indicates, pressurizes the heated refrigerant and forces it through the discharge valve (high pressure side) on the condenser (Item 2) (See Chart on Page 80-10-2.)

Ambient air passing through the condenser removes the heat from refrigerant resulting in physical state change in the refrigerant from a gas to a liquid.

The liquid refrigerant moves on to the receiver / drier (Item 3) (See Chart on Page 80-10-2.) where impurities such as moisture and dirt are filtered out. The receiver / drier also serves as the storage tank for the liquid refrigerant. The liquid refrigerant (still under high pressure) flows to the expansion valve (Item 4) (See Chart on Page 80-10-2.)

The expansion valve meters the amount of refrigerant into the evaporator coil (Item 5) (See Chart on Page 80-10-2.) As the refrigerant passes through the expansion valve, it again changes its physical state. It becomes a low temperature, low-pressure liquid and saturated vapor. The low pressure liquid immediately starts to boil and vaporize as it enters the evaporator. The hot humid air of the machine's cab is drawn through or blown into the evaporator by the evaporator fan (Item 6) (See Chart on Page 80-10-2.) Since the refrigerant is colder than the air, it absorbs the heat from the air and produces cooled air, which is pushed into the cab by the fan. The moisture in the air condenses on the evaporator coil and drips into the drain pan, which directs the water out of the cab.

The refrigerant cycle is completed when the heated low pressure gas is again drawn into the compressor.

TROUBLESHOOTING

Blower Motor Does Not Operate

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

Blower Motor Operates Normally, But Air Flow Is Insufficient

Possible Cause	Inspection	Solution
1. Evaporator inlet obstruction.	Check evaporator for plugging.	Remove obstruction and clean evaporator fins with air or water.
2. Air leak.	Check to make sure air hoses are properly hooked to Louvers, and air ducts.	Repair of adjust.
3. Defective thermo. switch (frozen evaporator).	Check thermostat using a circuit tester.	Replace thermostat.
4. Plugged cab filters	Check cab filter condition.	Clean or replace filters.

Insufficient Cooling Although Air Flow And Compressor Operation Are Normal

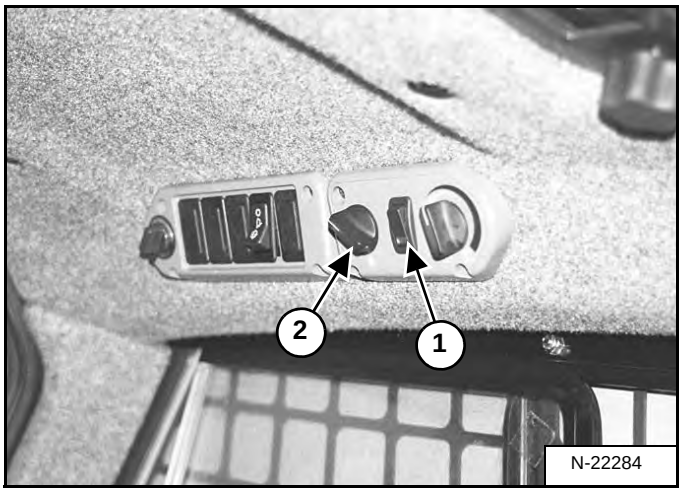
Possible Cause	Inspection	Solution
1. System low on refrigerant.	The high side pressure will be low and bubbles may be present in sight glass on receive drier.	Repair any leaks and recharge the refrigerant to the correct level.
2. Excessive refrigerant.	The high pressure side pressure will be high.	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.

The Compressor Does Not Operate At All, Or Operates Improperly

Possible Cause	Inspection	Solution
1. Loose drive belt.	The belt is vibrating or oscillating.	Adjust tension.
2. Internal compressor malfunction.	The compressor is locked up and the belt slips.	Replace compressor.
	Magnetic clutch related	
3. Low battery voltage.	Clutch slips.	Recharge the battery.
4. Faulty coil.	Clutch slips.	Replace the magnetic clutch.
5. Oil on the clutch surface.	Clutch slips.	Replace or clean the clutch surface.
6. Open Coil.	Clutch does not engage and there is no reading when a circuit tester is connected between the coil and terminals.	Replace clutch.
7. Broken wiring or poor ground.	Clutch will not engage. Inspect the ground and connections.	Repair.
8. Wiring harness components.	Test the conductance of the pressure switch, thermostat, Relay, etc.	Check operation / thermostat LED status.

Electrical System

Figure 80-30-4



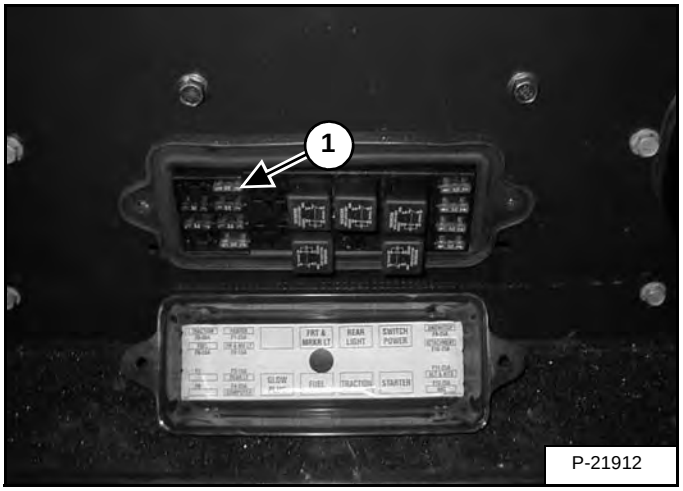
Check to see if the compressor clutch is engaging.

With an operator in the loader seat and the cab door open, turn the loader key switch to RUN (Standard Panel) OR press the RUN / ENTER Button (Deluxe Panel), without starting the loader.

Push the A/C switch (Item 1) to the ON position. Turn the blower fan switch (Item 2) **[Figure 80-30-4]** to the first On position.

The compressor clutch should make a click sound, which indicates the clutch is engaging.

Figure 80-30-5

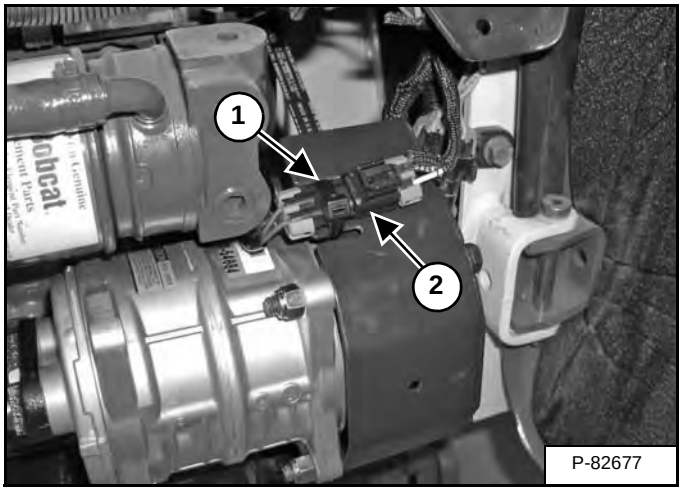


If the compressor clutch does not engage, check the loader fuse (Item 1) **[Figure 80-30-5]** located on the control panel in the loader cab.

Replace the fuse if burned out.

NOTE: The decal inside the fuse cover, refers to the fuse as HEATER. This fuse controls the power for both the Heater and the A/C systems.

Figure 80-30-6



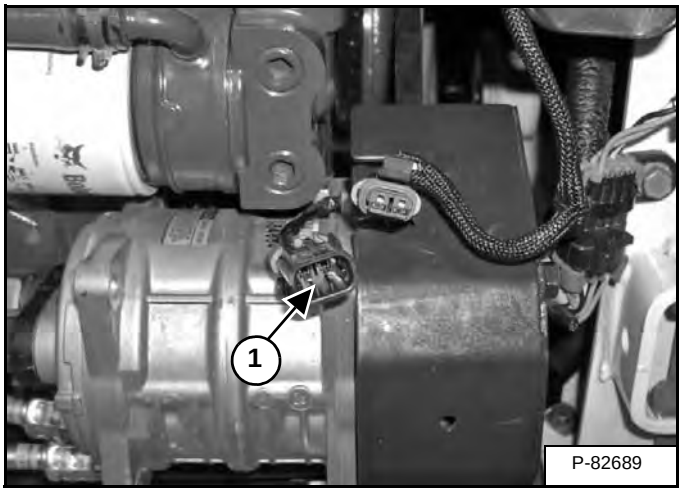
Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Remove the tie strap (Item 1) and disconnect the loader harness (Item 2) **[Figure 80-30-6]** from the compressor clutch wire.

Installation: Secure the harness with a new tie strap (Item 1) **[Figure 80-30-6]** after reconnecting.

Figure 80-30-7



With a multi meter, check the resistance to the compressor clutch (Item 1) **[Figure 80-30-7]**.

If there is no resistance value, replace the compressor clutch. (See Clutch Disassembly And Assembly on Page 80-50-5.)

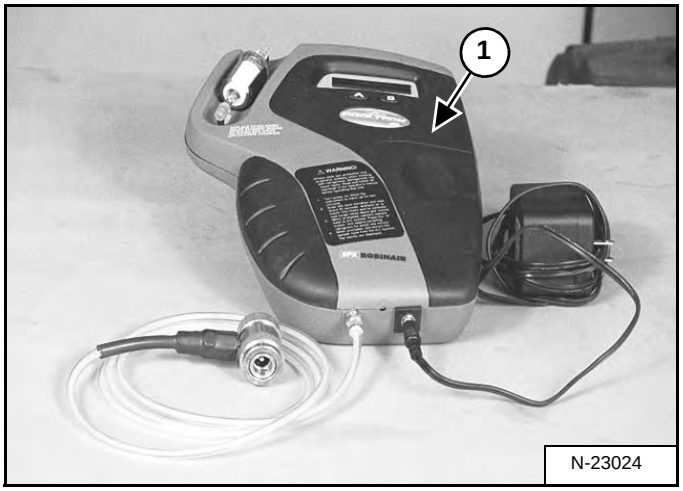
Refrigerant Identification

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

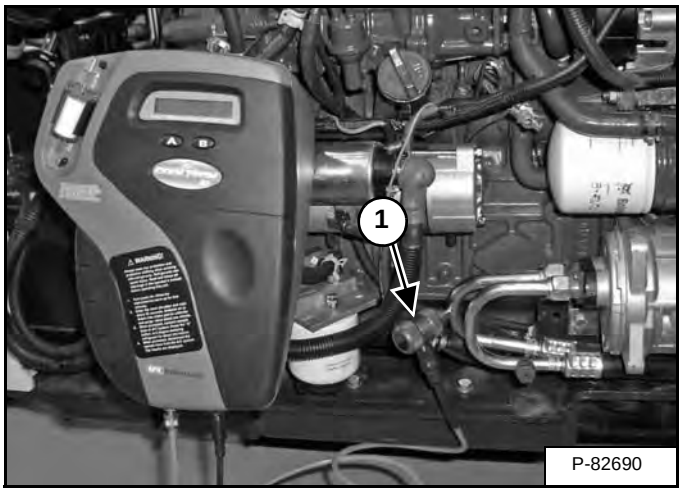
Figure 80-40-1



NOTE: It is recommended to identify the type of refrigerant that is in the A/C system and if it is pure enough to use. The tool MEL1592, Refrigerant Identifier (Item 1) [Figure 80-40-3] will determine, the kind of refrigerant and any possible harmful or dangerous substances that may be present in the system. Thus preventing mixing of dangerous material with your reclaimed R-134a in your reclaimer, and further contamination to other A/C systems that are reclaimed and charged from your MEL1581 Recovery / Recycling / Recharging Machine.

NOTE: This test is run with the loader engine OFF, and the A/C switch in the OFF position.

Figure 80-40-2



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Connect the Refrigerant Identifier to the low pressure hose (Item 1) **[Figure 80-40-2]**.

Connect the Refrigerant Identifier to its power source.

Follow the steps displayed on the refrigerant identifier screen.

Allow two minutes for the refrigerant identifier to display the type of refrigerant and air content. An alarm will sound if potentially flammable hydrocarbons are present and will also indicate on the visual display.

Disconnect the refrigerant identifier from the loader A/C.

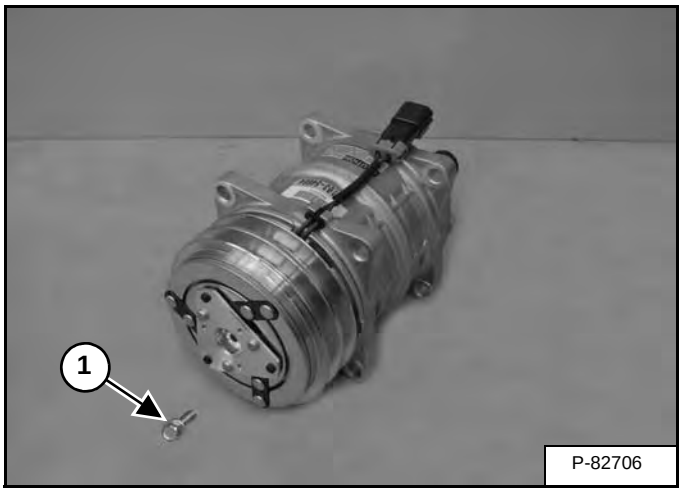
If the refrigerant is dangerous or flammable, it must be evacuated from the A/C system into a separate container and properly and safely disposed of.

If R-134a is found, evacuate the system.

COMPRESSOR (CONT'D)

Clutch Disassembly And Assembly

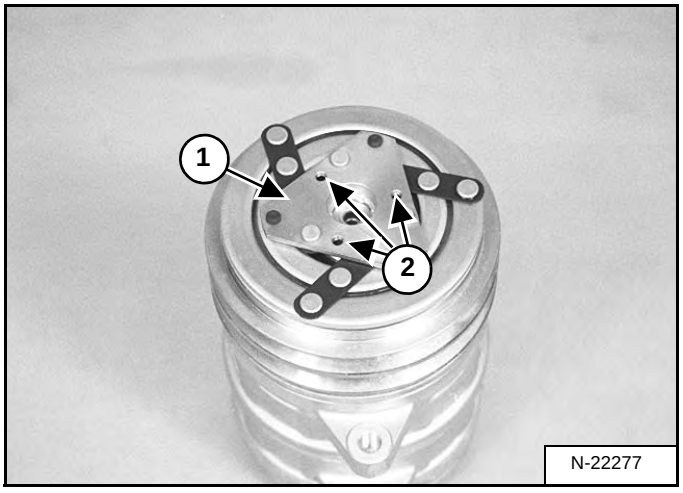
Figure 80-50-9



Remove the center armature bolt (Item 1) **[Figure 80-50-9]**.

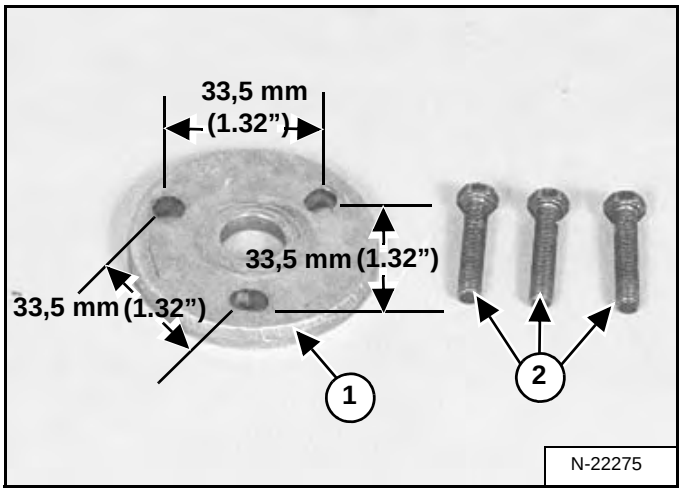
Installation: Tighten the armature bolt to 12 - 14 N•m (8 - 10 ft-lb) torque.

Figure 80-50-10



To remove the armature plate (Item 1) **[Figure 80-50-10]** from the clutch face, you must make an armature plate puller.

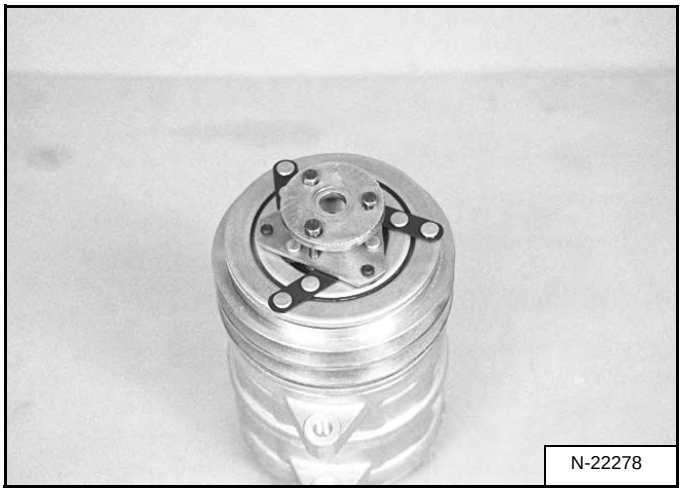
Figure 80-50-11



The armature plate puller, (Item 1) can be constructed by drilling three 10 mm holes in a flat circular plate, located 33,5 mm (1.32 in) apart **[Figure 80-50-11]**.

Attach the puller to the armature plate using three 8 mm bolts (Item 2) **[Figure 80-50-11]**.

Figure 80-50-12



Turn the bolts into the three 8 mm holes (Item 2) **[Figure 80-50-10]** on the armature plate as shown in **[Figure 80-50-12]**.

EVAPORATOR / HEATER UNIT

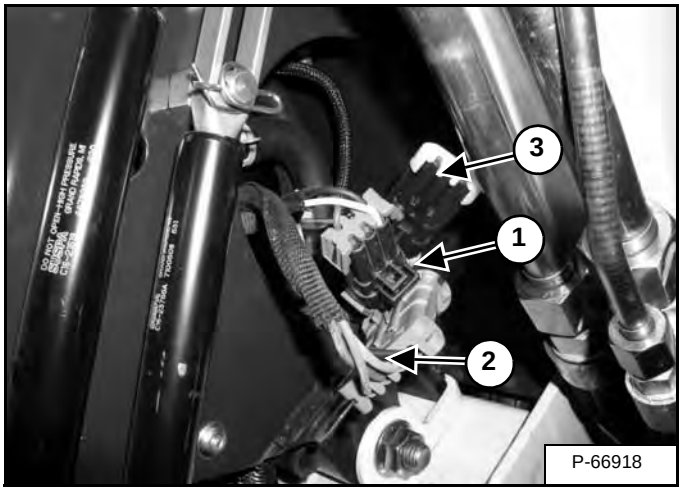
Removal And Installation

Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Evacuate the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

Figure 80-80-1

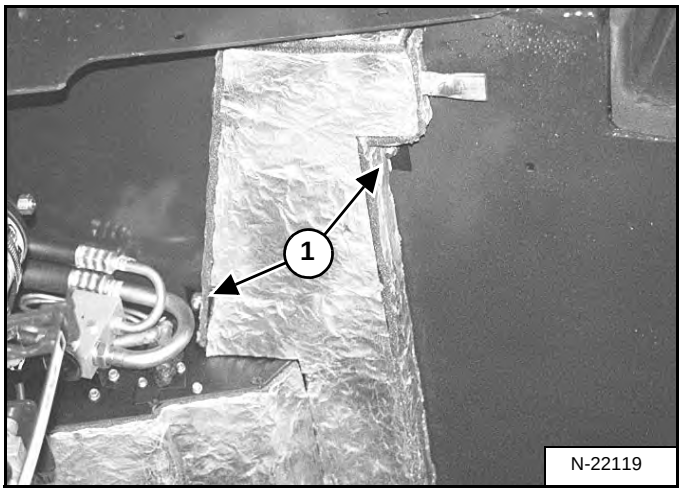


At the rear of the cab, disconnect the heater valve wiring connector (Item 1) **[Figure 80-80-1]**.

Disconnect the blower fan wiring connector (Item 2) **[Figure 80-80-1]** from the loader wiring harness.

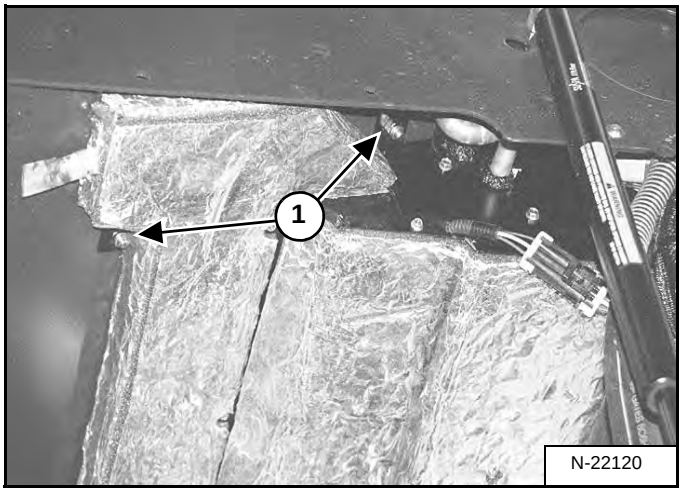
Disconnect the thermostat connector (Item 3) **[Figure 80-80-1]** from the loader wiring harness.

Figure 80-80-2



Remove the two mounting nuts (Item 1) **[Figure 80-80-2]**.

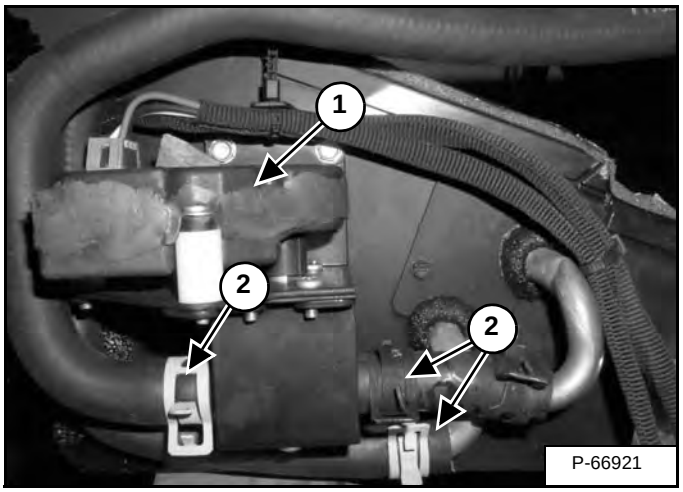
Figure 80-80-3



Remove the two mounting nuts (Item 1) **[Figure 80-80-3]**.

Removal And Installation Without A/C

Figure 80-120-6



Raise the lift arms and install an approved lift arm support device. (See Installing on Page 10-20-1.)

Raise the operator cab. (See Raising on Page 10-30-2.)

Remove the heater unit from the back of the cab. (See Removal And Installation on Page 80-80-1.)

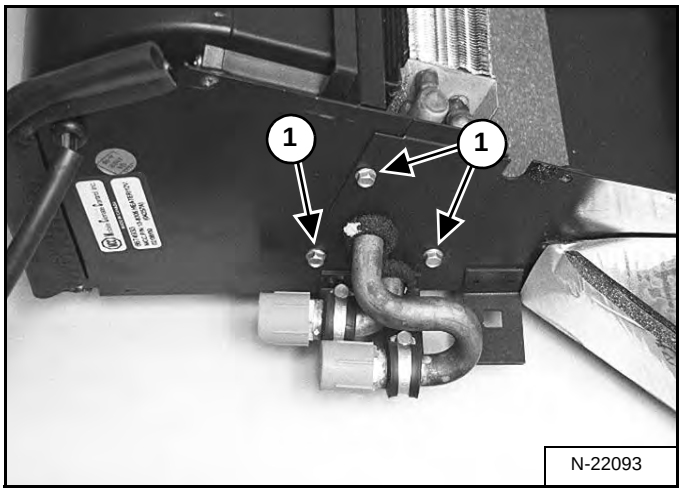
Remove the heater valve (Item 1) **[Figure 80-120-6]**. (See Removal And Installation on Page 80-140-1.)

Mark the heater hoses (Item 2) **[Figure 80-120-6]** for proper installation.

Cap the hoses and the heater coil with hydraulic caps and plugs to prevent oil loss from the system.

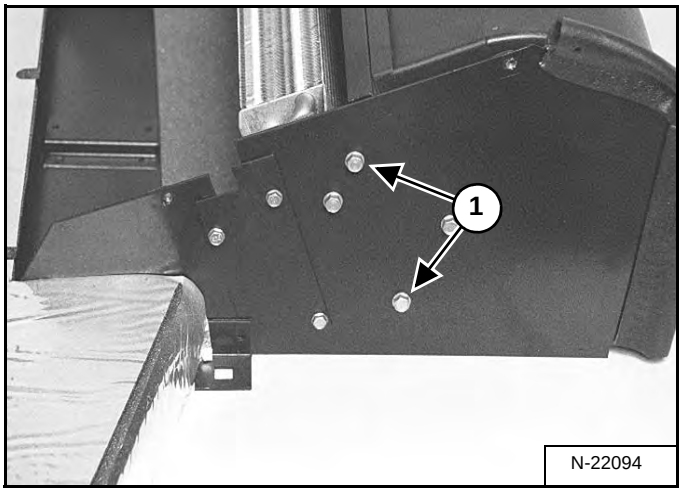
Remove the rear cover from the evaporator / heater unit. (See Evaporator / Heater Coil on Page 80-20-4.)

Figure 80-120-7



Remove the three mount bolts (Item 1) **[Figure 80-120-7]** and remove the mount plate from the end of the unit.

Figure 80-120-8



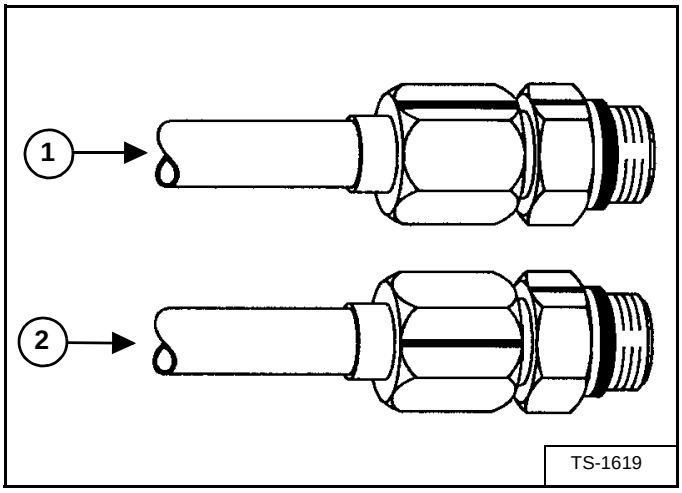
Remove the two mount bolts (Item 1) **[Figure 80-120-8]** from the heater coil.

Remove the heater coil from the unit.

SPECIFICATIONS

Flare Fitting

Figure SPEC-30-4



Use the following procedure to tighten the flare fitting:

Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-30-4]**

Figure SPEC-30-5

Flare Fitting Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	7/16” - 20	18 (13)
5/16”	1/2” - 20	23 (17)
3/8”	9/16” - 18	30 (22)
1/2”	3/4” - 16	54 (40)
5/8”	7/8” - 14	81 (60)
3/4”	1-1/16” - 12	114 (84)
7/8”	1-3/16” - 12	133 (98)
1”	1-5/16” - 12	160 (118)
1-1/4”	1-5/8” - 12	209 (154)
1-1/2”	1-7/8” - 12	221 (163)
2”	2-1/2” - 12	342 (252)

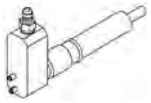
Use the chart **[Figure SPEC-30-5]** to find the correct tightness needed (Item 2) **[Figure SPEC-30-4]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

SERVICE TOOLS REQUIRED (CONT'D)

Electrical Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1609	Wheel Speed	S630 - S850 T630 - T870 A770		
MEL1428	Sensor Tester	S70 S450 - S850 T450 - T870 A770		
MEL1567	Seat Bar Adapter	S450 - S850 T450 - T870 A770		

Engine Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7024161	Diagmaster Kit (iT4 engine only)	S750 - S850 T750 - T870 A770	Includes: DST-i (Diagmaster Service Tool) Vehicle cable (7024272) USB cable (7024271) Diagmaster Diagnostic Software	
MEL10630	Engine Compression Test Kit	S70 S450 - S650, T450 - T650	Includes: MEL1352, MEL1433, MEL1489, MEL1546, MEL1551, MEL1594, MEL1594, MEL10630-1 - MEL10630-11 and MEL10630-14	
MEL1655	Compression Adapter	S450 - S650, T550 - T650	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1614	Compression Adapter	S750 - S850 T750 - T870 A770	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1656	Fuel Injection Pump Degree Restoring Tool			
MEL1657	Timing Gear Puller Tool			

See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

ST LDR-1014