

**GEHL**®

Form No.  
909767  
Revision C  
Dec. 2007

# 1202

## Compact Excavator

Serial Number AB00473 and up



**Service Manual**

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## General Specifications












Height	9'2" (2790 mm)
Width	7'10" (2400 mm)
Length	23'3" (7087 mm)
Arm Length	8'7" (2610 mm)
Slew Angle – Left	80°
Slew Angle – Right	50°
Front Boom Swing Radius	6'9" (2400 mm)
Ground Clearance	16.5" (420 mm)
Undercarriage width	7'10" (2400 mm)
Undercarriage Length	131" (3320 mm)
Rubber Track Width	19.7" (500 mm)
Max. Boom Height	17'4" (5283 mm)
Max. Dumping Height	19'4" (5885 mm)
Max. Digging Height	26'1" (7946 mm)
Max. Digging Radius	26'2" (7976 mm)
Max. Vertical Digging Depth	9'2" (2810 mm)
Max. Digging Depth	15'8" (4780 mm)
Min. Tail Swing Radius	5'5" (1645 mm)
Min. Arm Clearance	6'11" (2100 mm)
Dozer Blade Width	7'10" (2390 mm)
Dozer Blade Height	1'9" (550 mm)
Maximum Lift Above Ground	24.5" (622 mm)
Maximum Depth Below Ground	18.5" (470 mm)
Number of Track Rollers	6 per side
Operating Weight with Cab	25,397 lbs. (11,520 kg)
Average Ground Pressure	6.1 psi (0.43 bar)
Ground pressure (Rubber Tracks)	5.7 psi (0.39 bar)
Ground pressure (Steel Tracks)	5.8 psi (0.40 bar)
Gradability	30° (58%)
Sound Power	101 dB(A)
Sound Pressure	80 dB(A)
Travel Speed - Low Speed	2.2 mph (3.6 km/h)
Travel Speed - High Speed	3.9 mph (6.2 km/h)
Bucket Tooth Breakout Force	15,512 lbf (69.6 kN)
Arm Force	11,100 lbf (50.3 kN)
Swing Speed	11 rpm

...Table continued from previous page

Dimension	Tightening Torque	Port Code	Port Name
7/16 - 20 UNF - 2B	7.2 ~ 9.0 lb.-ft. (9.8 ~ 12.3 Nm)	PTA	Signal Port (Travel)
		PSW	Signal Port (Attachment)
		PP	Pilot Pressure Inlet Port
		HR	Negative Control Signal Port (Right Side)
		HL	Negative Control Signal Port (Left Side)
		PSP	Swing Priority Pilot Port
		dR4	Drain Port
		dL5	Drain Port
		dL6	Drain Port
		dR7	Drain Port
		dR8	Drain Port
		dL9	Drain Port
		Pe1	Travel Straight Pilot Port (For Add On Valve)
		(PAT)	Add On Valve Pilot Port
		(dST1)	Signal Port
PF - 3/4	108 ~ 130 lb.-ft. (147 ~ 176 Nm)	P3	Outlet Port (For Option Confluence)
		P4	Outlet Port (For Add On Valve)
PF - 1/2	72 ~ 87 lb.-ft. (98 ~ 118 Nm)	(PB3)	Inlet Port (For Add On Valve)
4 - M10	36 lb.-ft. (49.0 Nm)	T	Return Port

Service Activity	Daily	Every 50 Hours	Every 250 Hours	Every 500 Hours	Every 1000 Hours	Annual
Check Hydraulic Cylinder Performance Under Load					○	
Check Gear Ring				○		
Check Preheating System and Electrical Connections				○		
Check Air filter Restriction Gauge				○		
Pressure Check for Primary Pressure Limiting Valves		○				
Pressure Check for Secondary Pressure Limiting Valves		○				
Check Tracks for Cracks or Cuts	○					
Check Track Tension, Tighten if Necessary	○					
Check Bearing Play on Tread Rollers, Track Carrier Rollers and Front Idlers		○				
Check Cylinders, Piston Rods for Damage	○					
Check Bolts and Screws for Tightness	○					
Check Pin Lock and Line Fastenings (dipper arm and attachment)	○					
Check Bucket Teeth for Wear	○					
Check Hydraulic Line Clamps	○					
Check Hydraulic Pump Bolts		○				
Clean Hydraulic Fluid Cooler Fins		X				
Check Indicator Lights and Headlights for Correct Function	○					
Check Cab Operating Equipment (switches, pedals, levers, joystick, etc.)	○					
Check Cab Tilt Lock/Support Components					○	

◇	Change/Replace	○	Check/Inspect
X	Clean	◇ (1)	Change/Replace the first time

PUMP 1/Side Valve Block						X	
Function	Motion	Symbol	Pressure Limiting Valve	Measuring Point	Settings (1) psi (bar)	Checked	OK?
Dozer blade	UP		Primary pressure limiting valve PPLV 2 (Side valve block)	Measuring point MP3 (Side valve block)	Setting:		
					Fall:		
	DOWN				Setting:		
					Fall:		
Boom offset	LEFT		MP1 (Hydraulic pump)	Setting:			
				Fall:			
	RIGHT			Setting:			
				Fall:			
PUMP 1/Main Valve Block						X	
Function	Motion	Symbol	Pressure Limiting Valve	Measuring Point	Settings (1) psi (bar)	Checked	OK?
Boom	UP		Main pressure limiting valve MR-E1 (Main valve block)	Measuring point MP1 (Hydraulic pump)	Setting:		
					Fall:		
	DOWN				Setting:		
					Fall:		
Bucket	OUT		MR-E1 (Main valve block)	Measuring point MP1 (Hydraulic pump)	Setting:		
					Fall:		
	IN				Setting:		
					Fall:		
Auxiliary hydraulics	A				Setting		
					(2):		
	B				Fall:		
					Setting		
Drive left	FORWARD		Main pressure limiting valve MR-E2 (Main valve block)		Setting:		
					Fall:		
	REARWARD				Setting:		
					Fall:		

Fuel System

Fuel Circuit John Deere Engine Model 4045TF270 (SN AC02633 and up)

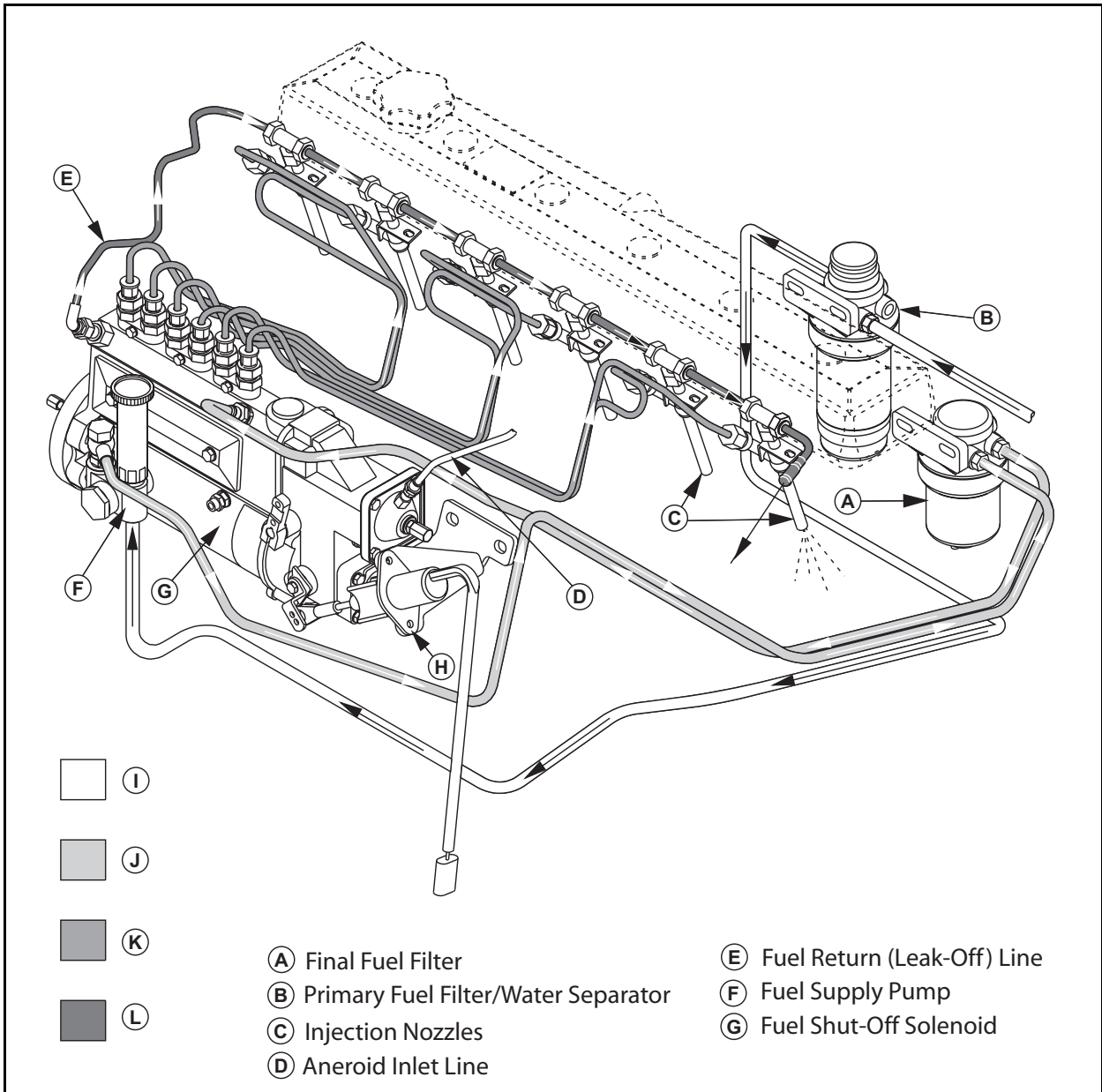


Figure 2-23 Fuel Circuit

In-Line Fuel Injection Pump Operation

Supply pump (F) draws fuel from the vented fuel tank through primary filter (B). The supply pump pressurizes the fuel so that it flows through the filter and into the injection pump galley. Supply pump output pressure varies depending on load and application.

Hydraulic System Component Positions

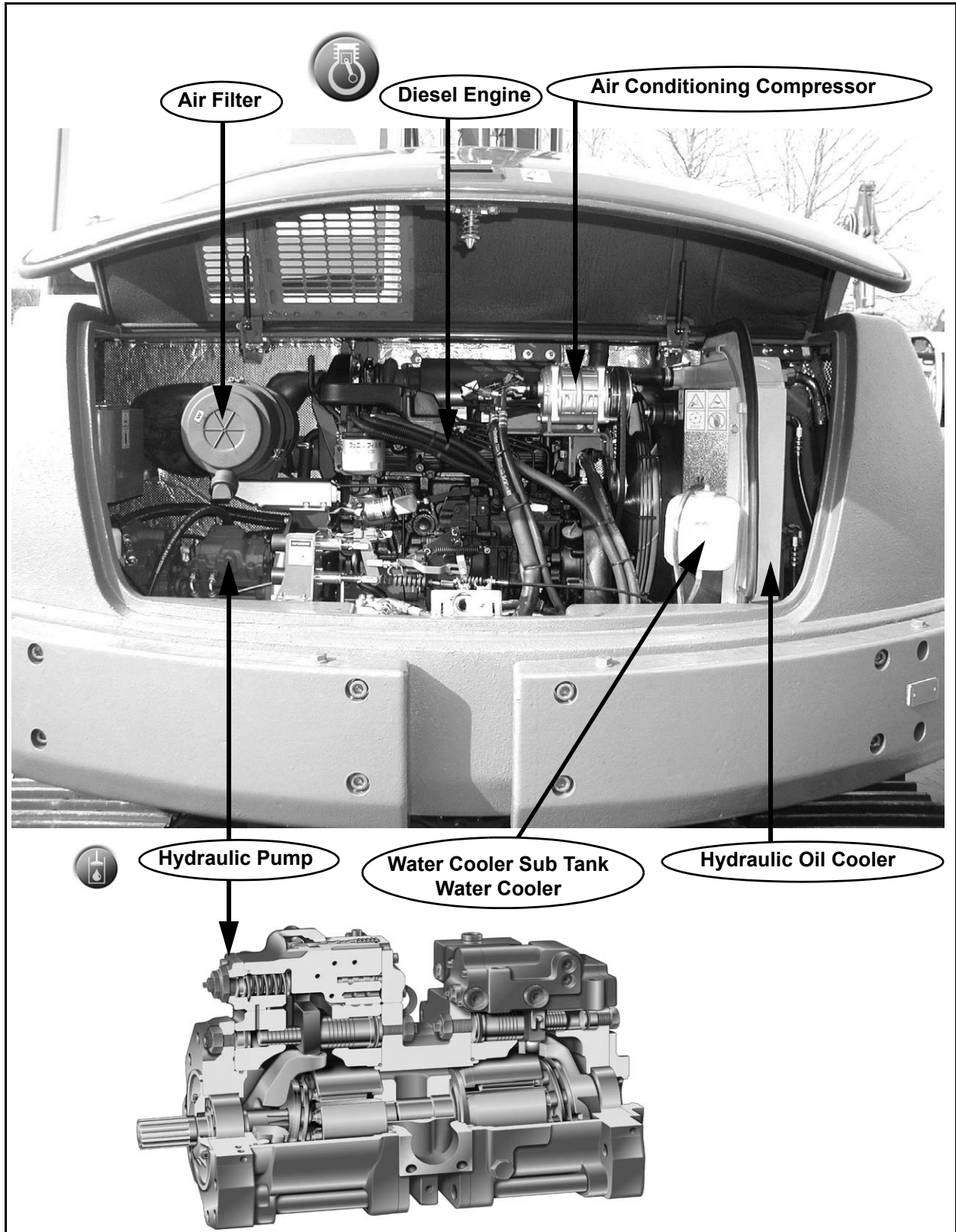
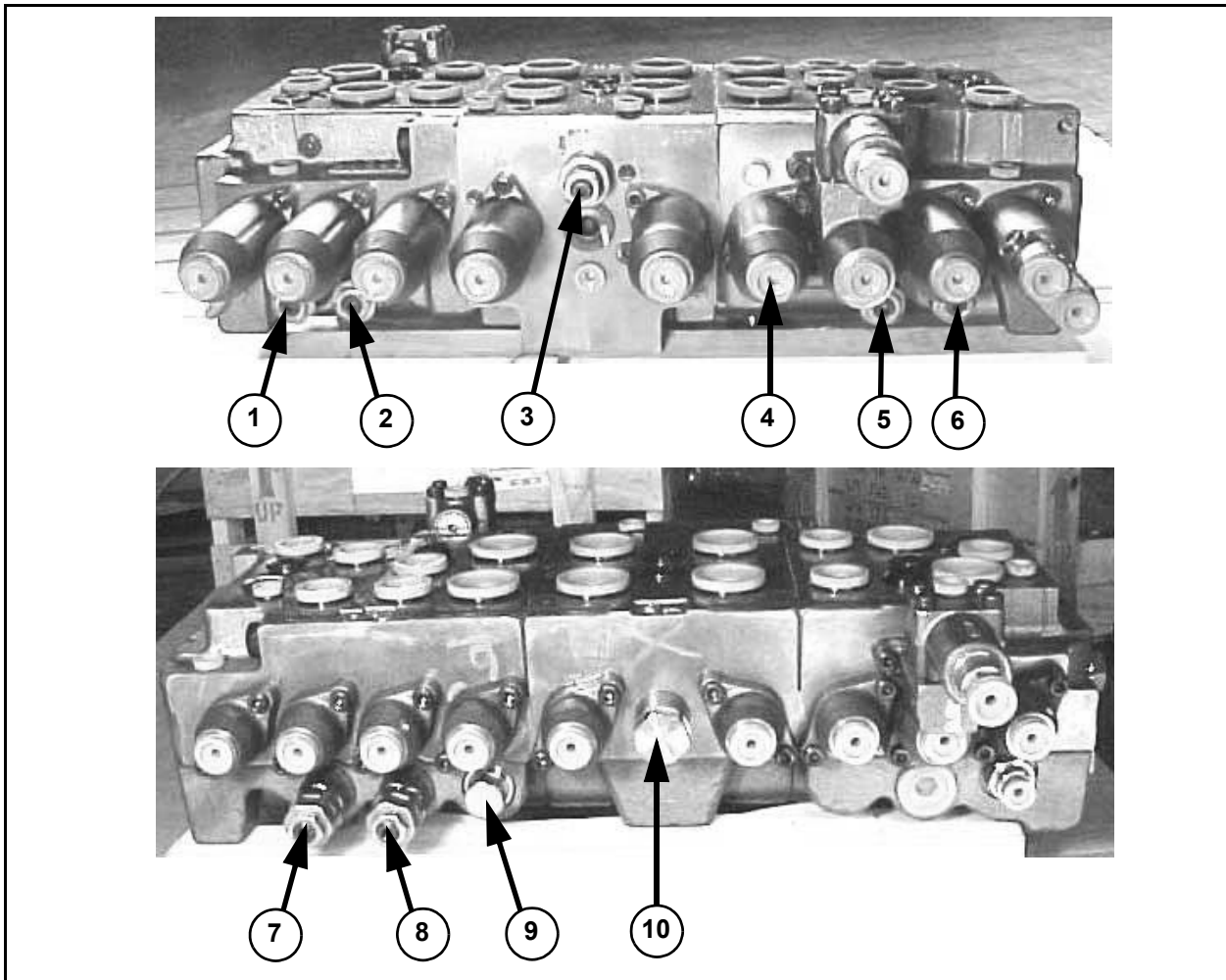


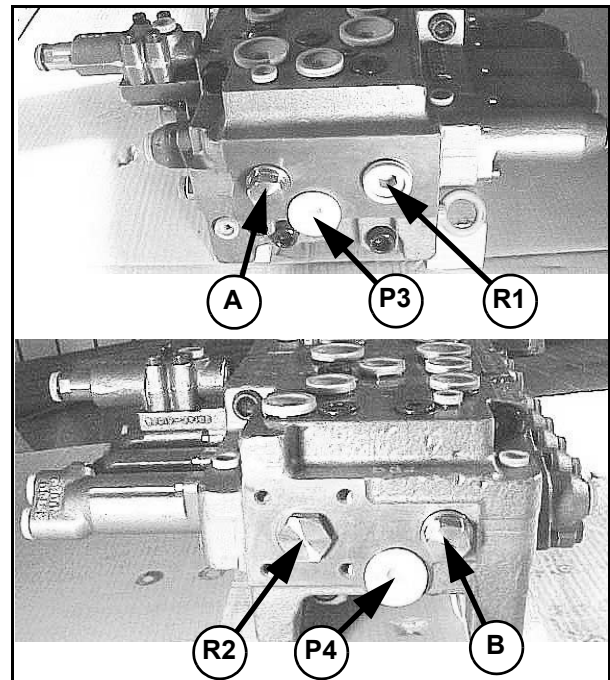
Figure 3-2 Component Positions



**Figure 3-12 Port Relief Valves**

1	Port relief valve dipper arm rod side (RAR3)
2	Port relief valve dipper arm bottom side (RBR3)
3	Main relief valve (P1+P2)
4	Port relief valve auxiliary hydraulics (option) (RBL2)
5	Port relief valve boom bottom side (RBL3)
6	Port relief valve bucket bottom side (RBL4)
7	Port relief valve bucket rod side (RAL4)
8	Port relief valve boom rod side (RAL3)
9	Port relief valve auxiliary hydraulics (option) (RAL2)
10	Straight travel valve

A	Negative control valve pump 1
B	Negative control valve pump 2
P3	Plug
R1	Tank pipe (suction valve swivel motor)
R2	Plug
P4	Supply for side valve block



**Figure 3-13 Return, Outlet Ports**

Function Torque Summation Control

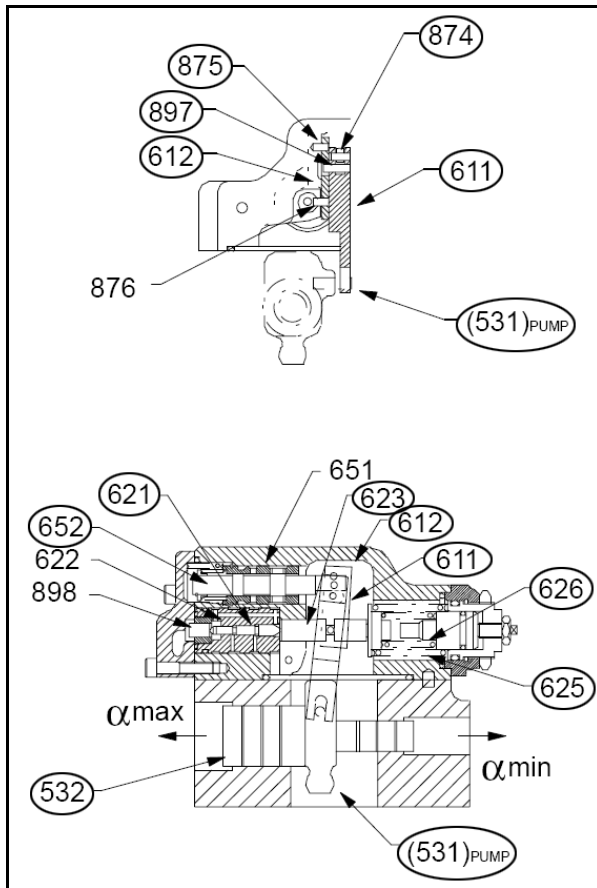


Figure 3-25 Function Torque Summation Control

531	Servo pivot
532	Servo piston
611	Feedback lever
612	Power control lever
621	Power control piston
623	Power push rod
625	Outer power springs
626	Inner power springs
652	Main spool
874	Fixed pivot
875	Fixed pivot
897	Feedback pivot

Power push rod (623) forces output pressure from variable pump 1 into the larger stepped diameter area of power control piston (621). Power push rod (623) forces return output pressure from variable pump 2 into the smaller stepped diameter area of power control piston (621). See Figure 3-25 and Figure 3-26.

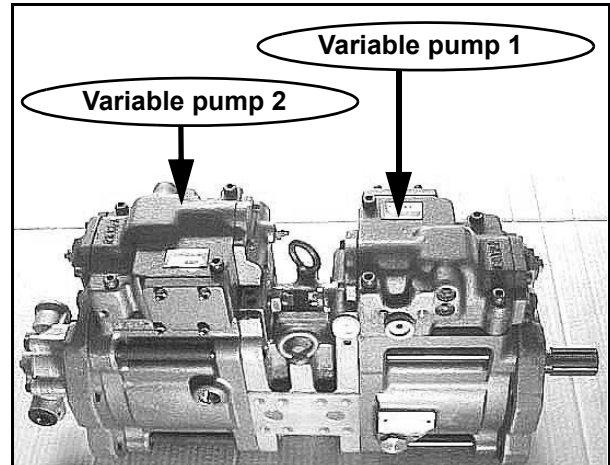


Figure 3-26 Variable Pump 2 and 1

Because these two stepped areas are equal, both pumps counter-stroke to the same displacement rate. The inner (626) and outer (625) power springs create a spring preload that balances the force produced. See Figure 3-25.

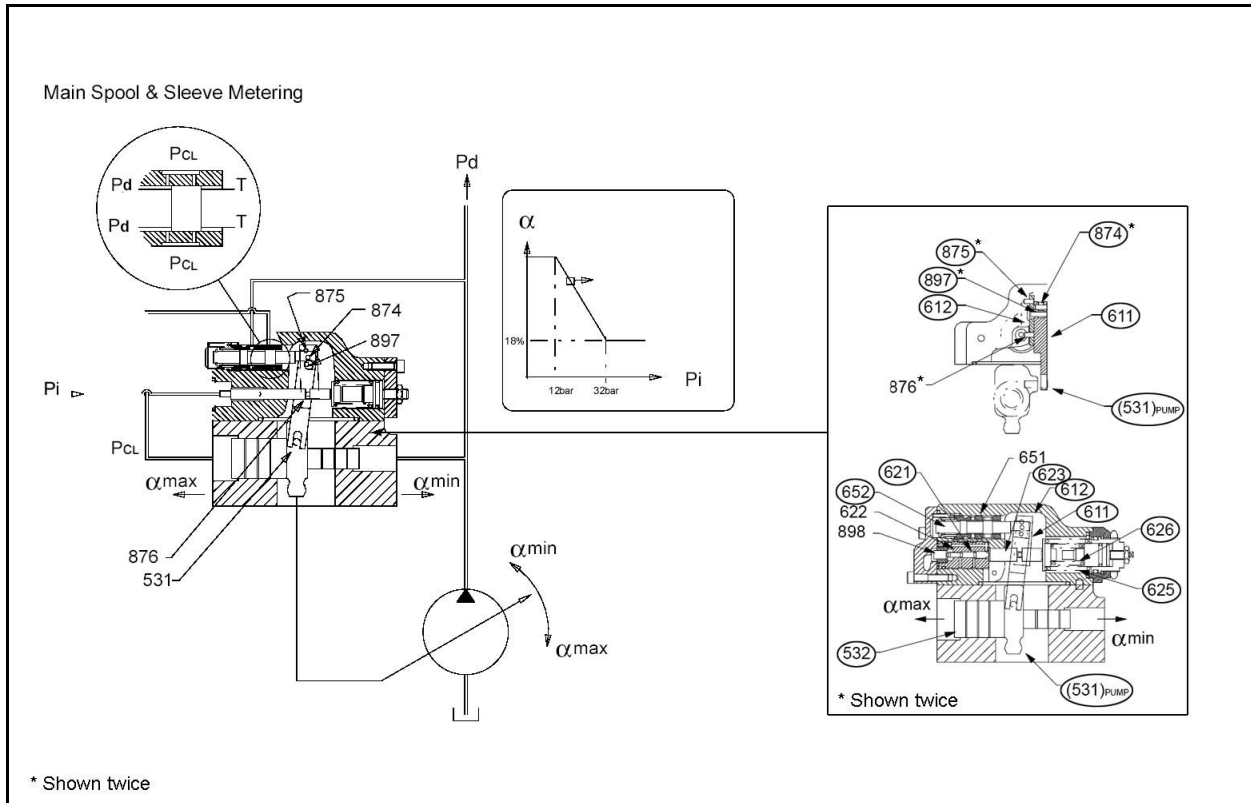
When return output pressure is low, only outer spring (625) is active. When increased output pressure from both pumps is forced into power control piston (621), outer spring (625) and inner spring (626) are both active. The change in spring rate provides the characteristic curve. See Figure 3-25.

Because of pump(s) pressure forces, power push rod (623) presses against outer power springs (625), and this action moves piston (621). Piston (621) movement presses power control lever (612), located on fixed pivot (875), to the right toward outer power springs (625). Power control lever (612) uses feedback pivot (897) to transmit movement to feedback lever (611). Feedback lever (611) rotates “clockwise” (to the right) around servo pivot (531). See Figure 3-25.

Fixed pivot (874) connects feedback lever (611) to main spool (652). Because of this connection, main spool (652) transports pressurized oil to the larger diameter area of servo piston (532). This counter-strokes the pump and rotates main feedback lever (611) “counter-clockwise” (to the left). See Figure 3-25.

When servo piston (532) position and pump displacement maintains main spool (652) in a central metering position, a state of equilibrium exists. In this central metering position, pressure forced into the larger diameter area of servo piston (532) maintains equilibrium. See Figure 3-25.

### Negative Control Valve Pressure Decreases, Pump Oil Flow Rate Increases



**Figure 3-36 Negative Control Valve Pressure Decreases, Pump Oil Flow Rate Increases**

Negative control pressure decreases and releases the displacement spring. The piston moves to the left of its previous position and the control pressure decrease reduces piston force displacement. See Figure 3-36.

Feedback pivot (897) and main spool (652) compression spring transmit power lever (left side) movement. Main spool (652) compression spring eliminates feedback by pulling main spool (652) to the left. Main spool (652) movement to the left meters the larger diameter area on the left side of the servo piston (532) pressure to the tank pressure. Because the small side of the servo piston (532) is connected to pump delivery pressure, when servo piston (532) moves to the left, pump displacement increases toward maximum. See Figure 3-36.

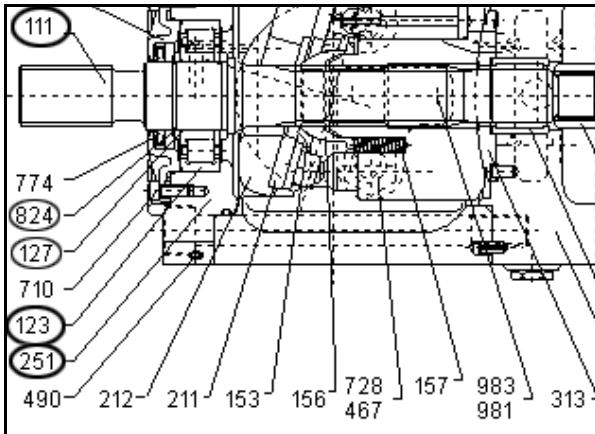
After servo piston (532) moves to the left and reaches its final position, feedback lever (611) shifts main spool (652) to the null position, restoring equilibrium. See Figure 3-36.

### Installing the Drive Shaft

If roller bearings are assembled, proceed to “Installing the Oil Seal and Seal Cover” on page 94.



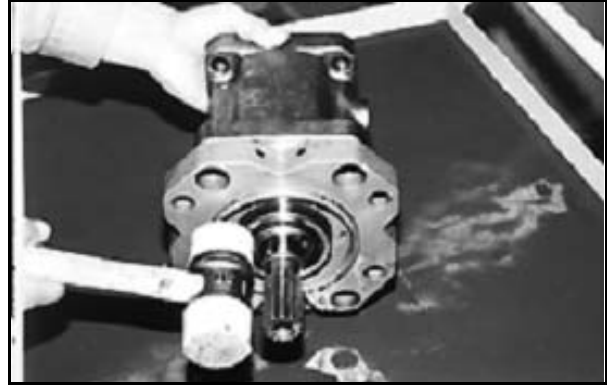
**Figure 3-62 Install Bearing Spacer**



**Figure 3-63 Drive Shaft**

1. Install bearing spacer (127) onto drive shaft (111). See Figure 3-62 and Figure 3-63.
2. Install roller bearing (123) onto drive shaft (111). See Figure 3-63.
3. Install snap ring (824) onto drive shaft (111). See Figure 3-63.
4. Install drive shaft assembly (111), complete with bearing (123), bearing spacer (127) and snap ring (824), onto swash plate support (251). See Figure 3-63.

**IMPORTANT:** Do not use plastic-headed hammer to tap drive shaft (111) because damage may occur.

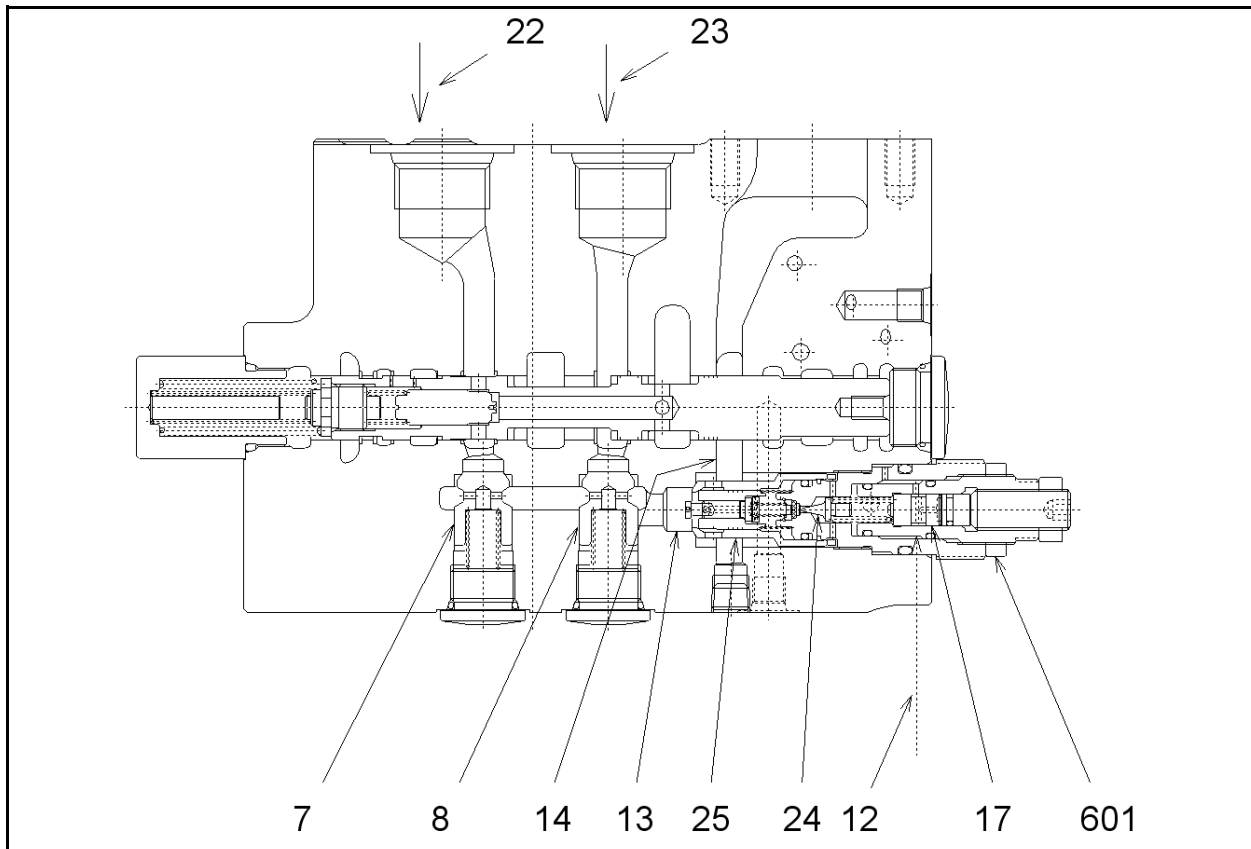


**Figure 3-64 Tap Bearing with Plastic-headed Hammer**

5. Use plastic-headed hammer to tap lightly on the outer rim of bearing to install drive shaft (111) assembly onto its support. See Figure 3-64.
6. Complete steps 1-5 for both the rear and front pumps.



## Circuit Pressure Protection



**Figure 3-98 Main Relief Operation While Traveling**

The control valve contains relief valves that limit circuit pressure:

1. Main Relief Valve (main pressure limiting valve): limits the pressure of the main hydraulic system.
2. Port Relief Valve (secondary pressure limiting valve): limits the service pressure within a cylinder circuit.

Lowering the Boom

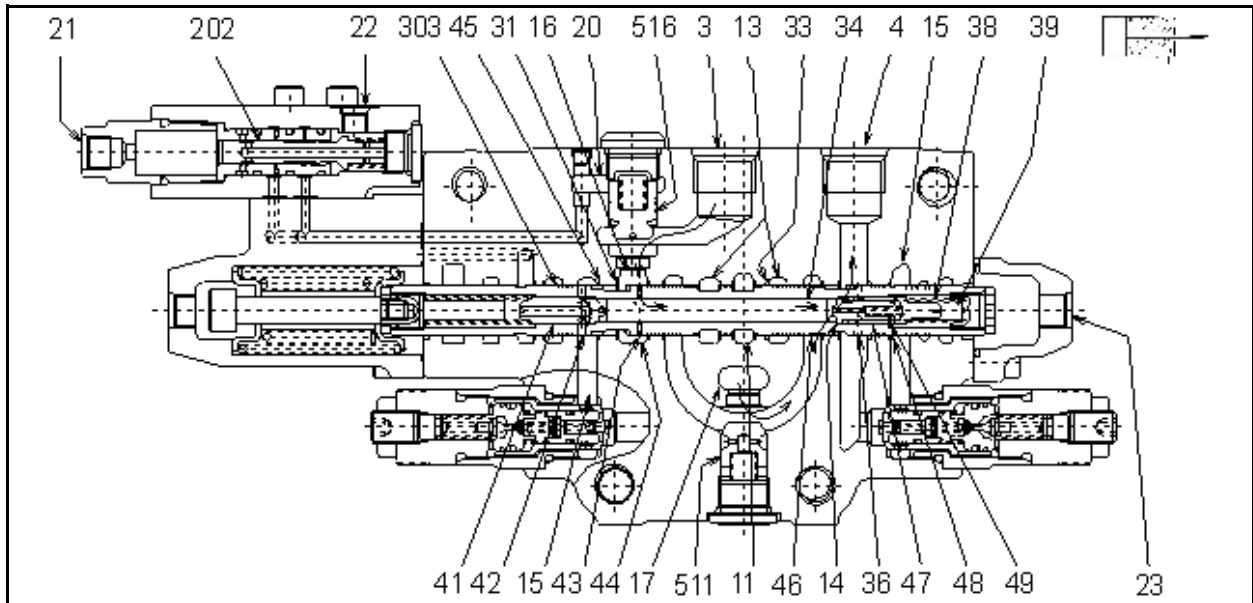


Figure 3-119 Lowering the Boom

While lowering the boom, pilot pressure from pilot control valve (25) flows through port (23) and shifts boom 1 spool (303) to the left against springs (322) and (328). See Figure 3-117 on page 122, Figure 3-119, and Figure 3-120.

Pilot pressure flows into pilot port (21) of boom lock valve (202, 516) and shifts spool (202). Boom 1 spool (303) center bypass (33) slightly opens. See Figure 3-119.

Front pump (27) hydraulic fluid flows through center bypass (13), center bypass (11) and line (26). The hydraulic fluid pressurizes the front pump regulator's negative control pressure, decreasing the discharge from front pump (27). See Figure 3-119 and Figure 3-120.

Front pump (27) hydraulic fluid from parallel path (17) flows through load check valve (511), path (46), and into port (4). Hydraulic fluid then flows through line (7) (not shown) and into the rod side of boom cylinder (1). See Figure 3-119 and Figure 3-120.

Return flow from the head side of boom cylinder (1) flows through line (6) (not shown), port (3), and into boom 1 spool (303). Within boom lock valve (516), pilot pressure from port (21) operates spool (202), and spool (202) forces the return flow through path (20) and into drain port (22). The pressure within the upper side of boom lock valve (516) decreases and the return flow from line (3)

flows into path (16). This return flow forces open boom lock valve (516). See Figure 3-119 and Figure 3-120.

Return flow lowers the boom cylinder by flowing through path (31), return path (15) and into the tank. See Figure 3-119.

Return flow in path (45) decreases, and the boom cylinder lowers at the speed suitable to the front pump discharge. See Figure 3-119.

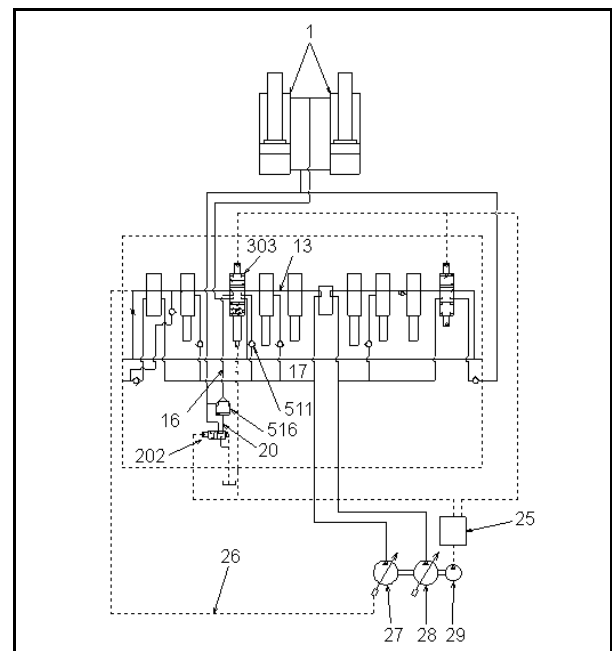


Figure 3-120 Boom Structure

Bucket Section

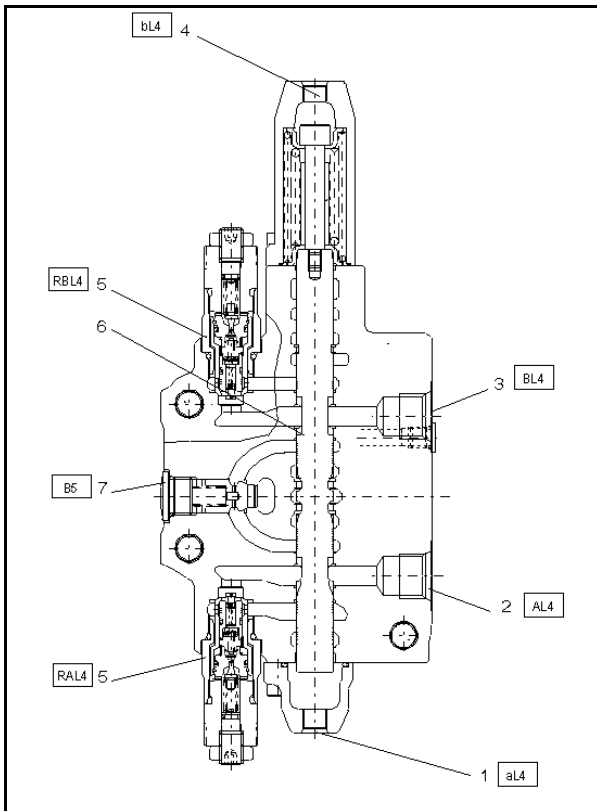
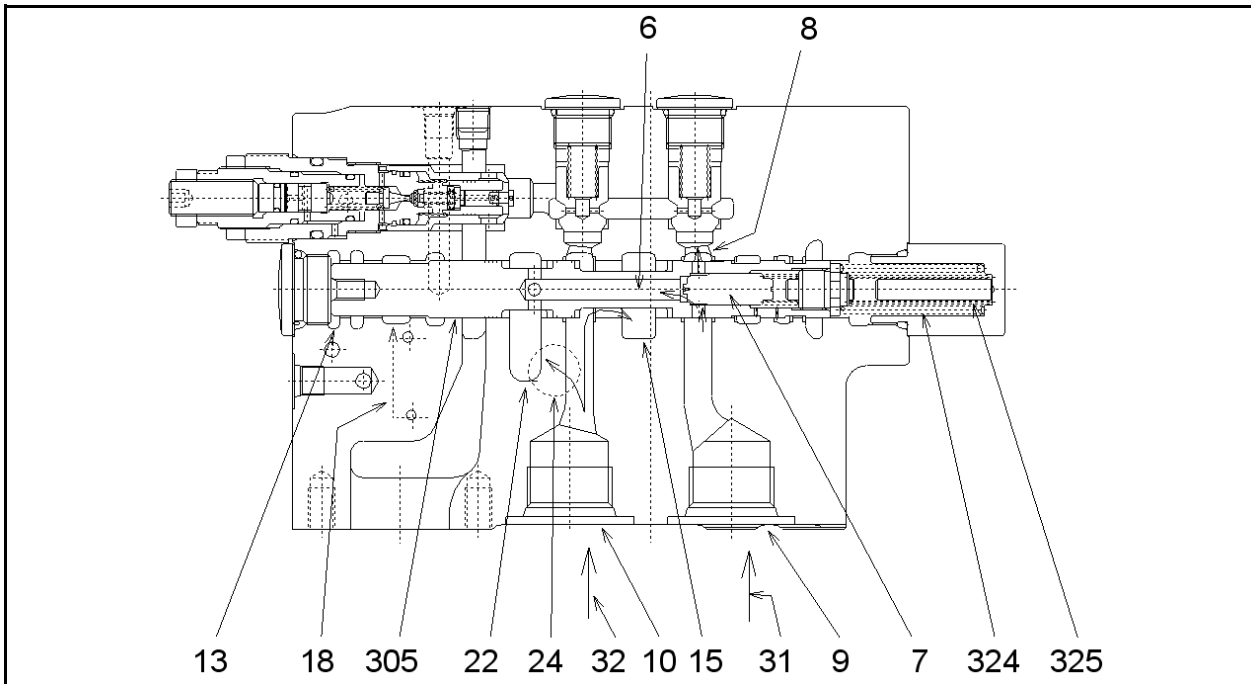


Figure 3-138 Bucket Structure

1	Pilot pressure port bucket cylinder extending
2	Port bucket cylinder rod side
3	Port bucket cylinder bottom side
4	Pilot pressure port bucket cylinder retracting
5	Secondary pressure limiting valve
6	Spool bucket
7	Direct piloted check valve

**Straight Travel Spool (no additional actuation)**



**Figure 3-152 Straight Travel Spool (no additional actuation)**

When only the travel spools are operated, pilot path (18) and spool chamber (13) pressure decreases. Spring (324) and spring (325) then shift straight travel spool (305) to the right. See Figure 3-152.

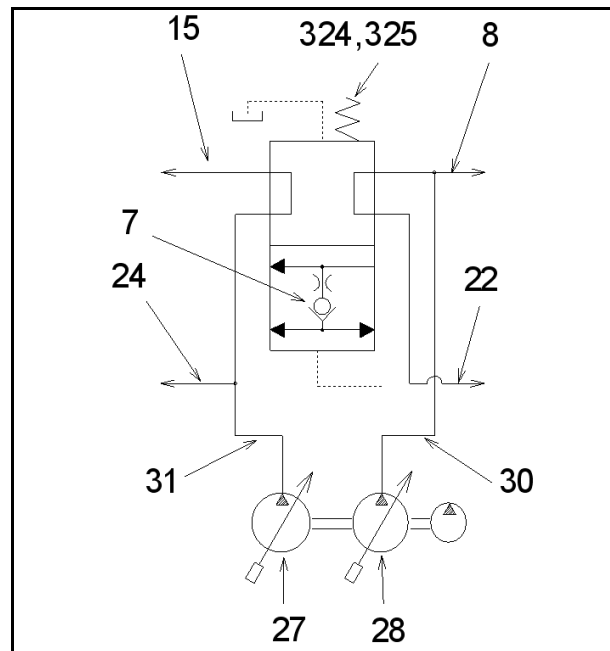
Front and rear pump hydraulic fluid then flows as follows:

1. Front pump (27) hydraulic fluid flows through line (30), port (10), and then separates into two flows. One flows through center bypass (15) and into travel left spool (301L). The other flows through parallel path (24) and into option spool (310), boom 1 (303), bucket (304), and arm 2 (308).

See Figure 3-143 on page 136 for arm 2 (308), Figure 3-146 on page 139 for spool (310), Figure 3-151 on page 142 for travel left spool (301L), boom 1 (303), bucket (304), Figure 3-152 and Figure 3-153.

2. Rear pump (28) hydraulic fluid flows through line (31), port (9), and then separates into two flows. One flows through center bypass (8) and into travel right spool (301R). The other flow opens check valve (7) to the right and flows through path (6), located in straight travel spool (305), and into parallel path (22). From parallel path (22), it flows into the spools of

swing (309), arm1 (302) and boom2 (306). See Figure 3-118 on page 122 for boom2 (306), Figure 3-151 on page 142 for travel right spool (301R), spools of swing (309), arm1 (302), Figure 3-152 and Figure 3-153.



**Figure 3-153 Pump Flow**

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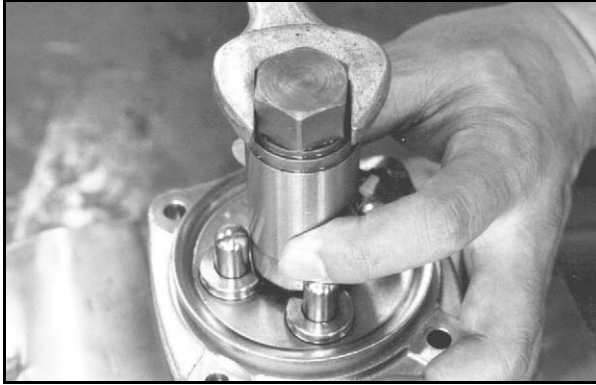


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**Assembling the Covers**

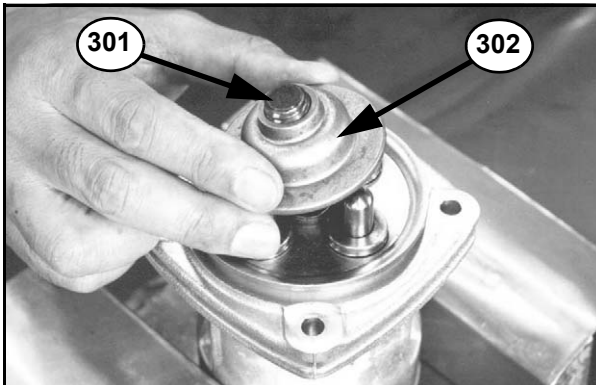
1. Assemble spool covers and lock valve selector to the non-spring assembly end of the spool.
2. Using a 8 mm hexagon wrench, tighten the hexagonal socket head bolts to tightening torque 18.0 ~ 21.7 lb.-ft. (24.5 ~ 29.4 Nm).
3. Confirm that O-rings are installed.
4. Assemble spring covers and lock valve selector to the spring end of the spools.
5. Using a 8 mm hexagon wrench, tighten the hexagonal socket head bolts to tightening torque 18.0 ~ 21.7 lb.-ft. (24.5 ~ 29.4 Nm).
6. Confirm that O-rings are installed.



**Figure 3-205 Rotating the Socket**

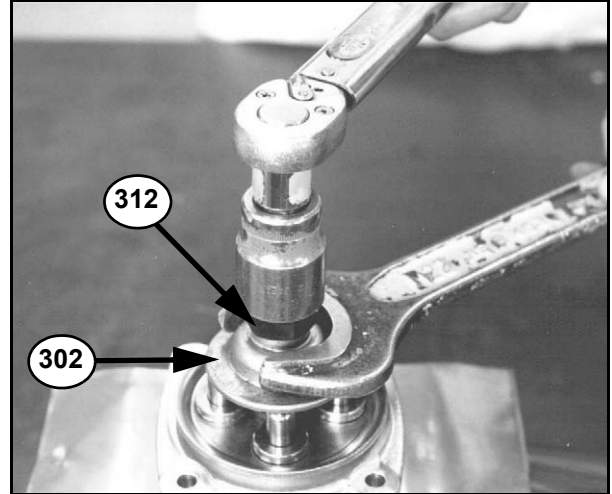
19. Using a wrench, rotate the socket to tighten universal joint M14 (301) onto casing (101) to tightening torque  $34.7 \pm 2.1$  lb.-ft. ( $47.1 \pm 2.9$  Nm).
20. Be sure that all four push-rods (212) are in contact equally.

**IMPORTANT:** Excessive tightening or wrong positioning of the disc can cause the valve to malfunction.



**Figure 3-206 Disc**

21. Install disc (302) onto universal joint M14 (301). See Figure 3-206.



**Figure 3-207 Adjustment Nut**

22. Install adjustment nut M14 (312). See Figure 3-207.
23. Using a spanner wrench, tighten disc (302). See Figure 3-207.
24. Tighten adjustment nut M14 (312) to tightening torque  $50.7 \pm 3.6$  lb.-ft. ( $68.8 \pm 4.9$  Nm). See Figure 3-207.

**IMPORTANT:** Do not allow the position of disc (302) to shift while tightening adjustment nut M14 (312).

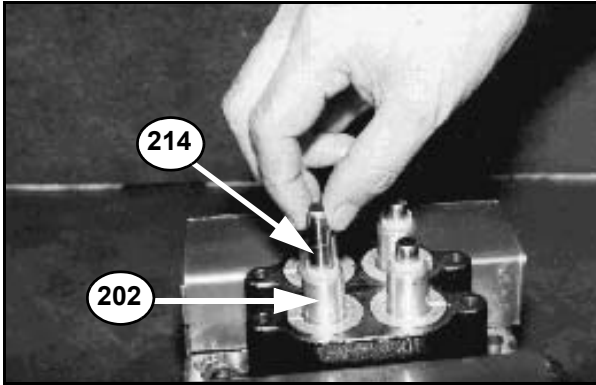


**Figure 3-208 Apply Grease**

25. Apply grease to the rotating component of universal joint M14 (301) and the end of push-rod (212). See Figure 3-208.

13. Write down the positions of casing (shock absorber) (102) and casing (101).

**IMPORTANT:** *The surface of push rod (214) can be damaged because of mishandling. Do not damage the surface of the push rod during removal.*

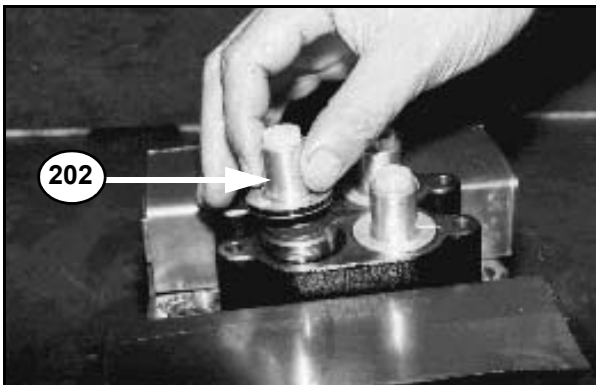


**Figure 3-225 Push Rod**

14. Remove push rod (214) from plug (202). See Figure 3-225.
15. Write down the positions of the plug and push rod. Do not damage the surface of the push-rod.

**! WARNING**

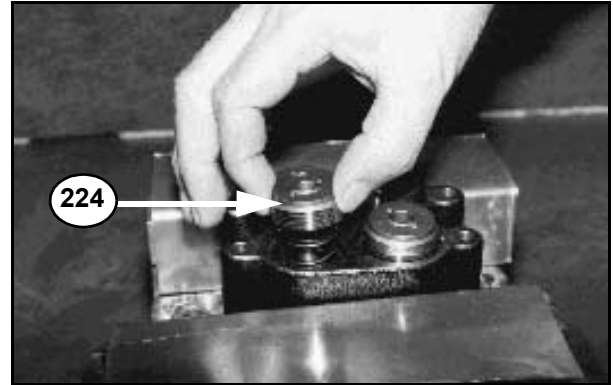
**ITEMS UNDER TENSION:** When the plug is removed, be sure piston (224) does not launch from spring (336), because this may cause damage and/or serious injury.



**Figure 3-226 Plug**

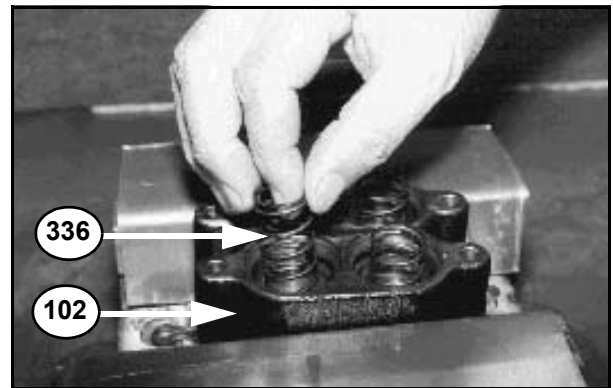
16. Remove plug (202) with grease cap (203), packing (210) and O-ring (212) attached.

17. Write down the plug (202) and casing (102) positions.



**Figure 3-227 Piston**

18. Remove piston (224). See Figure 3-227.
19. Write down the positions of piston (224) and casing opening.



**Figure 3-228 Spring**

20. Remove spring (336) from casing (102) as shown. See Figure 3-228.
21. Write down the positions of spring (336) and casing opening.

1	Section dozer blade
2	Primary pressure limiting valve 4931 psi (340 bar)
3	Secondary pressure limiting valve dozer blade cylinder bottom side 4351 psi (300 bar)
4	Section boom offset cylinder
A1	Port dozer blade cylinder rod side
A2	Port boom offset cylinder rod side
B1	Port dozer blade cylinder bottom side
B2	Port boom offset cylinder bottom side
P	Pressure line from the main valve block
T1	Tank line
TT	Tightening torque = 13 Lb.-Ft. (18 Nm)

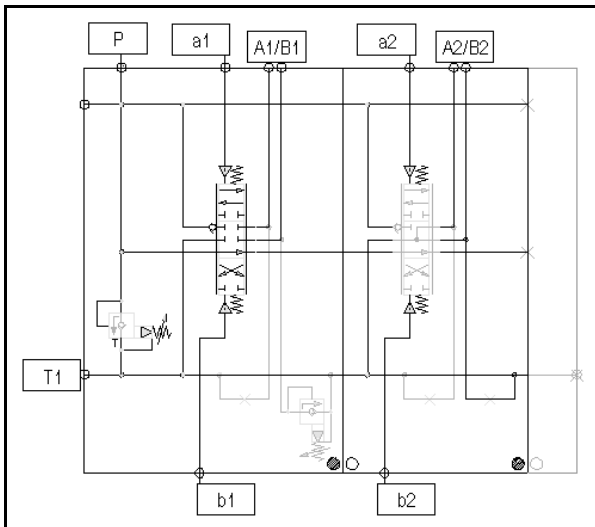


Figure 3-266 Pilot Pressure Hose

a1	Pilot pressure hose
a2	Pilot pressure hose
b1	Pilot pressure hose
b2	Pilot pressure hose

**Shuttle Valve Block**

Functions:

- Control signal to regulate the pump (NC) (by the summation segment of section dipper arm/NC Valve).
- Control signal to valve e1 for function drive counter-balancing.

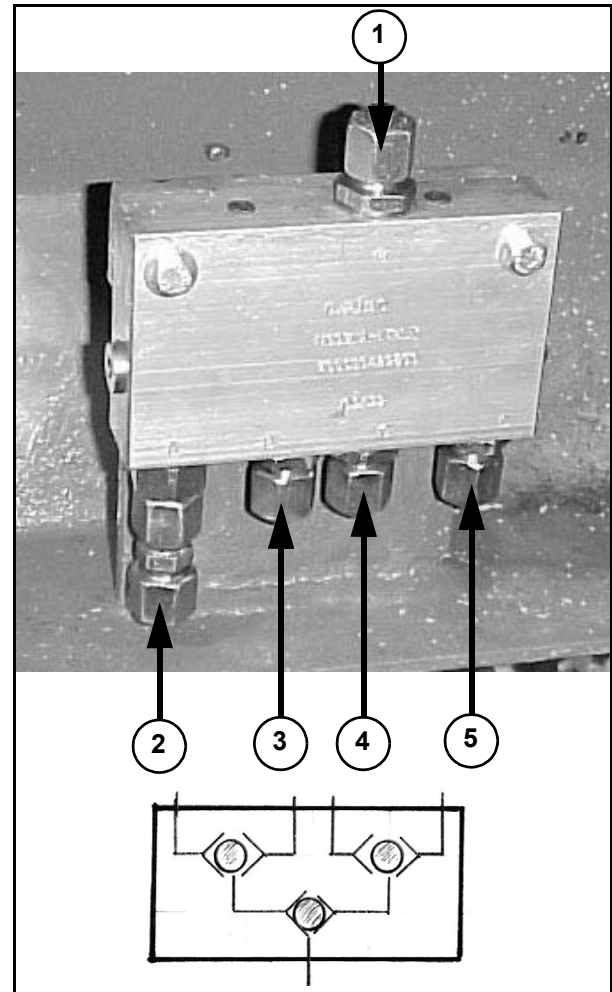


Figure 3-267 Shuttle Valve Block

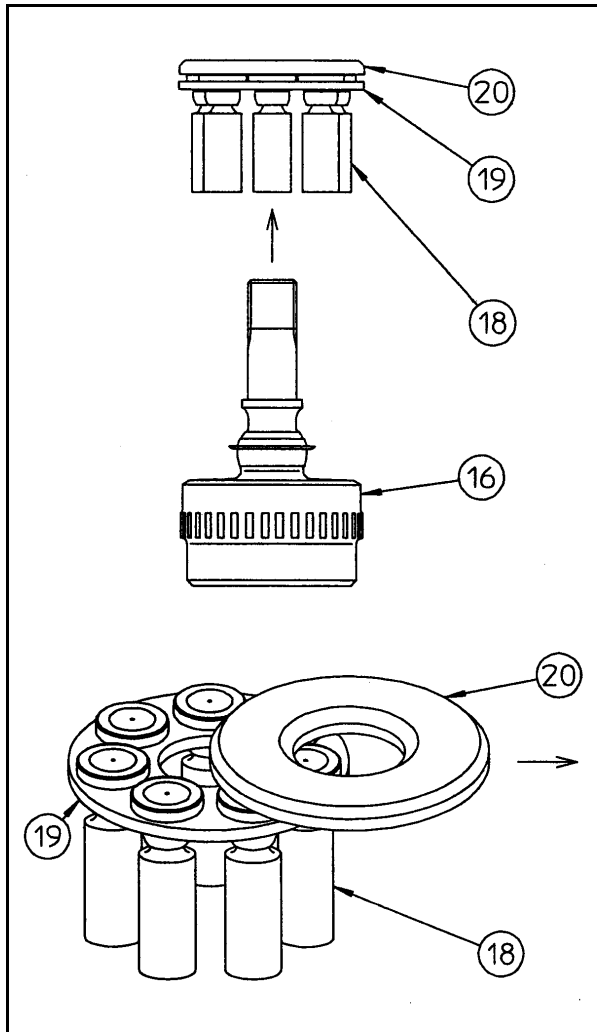
1	Control signal (to section dipper arm summation and valve e1).
2	Pilot pressure hose dozer blade cylinder bottom side.
3	Pilot pressure hose dozer blade cylinder rod side.
4	Pilot pressure hose boom offset cylinder rod side.
5	Pilot pressure hose boom offset cylinder bottom side.

- Using a driver and a hammer, remove shaft seal (24) from housing (22). See Figure 3-281.

**IMPORTANT:** Do not reuse shaft seal (24) after removing it.

### Disassembling the Cylinder

- Remove the inner-race plate from tapered roller bearing (1). See Figure 3-281.
- Set a gear extractor at two places of the inner-race plate of the tapered roller bearing and the spline end of the cylinder drum (16).
- Remove the inner-race plate of tapered roller bearing (1). See Figure 3-281.

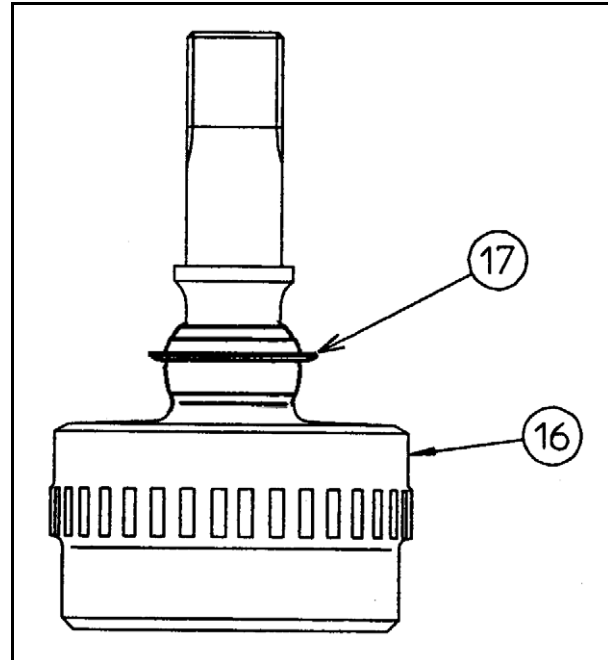


**Figure 3-282 Piston**

- Remove sliding disk (20), piston (18) and piston centering plate (19) from cylinder drum (16). See Figure 3-282.

- Remove sliding disk (20) from piston (18). See Figure 3-282.

**IMPORTANT:** Be sure to avoid damaging the sliding face of sliding disk (20).



**Figure 3-283 Locking Ring**

- Remove locking ring (17) from cylinder (16). See Figure 3-283.

# CHAPTER 4

## JOHN DEERE ENGINE 4045TF270 (SN AC02633 AND UP)

For specifications, see “John Deere 4045TF270 and Yanmar 4TNE106T-NS Specifications” on page 9.

### John Deere Engine Model 4045TF270 Overview

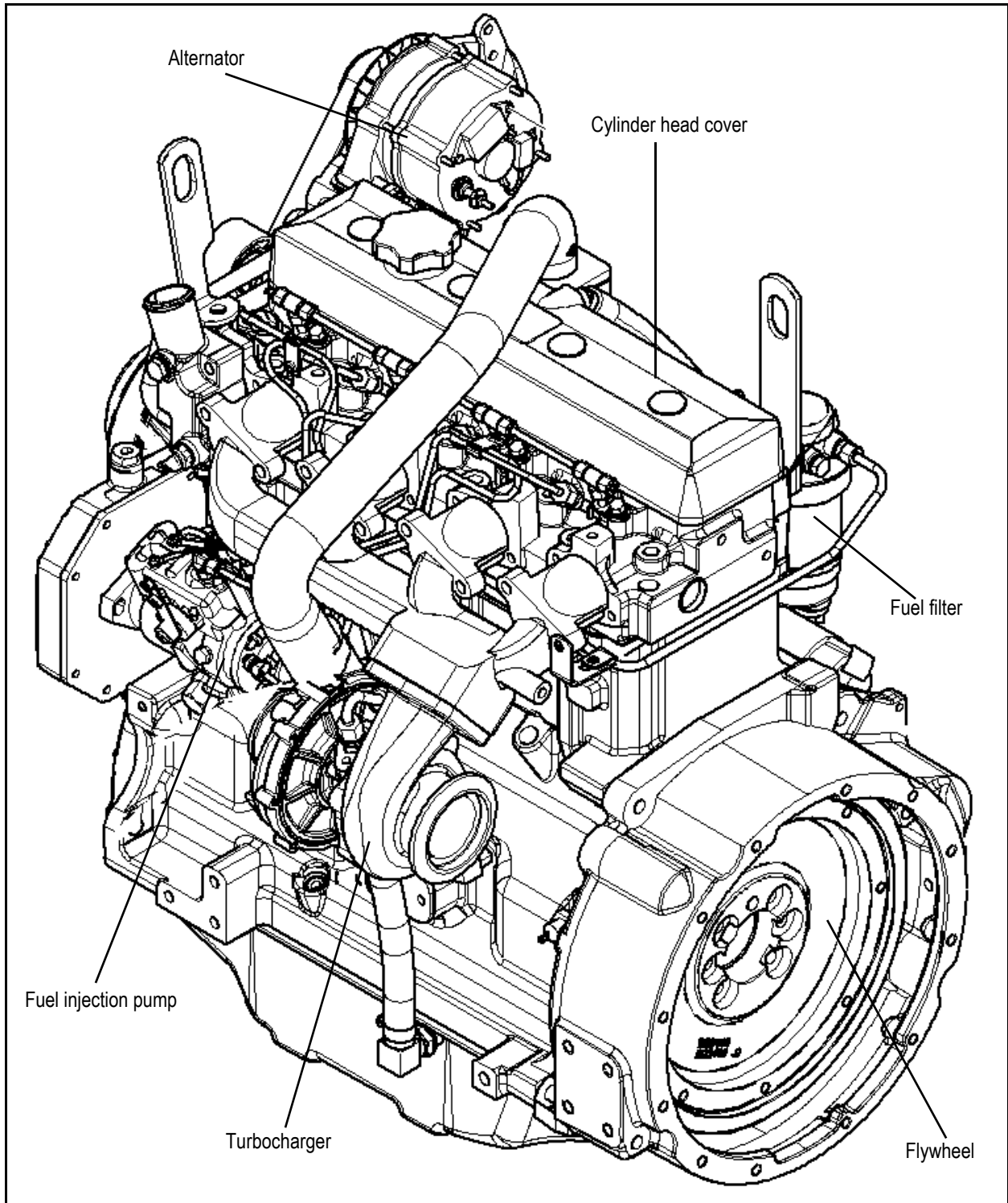
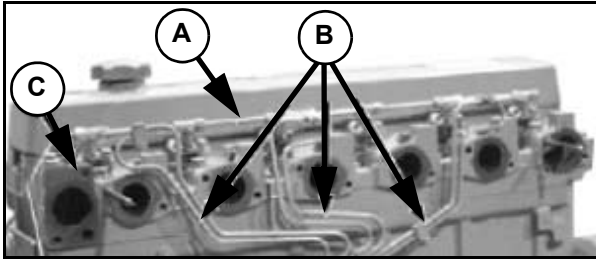


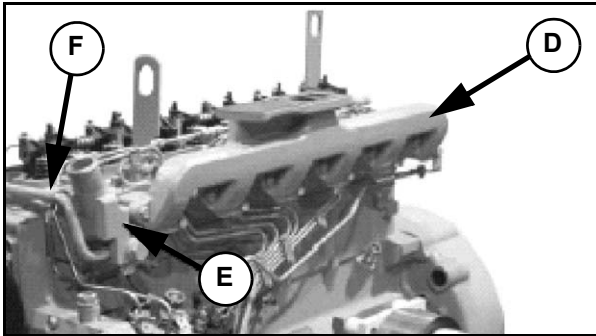
Figure 4-1 John Deere Engine (Overview), Flywheel View

### Installing the Fuel Lines, Fuel Filter/Water Separator



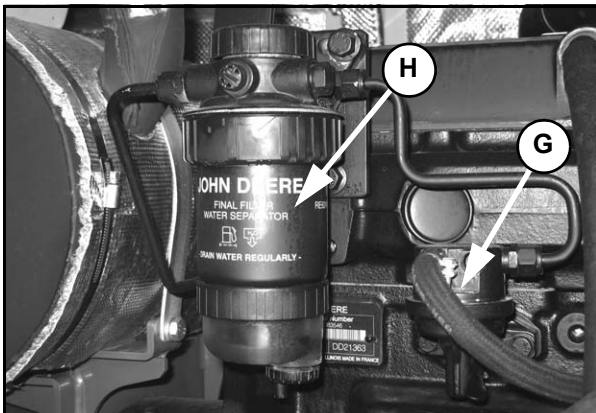
**Figure 4-26 Fuel Return Lines, Fuel Feed Lines, Injection Nozzle**

1. Install fuel injection nozzles (C). See Figure 4-26.
2. Install fuel return line (A) and fuel feed lines (B) as a unit. See Figure 4-26.



**Figure 4-27 Exhaust Bracket, Turbocharger and Oil Intake/Outlet Lines**

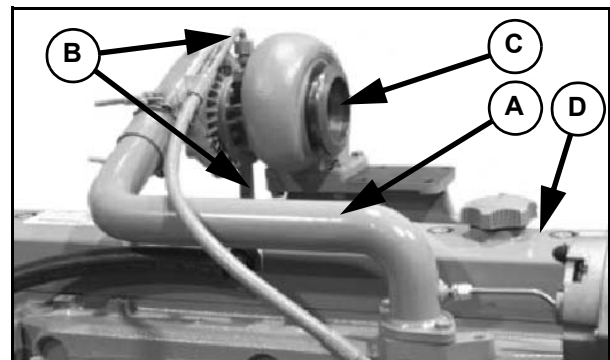
3. Install the tube that connects the thermostat housing with the coolant pump (F). See Figure 4-27.
4. (Optional) If the alternator was removed (see step 6 on page 208), install the alternator.



**Figure 4-28 Fuel Filter/Water Separator**

5. If removed, install fuel pump (G). See Figure 4-28.
6. Install fuel filter/water separator (H) and brackets if necessary. See Figure 4-28.
7. Install fuel lines.
8. Install thermostat housing/coolant supplier unit (E). See Figure 4-27.
9. Install exhaust bracket (D) using the guide pins. See Figure 4-27.

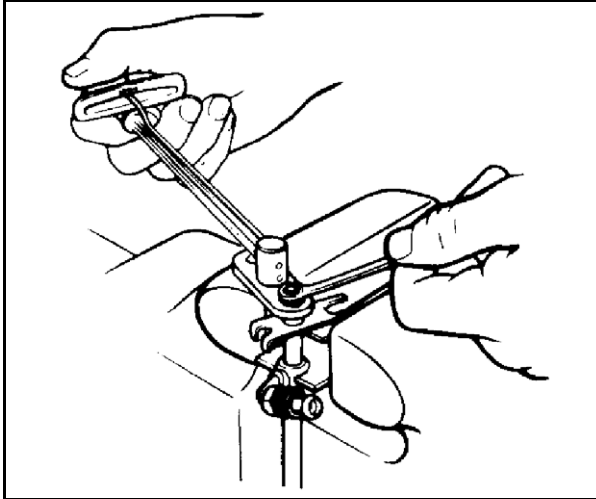
### Installing the Cylinder Head Cover



**Figure 4-29 Exhaust Elbow, Turbocharger and Cylinder Head Cover**

1. Install cylinder head cover (D). See Figure 4-29.
2. Install hexagon nuts and O-rings onto the cylinder head cover (D). See Figure 4-8.
3. Install turbocharger (C) and exhaust elbow (A). See Figure 4-29.
4. Connect oil return and intake lines (B) to turbocharger (C). See Figure 4-29.
5. Install exhaust elbow (A) at the air intake. See Figure 4-29.
6. Install the radiator cap.
7. Add radiator coolant.

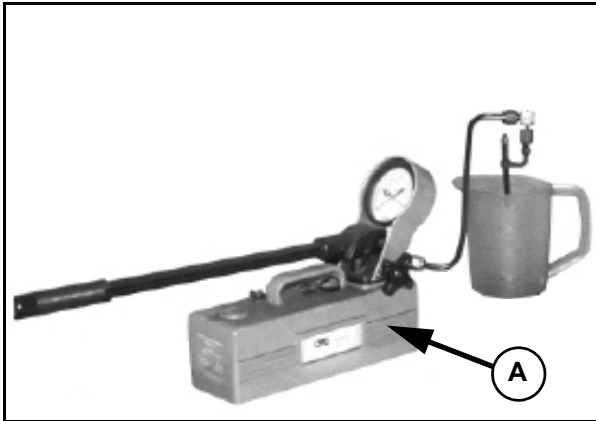
12. Remove the nozzle from the tester.
13. Insert the nozzle into positioning clip and secure positioning clip in a vice.
14. Tighten pressure set screw lock nut to 7 lb.-ft. (10 Nm). See Figure 4-47.



**Figure 4-47 Tighten Pressure Set Screw Lock Nut**

#### Adjusting the Nozzle Valve Stroke

1. Connect the nozzle to the nozzle tester (A). See Figure 4-48.



**Figure 4-48 Nozzle Connected to Nozzle Tester**

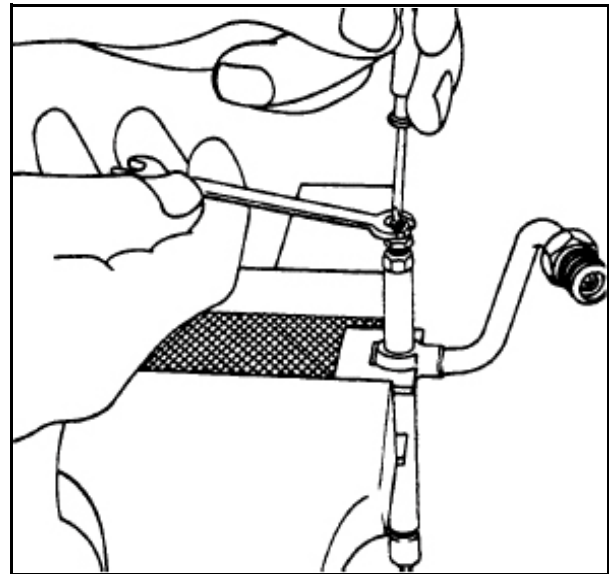
2. Actuate the pump to flush fuel through the nozzle. See Figure 4-48.
3. Hold the pressure set screw while slowly turning the lift set screw clockwise (to the right) until the valve does not open.

**IMPORTANT:** Do NOT use excessive manual force to hold the valve in place because the valve may bend.

4. Check for valve contact by raising the pressure to 200-500 psi (14-34 bar) above the nozzle opening pressure. See "Setting the Opening Pressure" on page 222.

**NOTICE:** It is acceptable for a very small amount of fuel to collect at the nozzle tip, it is not acceptable for a rapid dribble of fuel to flow from the nozzle tip.

5. Remove the nozzle from the nozzle tester.
6. Insert the nozzle into positioning clip and secure the positioning clip into a vice. See Figure 4-49.



**Figure 4-49 Nozzle Valve Stroke Adjustment**

7. Screw lift set screw counter-clockwise (to the left) until there is a tolerance of approximately 1/8 rotation.

Fuel System

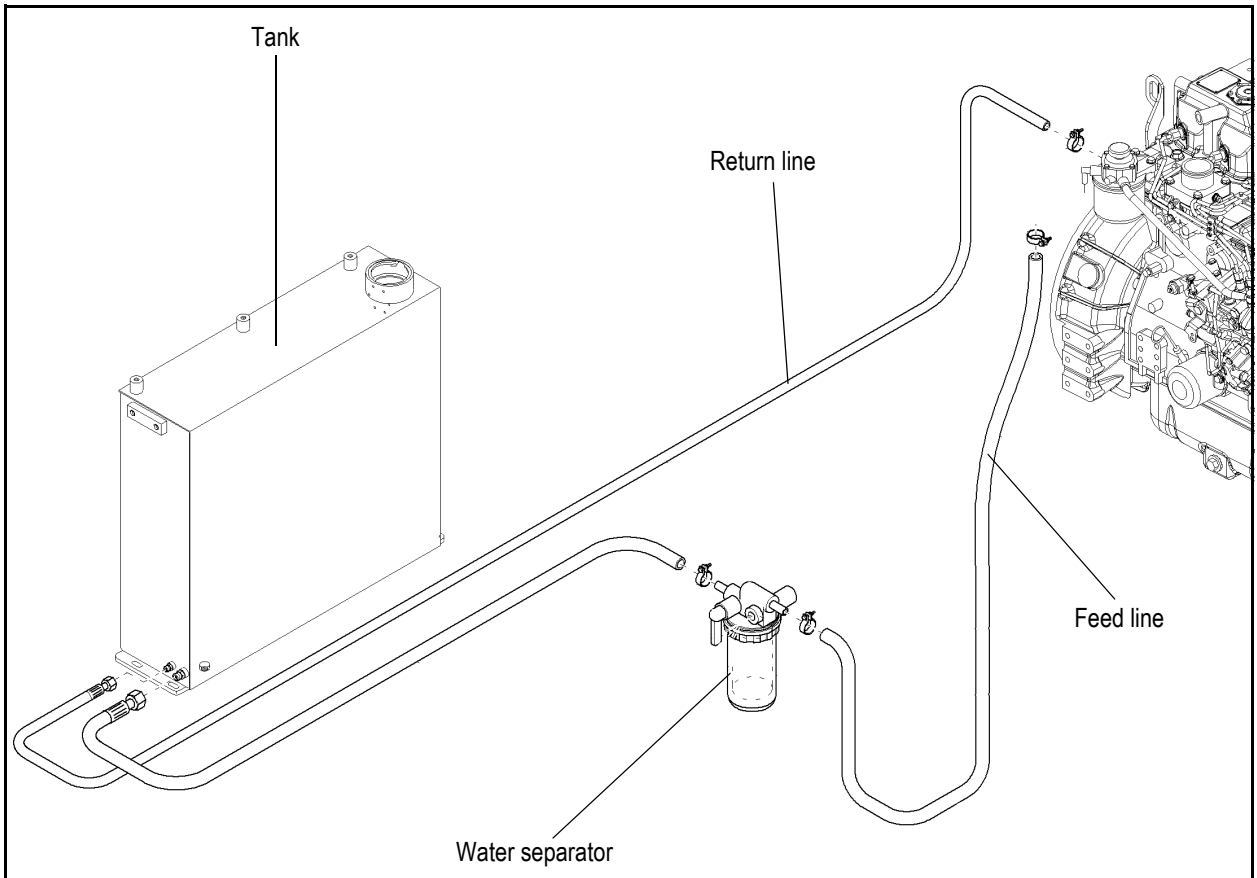


Figure 5-5 Fuel System

Coolant Circuit

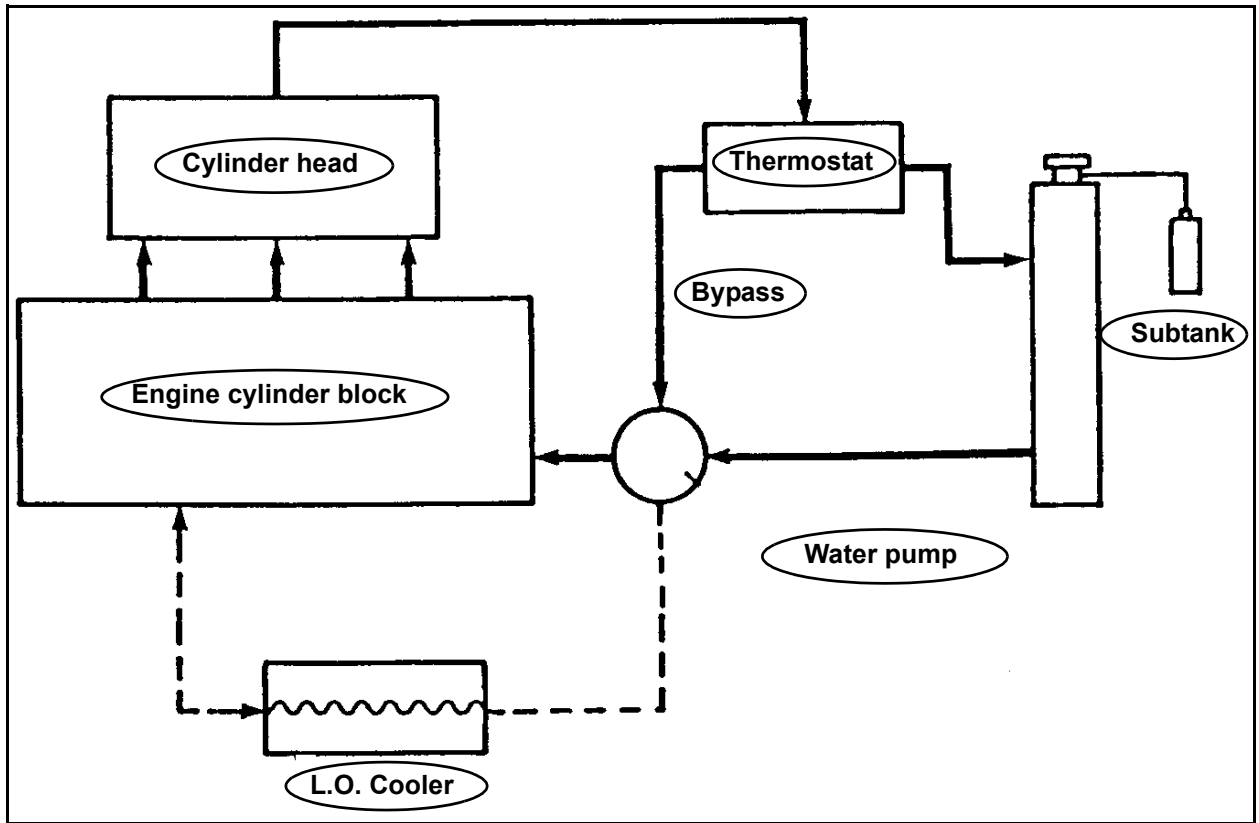
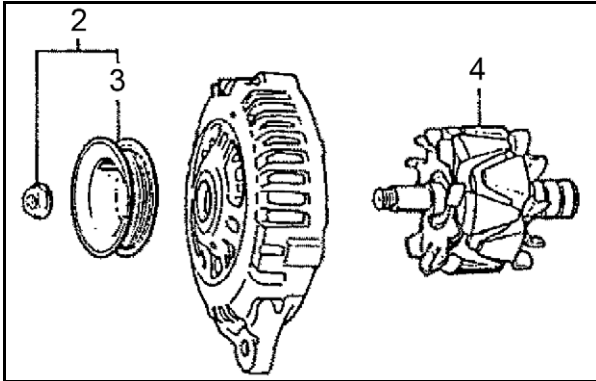


Figure 5-32 Coolant Circuit

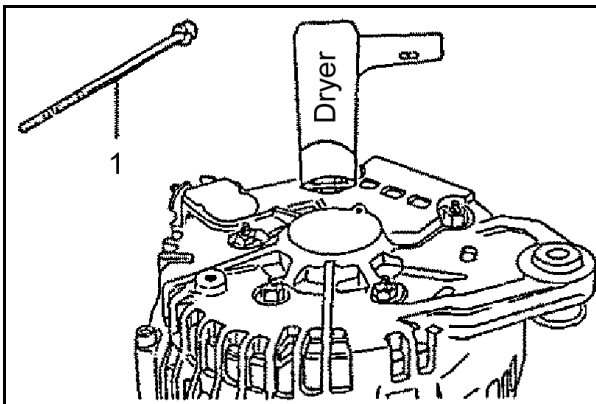
5. Inspect the rear side ball bearing. If abnormal rotation or sound exists, replace the ball bearing. See Figure 5-74.

### Assembling the Alternator



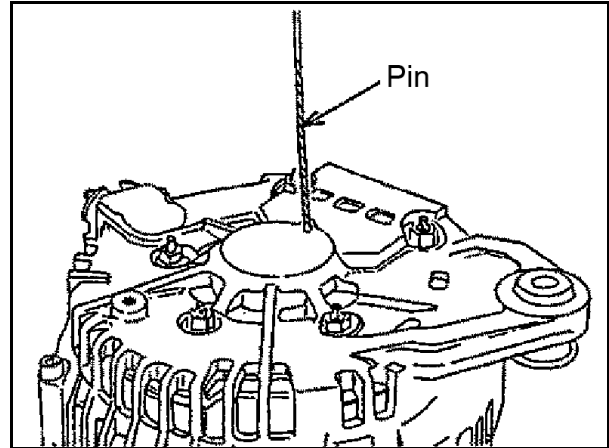
**Figure 5-75 Pulley Nut Assembly**

1. Using a 24 mm spanner wrench, install pulley nut M16. See Figure 5-75.
2. Install pulley nut assembly (2), pulley (3), and rotor (4).
3. Secure the front cover and rotor (front side) onto the rear cover and stator (rear side).



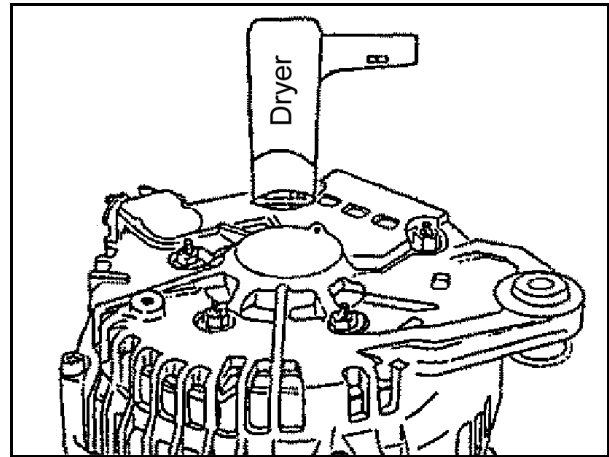
**Figure 5-76 M5 Through Bolt**

4. Install M5 through bolt (1). See Figure 5-76.



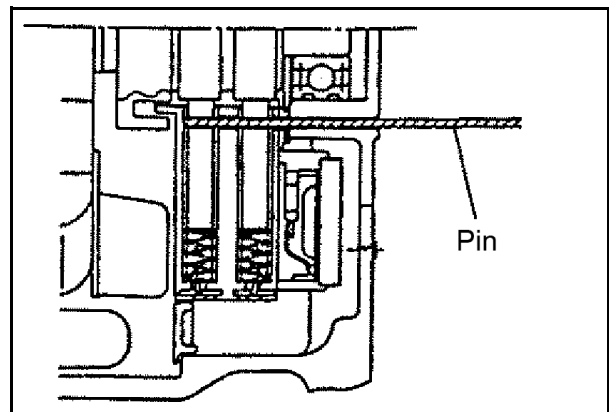
**Figure 5-77 Brush Holder Pin**

5. Insert a pin and force the brush into the brush holder as shown. See Figure 5-77.

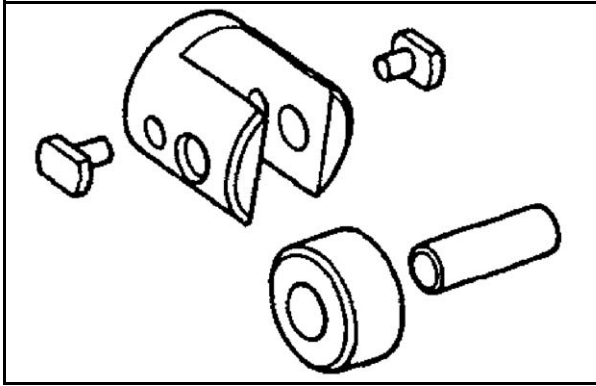


**Figure 5-78 Rear Cover**

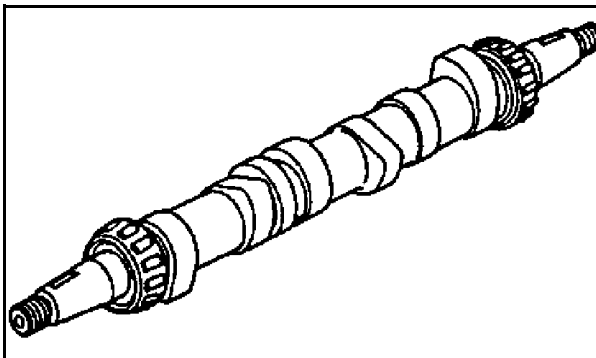
6. Using a dryer, blow hot air onto the rear cover for approximately one minute or until the rear cover temperature rises approximately 122°F (50°C). See Figure 5-78.



**Figure 5-79 Pin**

**Inspecting the Tappet****Figure 5-102 Tappet**

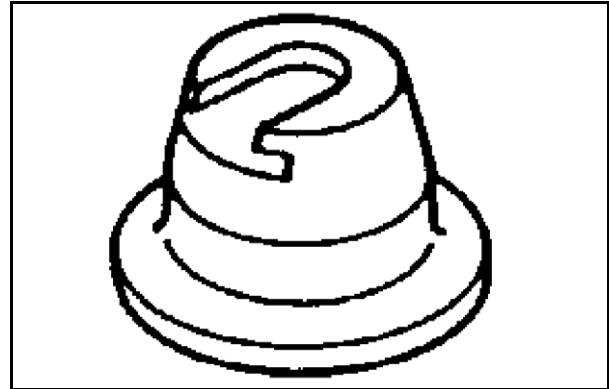
1. Check the pin hole, roller, pin and bushing for wear and damage. See Figure 5-102.

**Inspecting the Camshaft****Figure 5-103 Camshaft**

1. Check the camshaft surface for damage and wear. See Figure 5-103.
2. Check the key groove and thread for deformation.
3. Check the shaft for "bend."

**Inspecting the Bearing**

1. Check the roller bearing for wear.
2. Check the outer-race plate for surface defect.

**Inspecting the Plunger Spring Lower Retainer****Figure 5-104 Plunger Spring Lower Retainer**

1. Check the plunger spring lower retainer section that contacts the plunger for deformation and wear.

7. Rotate the piston (5) to the *bottom dead center* position and remove the connecting rod cap. See Figure 5-122.

For servicing the piston, see “Servicing the Piston” on page 279.

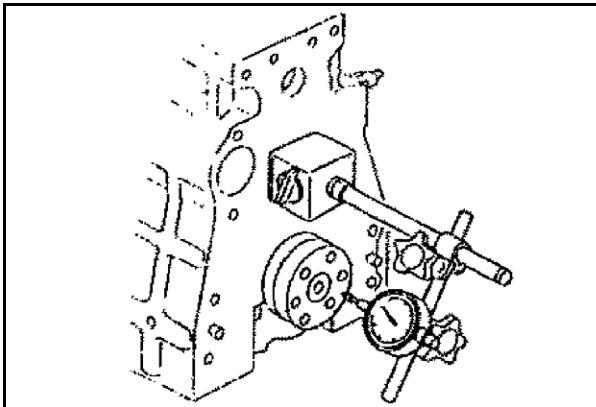
8. Rotate the piston to the *top dead center* position and push the connecting rod wide-end with the shaft of a hammer.

**NOTICE:** Do not allow the cylinder block to collide with the connecting rod wide-end.

9. Return the rod caps and crank-pin bearings to their correct combinations.
10. Position the engine with the cylinder block upper surface facing downward and secure it onto a base.
11. Remove the mounting flange (6). See Figure 5-122.
12. Remove and discard the mounting flange (6) oil seal.

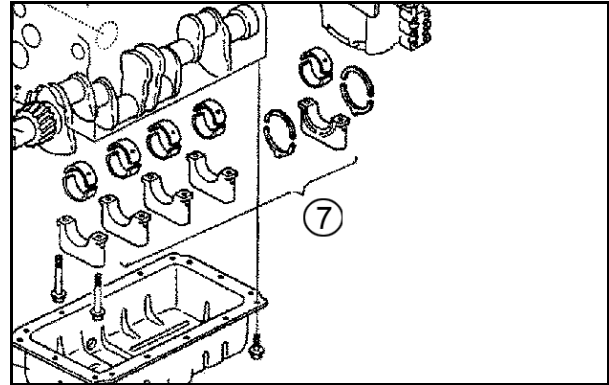
**IMPORTANT:** Do not damage the combustion surface when removing the mounting flange.

### Removing the Crankshaft

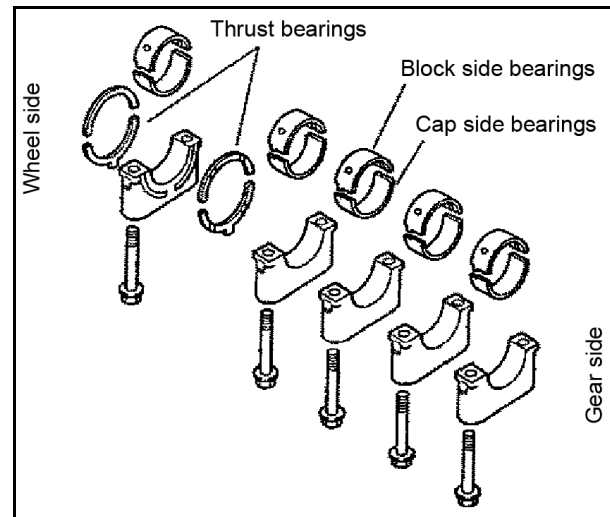


**Figure 5-123 Crankshaft Side Gap**

1. Measure the crankshaft side gap. The crankshaft side gap should measure 0.13~0.23 mm. If the side gap exceeds 0.23 mm, replace the thrust bearing with a thrust bearing exceeding 0.1” (2.605 mm) thickness.



**Figure 5-124 Bearing Caps**



**Figure 5-125 Crankshaft Bearings**

2. Remove the bearing caps (7) and cap side bearings. Identify and position upper and lower bearings as pairs. The upper bearing has an oil hole. See Figure 5-123 and Figure 5-124.
3. Remove the thrust bearings. Identify and position each thrust bearing in the direction of removal. See Figure 5-125.

**CAUTION**

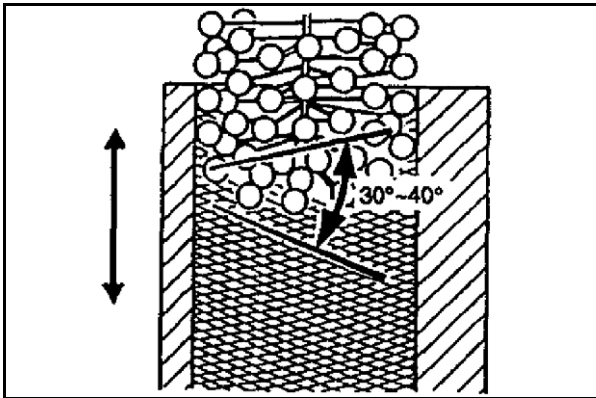
Use care when moving the crankshaft, mishandling the crankshaft can cause serious injury, and damage to the crankshaft.

Replace cylinder bores that contain major flaws.

7. Apply the honing fluid to the Flex-Hone and warm-up the electric drill to about 300-1200 rpm.

**IMPORTANT:** Do not exceed 1200 rpm, otherwise damage may occur.

8. Dip the Flex-Hone, attached to the electric drill, into the honing fluid.



**Figure 5-155 Honing Cross Hatch**

9. Insert the Flex-Hone into the cylinder bore while rotating the Flex-Hone and moving the electric drill up-and-down for approximately 30 seconds. This process obtains a honing mark with a cross-hatch angle of 30-40°. See Figure 5-155.

**IMPORTANT:** Do not insert or extract Flex-Hone into cylinder bore unless the Flex-Hone is rotating, otherwise the cylinder may be damaged.

## Yanmar Engine Model 4TNE106T-NS (SN AB00473-AB03158)

Problem	Possible causes
Engine does not start	Wrong intake/exhaust valve clearance
	Defective intake/exhaust valve
	Defective or broken piston ring
	Worn piston ring, piston and/or cylinder
	Defective crankpin metal and/or bearing
	Foreign matter trapped in combustion chamber
	Wrong intake/exhaust valves open/close timing
	Wrong lubricating oil properties
	Water in fuel system
	Clogged fuel filter
	Air in fuel system
	Clogged or cracked fuel pipe
	Insufficient fuel supply to fuel injection pump
	Priming failure
	Defective starting motor
	Defective alternator
Engine starts, but does not run smoothly or evenly	Wrong intake/exhaust valve clearance
	Valve seat compression leakage
	Defective intake/exhaust valve
	Defective or broken piston ring
	Defective crankpin metal and/or bearing
	Worn crankpin and/or journal bearing
	Loosened connecting bolt rod
	Foreign matter trapped in combustion chamber
	Excessive gear rearward backlash
	Wrong intake/exhaust valves open/close timing

**Bucket, Boom and Dozer Blade**

Problem	Possible Cause	Corrective Action
Rotating swing frame is difficult or impossible.	Swing brake does not release.	Contact authorized repair center.
	Insufficient lubrication.	Lubricate swing gear using remote grease fitting.
	Turntable drive unit defective.	Contact authorized repair center.
Front end attachments do not work or work only at a low performance level.	Low hydraulic fluid level.	Add hydraulic fluid.
	Hydraulic fluid is not warm.	Warm up the engine.
	Low engine power.	Contact authorized repair center.
	Engine to pump coupling or hydraulic pump damaged.	Contact authorized repair center.
	Pressure limiting valves set too low.	Contact authorized repair center.
	Hydraulic cylinder damaged.	Contact authorized repair center.
	Control valves damaged.	Contact authorized repair center.
Hydraulic cylinders lower too quickly.	Seals contaminated or damaged.	Contact authorized repair center.
	Heavy internal leakage at control spools.	Contact authorized repair center.
	Secondary cartridge valves damaged.	Contact authorized repair center.
Hydraulic lines overheat.	Hydraulic oil filter blocked.	Clean or replace filter.
	Low hydraulic fluid in hydraulic fluid reservoir.	Fill hydraulic fluid reservoir.
	Secondary cartridges set too low.	Contact authorized repair center.
	Hydraulic fluid cooling system not in working order.	Clean hydraulic fluid cooler.

**Hydraulic Pump**

For all abnormal operation, inspect the main pump, main control valve, third pump and circuit. Measure the pilot pressure, pump discharge pressure, load pressure, etc. If checking or partially disassembling the hydraulic pump, see “Disassembling and Assembling the Hydraulic Pump” on page 85.

Dust is very harmful to hydraulic components. If checking or partially disassembling the hydraulic pump, be sure dust, sand, debris, etc. do not enter the pump.

Handle movable parts carefully. Use an oilstone when performing corrections, even for small damage.

While inspecting the hydraulic pump, do not damage the O-rings. Damaging the O-rings causes internal and external oil leakage.

For all abnormal operation, complete the following sections:

- See “Inspecting Filter and Drain Oil” on page 303.
- See “Inspecting for Abnormal Vibration and Noise” on page 304.
- See “Measuring Pressure of Each Part” on page 304.

**Inspecting Filter and Drain Oil**

1. Inspect the hydraulic oil filter.
2. Check the hydraulic oil filter for an abnormally large amount of metallic powder. The hydraulic oil filter contains a small amount of metallic powder because of normal shoe and cylinder wear.
3. Inspect the shoe if the hydraulic oil filter contains an abnormally large amount of metallic powder. An abnormally large amount of metallic powder may indicate abnormal shoe wear.

<b>X15, male 13 poles AMP:</b>		
1	Pump regulation valve	Dark blue/ yellow
2	Potentiometer	Light blue
3	Potentiometer	Dark blue
4	Potentiometer	Green/black
5	3rd hydraulic circuit	Red/black/ red
6	3rd hydraulic circuit	Pink
7	Safety swich armrest	Brown/white
8	Boom swing/extended hydraulic	Light blue/ yellow
9	Climate temperature	Yellow
11	Climate compressor	Blue/yellow
12	Climate pressure	Yellow/red
13	Water temperature switch	Green/black

<b>X16, male 4 pole AMP:</b>		
1	Valves supply +15	Grey
2	Ground	Black
3	Plus 12 V	Red
4	Plus 12 V	Red

<b>X24 6 pole AMP</b>		
1	X15, P1	Dark blue
2	X15, P1	Green/black
3	X15, P1	Light blue
4	Ground	Black
5	Supply +12 V	Red
6	Res.	

<b>X25 6 pole AMP</b>		
1	Increase button	Grey
2	Set reset button	Green
3	Set reset button	Yellow
4	Increase button	Blue
5	Decrease button	Red
6	Decrease button	Black

<b>X27</b>		
1	Starter	White/black
2	Valves	Brown/white
3	Stop solenoid	Blue
4	Starter	White/black
5	Valves	Brown/white
6	Stop solenoid	Blue
8	Ground	Black
10	Supply +30	Red
11	Supply +15	Blue

<b>X28</b>		
1	Windshield wiper rear	Blue/red
2	Rotating beacon	Violet
3	Ground	Black
4	Windshield wiper	White
5	Cabin roof light front	Green
6	Windshield washer	White/black/ white
7	Supply +15	Blue
8	Supply +30	Red black
9	Cabin roof light rear	Yellow/black

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