MAINTENANCE CHART

Ref.	Component/System	Daily - 10 Hours	Weekly - 50 Hours	2 Weeks - 100 Hours	Monthly - 250 Hours	2 Months - 500 Hours	6 Months - 1500 Hours	12 Months - 3000 Hours	Service/Check	Instructions
1	ENGINE AIR CLEANER	X							Check restriction indicator	See page 21
				X					Clean or replace element	
2	RADIATOR, COOLING SYSTEM	X							Check coolant level	See page 20
							X		Drain and flush system	
3	ENGINE	X							Check oil, drain fuel filter	See engine manual
				X					Change oil and filters	
4	PLANETARY HUBS		X						Check oil level	See page 37
							X		Drain and refill, clean breather	
5	TIRES	X							Check pressures and general condition	See page 39
6	DIFFERENTIALS		X						Check oil level	See page 37
							X		Drain and refill, clean breather	
7	TORQUE CONVERTER AND TRANSMISSION	X							Check oil level	See page 28
					X				Drain and refill, change filter, clean breather (See Special Maintenance)	
8	HYDRAULIC OIL TANK		X						Check oil level	See page 88
							X		Drain and refill, clean breather and diffusers	
9	HYDRAULIC SYSTEM FILTERS					X			Clean screens, replace paper filters	See page 86
10	LUBRICATION FITTINGS	X	X						Lubricate with Lithium Base E.P. No. 2 bearing grease	See page 17
11	AIR SYSTEM (AIR TANK AND AIR DRYER)	X							Drain moisture from air reservoir	See page 51
						X			Clean or replace filter on compressor inlet	
								X	Overhaul compressor	
12	BRAKE MASTER CYLINDER		X						Check fluid level	See page 38
13	FUEL TANK	X							Fill at end of shift to minimize condensation	See engine manual
			X						Drain water and sediment from tank	
14	BATTERIES						X		Clean case, posts and connections	See page 63
15	SWING GEARBOX		X						Check oil level	See page 43
							X		Drain and refill, clean breather	
16	TURNTABLE BEARING	X							Lubricate open gear	See page 43
			X						Grease bearing race (central lube point in cab)	
					X				Check torque on capscrews (See Special Maintenance)	
17	ACCELERATOR MASTER CYLINDER	X							Check fluid level	See page 23
18	OPERATOR'S CAB	X							Clean thoroughly	See page 11
19	BOOM	X							Lubricate all grease fittings	See page 16
20	OUTRIGGERS	X							Remove mud and dirt before retracting	See page 18

SPECIAL MAINTENANCE

Every 4 Hours for First 20 Hours

Boom and Attachment ..... Lubricate linkage pins

End of First Day or First 10 Hours (Run-In)

Hydraulic Filters (in-line) ..... Replace micron elements, clean 100 mesh screens

Engine ..... See "Run-In" instructions in Engine Manual

End of First Week or First 50 Hours of Operation and/or After Overhaul

Turntable Bearing Capscrews ..... Check torque

Transmission and Torque Converter ..... Change oil and filter

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4. Slip a hose over the end of the bleed fitting on the slave cylinder. Submerge the other end in a glass jar partly filled with brake fluid, so that air bubbles escaping from hydraulic system can be seen.

5. Open bleed fitting on slave cylinder, then open pressure bleeder supply valve and permit fluid to flow from the accelerator system until bubbles are no longer visible in the glass jar.

6. Close the bleed fitting on the slave cylinder.

7. Close pressure-bleeder supply valve and remove hose and adapter from master cylinder fill port (if pressure bleeder was used). Fill master cylinder reservoir with clean fluid to within ¼ inch (6.3 mm) of top. Replace cap.

NOTE

If frequent bleeding is required, check system for leaks, look for dark accumulations of dirt around line connections.

NOTE

If accelerator response is still sluggish, it is possible the line leading to the swivel may need bleeding. To bleed this line, use the procedure below.

Bleeding Accelerator Swivel Line:

1. Pump up pressure using accelerator pedal. Place a heavy weight on the pedal to keep the pressure in the line. Pumping the accelerator pedal should create enough pressure for proper bleeding.

2. Loosen the accelerator hydraulic line at the top swivel fitting to bleed air out of the line. Close fitting and re-tighten. Remove weight from accelerator and test for proper response.

3. Bleed also at points A, B & C, figure 31. If air continues to enter the system, there is probably an internal leak in the master cylinder or slave cylinder.

TROUBLESHOOTING GUIDE - ENGINE

PROBLEM	POSSIBLE CAUSE	REMEDY
Engine lacks power, stalls at idle speed (excessive smoke)	1. Clogged air cleaner 2. Engine needs tune-up	1. Remove and clean or replace element 2. See engine manual
Engine overheats	1. Insufficient coolant or dirty fins 2. Defective thermostat 3. Insufficient lubricating oil	1. Check coolant level and fan belts; clean fins 2. Replace, see engine manual 3. Add oil, see engine manual
Engine does not develop full rpm	1. Low fluid in accelerator master cylinder 2. Accelerator linkage out of of adjustment 3. Engine needs tune-up	1. Check; refill if necessary 2. Adjust linkage to governor 3. See engine manual
Engine responds sluggishly when accelerator pedal is depressed	1. Air in hydraulic line 2. Accelerator lock not fully disengaged 3. Worn or defective master or slave cylinder 4. Defective fuel system	1. Bleed accelerator system 2. Check and correct 3. Disassemble and repair or replace item found defective 4. See engine manual
Engine won't start	1. Faulty cranking system 2. Faulty fuel system	1. See engine manual and Electrical System 2. See engine manual

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SPECIFICATIONS

ENGINE	DETROIT DIESEL 4-71 N	CASE 504 BDT
Type	Diesel, 4-cylinder	Diesel, 6-cylinder
Bore and Stoke	4.25 in. x 5 in. (108 mm x 127 mm)	4.625 in. x 5 in. (117 mm x 127 mm)
Displacement	284 cu. in. (4 654 cm^3)	504 cu. in. (8 259 cm^3)
Horsepower at Governed Speed	157 (117 kW)	164 (122 kW)
Horsepower — SAE Net	141 (105 kW)	148 (110 kW)
Compression Ratio	18.7 to 1	15.5 to 1
Governed RPM	2300	2100
High Idle RPM	2475	2250-2300
Low Idle RPM	550 ± 25	725 ± 25

TORQUE CONVERTER
- Model ..... Funk 20E 13T
- Type ..... Remote Mount
- Converter Size ..... 12.75 in (324 mm)

TRANSMISSION
- Model ..... Funk 1024R
- Type ..... Power Shift
- Gear Ratio
  - 1st 5.12:1
  - 2nd 2.70:1
  - 3rd 1.50:1
  - 4th 79:1

AXLE, FRONT
- Type ..... Planetary drive/steer
- Ratio 14.76:1

AXLE, REAR
- Type ..... Planetary drive, rigid
- Ratio 14.76:1

BRAKES, SERVICE
- Brake Shoe Size ..... 17.25 in x 4 in (438 mm x 102 mm)
- Lining Area ..... 135 sq in (871 cm^2)
- Location ..... One each wheel
- Type ..... Air-over-Hydraulic

PARKING BRAKE
- Type ..... Air-actuated, band
- Location ..... On input to rear axle

OUTRIGGERS
- Type ..... Hydraulic
- Number Used ..... 2 standard, 4 optional
- Pad Size ..... 14 in x 17 in (356 mm x 432 mm)

COUNTERWEIGHT
- Construction ..... Ironcrete
- Location ..... Rear of turntable
- Weight ..... 9200 lb (4 173 Kg)

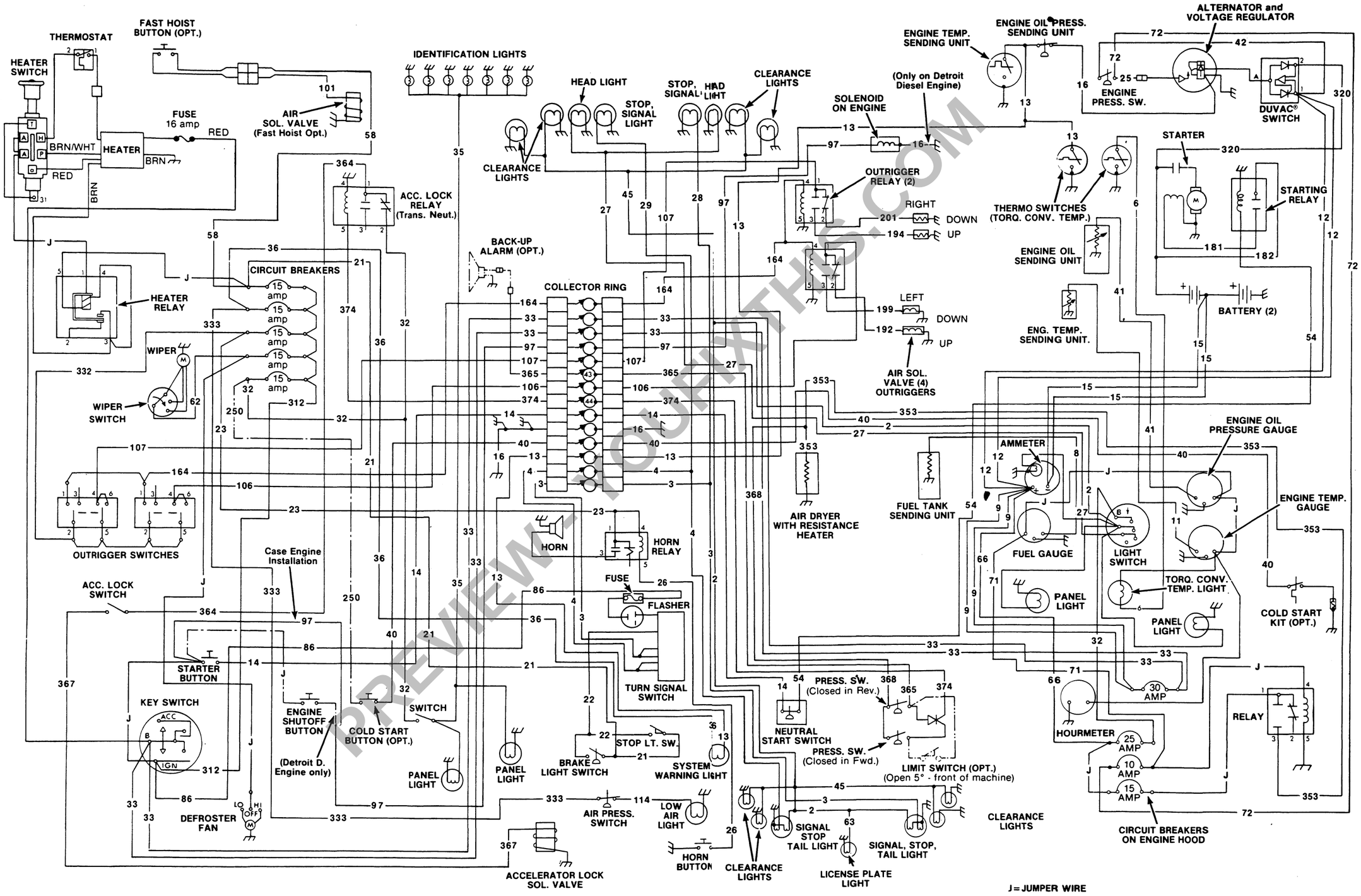
HEATER
- Type ..... Diesel Fuel
- Rating ..... 7,000 BTU/hr (2 000 W)
- Location ..... Rear of Cab

TURNTABLE BEARING
- Type ..... Single race, internal gear
- Diameter ..... 45.8 in (1 163 mm)

BRAKE, SWING
- Make ..... Drott
- Type ..... Integral disc
- Location ..... On swing gearbox
- Actuation ..... Mechanical, from cab

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Figure 295. Electrical Schematic
(12/24 Volt System – Machines Before PIN 6295126)

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NOTE: FOR PORT RELIEF PRESSURE SETTINGS, SEE PAGE 10.

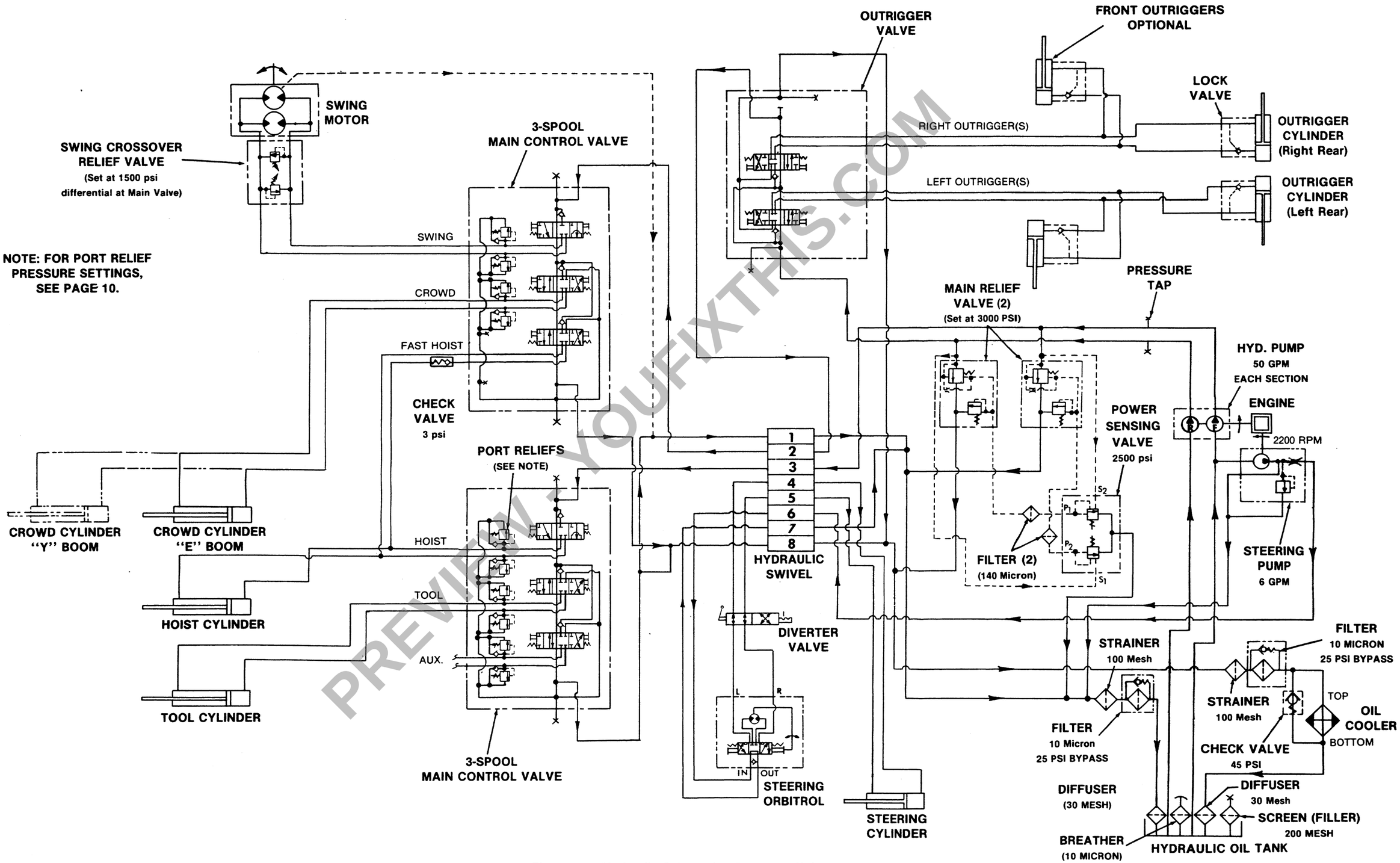
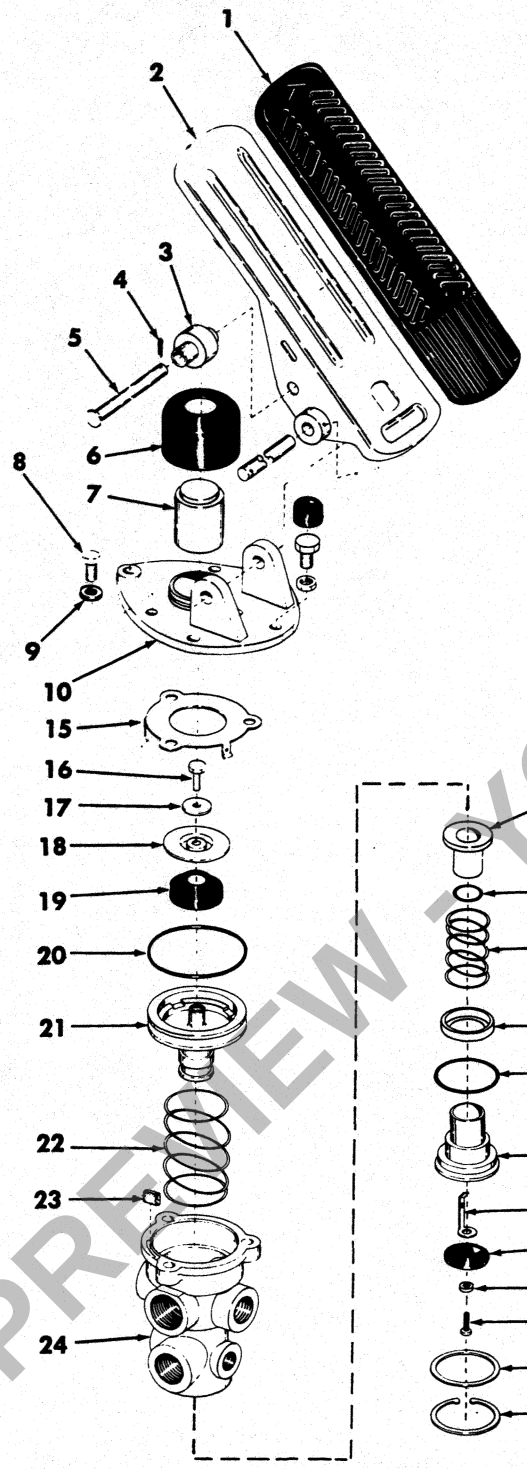
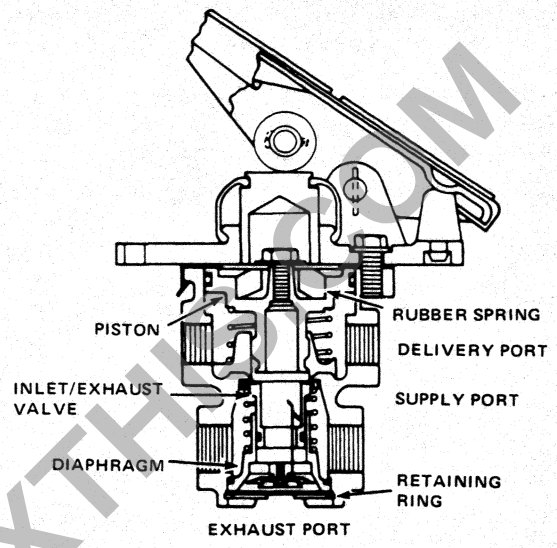


Figure 296. Hydraulic Schematic - Excavator Units

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1. Cover for Treadle
2. Treadle
3. Roller
4. Cotter Pin
5. Pin
6. Boot
7. Plunger
8. Screw (Quantity of 3)
9. Lockwasher
10. Mounting Plate
11. Shaft and Roll Pin
12. Cover for Stop Button
13. Stop Button
14. Nut
15. Retainer
16. Screw
17. Special Washer
18. Spring Seat
19. Rubber Spring
20. O-Ring
21. Piston
22. Piston Spring
23. Filter
24. Body
25. Inlet and Exhaust Valve
26. O-Ring
27. Spring
28. Valve Retainer
29. O-Ring for Exhaust Check Valve
30. Seat for Exhaust Check Valve
31. Spring

Figure 149. Foot Brake Valve

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TORQUE SPECIFICATIONS - AXLE			
LOCATION/DESCRIPTION	**DIA.**	**THDS.**	**TORQUE (lb-ft)**
Pinion Bearing Cage to Carrier Capscrews	3/8" 7/16" 1/2" 5/8"	16 14 13 11	30-40 50-65 80-105 130-170
Differential Bearing Cap to Carrier Capscrews	9/16" 5/8" 3/4" 7/8" 7/8"	12 11 10 14 9	116-129 160-180 290-320 375-415 470-520
Gear to Differential Case Bolt Nuts	5/8" 1/2"	18 20	210-270 105-135
Differential Case Capscrews and Nuts (Long & Short)	3/8" 7/16" 1/2" 1/2" 5/8" 5/8"	16 14 13 20 11 18	35-50 60-75 90-120 105-135 185-235 210-270
Planetary Spider Cover Capscrews	7/16" 1/2"	14 13	53-67 81-104
Planetary Spider to Hub Bolts	1/2" 3/4"	13 10	81-104 290-370
Planetary Ring Gear Lock Capscrews	5/16" 3/8" 7/16"	24 16 14	21-27 33-43 53-67
Steering Arm and Steering Bearing Cap Bolts	1/2" 5/8" 3/4" 7/8"	13 11 10 14	81-104 160-205 290-370 510-655
Spindle to Housing Nuts	5/8" 7/8" 1"	18 14 14	185-235 510-655 780-1000
Tie Rod Clamp Bolt	1/2" 5/8"	20 18	92-118 185-235
Brake Drum to Hub Bolts	5/8" 3/4" 7/8"	11 10 14	160-205 290-370 510-655

Conversion Factor: Lb-Ft x 1.355818 = Nm

(For use with Rockwell Axles only)

Torques given apply to parts coated with machine oil; for dry parts increase torques 10%; for parts coated with multi-purpose gear oil decrease torques 10%. Nuts on studs to use same torque as for driving the stud.

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TABLE OF CONTENTS

GENERAL

Index 2
Safety 3, 4
Introduction 5
Nomenclature, Description and Specifications 6-10

SECTION 1 - PREVENTIVE MAINTENANCE

Introduction 11
Hydraulic System Operating Pressures 12
Capacities, Lubricants and Fluids 12, 13
Maintenance Chart 14-16
List of Grease Fittings 17-19

SECTION 2 - THE MECHANICAL SYSTEM

Engine and Related Systems 20-25
Torque Converter and Transmission 26-35
Axles 36-41
Turntable Swing 42-45
Boom and Attachments 46, 47

SECTION 3 - THE AIR SYSTEM

Introduction 48
Air Supply System 49-52
Service Brake System 53, 54
Parking Brake 54
Outrigger and Fast Hoist Control 55
Troubleshooting 56, 57

SECTION 4 - THE ELECTRICAL SYSTEM

Introduction 58
Dual Voltage System (Machines Before PIN 6295126) 59-83
24 Volt System (Machines PIN 6295126 and After) 84-105

SECTION 5 - THE HYDRAULIC SYSTEM

Introduction 106
System Maintenance and Troubleshooting 107-113
Main Hydraulic System 114-138
Power Steering System 139-143
Trouble Charts 144-150

SECTION 6 - DISASSEMBLY AND REPAIR

General Cleaning Instructions 151
Repair of Components 152-297

TORQUE CHARTS AND SCHEMATICS

Torque Charts 298, 299
Air Schematic 300
Electrical Schematic - 12/24 Volt System 301
Electrical Schematic - 24 Volt System 302
Hydraulic Schematic - Excavator Units 303
Hydraulic Schematic - Logger Units 304

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SAFETY

THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

CAUTION: When doing any service on the machine, put a tag on the ignition switch or remove the key to prevent operation of the machine.

WARNING: Never disconnect any hydraulic line unless the boom is fully lowered and hydraulic pressure is relieved. To relieve hydraulic pressure, stop the engine and move the hydraulic controls forward and back several times.

CAUTION: ENGINE FAN AND BELTS. To prevent possible serious injury avoid contact with rotating fan and belts.

CAUTION: Be very careful when working with tires. Tires can come apart with explosive force. Never try to disassemble the wheel until all air is released from the tire.

CAUTION: Never operate the alternator on an open circuit. With no battery or other electrical load on the circuit, high voltage will occur in the alternator. This voltage can cause injury to any person who makes contact with the battery terminal of the alternator.

DANGER: Engine exhaust can cause death. If necessary to start the engine in a closed area, make sure there is enough ventilation.

WARNING: To prevent injury from burns, always use a solvent that is not flammable for cleaning component parts. DO NOT use gasoline or other flammable substances.

WARNING: Never fill the fuel tank near an open flame or while the engine is running. Keep cigarettes away.

WARNING: To prevent eye injury, wear eye protection when doing maintenance on this machine.

WARNING: Stop the engine before doing any maintenance or adjustments. If necessary to make checks while the engine is running, have one person at the controls while the other person makes the check.

CAUTION: Clean any oil spills immediatey and keep the work area as clean as possible. A clean area helps prevent accidents.

WARNING: Read the Operator's Manual before operating the machine.

CAUTION: To prevent personal injury, keep your hands away from the swing pinion when the turntable is being rotated.

WARNING: To prevent injury and possible death, keep hands, feet and loose clothing away from moving parts during operation.

POISON/DANGER: Batteries contain sulfuric acid which can cause severe burns. Avoid contact with skin, eyes or clothing. Antidote: EXTERNAL, flush with water; INTERNAL, drink large quantities of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Call physician immediately; EYE, flush with water for 15 minutes and get prompt medical attention. Keep out of reach of children.

CAUTION: When removing a battery, always disconnect the (-) negative ground cable first. When installing the battery, always connect the (-) negative ground cable last.

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One problem encountered with the standard differential, and overcome by the NoSPIN, is that of wheel slippage. With the standard differential, when one wheel slips, driving torque is lost to both wheels. The NoSPIN, with its automatic locking feature, will allow one wheel to turn faster than ring gear speed (when making turns) but will never permit either wheel to turn SLOWER than ring gear speed. Thus it provides more positive traction over slippery or rough terrain.

Planetary Hubs

Driving torque from the single reduction drive is transmitted to the planetary drives by the axle shaft which drives the sun gear of the planetary reduction.

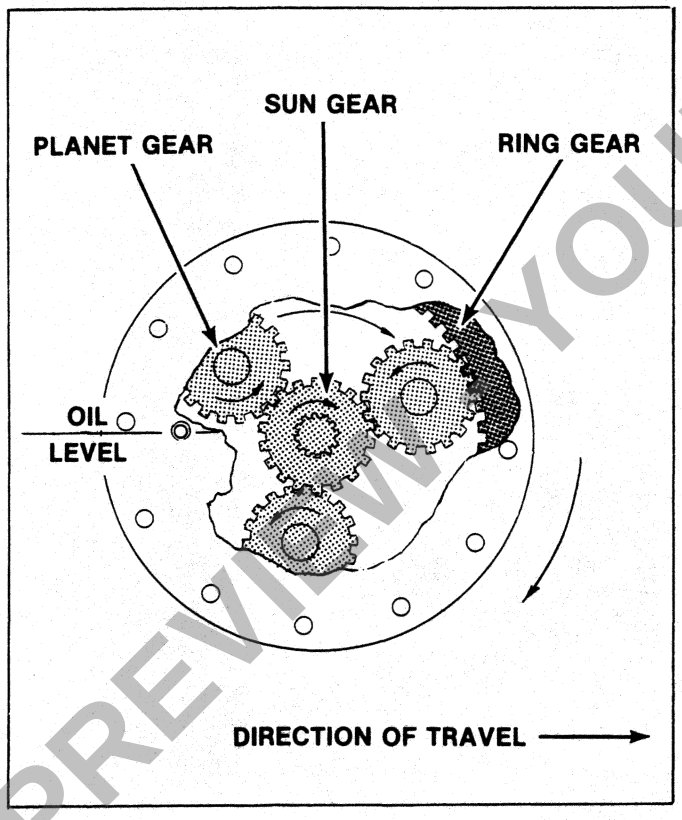


Figure 46. Planetary Operation

Each planetary drive consists of a sun gear and three planet gears which rotate within a floating ring gear. The planet spider which houses the planet gears is bolted to the wheel hub. As the planet gears rotate within the ring gear, torque is transferred through the spider to the wheel.

Air-Over-Hydraulic Brakes

The hydraulic master cylinder is located at the rear of the unit near the outrigger control valve. Hydraulic lines link the master cylinder to the individual wheel cylinders.

When either the service brake pedal or digging brake handle is applied, air pressure builds within the brake actuating air chamber and causes the master cylinder piston to move outwards. As the master cylinder piston extends, it forces fluid through the brake lines to the wheel cylinders to apply the brakes.

For information on air portion of brake system refer to the Air System Section of this manual.

Steering Axle

The front steering axle is basically the same as the rigid axle, except it uses a knuckle and a universal joint in the axle shaft to enable the planetary hubs to be steered.

A single hydraulic cylinder is used to power the steering. The cylinder base is attached to a bracket mounted on front of differential housing. The cylinder rod is attached to the steering knuckle flange of the right front wheel. Steering action is transferred to the left front wheel through the tie rod.

Scheduled Maintenance - Axles

The oil level in both the Planetary Hubs and the Differentials should be checked at least once a week. Before checking oil in planetary hubs, rotate the wheel being checked so that the words "Oil Level, Horiz." on end cap are in a horizontal position. Clean the area around check and fill plugs before removing them. Maintain oil to level of check plug (when in horizontal position). See arrow on cover.

Maintain oil to level of fill/check plug on side of the differential carrier. Use EP 80-90 gearlube in both the differentials and the planetary hubs. If unit is equipped with a NoSPIN differential, special lubricant may be required during cold weather. See Component Capacities Chart.

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The pressure switches on the transmission receive power through a relay and a 15 amp circuit breaker on the engine hood. See figure 92. This relay also controls the power to the air dryer. The coil of the relay is connected through a 10 amp circuit breaker to the pressure switch on the engine. Power is available to energize the relay when the engine is running.

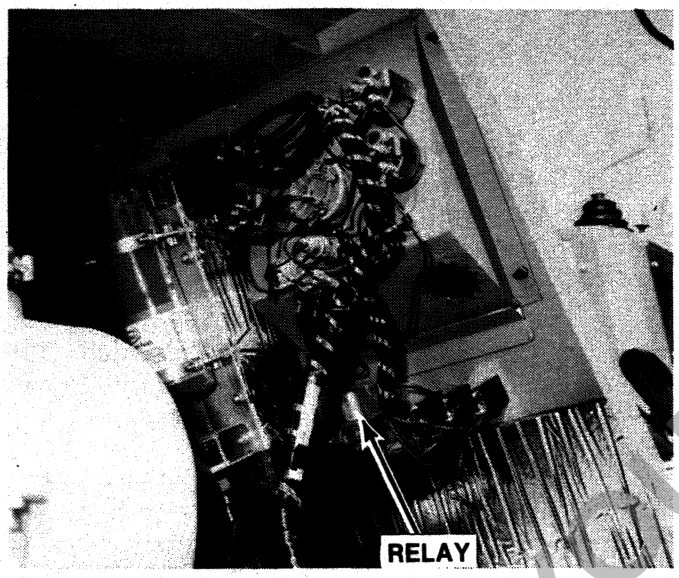


Figure 92. Location of Relay for Air Dryer and Pressure Switches on Transmission

BACK-UP ALARM (optional)

The back-up alarm connects to the reverse pressure switch on the transmission. The alarm is activated when there is pressure to the reverse clutch.

AIR DRYER

Power is available to the resistance heater of the air dryer through a relay and a 15 amp fuse, as explained above, when the engine is running.

The function of the heater and thermostat is to prevent freeze-up in the purge drain valve of the air dryer during cold weather. The thermostat range is 50° - 85° F (10° - 30° C).



Figure 93. Heater and Thermostat on Air Dryer

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tracked differently in different areas. To reseat the brushes lay a piece of sandpaper between the ring and the brush. Install the brush in the brush holder in proper alignment and rotate the core while applying pressure on the brush. If the core cannot be rotated, the sandpaper must be pulled across the brush surface. Wrap sandpaper at least 180° around ring to prevent rounding of the brush edges. Re-inspect the brush contact surface and repeat the sanding process if necessary until the entire contact surface appears uniform without pits.

IMPORTANT: Do not use emery paper or cloth to seat brushes since the emery will become embedded in the brush and continue the abrasive action against the ring and brush. Emery and many other abrasives are conductive and must not be used.

4. Brush springs.

   a. Inspect and test springs for proper tension. The brush tension springs should be set at 1.5 lbs per spring and as uniform as possible. Uniform settings for each brush prevent selective action by which certain brushes carry more or less than their share of the load. Insufficient brush pressure can cause loss of contact and overtension can cause excessive brush and ring wear.

   b. Measure spring tension. The spring tension should periodically be tested on all brushes to assure uniform brush tension. Test for tension as shown in Figure 102P.

5. Rings.

   a. Inspect the ring surface for dirt, oxidation or other contaminates. A properly operating ring will have a film that appears burnished in color where the brushes track with a darker surrounding color. If this condition does not exist cleaning will be necessary.

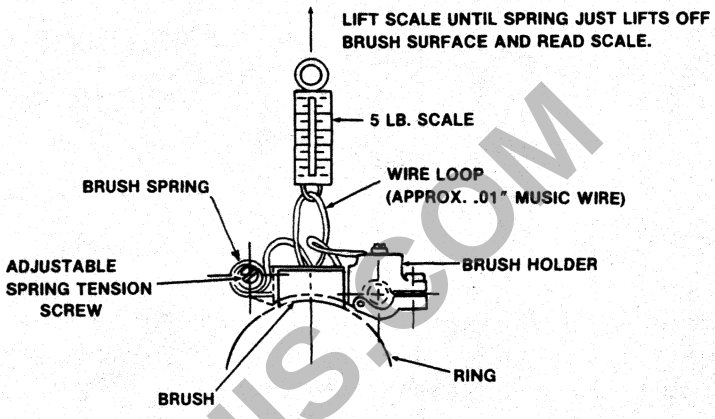


Figure 102P. Checking Brush Tension

   b. The ring should be cleaned with a non-conductive abrasive such as Ideal Industries' Flexible Abrasive for collector rings. Hold the abrasive against the ring with a medium amount of pressure while turning the core. If the core cannot be turned, the abrasive must be rubbed over the ring. Continue this process until the ring surface is polished without any dirt or contaminates left on the surface. To prevent abrasive from being lodged in the brushes, they should be lifted off the ring.

IMPORTANT: The ring insulator material is a Noryl resin which will soften or dissolve in halogenated and aromatic hydrocarbons. These compounds are contained in various cleaners and must not be used.

   c. Inspect rings for pitting. Pitting of the ring must be corrected since pits will produce arcing leading to the development of larger and more pits. Small pits can be removed by hand stoning the area. If large pits and/or extensive amount of pits are present on the surface, the surface must be machined. Machining is also necessary if concentricity of the surface is questionable. When stoning and machining rings, remove only enough material to eradicate the pits. Again, the brushes should be lifted from the surface when stoning or machining. Finish the ring surface to a 16-32 microfinish as described in preceding paragraph.

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POWER STEERING SYSTEM

General Description

The steering system uses the same oil supply as the main hydraulic system. The system includes the steering pump, steering orbitrol, diverter valve, hydraulic swivel, steering cylinder and hydraulic lines.

Oil Flow

Oil is available to the inlet of the steering pump from the inlet line to the main hydraulic pump. Approximately 6 gpm of the pump output is sent through a restrictive orifice and port 6 of the hydraulic swivel to the IN port of the steering orbitrol. The remainder of the pump output is returned to the hydraulic oil tank.

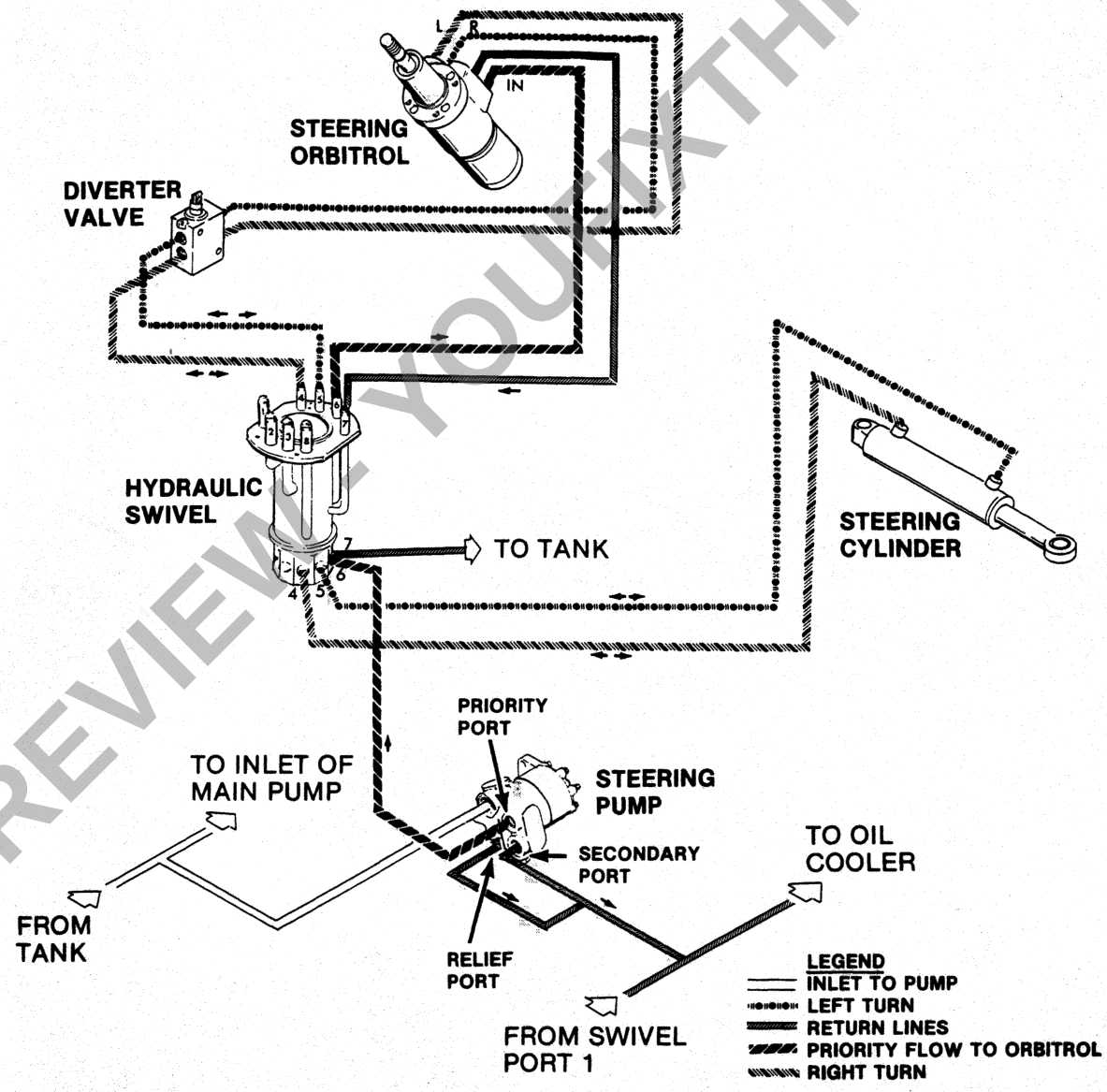
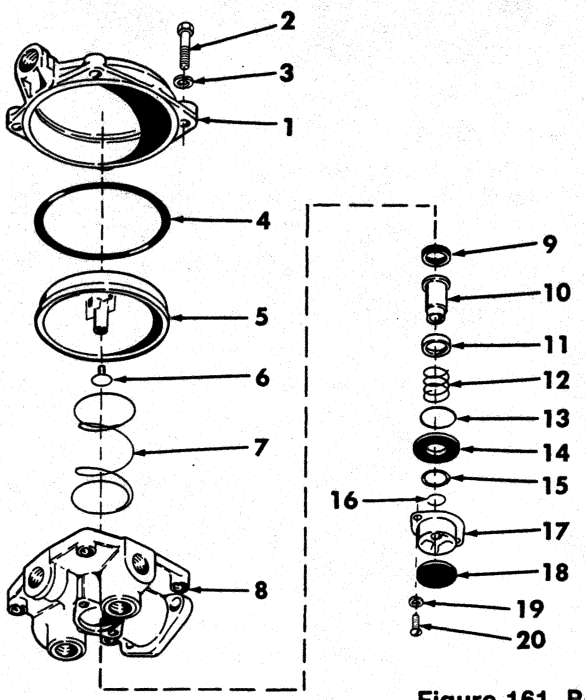


Figure 139. Steering System

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1. Cover
2. Bolt
3. Lockwasher
4. O-Ring
5. Piston
6. Exhaust Seat
7. Spring
8. Body
9. Inlet and Exhaust Valve
10. Inlet Valve Body
11. Valve Retainer
12. Spring
13. Seal Ring
14. Valve Guide
15. O-Ring
16. Retaining Ring
17. Exhaust Cover
18. Exhaust Check Diaphragm
19. Lockwasher
20. Screw

Figure 161. Relay Valve

3. Install the valve spring (12) over the body (10).

4. Apply lubrication and install o-ring (15) in the inner groove in the valve guide (14).

5. Push the valve guide (14) down and install retaining ring (16). A 9/16 inch twelve point socket can be used to push the retaining ring down until the ring engages in the groove in the inlet valve body.

6. Install o-ring on the valve insert.

To Assemble the Relay Valve:

1. Install the R-6 Insert in the valve body (8). Use care to prevent damage to the o-ring and the inlet and exhaust valve.

2. Install exhaust cover (17) and fasten with two screws and lockwashers (20, 19).

3. Press the exhaust check diaphragm (18) into exhaust cover (17).

4. Turn valve over. Apply lubrication and install o-ring (4) in body groove.

5. Install o-ring on piston and install piston in cover.

6. Install spring (7) over guide in body.

7. Install the cover and piston (with service port in correct location) over spring.

8. Install cover and fasten with four bolts and lockwashers (2, 3).

PROCEDURE TO TEST THE RELAY VALVE

After installation of a rebuilt valve, test the relay valve for correct operation and for leakage.

1. Start engine and wait until pressure in the air system is at normal operating pressure.

2. Apply and release the brake several times. The application and the release of the brake must be immediate. If there is delay in the brake action, the relay valve is not working correctly. Repair or replacement of the valve is necessary.

3. With a soap solution, check for leakage at the exhaust port of the relay valve. Also check the connections at the valve.

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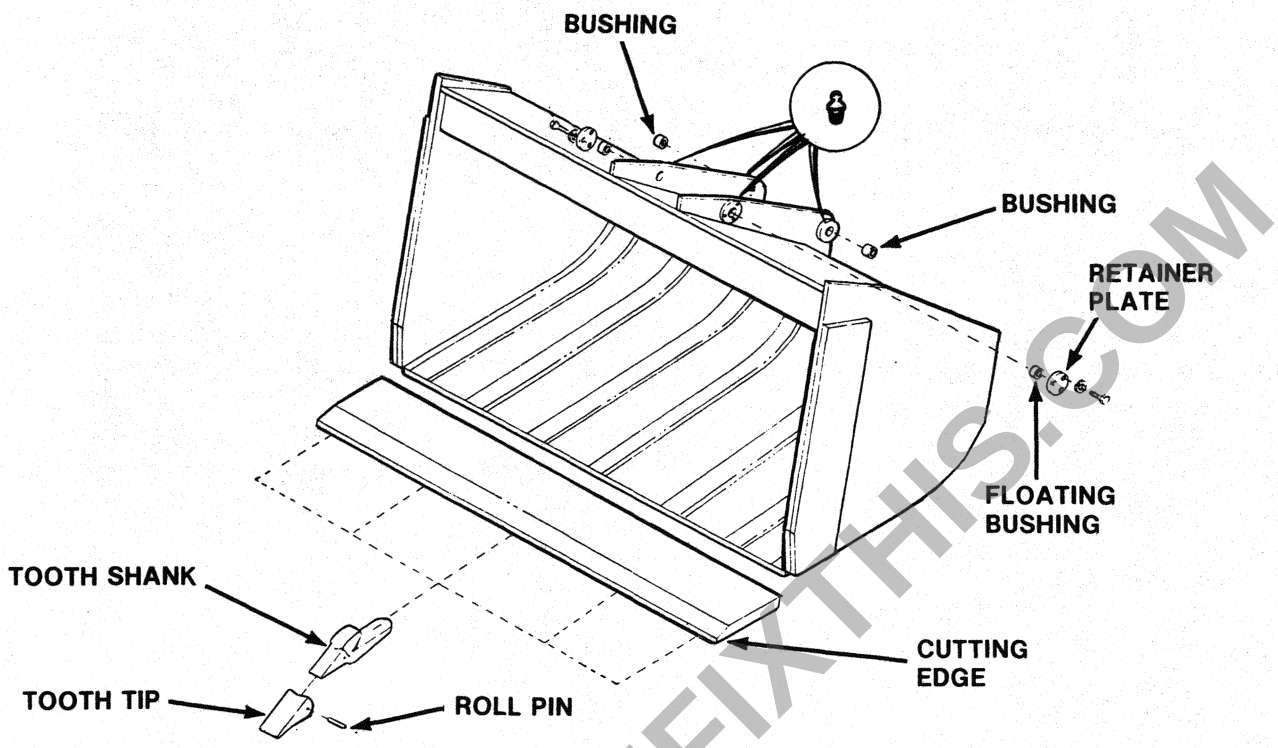


Figure 188. Front Loading Bucket

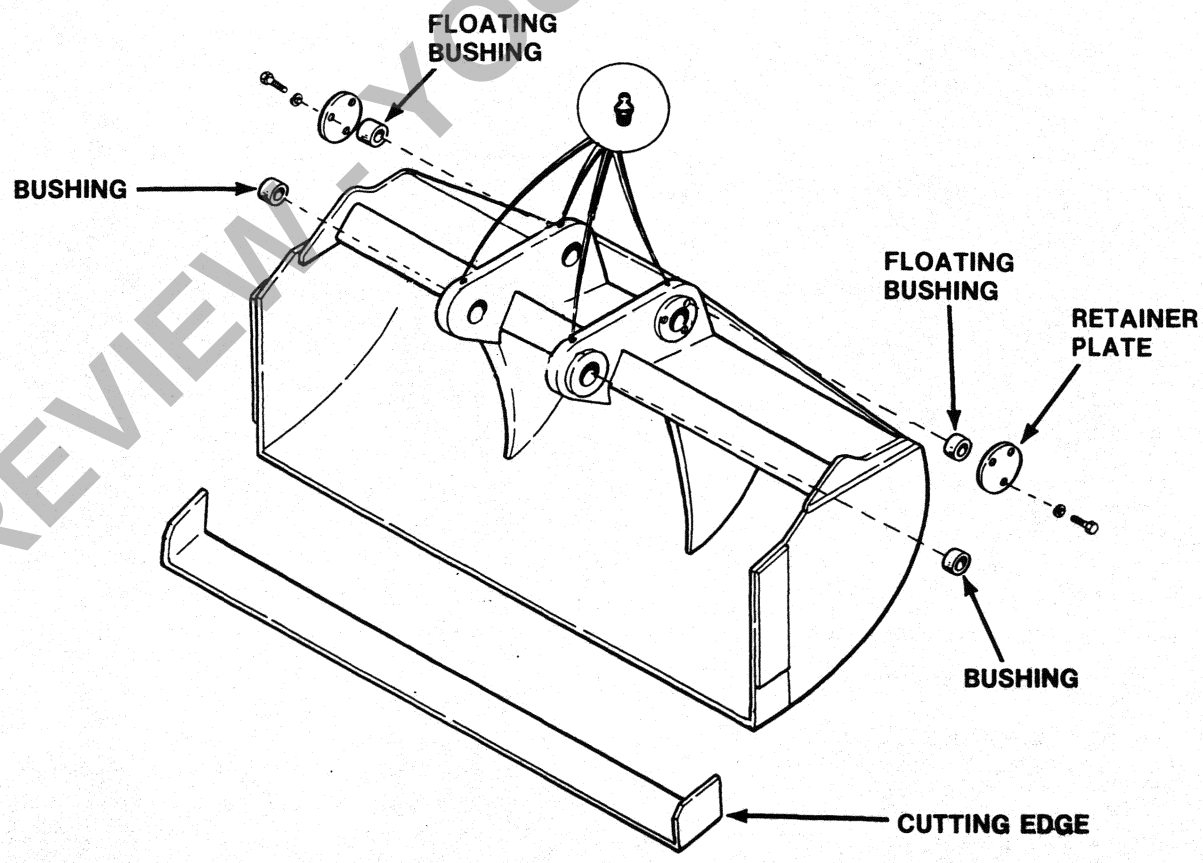


Figure 189. Ditch Bucket

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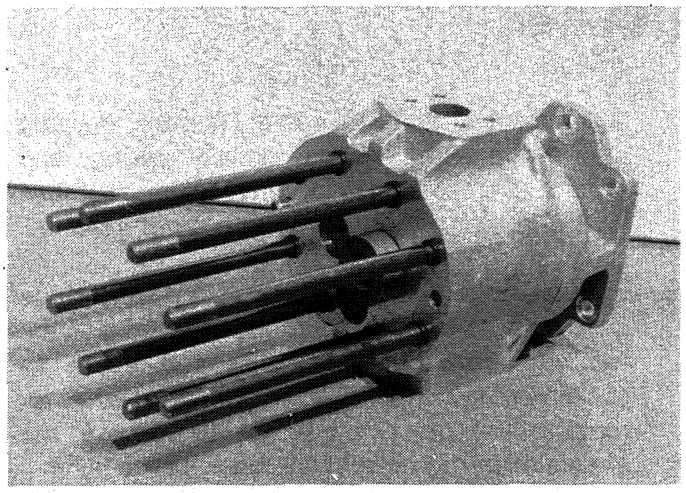


Figure 228. Coupling and Stud O-Rings Installed

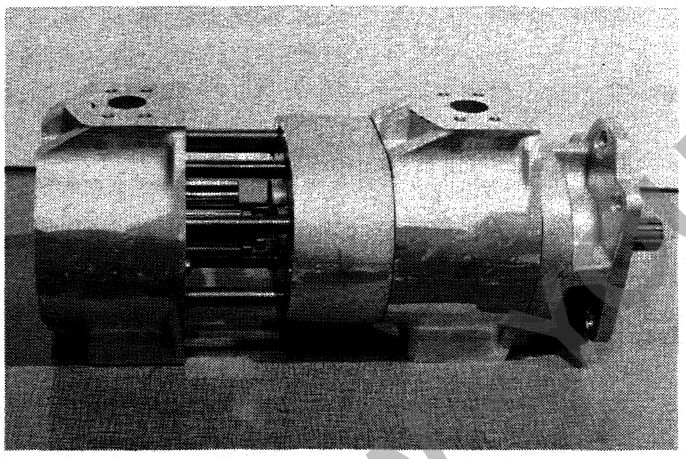


Figure 229. Installing Rear Body

19. Install washers and nuts (45, 46) on studs. Tighten two opposite nuts. Use a 10 inch long wrench and turn the drive shaft. The drive shaft must turn freely with 5-7 lb-ft (7-9 Nm) of torque applied. If the drive shaft does not turn freely, disassemble the pump and check for restriction or wrong assembly.

20. When the drive shaft turns freely, tighten all nuts to a torque of 80-90 lb-ft (110-120 Nm).

INSTALLATION AND RUN-IN PROCEDURE

When a new or rebuilt pump is installed, use the following run-in procedure to prevent damage to the pump.

1. Fill the pump with hydraulic oil before you connect the inlet and outlet lines to the pump.

2. Decrease the pressure setting of the two main relief valves in the pump circuit to zero. Engage the pump.

3. Start the engine. Let the engine run at low idle rpm for five minutes.

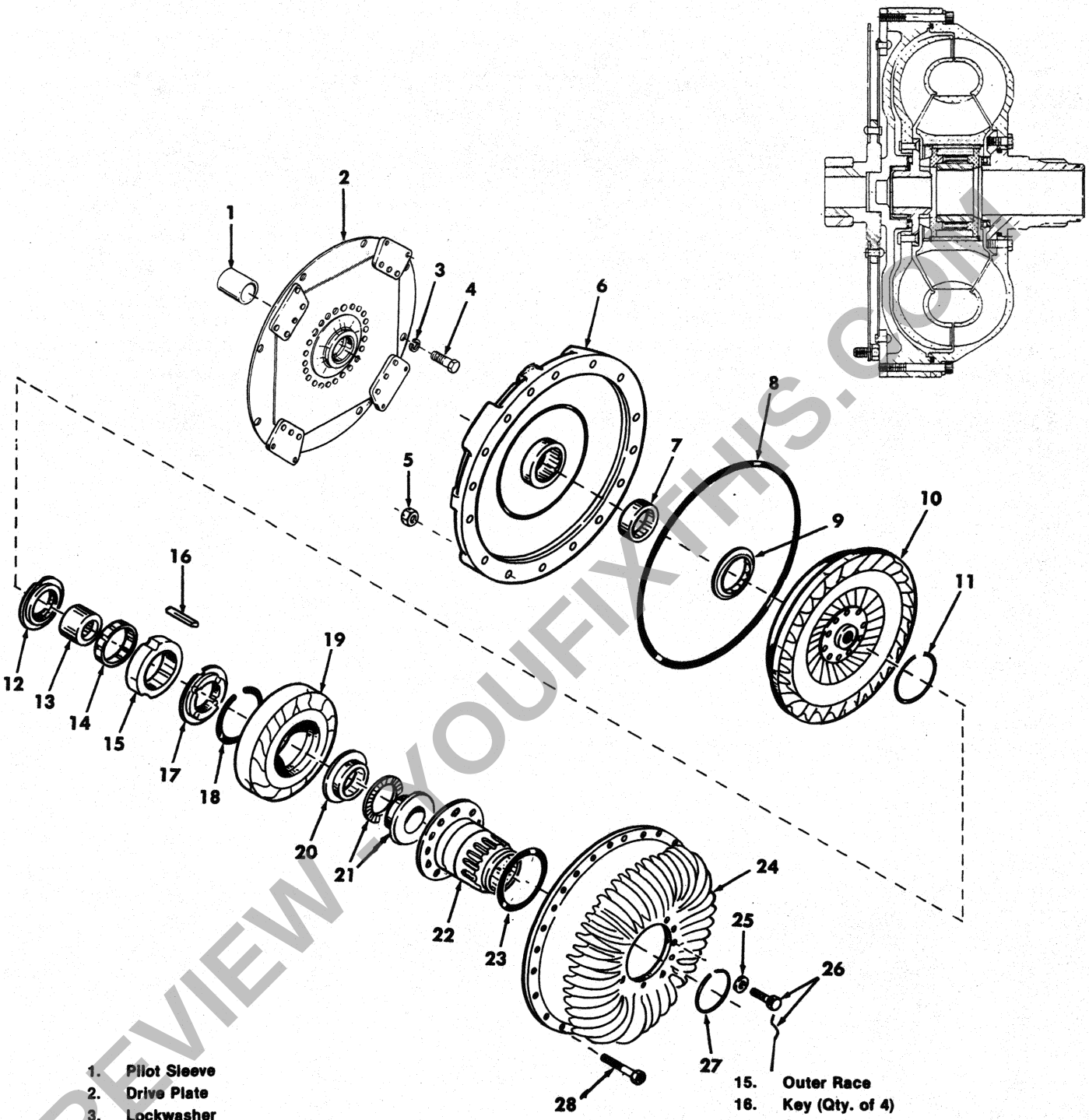
NOTE

During this procedure, it is important to constantly check the pump for a rapid increase in heat. The gear sections must be at approximately the same temperature as the hydraulic lines near the pump. A rapid increase in heat indicates a loss of efficiency in the pump.

4. SLOWLY increase the engine rpm and the pressure setting of the main relief valves, 500 psi (3 450 kPa) at a time, until the correct pressure is reached. See "Procedure to Adjust the Main Relief Valves", page 124.

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1. Pilot Sleeve
2. Drive Plate
3. Lockwasher
4. Bolt (Qty. of 8)
5. Lock Nut (Qty. of 16)
6. Front Cover
7. Bearing
8. O-Ring
9. Thrust Bearing and Thrust Race
10. Turbine
11. Retaining Ring
12. Clutch Retainer (front)
13. Inner Race
14. Sprag
15. Outer Race
16. Key (Qty. of 4)
17. Clutch Retainer (rear)
18. Retaining Ring
19. Stator
20. Thrust Washer
21. Thrust Bearing and Thrust Race
22. Impeller Hub
23. O-Ring
24. Impeller
25. Washer
26. Bolt and Lock Wire
27. Ring Seal
28. Bolt (Qty. of 16)

Figure 276. Converter and Drive Plate

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