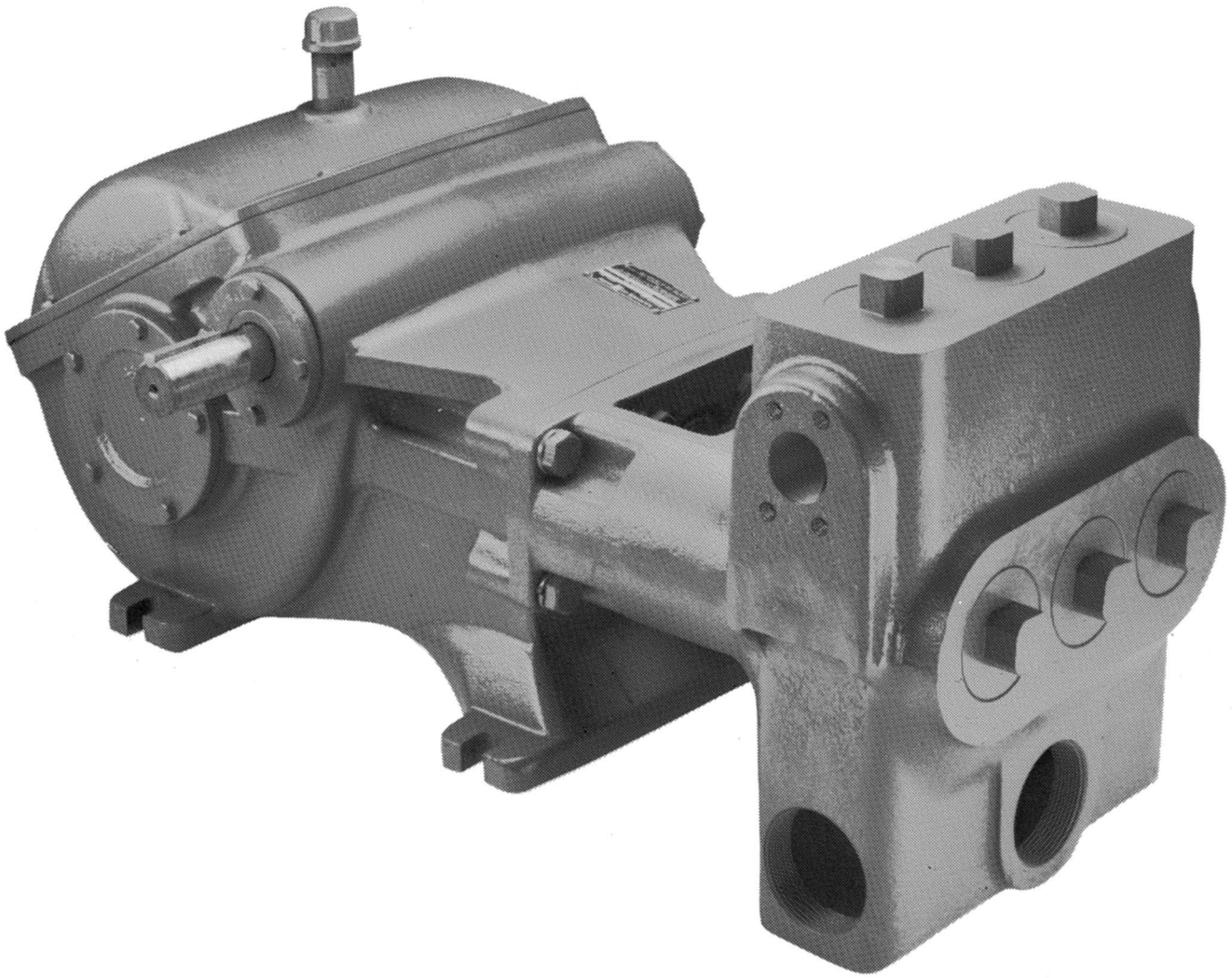
Myers®

Pentair Pump Group

DP Series Industrial Pump Instructions, Service Manual and Parts List



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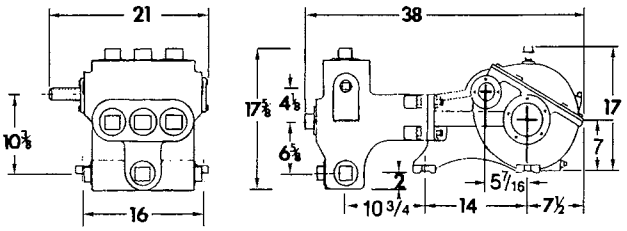
SPECIFICATIONS

Gear Reduction Ratio	Temp. Rating F° (C°)	Size in Inches (Millimeters)					Wgt. Lbs. (Kg)
		Plunger Stroke	Suction Size (NPT)	Dischg. Size	Input Shaft	Keyway	
3.95 to 1	180 (82)	3.750 95.25	3 76.20	1 1/2 38.10	1 5/8 41.3	3/8 x 3/16 9.53 x 4.76	725 (328.8)

Discharge Port Connections: (Both Sides)
SAE 1 1/2 Hydraulic 4 Bolt Flange .3000# for Fluid End A
SAE 1 1/2 Hydraulic 4 Bolt Flange .6000# for Fluid End B
Suggested Drive for 1750 R.P.M. Motor
Drive Sheave 5V Section 4 Groove 12.5" O.D.
Driven Sheave 5V Section 4 Groove 12.5" O.D.
1 5/8 Bore 3/8 x 3/16 K.W. • Belts – Matched Sets of
(4) 5V 1000 (100" Outside Circumference), 30.4" Center Distance

DIMENSIONS (For estimating only)



MATERIAL SPECIFICATIONS

POWER END	
Crankcase	Cast Iron ASTM A-48 CL30
Crankshaft	4140H Heat Treated Forging
Pinion Shaft	AIS18620 Carburize & Induction Harden
Ring Gear	4140H Heat Treated Forging
Link	Ductile Iron ASTM A536
Crosshead	Ductile Iron ASTM A536
Pony Rod	303 SST
Wrist Pin	CDS C1018 Carburize & Hardened
Pinion & Crankshaft Main Bearing	Tapered Roller
Crankshaft Journal Bearing	Steel/Babbit Inserts
Wrist Pin Bearing	Bronze Bushing
Bearing Cap	Cast Iron
Crankcase Cover	Cast Iron
Drain Plug	Magnetic

FLUID END	
Body Fluid End	Ductile Iron ASTM A536
(AB Model)	Aluminum Bronze ASTM B148-9D (CDA955)
Valve Cap	Ductile Iron ASTM A536
(AB Model)	316 SST
Valve	Delrin
Valve Seat	420F SST Hardened
(AB Model)	316 SST
Valve Spring	316 SST
Spring Retainer	302 SST
Nylok Cap Screw	316 SST
Packing Spring	302/304 SST
Seal Cartridge Back & Front Ring	Aluminum Bronze
Plunger	Alumina Ceramic Al2O3
Plunger Packing	Braided Aramid/PTFE/Graphite GFO

SERVICE TOOL

19555B001	Valve Seat Removal Tool Kit

ACCESSORIES

ENG. NO.	Recommended Pulsation Dampner for Pump Models
24976C000	DP120-12, DP90-18, DP80-20
24976C001	DP70-22, DP55,28
24976C002	DP40-38, DP28-55

ENG. NO.	Recommended Pulsation Dampner for Pump Models
24977B000	DP120-12
24977B001	DP90-18, DP80-20, DP70-22, DP55,28
24977B002	DP40-38, DP28-55

PUMP PERFORMANCE*

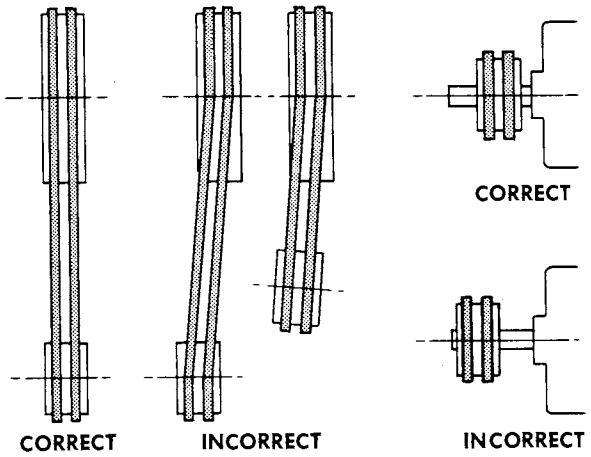
Eng. No.	Cat. No. ***	Max. Rated Capacity GPM (LPM)	Max. Rated Pressure PSI (BAR)	Max. Rated Speed RPM/SPM	Plunger Size Ince (MM)	Max. HP (KW)	Valve** (Set)	Fluid End Material	Fluid End Size
24960F000 24960F010	DP120-12 DP120-12AB	120 (454)	1,200 (82.7)	1800/456	2 5/8 (66.7)	99 (73.9)	A	Ductile Iron/ Aluminum Bronze	A
24960F001 24960F011	DP90-18 DP90-18AB	88 (333)	1,700 (117.2)	1800/456	2 1/4 (57.2)	103 (76.8)	A	Ductile Iron/ Aluminum Bronze	A
24960F002 24960F012	DP80-20 DP80-20AB	79 (299)	1,900 (131.0)	1800/456	2 1/8 (54.0)	103 (76.8)	A	Ductile Iron/ Aluminum Bronze	A
24960F003 24960F013	DP70-22 DP70-22AB	70 (265)	2,150 (148.3)	1800/456	2 (50.8)	103 (76.8)	A	Ductile Iron/ Aluminum Bronze	A
24960F004	DP55-28	53 (201)	2,800 (193.1)	1800/456	1 3/4 (44.5)	103 (76.8)	B	Ductile Iron	B
24960F005	DP40-38	40 (151)	3,800 (262.1)	1800/456	1 1/2 (38.1)	102 (76.1)	B	Ductile Iron	B
24960F006	DP28-55	27 (102)	5,500 (379.1)	1800/456	1 1/4 (31.8)	103 (76.8)	C	Ductile Iron	C

* Pump performance data are based upon 100% volumetric efficiency & 85% overall efficiency.
** Pump performance based on valve listed.
*** Catalog number listed does not define maximum rated capacity and pressure.

INSTRUCTIONS

CAUTION — Positive Displacement Pumps must have a proper size and operable type of pressure regulating valve or pressure relief valve piped into the discharge line. This is mandatory to prevent damage to pump and piping or possible injury to personnel. Do not install any valves or shut-off devices in the by-pass line from pressure regulator to tank or supply.

It is recommended to install a pulsation dampner in discharge line to smooth out pressure pulse. This can protect pump parts and piping for longer life and quiet operation.



PULLEY LOCATION ON PUMP AND MOTOR SHAFT

BELT DRIVE

With belt drives, pulley on both engine and pump should be located as closely as possible to bearing to reduce bearing and shaft bending loads. Make sure that all bolts, nuts, set screws, and keys are properly tightened.

STARTING PUMP

A. Before starting:

1. Read all instructions carefully.
2. Fill pump crankcase with recommended oil to level mark on oil saber. Oil recommendations are covered in lubrication section of pump instructions.
3. Replace all drain plugs in pump and piping.
4. Inspect tank to be sure that no foreign material is in tank or suction line.
5. Fill tank at least half full or connect suction to water supply. Open valve (if present) in suction line. **Avoid prolonged dry operation which may cause excessive wear on plunger packing. Be sure that an operating pressure gauge is located in discharge line. Use heavy duty, liquid filled, pulsation free pressure gauge.**
6. Make sure all valves, including spray gun or nozzles, are open in discharge line. Spray gun may be anchored to discharge back into tank.
7. Completely back off pressure adjusting device on pressure regulating valve.
8. Check pressure rating for pulsation dampner pressure regulator & pipe fitting to make sure working pressure is not over maximum pressure rating.

B. Starting the Unit:

1. After starting, close discharge valve or spray gun slowly while watching pressure gauge to make sure relief valve or unloader is operating properly.
2. Adjust relief valve or unloader to desired pressure. See regulator instructions.
3. Cycle nozzles or gun on and off to be sure that pressure adjustment and regulator operation is satisfactory.

NOTE: Nozzle capacity should not exceed 90% of pump capacity for satisfactory regulator operation. AVOID FREEZING by draining all water from pump and system in cold weather.

SUGGESTED MAINTENANCE SCHEDULE

OPERATION	INTERVAL
Check oil level	Daily
Drain & change oil	300 hr. (1)
Inspect plunger packing and spacer rings	500 hr. (2)
Inspect valves and springs	500 hr. (3)
Inspect connecting link bearing inserts	1000 hr. (4)
Inspect crankshaft tapered roller bearings	2000 hr.
Inspect plunger	2000 hr. (5)

1. Drain at operating temperature to prevent contamination from setting.
2. Inspect frequently for leakage; plunger packing is allowed to drip at 10 to 60 drops/min./plunger in order to cool and lubricate packing. Replace if there is a stream leak.
3. Replace if cracks and heavy wear are present.
4. Replace at first signs of fatigue or wear to prevent damage to crankshaft.
5. Replace if any pitting or rough surface on the seal surface. Ceramic plungers should be cleaned by soaking in muriatic acid to remove any build-up of packing material.

LUBRICATION

Fill gear case with Mobilgear 630 or equal and additive to capacity listed in chart. Maintain oil level at mark on oil dipstick.

Mobilgear 630 equivalent:

A. Amoco: Permagear EP220 or Amogear EP220

B. Chevron: NL Gear Compound 220

C. Exxon: Spartan EP220

D. Kendall: NSMP 80w-90

E. Shell: Omala 220

F. Standard/Sohio/Boron: Gearep 80w-90

G. Texaco: Meropa 220

NOTE: After first 30 hours of operation drain oil from gearcase (preferably drain at operating temperature), replace plug and refill crankcase with new oil as above. Change oil every 300 hours thereafter. Check oil level daily and add oil as needed. Oil cleanliness is very critical to precision machined parts and seals. Clean oil can prolong power end parts' life and it is the most inexpensive maintenance.

ADDITIVES FOR CRANKCASE OIL

Use of Molybdenum Disulfide (MoS_2) is recommended by Myers as an additive to non-synthetic oil in back geared pumps manufactured by Myers. The additive is compatible with all known oils. It is so effective in reducing wear and friction that power train life may be doubled between overhauls.

The chart below gives volume of MoS_2 concentrate required.

PUMP	GEAR CASE CAPACITY OIL	VOLUME MoS_2 CONCENTRATE OR DISPERSION "M" FOR 5%	VOLUME MoS_2 CONCENTRATE OR DISPERSION "M" FOR 10%
DP Series	6½ Qts.	10 Fl. Oz.	20 Fl. Oz.

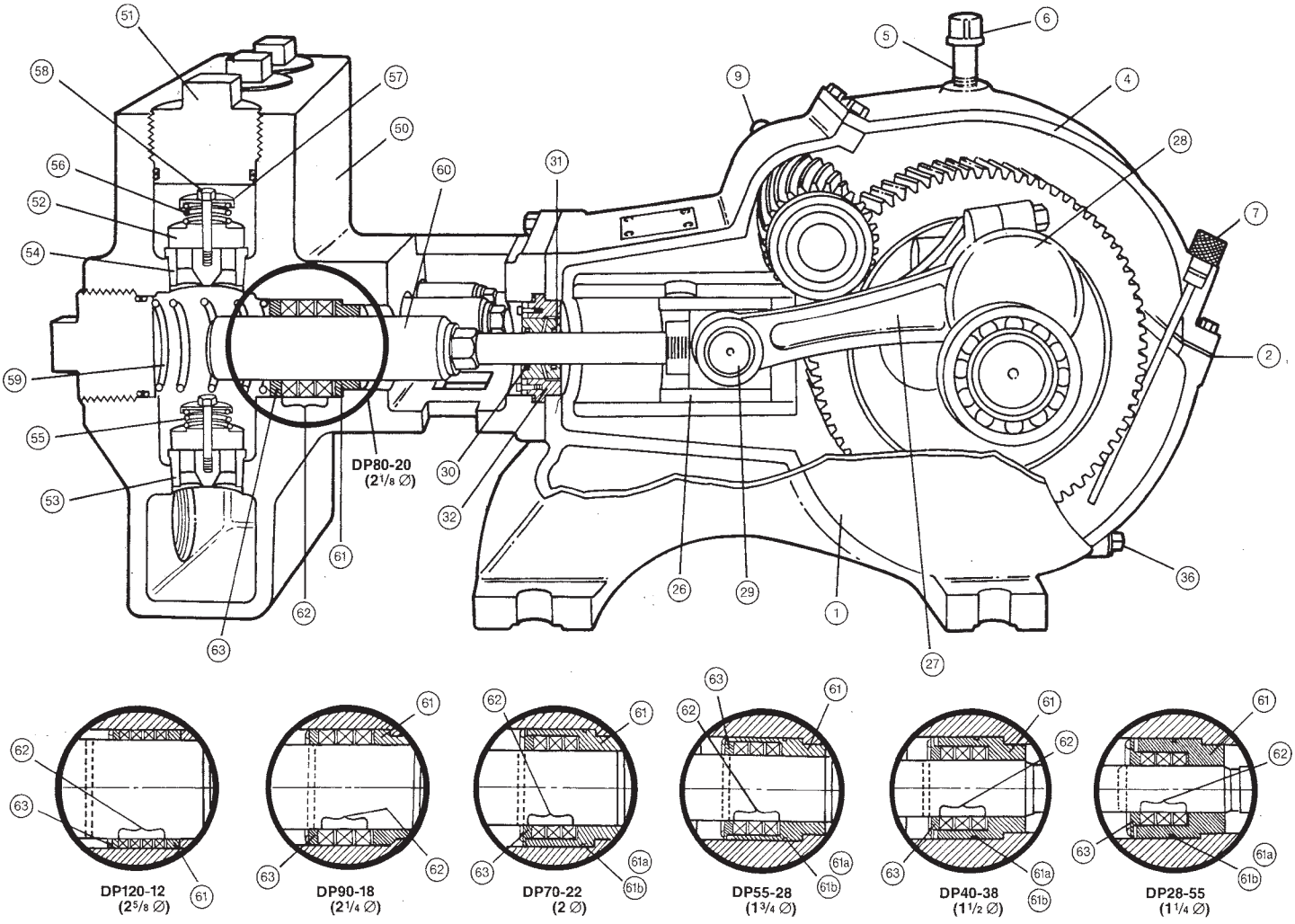


FIG. 1 DP Series Plunger Pump

SERVICE

CAUTION — Disengage clutch, disconnect electrical leads to motor, or remove spark plug leads on engine.

Following work on any internal pump parts, it is important to tighten all clamps, caps and assemblies to specific torque ratings: refer to Recommended Torque chart.

REMOVING PLUNGER AND PACKING

CAUTION — The coated plungers are very hard and ground to super smooth surface. Special care must be taken when removing or installing.

1. Use wrench to unscrew front valve cap (51) and remove it.
2. Remove packing spring (59) by hand.
3. Remove top sheet metal cover (64).
4. Use open wrench to grab hex part of plunger to unscrew completely off the stainless steel cross-head rod. CAUTION: DO NOT grab any other area except the hex to unscrew plunger.
5. Pull plunger off from front cylinder bore.
6. Use $2^{23}/_{32}$ dia. × $3^{3}/_{4}$ lg. bar for fluid end A or use $2^{5}/_{16}$ dia. × $3^{3}/_{4}$ lg. bar for fluid end B to push packing assembly/cartridge out by rotating pump shaft which in turn moves crosshead rod forward.
7. Inspect packing set and spacer ring, check diametrical clearance between plunger and spacer ring. Replace if greater than .035" in diameter.
8. Same procedures applies to the other two cylinders.

INSTALLING PACKING AND PLUNGER

1. Refer to Fig. 1 for plunger packing arrangement for each model. Note that the anti-extrusion spacer ring is to be installed on back side of each braided packing.
2. Before installing plunger packing assembly, inspect the bore, clean out any rust or corrosion in the bore, lubricate with grease for easier installation.
3. For models DP120, DP90 and DP80, slide AL-BR seal back ring (61) into bore until it bottoms out and seats in place.

3a. For models DP70, DP55, DP40 and DP28, place spacers and braided packing rings (refer to Fig. 1) into the seal cartridge (61). Make sure braided packing is installed in staggered position.

4. For DP120, DP90 and DP80, place spacer and packing into bore, make sure that braided packing rings are installed in staggered position. (Refer to Fig 1).

4a. For models DP70, DP55, DP40 and DP28, check O ring (61a) and back-up ring (61b), replace if you see any sign of wear. Slide the seal cartridge (61) into seal bore until it bottoms out.

5. Place spring washer (63) into bore as shown in Fig. 1.
6. Insert coated plunger into seal bore and hand tighten to the crosshead rod. Final tighten the hex (only grab on hex) until the end makes contact. Note that the plunger shoulder must contact the end of crosshead rod, or the plunger load will act on the thread connection and may strip off thread.
7. Place packing spring (59), check O ring and back-up ring in valve cap (51). Replace if you see any sign of wear.

REMOVING SEATS

Center Post Valves (See Fig. 2)

A. First remove the valve caps (51) which provide access to both suction and discharge valves. Remove the stainless steel shoulder screw (58) which serves as a valve guide and spring retainer. The suction shoulder screw can be removed with a box end wrench, and the discharge will require a socket with short extension. Remove shoulder screw (58), spring retainer (57), spring (55, 56) and vlave (52) from the pump fluid end.

B. Use Kit 19555B1, Assemble stud, retainer and three LARGE screws as shown in Fig. 2. Insert screw heads thru holes in valve seat, rotate retainer to right until heads catch, and secure in place by screwing down stud firmly by hand. Place plate over stud, screw on nut, and torque slowly with wrench until seat breaks loose.

C. Suction valve seats are removed as above except two stud lengths are joined using coupling.

NOTE: Valve seats are usually distorted and cannot be reused unless face is reground to flat condition.

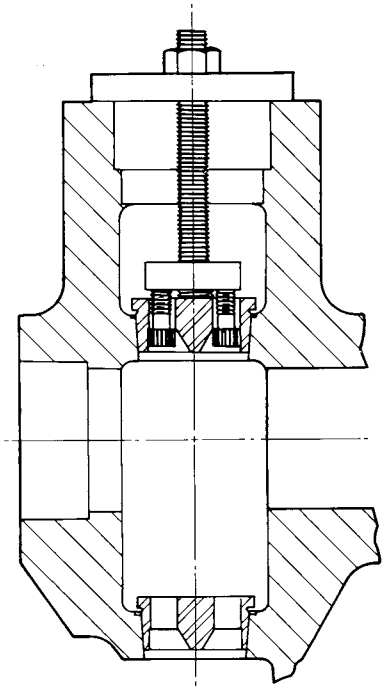


FIG. 2 Valve Seat Removal

Replacement

A. Inspect tapered valve seat bore in fluid end for rust and wipe out excess with a rag. Place a new lower seat in tapered hole. With a hardwood round dowel, drive lower seat firmly into place with a hammer. Repeat for upper seat being sure to also inspect the tapered bore in housing for rust.

B. Reassemble valve, spring, and spring retainer as shown in Fig. 1. Be sure that springs are in correct location. The heavier spring (larger diameter wire) is always installed on upper or discharge valve.

NOTE: Be sure that shoulder screw is bottomed in valve seat. This screw is furnished with a "Nylock" locking pellet to prevent accidental loosening of screw. Also be sure that valve disc is installed on valve with flat face down.

C. Inspect O rings and back-up rings on valve caps (51). Replace if O rings show signs of wear or "nibbling." Lubricate O rings and replace valve cap. Torque valve cap until it stops.

CAUTION–Do not use a hand or arbor press to install valve seats. It is possible to crack cylinder body with excessive pressure

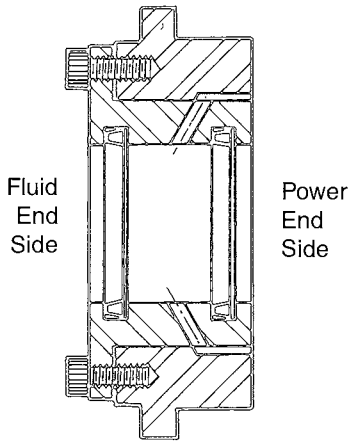


Fig. 4 Oil Seal Housing Assembly

REPLACING CROSSHEAD ROD OIL SEALS (31)

The rod seal assembly contains two seals, two oil seals with lips facing power end. The oil seal can be replaced without taking the fluid end off. By taking the front cylinder head valve caps (51) off and unscrew and push ceramic plunger toward front to allow access for oil seal housing. Unscrew two Allen screws and place into the other two tapped holes. Gradually screw them in to push oil seal housing (30) off the retainer (32). After assembling new seals (31) in oil seal housing (30), an assembly thimble should be used on end of crosshead rod for sliding oil seal housing (30) back into retainer (32). Check gasket (34), replace if damaged. Fig. 5 shows a recommended thimble for installation. The thimble should be machined from high carbon steel and polished on the exterior to reduce possibility of seal lip damage. Place two Allen screws into clearance holes and tighten snug.

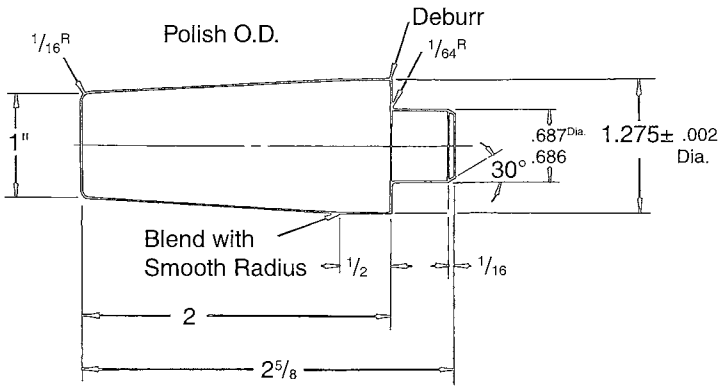


Fig. 5 Oil Seal Installation Thimble

REMOVING CRANKSHAFT AND PINION SHAFT

Remove front valve cap and plungers. Remove connecting link caps and move the link-crosshead assembly as far forward as possible.

IMPORTANT–Note the markings on the connecting links and caps; these parts are not interchangeable and must be reassembled in their original positions.

Wedge a 3/4 in. board between crankshaft gear and gear case so that crankshaft will be held in place against pinion shaft. Remove both crankshaft bearing caps. (See Fig. 6). Hold crankshaft at ring gear and left-hand link journal (to prevent dropping into bearing bores), remove from gear case by moving crankshaft to right until left end can be swung free.

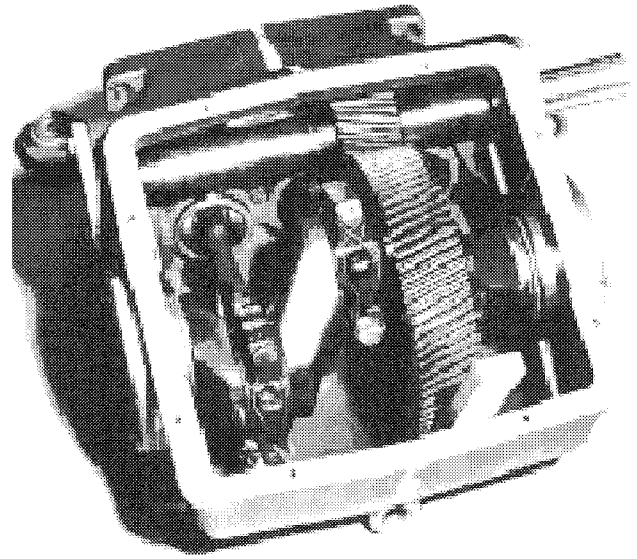


Fig. 6

Next, using a lead or rawhide hammer, tap the end of pinion shaft extension to remove bearing cup at opposite end. After removing pinion shaft, the remaining bearing cup can be removed by gently tapping against the peripheral edge of the cup with a brass rod.

REPLACING PINION SHAFT AND SHIMMING BEARINGS

After installing the link-crosshead assemblies and moving them toward the fluid end as far as possible, tap right-hand pinion shaft bearing cup into position using the bearing cap. Make sure that the spacer is properly seated on drive end of pinion shaft (the curve side should match the fillet radius of pinion shaft). Place pinion shaft in position and tap left-hand bearing cup into place.

A. Cover shaft keyway with vinyl tape to protect lip of oil seal, slide on the open bearing cap to which has been added approximately .030 shim, tighten the four cap screws to recommended torque.

B. Put on other cap using total shim thickness known to be more than needed so that resulting end play is greater than required. Tighten cap screws holding pinion or crankshaft caps to gear case. Rotate pinion shaft back and forth and apply about 15 lbs. axial force to properly seat tapered rollers. Measure end play by using an indicating gage in a manner shown in Fig. 7.

C. Subtract recommended end play (.005-.009) from actual end play as found above. This is the amount of shim that must be removed. After excess shim thickness has been removed, replace caps and retighten cap screws. Again measure end play. If end play is not within limits recommended, add or subtract shims as required.

REPLACING PINION SHAFT AND SHIMMING BEARINGS ON HYDRAULIC DRIVEN PUMPS

After installing the link-crosshead assemblies and moving them toward the fluid end as far as possible, refer to assembly drawing insert of hydraulic driven pumps.

1. Press bearing cones onto both ends of the pinion shaft, being sure bearing "seats" completely against stop on shaft.
2. Place pinion and bearing cone assembly into the crankcase positioning the pinion gear over the crankshaft gear.
3. Carefully "hand" press bearing cups into both sides of the crankcase. Tap cups until bearing cups and cones are completely together, and pinion is in the proper location in the crankcase.
4. Press shaft seal into cap, bearing and seal plate. Seal is to be recessed 1/8" as indicated in drawing. Be sure the "lip" in both caps is installed with the lip towards the center of the pump as shown.
5. Install right bearing cap with two .003 thick shims and tighten the eight socket head cap screws to the recommended torque.
6. Install left bearing cap with one, .015 thick and one .003 thick shim and tighten the eight socket head cap screws to the recommended torque. Rotate pinion shaft back and forth and apply about 15 lbs. axial force to properly seat the tapered rollers. Measure end play by using an indicating gage in a manner as shown in Fig. 7.
7. Subtract recommended end play (.005-.009) from actual end play as found in step 6 above. This is the amount of shim that must be removed. After excess shim thickness has been removed, replace left cap and retighten cap screws. Again measure end play. If end play is not within limits recommended, add or subtract shims as required.

Good performance of tapered roller bearings on a shaft require that correct shaft end play first be made by shimming. This insures that uneven heating, as encountered during warm-up, will not overload the bearings, and that after all parts are heated to approximately the same temperature the resulting end play will be correct. Shouldered roller bearings also require correct shimming to insure that the shoulder will properly locate the shaft and yet not bind.

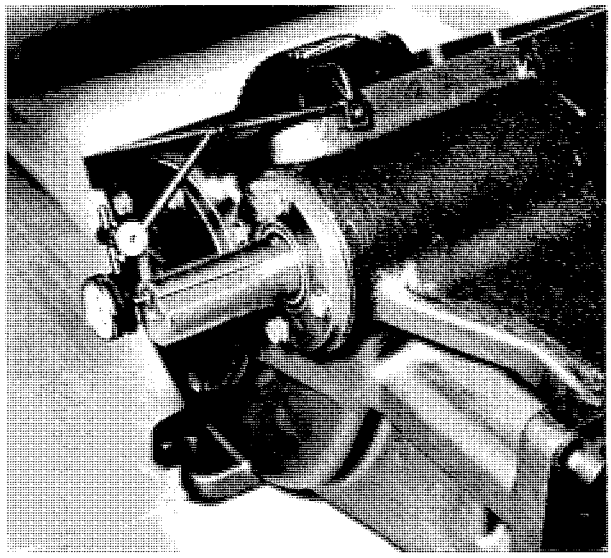


Fig. 7

REPLACING CRANKSHAFT AND SHIMMING BEARINGS

Press the bearing cups into the caps. Place one cap into position on the right side with cap screws engaged about one turn; install crankshaft (left end first, then push both bearing caps into place. Extreme care should be exercised to avoid damage to gear teeth, bearings, and link journals.

For quiet operation and long life, the crankshaft and bearings must be installed with .003 to .005 in. preload; the following procedure will provide an accurate adjustment. Before starting, loosen the four cap screws on the pinion shaft bearing cap.

A. Place about .045 shim on the right crankshaft bearing cap, tighten the five cap screws.

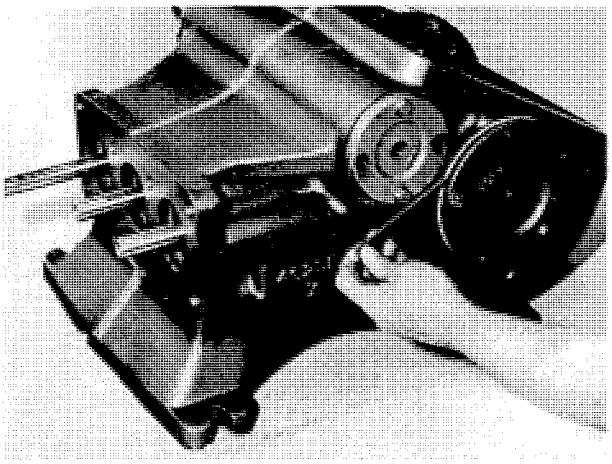


Fig. 8

B. Install the left cap without shims, secure with two cap screws positioned exactly as shown in Fig. 8. Torque the two cap screws at 13 foot-pounds, rotate the crankshaft, retorque the cap screws. Do this three times to properly seat the tapered roller bearings.

C. Measure (adjacent to the cap screws) the shim gap remaining between the bearing cap and the gear case.

D. The required shim thickness for this cap is equal to the average gap measurement plus .022".

E. Insert correct shim thickness under left bearing cap and tighten cap screws.

F. Install connecting links and caps; note the markings; torque cap screws to 40 ft. lb.

G. IMPORTANT—Check for adequate side clearance of links on crankshaft. Some shims must be moved from one end of the crankshaft to the other until sideways movement of all links can be seen.

H. Check torque of cap screws on all bearing caps.

RECONDITIONED CRANKSHAFTS

When the crank throws are only slightly damaged, such as small surface grooves cut part way around the bearing surface, they can sometimes be reconditioned for further use. This can be done by sandpapering and polishing until all ridges are completely removed. The final polishing operation should be with very fine emery cloth. If the surface is badly damaged, the crankshaft can often be salvaged by "metalizing" the crank throw and then regrinding and polishing to the original diameter of 3.1240-3.1245". Contact Engineering Department for detail.

SERVICING CONNECTION LINKS

The connecting rod link is furnished with replaceable split sleeve bearing inserts at the crank throw. It is never practical to attempt to re-fit connecting links to the crankshaft bearings by filing or grinding the mating faces of the link cap where it contacts the link. **Always be sure that the proper side of the link is placed upward when attaching it to the crankshaft.** The upper side contains an oil hole at the crosshead end of the link. This oil hole must be up to allow proper oil feeding to the crosshead pin bushing. The wrist pin is press-fitted into crosshead and slip-fitted through the bronze bushing. Use arbor press instead of hammering the wrist pin to force it in. Check to see if link is free to rotate after the wrist pin is pressed in. Make sure that either side of wrist pin does NOT protrude beyond the crosshead.

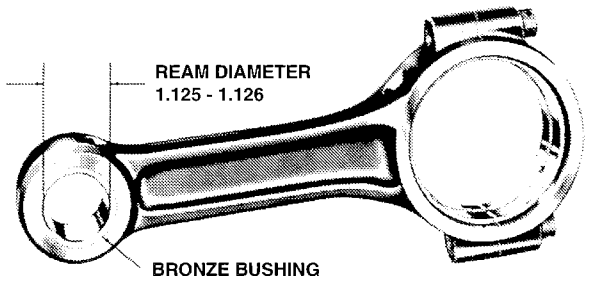


Fig. 9

The crosshead end of the connecting link is fitted with a bronze bushing. When new replacement links are obtained, these bushings are reamed to the proper size for immediate installation. If the bushing only is replaced, it may be necessary to ream the new bushing to the proper inside diameter after it is pressed into the link. When placing the bushing on the link be sure that the oil holes in the bushing and link will be in line after the bushing is pressed into position. Fig. 9 shows the proper diameter to which the bushing must be reamed for proper seating of the crosshead pin. Note that the ream diameter must be parallel to the I.D. of the sleeve bearings within 0.001" T.I.R.

CROSSHEAD AND PISTON RODS

Repair parts for the crosshead and piston rod are supplied only as a complete unit. If either of these parts becomes worn it is necessary to replace both the crosshead and piston rod. Under normal conditions a crosshead will not wear nor will the bore of the crankcase wear to the extent that oversize crossheads will be required. If extreme wear does occur, it will be due to severe damage from the lack of oil or a fairly large metal object scoring the crosshead bore. A clearance of .002" to .004" is standard for the crosshead. The parts can wear until considerably more clearance than this exists before harmful operation will occur.

RECOMMENDED TORQUE (Foot-pounds)

FASTENER LOCATION	
Link Bearing Caps	40
Crankshaft End Caps	20
Pinion Bearing End Caps	20
Cap Screw, 3/4 (Fluid End to Power End)	250
Cap Screw, 5/8 (Fluid End to Power End)	150

SERVICE CHART

—WARNING—

THIS PUMP MUST BE INSTALLED WITH A PRESSURE RELIEF VALVE IN DISCHARGE LINE.

SERVICE PROBLEM

A Failure of pump to build pressure with discharge closed
B Failure to hold pressure with discharge open
C Pump is noisy
D Pump gets hot
E Pressure gauge shows abnormal fluctuation

POSSIBLE CAUSE OF PROBLEM	E	D	C	B	A
1. Pump not primed					X
2. Valve closed in suction line			X		X
3. Suction line or sediment chamber clogged			X	X	X
4. Air leak in suction line			X	X	X
5. Pressure regulator valve badly worn or not properly adjusted				X	X
6. Broken valves or springs	X		X	X	
7. Pump packing or valves badly worn	X		X	X	
8. Pressure regulator bypassed by open #1 valve				X	X
9. Pump cylinder body cracked			X	X	X
10. Water in crankcase		X			
11. Worn connecting link inserts or wrist pin bushings		X	X		
12. Lack of oil in crankcase		X	X		
13. Foaming mixture in tank	X		X	X	
14. Regulator plunger sticking	X				
15. Foreign matter under pump valve	X		X	X	
16. Loose plunger rod			X		
17. Improper preload of crankshaft bearings		X	X		

EXPLANATION OF THE SERVICE CHART

1. Pump priming is usually not necessary when the pump is installed correctly. However, there are certain unusual conditions which may make it necessary to prime the pump to get the pumping action started. Priming will be required under conditions where it is impossible for the plunger to displace the air in the pump and replace it with water. This could be caused by a high suction lift (high from the water supply to the pump), the valves being stuck on the seat, such as after pumping a sticky fluid, or it might be caused by valves sticking due to extreme corrosion of the valves and seats. A pump will not prime readily if someone has tampered with the valve springs causing them to exert undue pressure of the valve plates against the valve seats. When the pump appears to need priming this condition can be checked by pouring water into the cylinder body through one of the valve cap openings or into the pump discharge opening at the same time operating the pump to work the water in to the cylinder and valve passages.
2. Frequently a gate valve is installed in the suction line between a tank or pressure line and pump sediment chamber. This valve is usually installed in the line to shut off the supply source for cleaning sediment chamber or for pump repairs.

   If this valve is closed or even partially closed it will interfere with the flow of water to the pump suction to such an extent that the pump will not perform to full capacity. If the valve is partially closed it may cause severe knocking and vibration of the pump because the water cannot flow into the cylinder cavities fast enough.
3. A sediment chamber should be installed in the suction line between the gate valve and the pump suction. The strainers in these sediment chambers are of more than adequate capacity to allow a free flow of the liquid to the pump. However, because of its normal function of collecting sediment the strainer may become severely clogged and in some cases, it will completely stop the flow of liquid to the pump. The length of time the pump may operate before it is necessary to clean the strainer will depend upon the type of liquid pumped. After the pump has been used a short period the operator will soon become familiar with the amount of running time between strainer cleanings.

4. Any plunger pump, when operated at high pressure will not operate satisfactorily or quietly if a mixture of air and water is allowed to enter the pump suction. For this reason, a small air leak in the suction line will cause the pump to knock and vibrate excessively. This holds true only for a small air leak which allows the pump to draw a certain amount of water mixed with air on each stroke of the piston. A large air leak will cause the pump to lose prime after which it cannot be reprimed until the air leak is stopped. Air leaks may occur at the joints of the suction line piping, at the gate valve in the suction line, at the gasket sealing the cap on the sediment chamber or by a crack in the suction wall of the cylinder body, such as might be caused by freezing if the pump is not properly drained in freezing weather. There is also a definite possibility of air drawing past the packing on the suction stroke if the packing is badly worn.
5. If the pressure regulator internal bypass valve is badly worn it will allow too much of the pump capacity to be by-passed and recirculated back to the tank. By examining the flow from this valve with the discharge turned on, it can be determined whether or not the valve is worn. If a heavy flow continues when the discharge is turned on, it is usually a good indication that the valve is badly worn and should be replaced or that something is lodged under the valve holding it open.
6. A broken pump valve or spring will often prevent one cylinder from functioning properly. Very rough pulsing discharge, a knocking sound, and a loss of capacity will result. If not repaired promptly, the rough running pump can cause mechanical damage to itself or other system components.
7. Badly worn packing or valves and valve seats will cause a serious drop in pump capacity. This will be indicated by a drop in pressure when guns are turned on. Worn packing is very easy to detect because of the water leakage. The packing should be replaced just as soon as this stream leakage is noticed. If it is allowed to continue some of the water may work past the rod seals into the pump crankcase. Water in the pump crankcase will cause severe corrosion of the bearings causing rapid wear. Worn valves can only be detected by visual examination of each valve assembly. The most prevalent cause of valve wear is the use of highly abrasive liquids which will cause the valve and valve seat to wire cut. The cut starts as a very small groove but increases rapidly once the valve starts to leak through this groove. If the valves are replaced as soon as they start to show this cutting action it will prevent the valve seat from becoming cut in a similar manner and keep the cost of replacement parts to a minimum.
8. If a portion of the pump delivery is allowed to bypass because the #1 control valve is not completely closed there may not be adequate flow to develop full pressure. This also will cause rapid wear in the control valve; any excess flow should be bypassed only by the pressure regulator.
9. Pump cylinder bodies must withstand an extreme amount of shock and pulsation while the pump is in operation. If the pump is allowed to freeze, due to not being drained, the freezing may crack the cylinder body walls in almost any location. If the crack should occur on the suction valve or cylinder portion of the body it may allow a small amount of air to enter on the suction stroke and cause noisy operation or a decrease in pumping capacity. If the crack develops in the walls between the cylinder cavities or discharge valve cavity it may allow the water to flow from one cavity to the adjacent cavity and rob the pump of its effective displacement. This will not cause noisy operation but will reduce the pump capacity and may show up as a drop in pressure when the discharge is open.
10. Water may accumulate in the pump crankcase from two sources; the most prevalent being leakage of the packing as explained in paragraph 7. The other means of accumulation being a condensation of moisture inside the crankcase due to changes in weather or the repeated heating and cooling of the pump due to its normal usage. Pumps that are used rather consistently and run for a considerable period of time to heat the oil and other working parts will not normally accumulate water by condensation.
11. Worn connecting link bearings will only develop because of unusual or adverse operating conditions. They will, however, be seriously affected by corrosion if water is present in the crankcase and they will wear out from overheating if the oil is not clean and of good quality. For this reason we recommend thorough draining, cleaning and refilling with new oil at the specified interval and prior to any storage period. Replace link inserts as soon as any wear is noticed to avoid damage to crankshaft journals. See also paragraph 17 and Lubrication instructions.
12. Lack of sufficient oil in crankcase can quickly cause failure of pump power end and result in extensive repairs. Oil level should be checked periodically during normal operation as well as when maintenance work of any nature is performed. Insufficient oil will first be indicated by excessive heat and should be corrected immediately.
13. A foaming mixture will sometimes have the same effect as a small air leak in the suction line. This is because various quantities of the foam is drawn through the suction line into the pump disrupting the normal flow of water.

14. Pressure regulators may become sluggish in action due to the plunger sticking or fitting too tightly in its cylinder. This condition may be caused by an accumulation of chemicals collecting in and around the plunger, or may be due to excessive corrosion of the plunger parts. To check this condition, remove and clean the plunger. After cleaning the plunger, parts should be covered with a waterproof grease before assembling. In some cases there is a tendency for the pressure regulator to chatter or vibrate excessively. This is an indication of unstable operation due to nozzling in the high or low capacity range of the regulator; the nozzling requirements should be at least 50% and not exceed 90% of pump capacity.

    Due to nozzle wear, the system requirements may exceed the 90% limit, resulting in cycling or hammering of the regulator. This can readily by checked by replacing the worn nozzle.

15. If a large piece of foreign matter becomes lodged between a pump valve and valve seat or if something of this kind becomes wedged in so that it prevents the valve from operating normally we can expect drastic drop in capacity and considerable surge or pulsation will be noticed in the discharge line. To correct a condition of this kind it is usually necessary to examine each valve in the pump until the offending condition is located. The use of clean liquid and seeing that the suction strainer is in proper condition will prevent trouble of this kind.

16. Noisy pump operation will sometimes be caused by a plunger rod being loose in the crosshead.

    This will only become evident after the rod becomes so extremely loose that some end motion can be found between the rod and crosshead. A noise of this kind usually has a regular cadence timed with each stroke. When this condition occurs it is always necessary to replace both the rod and the crosshead.

17. More than the recommended amount of preload to the crankshaft bearings will reduce bearing life, require more power, and generate more heat. Less than the recommended preload may cause a knock timed with the crankshaft rotation. Check for loose bolts on the crankshaft end caps or adjust shims to obtain proper bearing preload.

    Worn roller bearings will continue to run for a long time but will introduce wear particles into the oil (which can cause other damage), may cause overheating, and may or may not cause a noticeable noise. Check oil regularly, check for wear particles when changing oil.

UNUSUAL CONDITIONS WHICH MAY CAUSE TROUBLE

Pinion shaft breakage on the drive side of the pump may be caused by having the pulley or sprocket positioned too far away from the pump bearing. It may also be caused by a loose drive chain if the pump is chain driven.

If the V-belts have a tendency to wear rapidly, it may be due to having the belt tightener pulley adjusted too far into the belt, throwing a reverse bend in the belt where it passes over the pulley. If very much reverse angle seems necessary to keep the belt tight, other provisions should be made for tightening, such as placing shims under the pump base or otherwise spreading the drive centers enough to take up the belt length. On multiple V-belt drives, a complete set of belts should be installed when making a replacement. Further, all the belts in one set should be checked for length and accurately matched to avoid placing an undue load on any one belt.

INSTRUCTIONS FOR DRAINING PUMP IN FREEZING WEATHER

1. Open suction line to atmosphere at lowest point in suction piping. If the pump is at lowest point remove suction pipe plug.
2. Open discharge line to atmosphere at the lowest point in discharge piping. If there are several low points in the discharge line as in a hose reel they will have to be drained individually.
3. Drain by-pass line by disconnecting or if there is a drain point remove plug.
4. If pump has the 13015A000 series valve lifters, turn hand wheel to unseat valves. Leave valve lifters this way to insure valves do not frost to valve seats. If valve lifters are used you can disregard line 5.
5. With the piping lines open to atmosphere start and run pump 15-20 seconds. **Make sure pump is NOT run longer than stated as this can ruin the packing if run dry for a longer period.**
6. Priming pump might be difficult after draining pump in freezing weather due to valves frosting to valve seats. The valves can be freed by using warm water, heat tape on fluid end, a warm environment, removing caps and unseating valves, or 13015A000 series valve lifters.

PARTS LIST

POWER END PARTS (ALL 7 MODELS) E.N. 24960F101 L.H.** & 24960F100 R.H.**

Ref. No.	Description	Qty. Req'd.	Part No.
1	Case, gear	1	04625E010E
2	Gasket, lid	1	06201C000
3	Screw, cap, 5/16"-18 UNC x 1/4", steel	8	19100A005
4	Lid	1	04561B000
5	Nipple, special vent	1	17995A000
6	Cap, pipe	1	05737A002
7	Gauge, oil, with "O" ring	1	7206-0094-00K
8	"O" ring, 5/16" I.D., 7/16" O.D., 1/16" thick	1	05876A063
9	Shaft, pinion	1	20164B000
	Spacer	1	20164B002A
10	Shim, plastic, green, .003"	4	05231A074
11	Shim, plastic, pink, .015"	4	05231A075
12	Cone, bearing	2	05674A013
13	Cup, bearing	2	05675A009
14	Cap, open	1	04563A001
15	Cap, closed	1	04741B001
16	Oil seal	1	05710A017
17	Screw, cap 3/8"-16 UNC x 1", steel	18	19101A013
18	Washer, seal	18	14946A003
19	Crankshaft	1	20355C010
20	Cone, bearing	2	05674A018
21	Cup, bearing	2	05675A013
22	Cap, bearing	2	04624B004
23	Shim, plastic, green, 6 7/32" x 5 1/32" x .003	6	05068A018
24	Shim, plastic, pink, 6 7/32" x 5 1/32" x .015	6	05068A016
25	"O" ring, 5" I.D., 5 1/8" O.D., 1/16" thick	2	05876A098
* 26	Crosshead	3	24956B000
27	Link, ductile iron	3	17042C002
	Bushing	3	B01619A001
	Screw, cap	6	19103A016
28	Bearing, two halves	3	15245A002
29	Wrist pin	3	M1525A001
* 30	Housing, oil seal	3	24959A000
* 31	Oil seal	6	22835A003
* 32	Retainer, oil seal housing	3	24958A000
* 33	Screw, Allen	6	06106A034
* 34	Gasket, seal housing	3	05059A434
35	Gasket, retainer	3	05059A058
36	Plug, pipe, magnetic	1	17481A002
37	Screw, socket hd., 3/4"-10 UNC x 3", GR 5	4	19106A006
38	Lockwasher	4	05454A003
39	Screw, cap, 5/8"-11 UNC x 2", steel, GR 5	4	19105A008
40	Spring	3	M1643A000

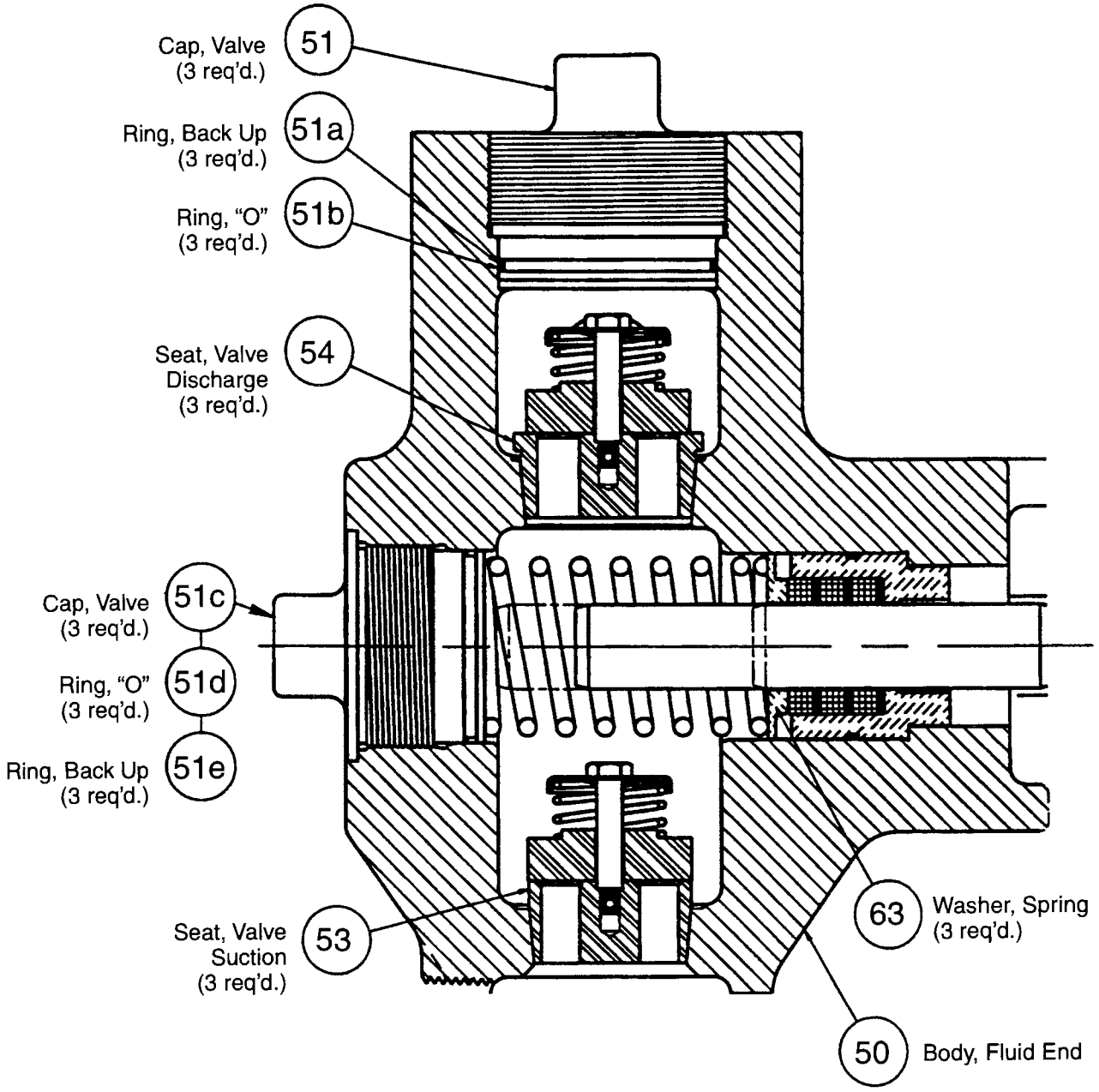
* New part for DP Power End

** L.H. = Left Hand Drive and R.H. = Right Hand Drive
Picture on first page of this instructions illustrates right hand drive pump.

FLUID END PARTS – DP SERIES

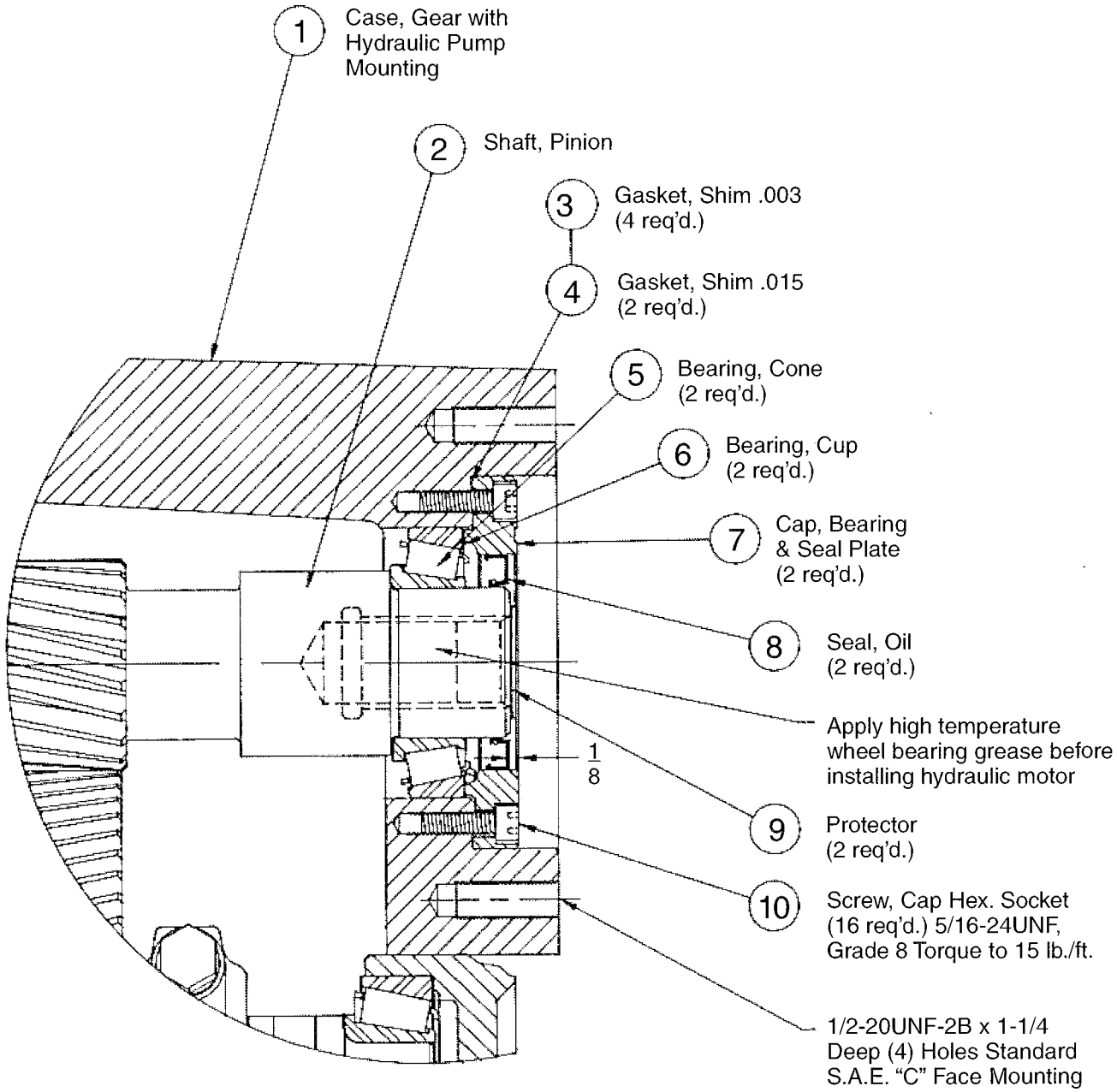
Ref. No.	Description	Qty. Req'd.	Part No.	Model
50	Body, Fluid End A (L.P.)	1	24961F000	DP120-12, DP90-18, DP80-20, DP70-22
	Body, Fluid End B (H.P.)	1	24961F001	DP55-28, DP40-38
	Body, Fluid End C (V.H.P.)	1	24961F003	DP28-55 (After August 1996)
	Body, Fluid End AL-BR (L.P.)	1	24961F002	All AB Models
51	Cap, Valve	6	24797A000	All Models Except AB (DP28-55 Qty. 3)
	Cap, Valve, SST	6	24797A001	All AB Models
51A	"O" Ring	6	05876A168	All Models (DP28-55 Qty. 3)
51B	Ring, Back-up	6	18753A007	All Models (DP28-55 Qty. 3)
52	Valve, Delrin	6	18834A003	All Models
53	Seat, Suction Valve F.E.A	3	24796A000	DP120-12, DP90-18, DP80-20, DP70-22
	(AB) F.E.A	3	24796A004	All AB Models
	F.E.B	3	24796A002	DP55-28, DP40-38
	F.E.C	3	24796A012	DP28-55 (After August 1996)
54	Seat, Discharge Valve F.E.A	3	24796A001	DP120-12, DP90-18, DP80-20, DP70-22
	(AB) F.E.A	3	24796A005	All AB Models
	F.E.B	3	24796A003	DP55-28, DP40-38
	F.E.C	3	24796A013	DP28-55 (After August 1996)
55	Spring, Suction Valve	3	11829A000	All Models
56	Spring, Discharge Valve	3	11829A001	All Models
57	Retainer, Spring	6	18833A001	All Models
58	Screw, Cap, Thrd. Lock	6	18832A002	All Models
59	Spring, Packing	3	24799A000	DP120-12, DP120-12AB
	Spring, Packing	3	24799A001	DP90-18 & AB, DP80-20 & AB, DP70-22 & AB
	Spring, Packing	3	24799A002	DP55-28, DP40-38, DP28-55
60	Plunger, Coated (2 5/8" D.)	3	24798B020	DP120-12, DP120-12AB
	(2 1/4" D.)	3	24798B021	DP90-18, DP90-18AB
	(2 1/8" D.)	3	24798B022	DP80-20, DP80-20AB
	(2" D.)	3	24798B023	DP70-22, DP70-22AB
	(1 3/4" D.)	3	24798B024	DP55-28
	(1 1/2" D.)	3	24798B025	DP40-38
	(1 1/4" D.)	3	24798B026	DP28-55
61	Ring, Seal Back (2 5/8")	3	24954A000	DP120-12, DP120-12AB
	(2 1/4")	3	24954A001	DP90-18, DP90-18AB
	(2 1/8")	3	24954A002	DP80-20, DP80-20AB
	Cartridge, Seal (2")	3	24953B000	DP70-22, DP70-22AB
	(1 3/4")	3	24953B001	DP55-28
	(1 1/2")	3	24953B002	DP40-38
	(1 1/4")	3	24953B003	DP28-55
61A	"O" Ring, Seal Cartridge (2)	3	05876A167	DP70-22, DP70-22AB
	(1 3/4, 1 1/2, 1 1/4)	3	05876A166	DP55-28, DP40-38, DP28-55
61B	Ring, Back-up, Seal Cartridge (2)	3	18753A006	DP70-22, DP70-22AB
	(1 3/4, 1 1/2, 1 1/4)	3	18753A005	DP55-28, DP40-38, DP28-55
62	Packing, Plunger 2 5/8 (4/set)	3	24962A001	DP120-12, DP120-12AB
	2 1/4 (3 /set)	3	24962A002	DP90-18, DP90-18AB
	2 1/8 (3 /set)	3	24962A003	DP80-20, DP80-20AB
	2 (3/set)	3	24962A004	DP70-22, DP70-22AB
	1 3/4 (3/set)	3	24962A005	DP55-28
	1 1/2 (3/set)	3	24962A006	DP40-38
	1 1/4 (3/set)	3	24962A007	DP28-55
63	Washer, Spring 2 5/8	3	24955A000	DP120-12, DP120-12AB
	2 1/4	3	24955A001	DP90-18, DP90-18AB
	2 1/8	3	24955A002	DP80-20, DP80-20AB
	2	3	24955A003	DP70-22, DP70-22AB
	1 3/4	3	24955A004	DP55-28
	1 1/2	3	24955A005	DP40-38
	1 1/4	3	24955A009	DP28-55 (After August 1996)
64	Lid, Cylinder	1	M1520A000	All Models
65	Slinger	3	05059A263	All Models
66	Plug, Pipe, 3"	2	03210A000	All Models Except AB
	3" AL-BR	2	03210A010	All AB Models
68	Plug, Pipe, 1"	3	05022A043	All Models Except AB
	1" AL-BR	3	05022A064	All AB Models

DP28-55
(Aft 13 Aug 1996)



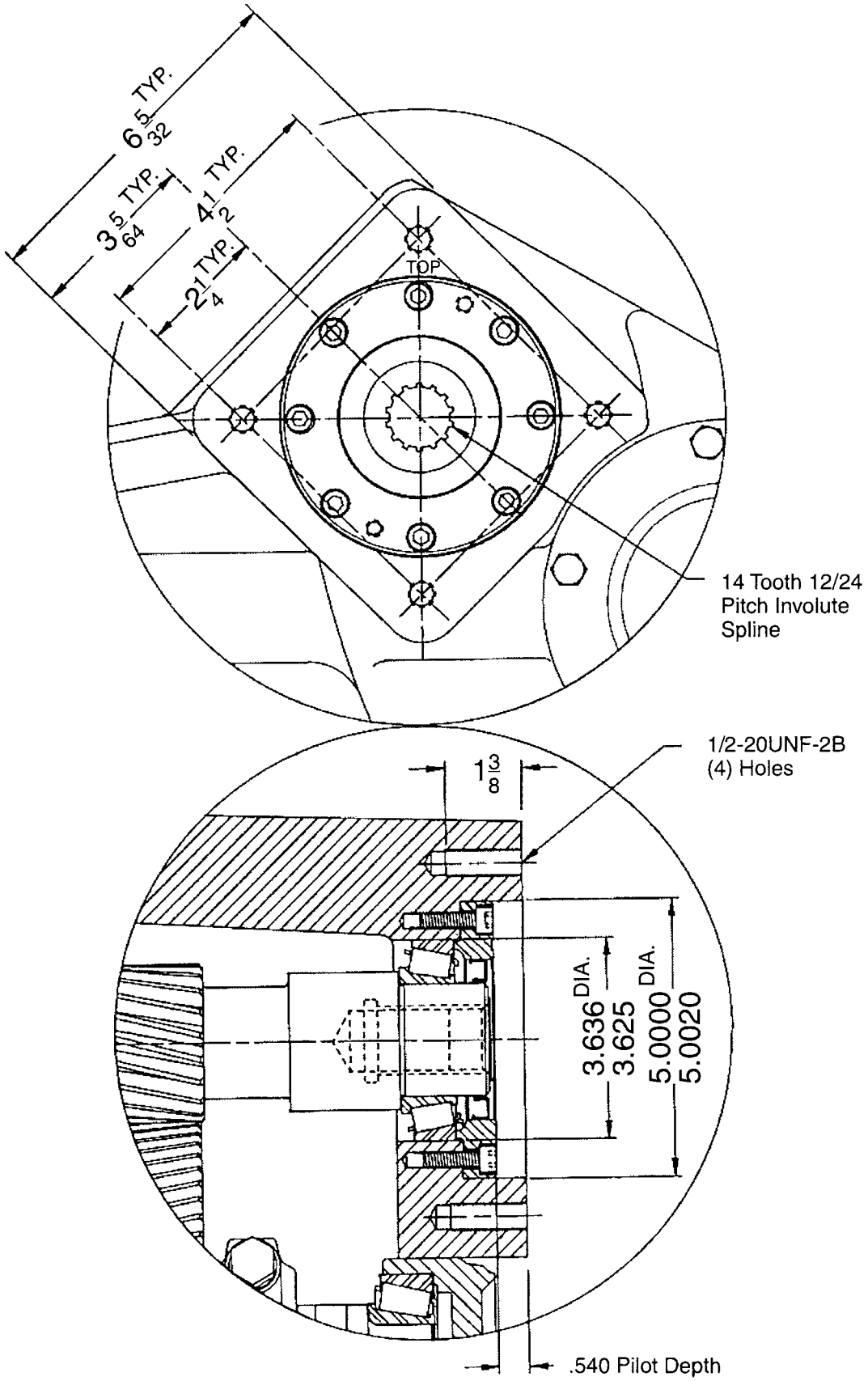
Ref. No.	Description	Qty. Req'd.	Part No.	Model
50	Body, Fluid End	1	24961F003	DP28-55 (After 13 August 1996)
51	Cap, Valve, Discharge	3	24797A000	All Models
51A	Ring, Back-up	3	18753A007	All Models
51B	"O" Ring	3	05876A168	All Models
51C	Cap, Valve, Suction	3	24797A002	DP28-55 (After 13 August 1996)
51D	"O" Ring	3	05876A221	DP28-55 (After 13 August 1996)
51E	Ring, Back-up	3	18753A010	DP28-55 (After 13 August 1996)
53	Seat, Suction, Valve	3	24796A012	DP28-55 (After 13 August 1996)
54	Seat, Discharge, Valve	3	24796A013	DP28-55 (After 13 August 1996)
63	Washer, Spring (1 1/4)	3	24955A009	DP28-55 (After 13 August 1996)

HYDRAULIC DRIVE COMPONENTS



Item	Qty.	Part No.	Description
1	1	04625E100	Case, Gear
2	1	20164B011	Shaft, Pinion
3	4	05863A024	Shim, Green, .003 Thk.
4	2	05863A023	Shim, Pink, .015 Thk.
5	2	05674A020	Cone, Bearing
6	2	05675A019	Cup, Bearing
7	2	04741B010	Cap, Bearing & Seal
8	2	05710A046	Seal, Oil
9	2	17272A022	Protector, Plastic
10	16	06106A048	Screw, Cap, Socket Head Grade 8 5/16-24UNF x 1" Long (Torque 15 lb./ft.)

DIMENSIONS, S.A.E. "C" FACE MOUNTING



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