Commercial Hydraulics

Pump & Motor Division

PGP/PGM 300 Series
Service Manual

Parker

ENGINEERING YOUR SUCCESS.

⚠ WARNING — User Responsibility

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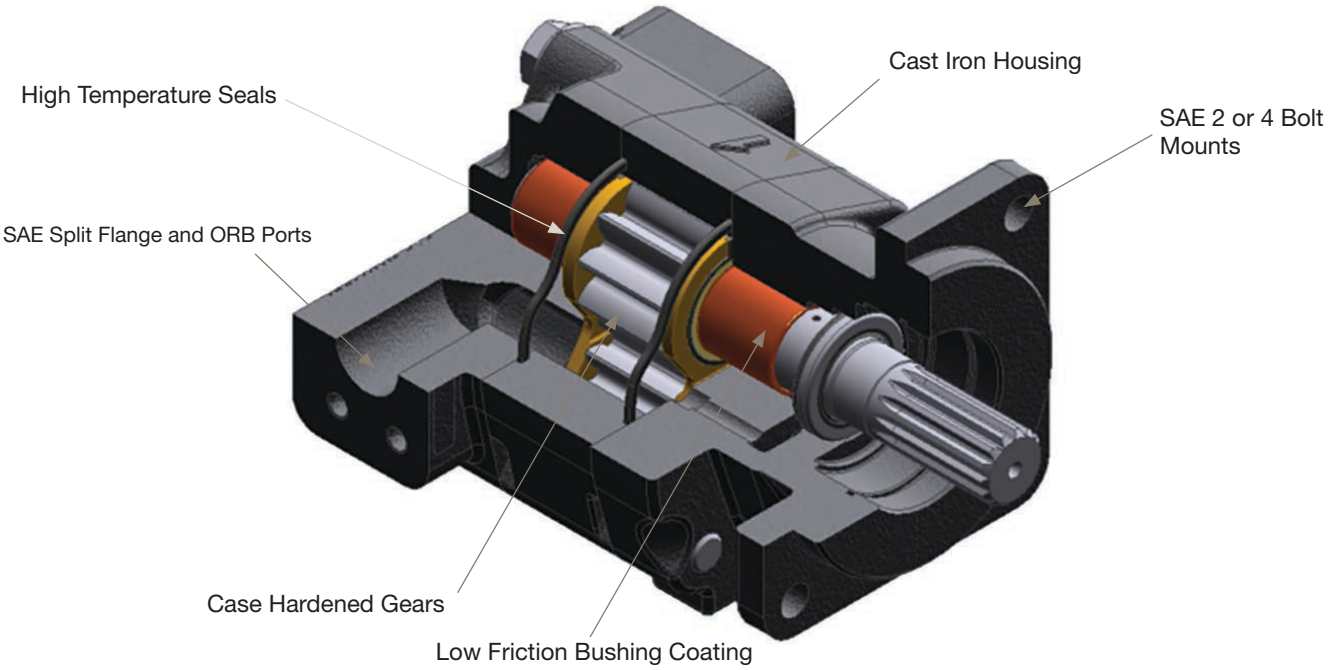
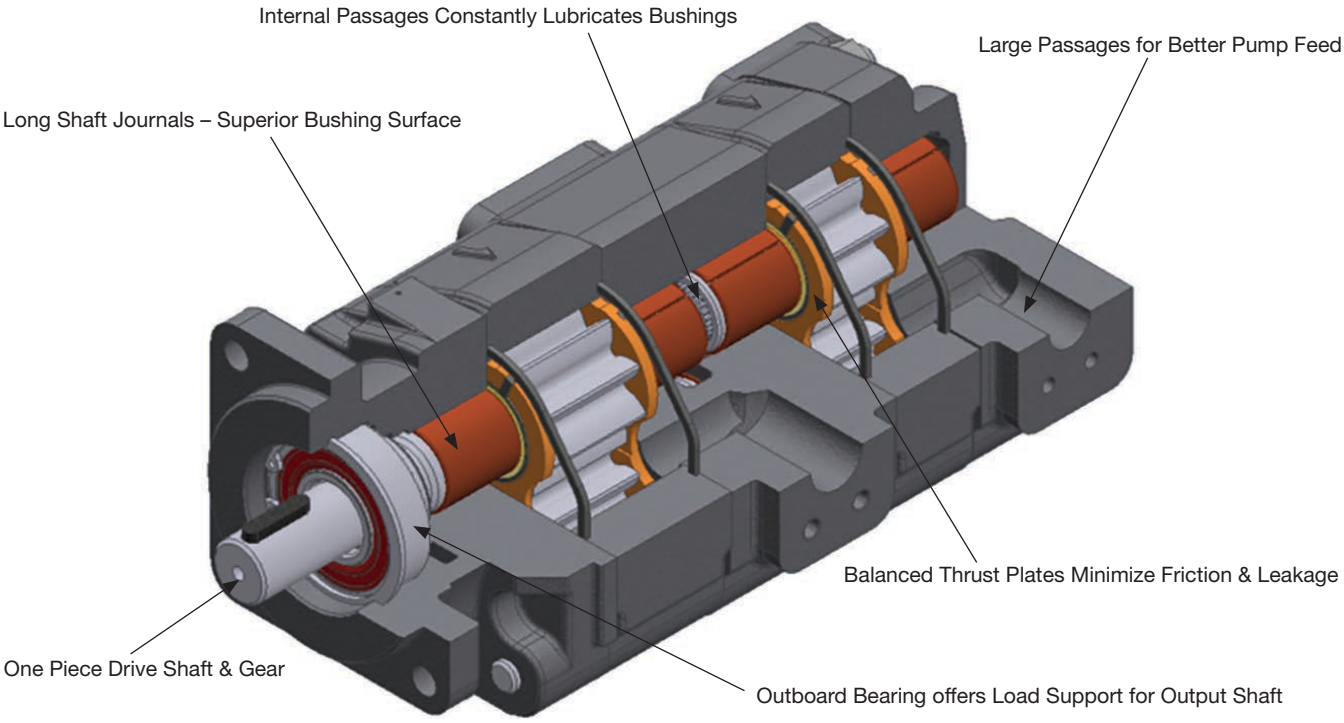
Single Pump



Multiple Pump



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Use Genuine Parker Replacement Parts

These service instructions will familiarize you with Parker's single and multiple pumps, their component parts, the relative position of each part proper methods for assembly or disassembly of the units

To facilitate the repair of these units, and before any work is done, we suggest that you first read all of the steps used in disassembly and assembly.

Dirt is the enemy of any hydraulic system. The first requirement of good maintenance of hydraulic equipment is cleanliness. MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA.

The pictures show Model PGP365. Notes in the text cover variations between this unit and the other models.

It is important to airblast all parts and wipe them with a clean, lintless cloth before assembly.

USE CAUTION IN GRIPPING ALL PARTS IN THE VISE TO AVOID DAMAGING MACHINED SURFACES

A pump must be driven in the direction of rotation for which it was built; otherwise, the pressure will blow the shaft seal. Check the exploded view and notes at right for proper direction of rotation.

Parker’s Replacement Parts

Parker’s replacement parts are of original equipment standards. For assured quality of material and workmanship, and for compatibility in assembly, USE ONLY GENUINE PARTS.

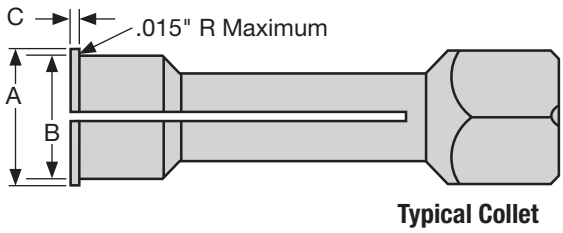
Check all replacement parts before installing them to be certain that they were not damaged in shipment.

Tool List

Arbor press	Bearing puller (Owatonna Tool Co. M D - 956 or equivalent)
Awl	Deburring tool (an old file with cutting teeth ground off)
1-1/2" Dia. steel ball	No. 3 non-hardening sealant or equivalent
Clean, lintless cloths	Permatex Aviation Form-A-Gasket™
Machinist's hammer	Medium grit carborundum stone
Soft hammer	Scale (1/32" or 1/64" graduations)
Oil and grease	Vise with 6" minimum opening
Snap ring pliers	Bushing remover tool (See A)
Prick punch	Seal removal tool (See B)
Small screw driver	Bushing installation tool (See C)
Torque wrench	Special steel sleeve (See D)

Bar for lip seal installation:	
PGP/PGM315 use 1-5/8" dia. x 2" bar	PGP/PGM350 use 2-1/2" dia. x 2" bar
PGP/PGM330 use 1-3/4" dia. x 2" bar	PGP/PGM365 use 2-1/2" dia. x 2" bar

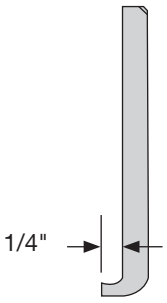
A **Bushing Puller:** The bushings may be removed from their bores, using blind hole collet-type bushing pullers similar to those manufactured by Owatonna Tool Co. The table illustrates the modifications necessary to adapt the OTC collets to this task. Equivalent pullers from other suppliers may be modified in similar fashion.



Typical Collet

Pump/Motor	A	B	C	Make from OTC Collect No.
PGP/PGM 315	.900" .800"	.800" .790"	.100" .090"	33863
PGP/PGM 330	.980" .970"	.875" Ref.	.100" .090"	33863
PGP/PGM 350	1.122" 1.122"	1.000" 0.990"	.072" .052"	33864
PGP/PGM 365	1.382" 1.372"	1.250" 1.250"	.100" .120"	33865

B **Seal Removal Tool**
Easily made from an old screw driver. Heat the tip and bend as shown. Grind the tip to fit the notch behind the shaft seal.



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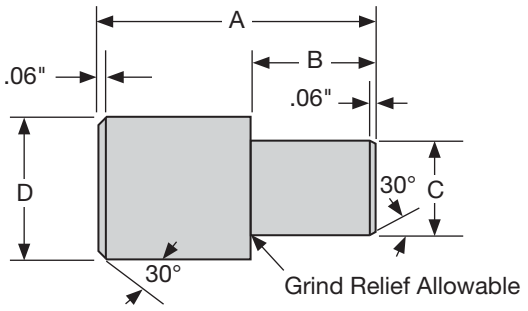
General Information

C **Bushing Installation Tool:** A.I.S.I 8620 Bearing Quality Steel Heat Treated



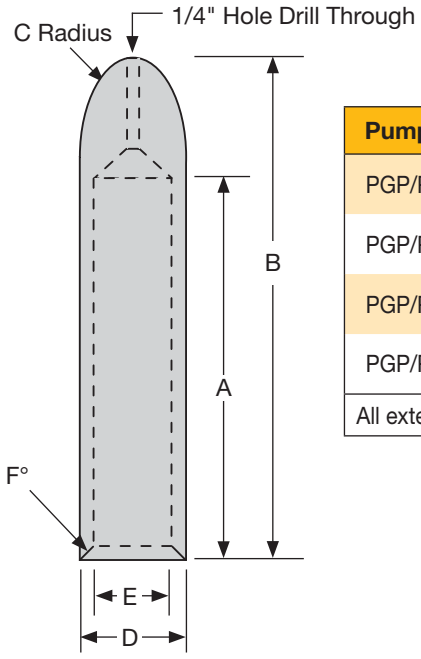
Pump/Motor	A	B	C Dia.	D Dia.
PGP/PGM 315	2.312"	1.15"	.937" +.000" -.002"	1.250
PGP/PGM 330	3.000"	1.47"	1.054" +.000" -.002"	1.250
PGP/PGM 350	3.000"	1.47"	1.282" +.000" -.002"	1.625
PGP/PGM 365	3.000"	1.73"	1.492" +.000" -.002"	1.750

D **Special Steel Sleeve**

The special steel sleeve is used to insert the drive shaft through the lip seal without damage and can be made from bar stock:

PGP/PGM315: Use a 1" dia. x 3-1/8" bar
PGP/PGM330: Use a 1-1/8" dia. x 4-5/8" bar or
PGP/PGM330: Use a 1-1/4" dia. x 4-5/8" bar
PGP/PGM350: Use a 1-3/8" dia. x 4-5/8" bar
PGP/PGM365: Use a 1-1 /2" dia. x 4-5/8" bar

The drawing and chart give details for making this special tool.



Pump/Motor	A	B	C Radius	D Dia.	E Dia.	F° Chamfer
PGP/PGM 315	1-7/8"	3"	9/16"	.944" +.000" -.002"	.885" +.000" -.002"	.050" x 60°
PGP/PGM 330	3-3/8"	4-1/2"	9/16"	1.065" +.000" -.002"	1.002" +.000 -.002"	.015" x 45°
PGP/PGM 350	3-3/8"	4-1/2"	9/16"	1.290" +.000" -.002"	1.250" +.000" -.002"	.015" x 60°
PGP/PGM 365	3-3/8"	4-1/2"	9/16"	1.377" +.000" -.002"	1.250" +.000" -.002"	.015" x 60°
All external surfaces must be free of scratches and burrs.						

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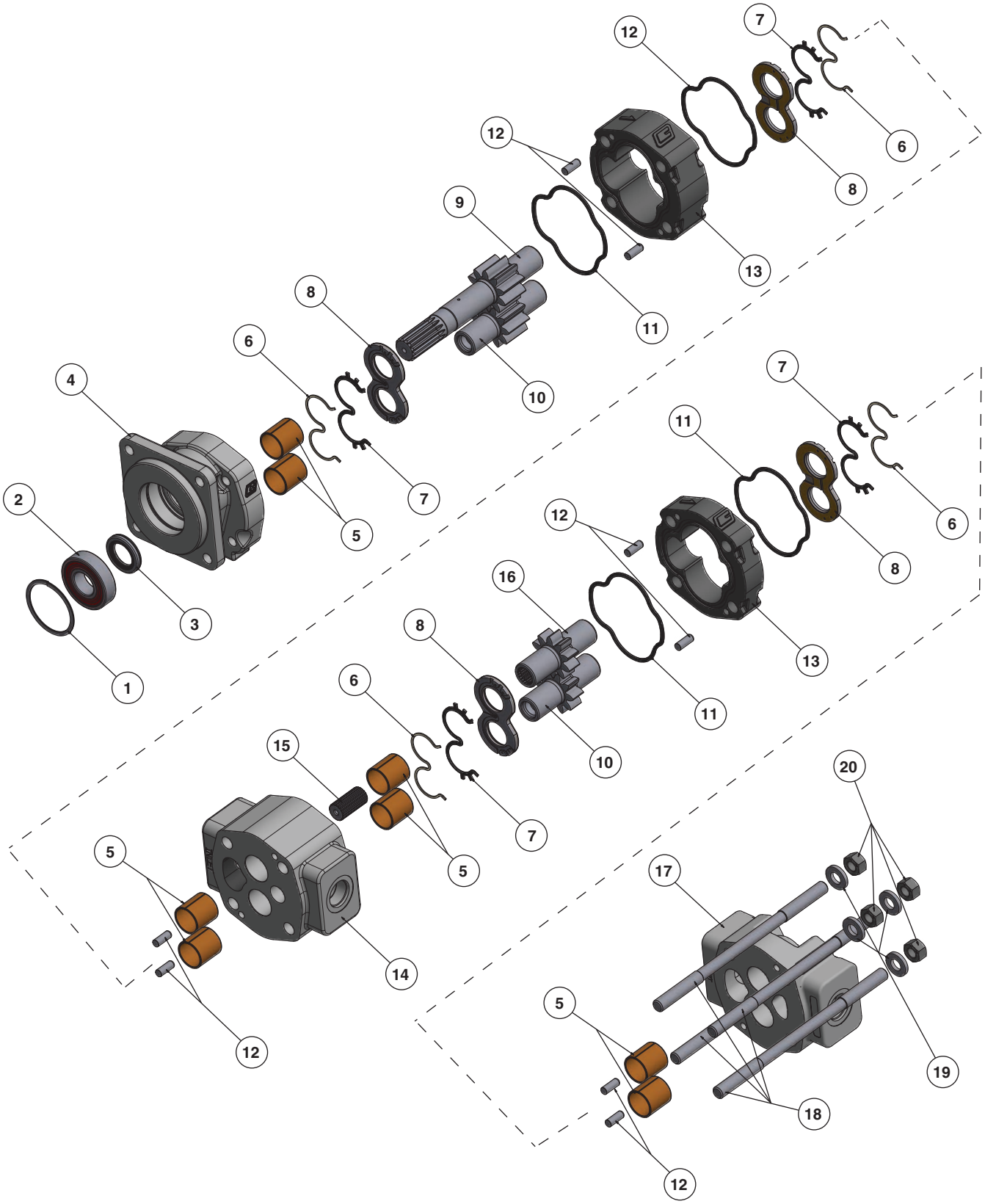

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ITEM	DESCRIPTION
1	Snap Ring
2	Outboard Bearing
3	Lip Seal, Shaft Seal
4	Shaft End Cover, Flange
5	Bushing
6	Backup Seal
7	Channel Seal
8	Thrust or Pressure Plate
9	Gear Shaft, Drive Gear
10	Driven Gear, Idler Gear
11	Square Seal, Section Seal
12	Dowel Pin
13	Gear Housing, Body
14	Bearing Carrier
15	Connecting Shaft
16	Drive Gear
17	Port End Cover, Rear Cover
18	Stud, Cap Screw, Fastener
19	Washer
20	Hex Nut

Start Disassembly

CAUTION:
1. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.
2. If parts are difficult to fit during assembly, tap gently with a soft hammer. (Never use an iron hammer).
3. Gears are closely matched, therefore they must be kept together as sets, avoid touching gear journals when removed from a unit. Handle with care to avoid damage to the journals or teeth.
4. Never hammer bushings into bores. Use an arbor press.

1) Place the pump in a vise with the drive shaft pointing down (**Fig. 1**). Match-mark all sections. Be sure to align these marks when reassembling.

DO NOT GRIP ON OR NEAR ANY MACHINED SURFACES DURING ASSEMBLY OR DISASSEMBLY.


Figure 1

2) Remove four bolts and cap screws on single units or the 4 hex nuts, studs and washers of multiple units (**Fig. 2**). Use an impact driver in a cross-pattern. Inspect threads and cap screws for wear.


Figure 2

3) Lift off the port end cover and look at underside for any damage (**Fig. 3**). If prying is necessary, be careful not to damage the machined surfaces. Dowel pins will remain in either the port end cover or the gear housing. Make sure they are firmly in place and not missing for reinstallation.


Figure 3

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Disassembly Instructions

4) Remove the thrust plate (**Fig. 4**). Examine both sides for wear and replace if necessary.

See Step 12, on page10, for examples of thrust plate wear.

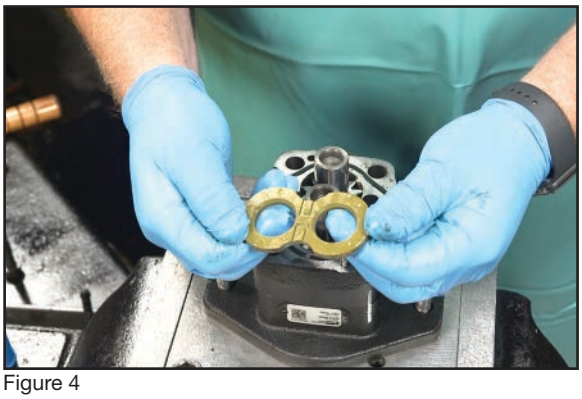

Figure 4

5) Match mark gears in center (**Fig. 5**). This will ensure the pump is correctly reassembled.

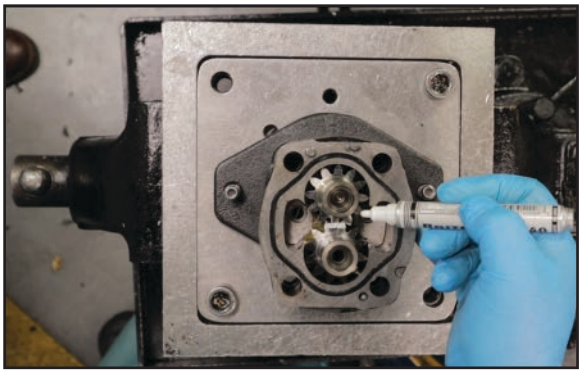

Figure 5

6) Carefully remove idler gear first (**Fig. 6**). Avoid tapping the gear teeth together or against other hardened surfaces.

Figure 6

7) Next, remove the drive shaft. Keep these gears together because they are a matched set. Examine and replace if necessary (**Fig. 7**). (See pages 19-20)

Figure 7

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8) ***For multiple assemblies only:***
Remove the thrust plate from the bearing carrier. Examine and replace if necessary.

9) Lift or pry off the section gear housing. If prying is necessary, take care not to damage machined surfaces (**Fig. 8**). Examine and replace if necessary (See pages 19-20).

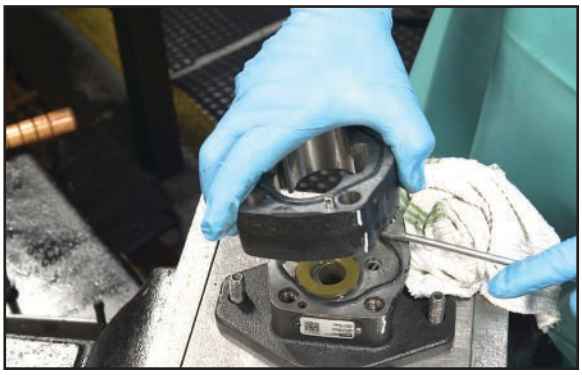
Figure 8

10) Remove section seal and examine for damage. Insert seal back into the bottom of the gear housing for reassembly (**Fig. 9**)


Figure 9

11) Inspect gear housing for damage/cutout at the gear bore (**Fig. 10**). See pages 19-20 for wear guide.

Example of excessive cutout on gear housing, circled in yellow (**Fig. 11**).


Figure 10

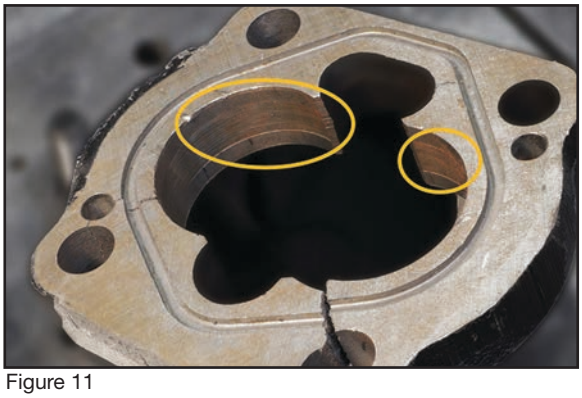
Figure 11

Disassembly Instructions

12) Remove thrust plate and examine for wear.

Wear on thrust plate will reveal exactly what happened to the thrust plate (**Fig. 12**).

Examples of damaged plates (**Fig. 12a & 12b**).

Figure 12

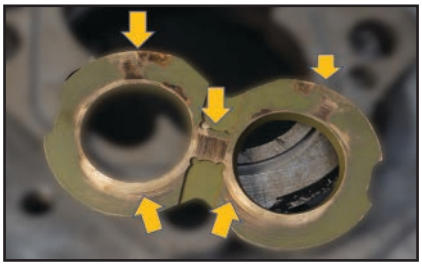

Figure 12a

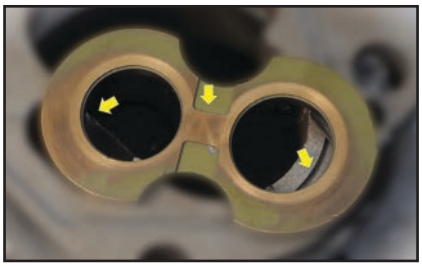

Figure 12b

13) Examine top of Shaft End Cover as well as bushings and lip seal for wear or damage. Ensure that they are free of debris (**Fig. 13**).

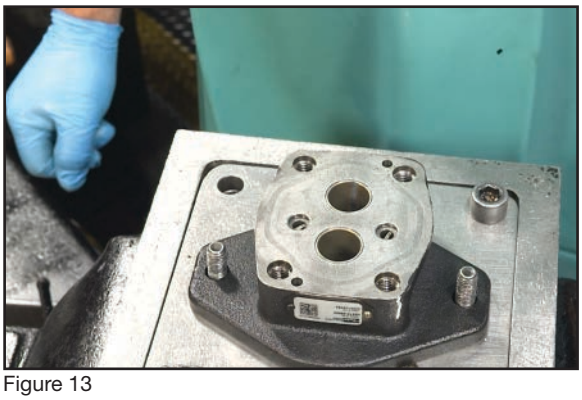

Figure 13

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14) Examine bottom of Shaft End Cover (**Fig. 14**).

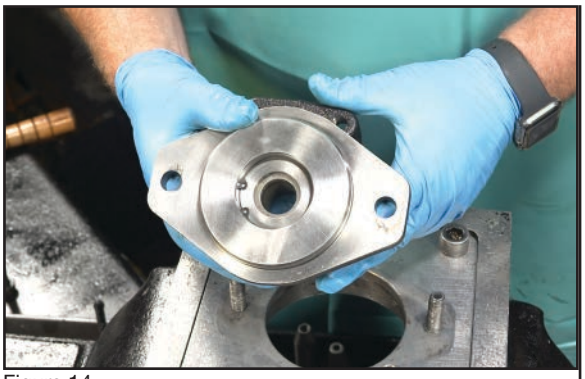

Figure 14

If your pump is NOT equipped with an outboard bearing, skip to #17.

15) ***Outboard bearing pumps ONLY:***
Remove snap ring (**Fig. 15**). Place the shaft end cover in the vise with the mounting face up. Remove the snap ring with snap ring pliers. If a unit is equipped with a spiral-lock retaining ring, remove with a small screwdriver or awl.

Figure 15

16) ***Outboard bearing pumps ONLY:***
Remove outboard bearing (**Fig. 16**). Use a bearing puller to remove bearing.

Figure 16

17) Remove lip seal (**Fig. 17**). Grip the shaft end cover in a vise with the mounting face down. Remove double lip seal by inserting the special seal removal tool (see Tool List on page 3) into the notch between the double lip seal and the shaft end cover. Tap the seal out and discard. Remove and discard all rubber and polymer seals.

Figure 17

Start Assembly

1) Before starting assembly, clean all machined surfaces and make sure they are free of debris.

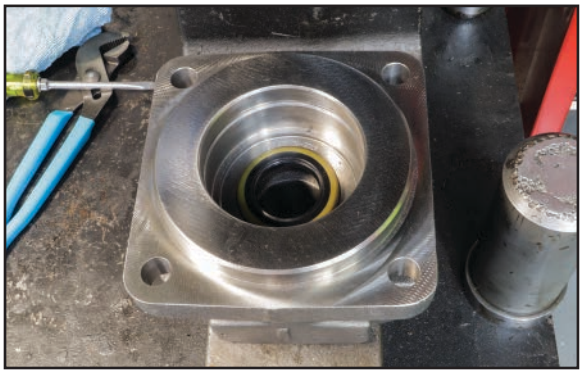

Figure 1

2) Prep new lip seal by coating the outer edge of the seal with Aviation Gasket sealant, also coat the lip seal cavity (**Fig. 1 & 2**).

Figure 2

3) Replace lip seal (**Fig. 3 & 4**). With the metal side of the lip seal up, press it into the mounting flange side of the shaft end cover with an arbor press and bar (see Tool List on page 4). Be careful not to damage the lip of the seal.

Press in until flush with the recess. Wipe off excess sealant.

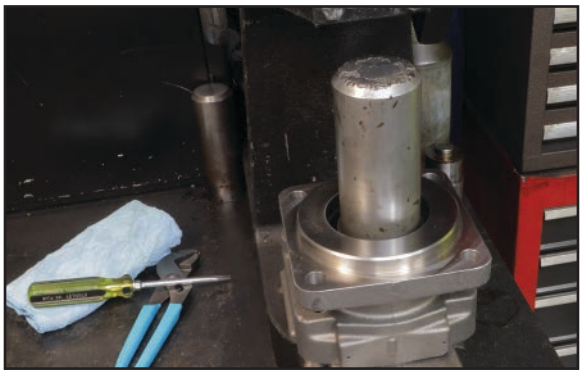

Figure 3

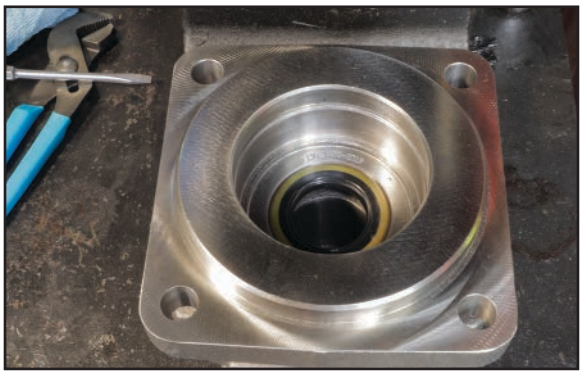

Figure 4

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4) If the unit is equipped with an outboard bearing, install bearing with arbor press then install new snap ring (**Fig. 5, 6, & 7**).


Figure 5


Figure 6

5) Assemble the snap ring (**Fig. 7 & 8**). Using snap ring plyers, seat new snap ring on top of bearing and lip seal.

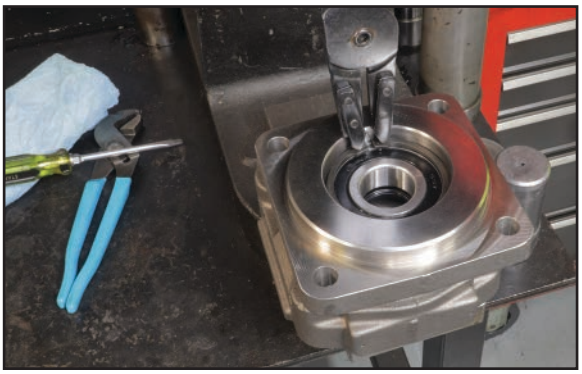
Figure 7

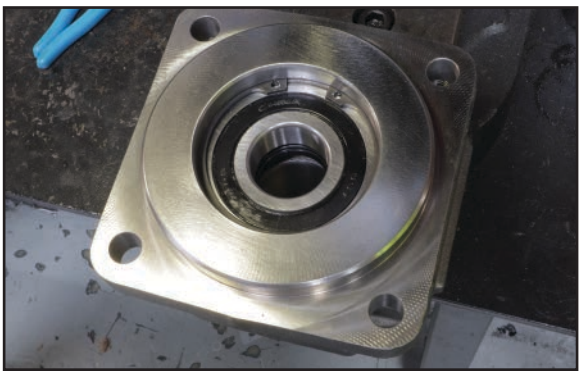
Figure 8

6) Mount shaft end cover facing down in a vise and examine checks and/or plug (**Fig. 9**). Make sure checks and/or plug are tightly in place. They might still be inside the shaft end cover from disassembly. Replacement is necessary only if parts are damaged. Remove with screwdriver.

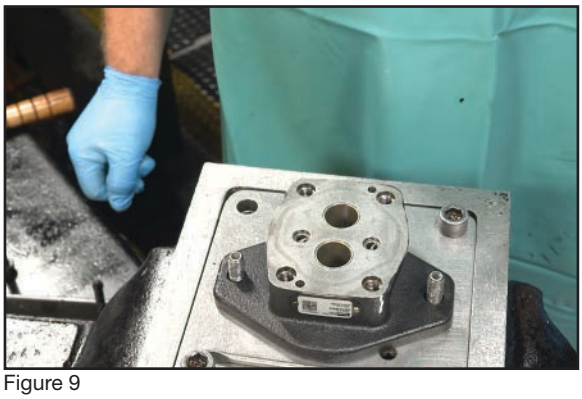

Figure 9

7) Verify dowel pins are in place in any new castings (**Fig. 10**). Examine all of the dowels. Before inserting, make certain that the hole is clean and free from burrs. Gently start the pin straight into the hole and tap lightly with a soft-faced hammer.

Figure 10

8) Re-affix or replace section seal (**Fig. 11**). Verify both sides of the section seal are free of debris. If replacing section seal, grease the new seal then insert firmly into the grooves on both sides of the gear housing.

Figure 11

9) Place gear housing over shaft end cover and dowels, lining up witness marks (**Fig. 12**).

Tap it with a soft hammer until it rests tightly against the shaft end cover. Be careful not to pinch the gasket seal. Also be sure that the large rounded core is on the inlet side.

Figure 12

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10) Assemble new sealing parts in pressure plate and verify orientation.

The sealing parts can be fixed with grease (see below for steps to install sealing parts correctly).

i. Turn the pressure plates so the seal groove faces up.

ii. Place the soft black into the seal groove with the flat side down.

iii. Place the hard nylon back-up seal, flat side up, into the groove on top of the rubber seal.

Pump Pressure Plate - Back Side (**Fig. 13**)
Pump Pressure Plate - Seals in Place (**Fig. 14**)
Motor Pressure Plate - Back Side (**Fig. 15**)
Motor Pressure Plate - Seals in Place (**Fig. 16**)

The proper seal installation is very important. If these seals are assembled upside down, they will most likely fail in a short period of time under system pressure.

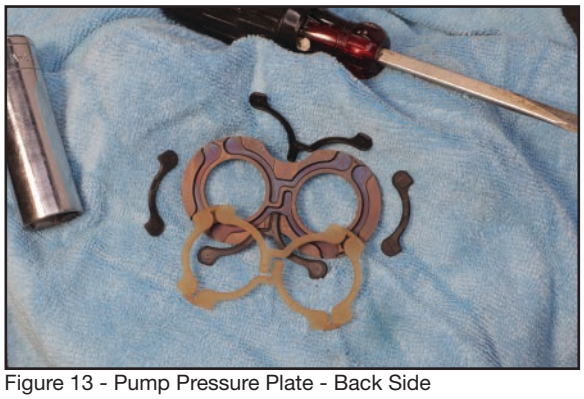


Figure 13 - Pump Pressure Plate - Back Side

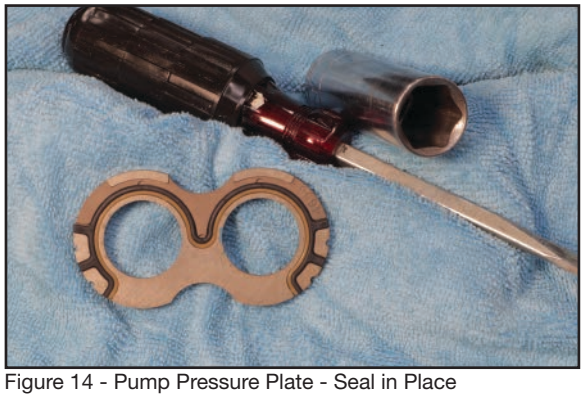


Figure 14 - Pump Pressure Plate - Seal in Place

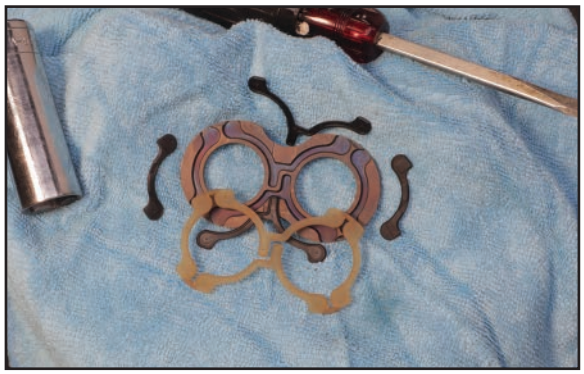


Figure 15 - Motor Pressure Plate - Back Side


Figure 16 - Motor Pressure Plate - Seal in Place

11) Place bottom thrust plate into shaft end cover (**Fig. 17**).

Orientation is rotation sensitive for pumps and the seals should be pointed down and facing the high-pressure side of the pump, the pressure port.

Gently tap the thrust plate with a soft mallet until it touches the shaft end cover.

Figure 17

12) Insert a seal guide to protect drive shaft (**Fig. 18**). Coat seal guide with grease and place into pressure plate.

Figure 18

Example of a shaft seal guide being used to protect a gear bearing bores to engage the dowels and to move parts together in the final seating (**Fig. 19**).

Figure 19

13) Place drive shaft through seal guide and in place in thrust plate (**Fig. 20**). Press it down while turning drive shaft from the bottom to move witness marks back into center and the integral gear rests against the thrust plate. Avoid damaging the lip seal. The seal guide will drop out of the bottom of the pump. Squirt clean oil over the gears.

Figure 20

14) Insert idler gear (**Fig. 21**). Line up witness marks and push down.

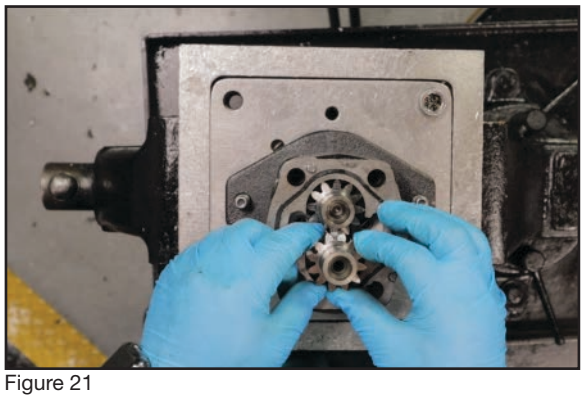


Figure 21

15) Install top thrust plate (**Fig. 22**). Make sure the seal in the thrust plate is facing up over the gear journals and towards the housing bore. The flat side of the seal should face up with the relief groove facing the outlet side.

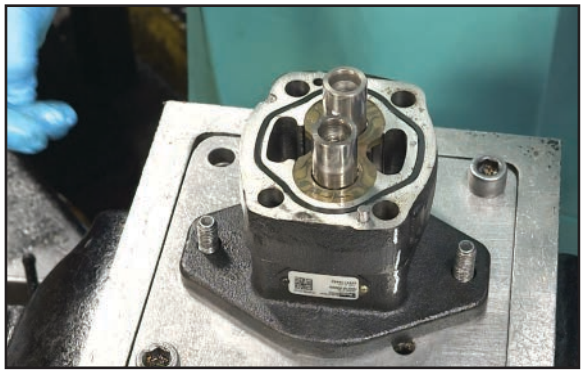


Figure 22

16) Place port end cover over the gear journals (**Fig. 23**). Examine port-end cover that is free of any debris that might get stuck in the section seal. Align the dowels with the holes in the mating casting. Being careful not to pinch the gasket-seal, tap the port end cover lightly in the center between bearing bores to engage the dowels and to move parts together in the final seating and it touches the section seal surface. Make sure witness marks line up.

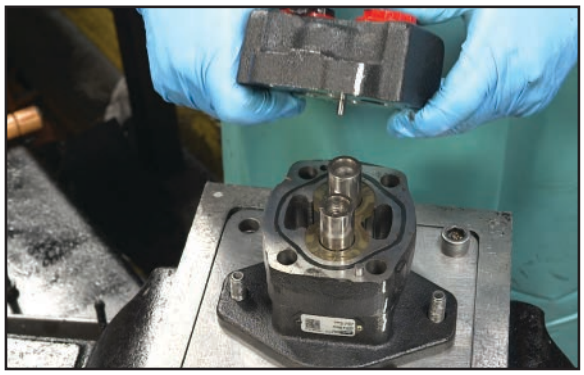


Figure 23

17) Insert and hand tighten bolts and washers (**Fig. 24**). Finish tightening with an impact gun in a cross pattern.

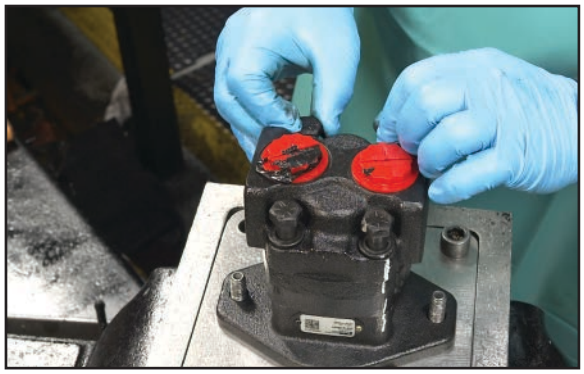


Figure 24

WARNING: This product can expose you to chemicals including lead or DEHP which are known to the state of California to cause cancer, birth defects, and other reproductive harm. www.p65warnings.ca.gov

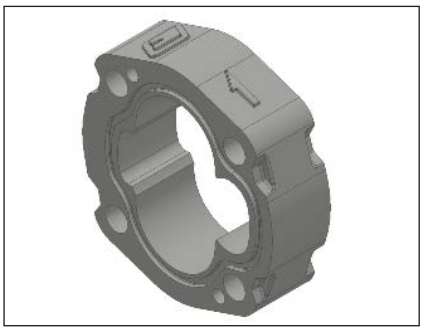
18) Torque fasteners in cross-pattern (**Fig. 25**).
Do not lubricate fastener threads before assembly.
Follow below torque guide.

Figure 25

300 Torque Guide	
Series	**Lbs-ft**
PGP315/PGM315	142
PGP330/PGM330	200
PGP350/PGM350	200
PGP3365	200
PGM365	450

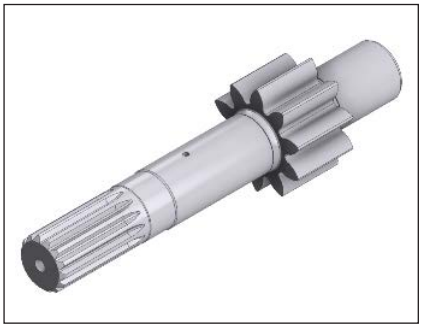
Gear Housings
Wear in excess of .007" cut-out necessitates replacement of the gear housing. Place a straight-edge across bore. If you can slip a .007" feeler gauge under the straight-edge in the cut-out area, replace the gear housing.

Pressure pushes the gears against the housing on the low pressure side. As the hubs and bushings wear, the cut-out becomes more pronounced. Excessive cut-out in a short period of time indicates excessive pressure or oil contamination. If the relief valve settings are within prescribed limits, check for shock pressures or tampering. When the cut-out is moderate, 007" or less, the gear housing is in good condition and may be reused.



Gears
Any scoring on gear hubs necessitates replacement. Scoring, grooving, or burring of the outside diameter of the teeth requires replacement. Nicking, grooving, or fretting of teeth surfaces also necessitates replacement.

Drive Shafts
Replace if there is any wear detectable by touch in the seal area or at the drive coupling. The maximum allowable wear is .002". Wear in the shaft seal area indicates oil contamination. Wear or damage to splines, keys, or keyways necessitates replacement.



Thrust Plates
The thrust plates seal the gear section at the sides of the gears. Wear here will allow internal slippage, that is, oil will bypass within the pump.

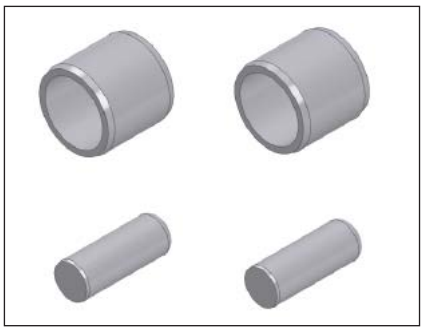
A maximum of .002" wear is allowable. Replace thrust plates if they are scored, eroded or pitted. Check center of thrust plates where the gears mesh. Erosion here indicates oil contamination.

Pitted thrust plates indicate cavitation or oil aeration. Discolored thrust plates indicate overheating, likely due to insufficient oil.

Guidelines for Acceptable Wear

Dowel Pins
If either the dowel or dowel hole is damaged, the dowel or machined casting, or both, must be replaced.

If more than reasonable force is required to seat dowels, the cause may be poorly deburred or dirty parts; cocking of the dowel in the hole or improper pin-to-hole fit.



Bushings
If gears are replaced, bushings must be replaced. Bushings should fit into the bore with a heavy press fit.

Seals and Gaskets
Replace all rubber and polymer seals, including all o-rings, thrust plate channel seals, shaft seal and gasket seals.

Plugs
Examine the plugs in the shaft end and port end cover to make sure that they are in the proper position and tight. The PGP/PGM315 and PGP/PGM330 should have two plugs in both the shaft end and port end in tandem units only. The PGP/PGM350 and PGP/PGM365 have one plug in their shaft and port ends high pressure side only.

Hydraulic Oil Recommendations

When choosing your Hydraulic Oil, duty cycle and oil temperature must be factored in to optimize your system performance since hydraulic systems often work under extreme temperature changes, especially in moderate to severe duty cycles, the lubrication qualities of the oil in tight tolerance components is even more critical.

Viscosity choice is always a compromise; the fluid must be thin enough to flow easily but thick enough to seal and maintain a lubricating film between bearing and sealing surfaces. This film of oil helps to reduce friction and heat, which can ultimately lead to component damage.

Fluid temperature does affect viscosity. When choosing a fluid, it is important to consider the start-up and operating temperatures of the hydraulic system In general, as the fluid warms, it gets thinner and its viscosity decreases. At the highest temperatures, the fluid must be thick enough to provide lubrication and minimize internal leakage. Low viscosity leads to the following problems:

- Higher leakage across all sealing gaps in the pump leading to lower volumetric efficiencies and heat.
- Heat will cause loss of lubrication and will create severe wear because of metal to metal contact, causing premature failure of the gears, thrust plates and bearings.

The opposite is true when the fluid cools, its viscosity increases. At the lowest temperatures, the fluid must be thin enough to flow readily. High viscosity oil leads to the following problems:

- Sealing and lubrication gaps not being filled, loss of lubrication
- Filling losses occur which causes cavitation damage to the pump

Under normal operating temperatures it is recommended to keep the temperature of the hydraulic fluid in the range of 120°F to 140°F (49°C to 60°C). Fluids may break down or oxidize at high temperatures, which leads to varnish or sludge deposits in the system and also reduces lubricity and results in reduced life of the unit. As a rule of thumb, operating temperatures over 176°F (80°C) reduce the service life by half for every 50°F (10°C) temperature increase, and should be avoided.

Petroleum Oils (Mineral-based)

Viscosity Recommendations
Optimum operating viscosity is considered to be about 100 SUS (20 cSt).

Minimum approximately: 50 - 60 SUS (7.5 - 10 cSt)
Maximum at start up approximately: 7500 SUS (1600 cSt)

Recommended Viscosity Grades:

Grade	Viscosity at 100°F (40°C)	Viscosity at 210°F (100°C)
ISO 32	165 SUS (32 cSt)	44 SUS (5 cSt)
ISO 46	240 SUS (46 cSt)	49 SUS (7 cSt)
SAE 10	150 SUS (32 cSt)	41 SUS (4 cSt)
SAE 20	300 SUS (71 cSt)	51 SUS (7 cSt)

Other Desirable Properties	Additives Usually Recommended:
Viscosity Index: 90 minimum	Rust and Oxidation (R & O) Inhibitors
Aniline Point: 175 minimum	Foam Depressant

NOTE: Antiwear (AW) additives are not necessarily recommended. In some instances the presence of zinc compounds can actually be harmful to copper, bronze, or brass components used in the system. The use of Aw oil is optional with our gear units.

General Recommendations
High quality hydraulic oils are essential for satisfactory performance and long life of any hydraulic system. Such oils are usually prepared from highly refined, turbine oil stocks with which select additives are compounded. We suggest following the manufacturer's specifications or the recommendations of a reputable oil supplier for the specific oil requirements on your machine.

A high viscosity oil will generally give better performance and life than a thin oil. Oil of around 100 SUS (20 cSt) will give optimum performance. Your selection should be as near to optimum as possible at operating temperature but not so heavy at start-up as to cause cavitation. Cold start-up procedures which allow the use of heavier oils should prove worthwhile by increasing pump life. The oil must be clean and contain less than 0.1% water.

Hydraulic Oil Recommendations (Continued)

Petroleum Oils (Mineral-based) (Continued)

Operating Temperature
The optimum oil operating temperature is in the range of 120°-140°F (49°-60°C). Oil operating temperature should not exceed 200°F (93°C) with a maximum of 180°F (82°C) generally recommended. If the oil temperature will be above 180°F (82°C) for significant periods of time, then Viton (FKM) seals should be used. High temperatures may result in rapid oil deterioration and may point out the need for an oil cooler or a larger reservoir. The nearer to optimum temperature, the longer the service life will be of the oil, pump and other components.

Cold Weather Operation
Oils for use in cold weather should have a viscosity not exceeding 7500 SUS (1620 cSt) at the minimum start-up temperature and a pour point of at least 20°F (0° C) below that temperature. Experience on the Alaskan North Slope has been satisfactory without using special oils or fluids. Start-up procedures must allow for a gradual warm-up and equipment should not be operated at full pressure until the oil reaches a reasonably fluid state.

Inlet Vacuum
Vacuum measured at the inlet port of the pump generally should not exceed 5 in. (13 cm) Hg. Higher vacuum can result in cavitation which may severely damage the pump. A usually acceptable rule of thumb is that the inlet line velocity should not exceed 8 fps (2.5 m/s). A long inlet line or the use of several fittings may necessitate increasing the line size. We suggest that each inlet port of a tandem pump have its own line from the reservoir.

Reservoir
Reservoir capacity in gallons should at least equal total pump output in GPM. When filling the reservoir, oil should pass through a 100-mesh screen. Pour only clean oil from clean containers into the reservoir. The reservoir should have a breather to allow air in or out. The filler cap and breather should be sealed to prevent moisture from entering. A hydraulic oil water content of as little as 0.1% can cause damage to hydraulic components.

Filtration
Good filtration assures improved service life at today's high operating pressures. System filtration is recommended that will maintain a contamination level according to ISO 4406:

ISO 4406	psi	bar
21/19/16	2000	140
19/17/14	3000	210
17/15/12	4000	275

The specific filter recommendation should come from your equipment manufacturer or filter supplier.

A 100 mesh screen should generally be used in the suction line leading to the pump. It should be of sufficient size to handle twice the pump capacity. The screen must be cleaned and checked regularly to avoid pump and system damage.

Oil and filters should be changed on a regular schedule and the system flushed in accordance with the original equipment manufacturer's recommendations. Reservoir air breather filters should be cleaned periodically.

Filtration is not a substitute for practicing cleanliness and proper preventive maintenance.

Hydraulic Oil Recommendations (Continued)

Water Base Fire Resistant Fluids

Two types of water base fluids (WBF) may be used with our gear pumps and motors. Both types of WBF come in various viscosity grades. Select the grade best suited to the equipment and its operation in terms of pressure, speed, temperature, duty cycle, etc. The fluid used should be recommended by the O.E.M. or a reputable fluid supplier.

Operations outside the range of 400 to 2000 rpm and over 3000 psi (2000/2500 psi in the wider gear widths) should be reviewed with your Parker sales representative.

Water-in Oil (60/40) invert Emulsions
Invert emulsions are approved for use with our bushing style pumps at pressures up to 3000 psi or 500 psi below catalog rated pressures, whichever is lower.

With roller bearing pumps, life may be reduced to 20% to 50% of that experienced with petroleum oil. Reducing the pressure and/or gear width can extend pump life appreciably.

Water Glycol Solutions
Water glycol solutions of the types normally used in hydrostatic systems are recommended for use with our bushing style pumps. These consist of about 60% glycol and about 40% water with additives to improve lubricity and other characteristics. Pressures up to 3000 psi are approved, depending on the gear width. Water glycol solutions are not approved for use with our roller bearing pumps.

WBF Filtration
Filtration that seems to give the best results consists of a 100-mesh inlet screen and a return line filter. For water base fluids, the inlet screen should be sized up three to four times the pump capacity. The return line filter should be of a rating and size recommended by the fluid and filter manufacturers to achieve a recommended ISO contamination level.

NOTE: Finer filtration may be required by other components in the system.

High Water Base Fluids (HWBF)
The use of 95/5 emulsion is not recommended.

Phosphate Ester
Phosphate ester does not appear to affect pump performance and service life, but Viton (FKM) seals should be used with this fluid. Viscosity characteristics of phosphate ester fluid limit the recommended ranges of operating and ambient temperatures. Questions on the use of fluids with our equipment should be discussed with a sales representative or Product Support Dept.

Comments: Use of other oils and fluids

Biodegradable Oil (Vegetable-Based)
Oils of this type with properties similar to recommended petroleum oils may be used with our bushing style pumps only. These are not approved for use in our roller bearing pumps. Performance, pressure ratings and durability are not adversely affected in bushing style pumps.

Automatic Transmission Fluid (ATF)
In general, these oils have low viscosity and may be used only at reduced operating pressures and oil temperatures.

Diesel Fuel, Kerosene, Coal Oil
Although sometimes used as a dilutant for cold weather operations, their use is not recommended because they are insufficiently refined products.

Transformer Oil
Sometimes used for extremely cold weather operation. It is not generally recommended as it becomes too thin at normal operating temperatures. Oil to U.S. Military Spec MIL-H-5606 is in this category.

Operating Limits Generally Recommended with Various Fluids

Fluid	Max. Operating Temp.	Max. Inlet Line Velocity	Max. Inlet Vacuum
Petroleum Oil	180°F (82°C)	8 fps (2.5m/s)	5" (13cm) Hg
WIO Emulsion	150°F (65°C)	4 fps (1.2m/s)	0" (0cm) Hg
Water Glycol	150°F (65°C)	4 fps (1.2m/s)	0" (0cm) Hg

NOTE: These figures represent generally accepted maximums and will not prove satisfactory in all installations. For very severe duty cycles, it will likely be advantageous to design and operate the system at something less than these maximum limits.

- DO NOT USE ANY TYPE OF FLUID NOT RECOMMENDED IN THIS BULLETIN WITHOUT FIRST CONSULTING OUR PRODUCT SUPPORT DEPT
- OBTAIN YOUR FINAL FLUID RECOMMENDATION FROM YOUR FLUID SUPPLIER