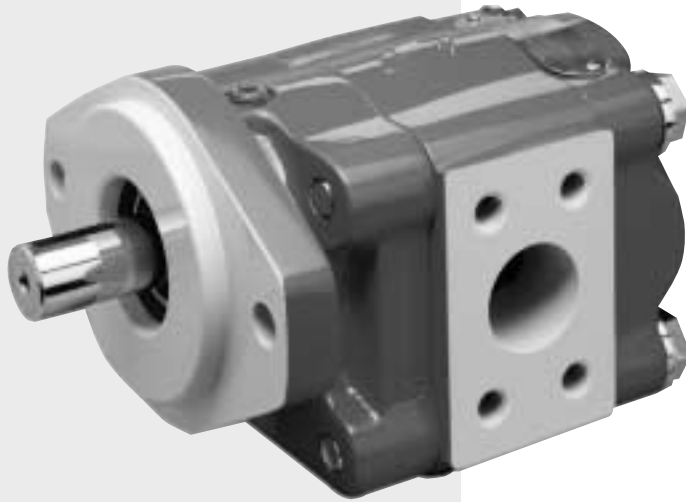




Service Manual
HY09-SM030/031/050/051/US

Service Manual PGP030/031 Series PGP050/051 Series

Effective: August 2002
Supersedes: June 1989



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Use Genuine Parker Replacement Parts



WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the "Offer of Sale".



**Commercial
Hydraulics**

PGP030/031/050/051 Service Manual

General Instructions

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.**

Our pictures show a Model PGP051. 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.

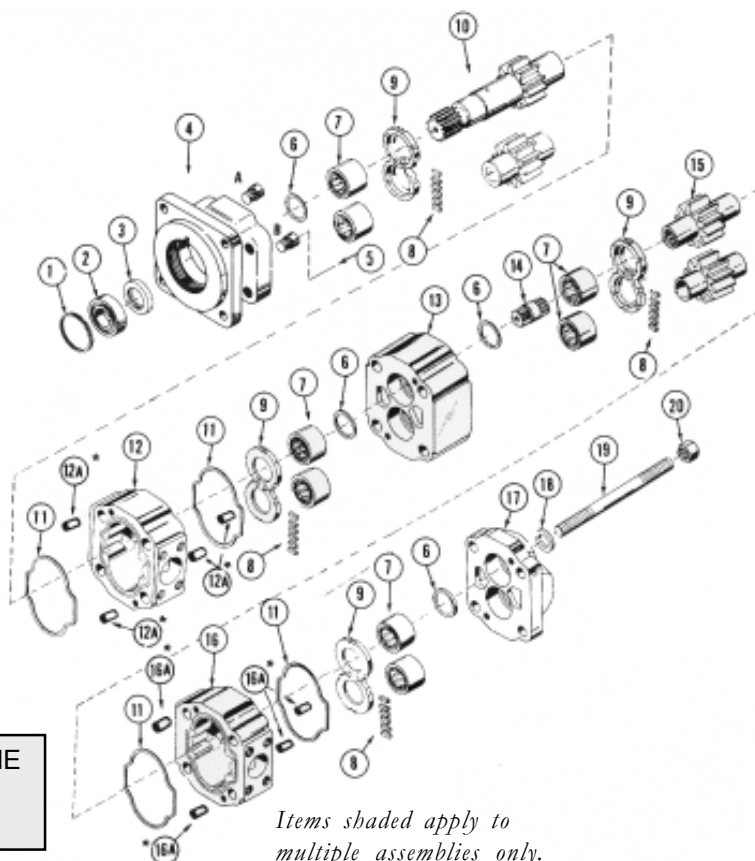
USE CAUTION IN GRIPPING ALL PARTS IN THE VISE TO AVOID DAMAGING MACHINED SURFACES.

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.**

It is a good idea to check all replacement parts before installing them to be certain that they were not damaged in shipment.



Plug 5 in position B gives clockwise rotation.

Plug 5 in position A gives counterclock-wise rotation.

Check valves in both positions give bi-directional rotation.

PARTS LIST

- | | |
|--|-------------------------------------|
| 1. Snap Ring | 11. Gasket Seals |
| 2. Outboard Bearing | 12. Dowel Pins
(PGP031/051 only) |
| 3. Seal | 13. Bearing Carrier |
| 4. Shaft End Cover | 14. Connecting Shaft |
| 5. Check Assemblies
or Plug | 15. Matched Gear Set |
| 6. Ring Seals | 16. Gear Housing |
| 7. Roller Bearings | 17. Port End Cover |
| 8. Pocket Seals | 18. Washers |
| 9. Thrust Plates | 19. Studs or Cap Screws |
| 10. Integral Drive Shaft
and Gear Set | 20. Nuts |

Start Disassembly Here

CAUTION:

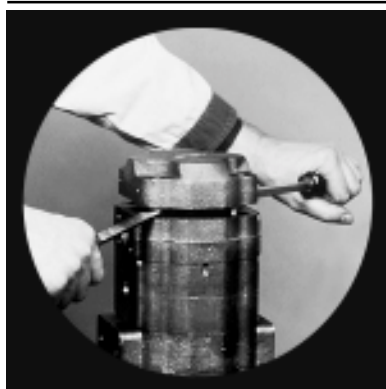
1. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.
2. Do not force parts during assembly, and never use an iron hammer.
3. Gears are closely matched, therefore they must be kept together as sets, when removed from a unit. Handle with care to avoid damage to the journals or teeth.
4. Never hammer roller bearings into bores. Use only an arbor press or other suitable tool.



1) Mount the pump in a vise with the shaft end pointing down. Index mark all sections with a punch. Be sure to align these marks when reassembling.



2) Remove the 4 cap screws on single units, or the 4 hex nuts, studs, and washers on multiple units with a socket wrench.



3) Lift off the port end cover. If necessary to pry loose, refer to caution note. If the thrust plate remains in the gear housing, it can be tapped out later with a wooden hammer handle. Be careful not to distort the thrust plate.



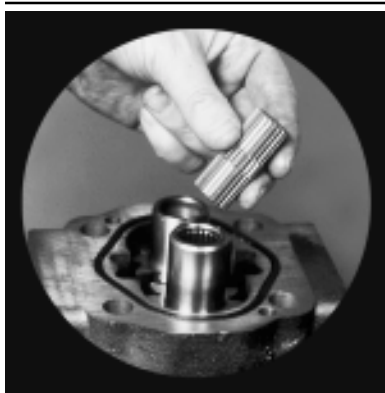
4) Lift the gear housing from the gears. Take care not to damage machined surfaces. For PGP031/051 - Pry the gear housing from the gears and off the dowels from opposite sides, taking care not to damage machined surfaces. *For multiple assemblies only.*



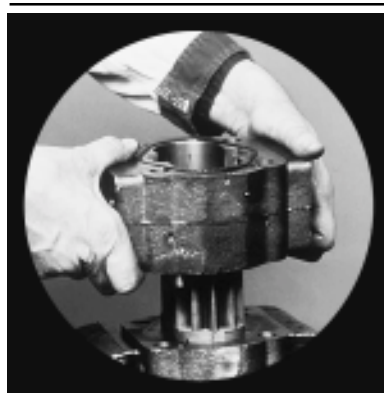
5) Carefully remove the drive and driven gears, without allowing the teeth to come into rough handling contact. Keep these gears together, because they are a matched set. Examine and replace if necessary. (See page 9.) *For multiple assemblies only.*



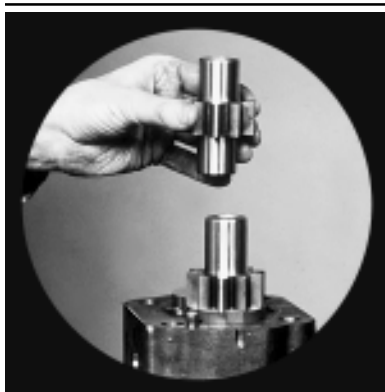
6) Lift or pry off the bearing carrier carefully to prevent damage to contact face and edges. For PGP031/051, pry the bearing carrier off the dowels from opposite sides. Take care not to damage the machined surfaces. Lift off the bearing carrier. *For multiple assemblies only.*



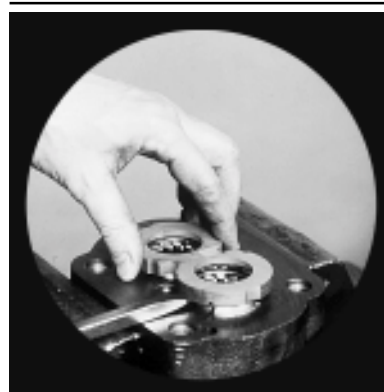
7) Remove the drive gear connecting shaft.
For multiple assemblies only.



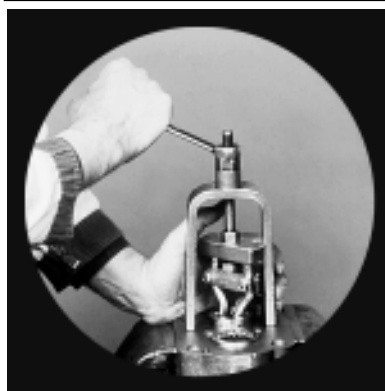
8) Lift or pry off the first section gear housing. Be careful not to damage machined surfaces. If the thrust plate remains in the gear housing, remove as described in Step 3.



9) Remove the driven gear and the integral gear and drive shaft. Keep these together as they are a matched set. Examine and replace if necessary. Be careful not to damage the machined surfaces of the gears.



10) Pry the thrust plates from the shaft end cover, port end cover, or bearing carrier with a screwdriver or similar tool. Avoid distorting the thrust plates. Visually inspect thrust plates for wear or damage. Replace if necessary. (See page 9.) Remove and discard all rubber pocket seals and gasket seals.



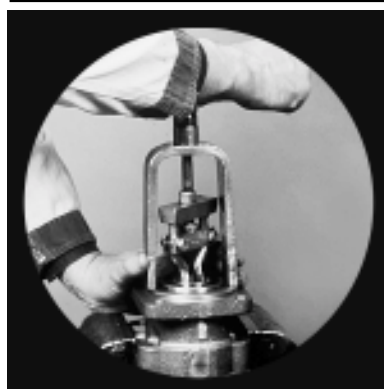
11) Examine all roller bearings for scoring, spalling, or pitting. If replacement is necessary, remove the bearings with a bearing puller.



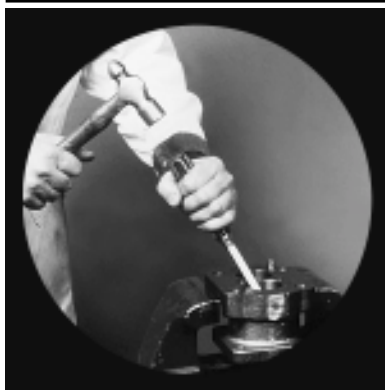
12) It is generally advisable to replace ring seals when rebuilding the unit. To replace, remove the drive gear bearing with a bearing puller, and remove the ring seal from the bottom of the bearing bore.



13) If the pump is equipped with an out-board bearing, place the shaft end cover in a vise with the mounting face up. Remove the bearing snap ring with a small screwdriver or awl.



14) Use a bearing puller to remove the outboard bearing.

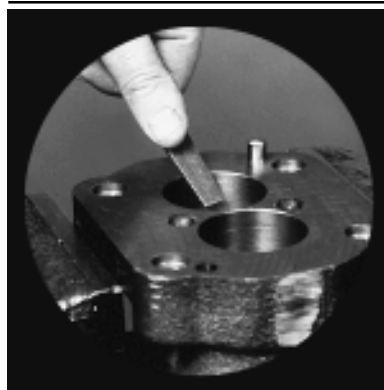


15) With the mounting face down, remove the double lip seal by inserting the special seal removal tool (see Tool List Pg. 10) into the notch between the double lip seal and the shaft end cover. Tap the seal out and discard.

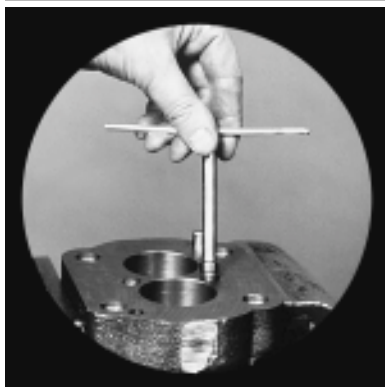
Start Assembly Here



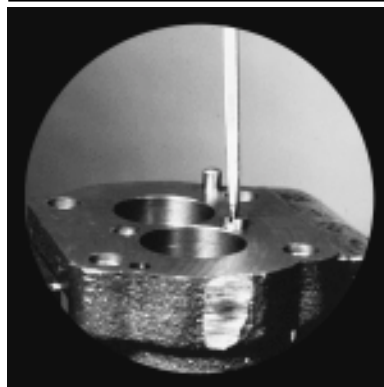
1) Stone off all machined surfaces with a medium-grit, carborundum stone.



2) If the bearings have been removed, deburr bearing bores. Rinse parts in a solvent. Air blast all parts and wipe with a clean, lintless cloth before starting assembly.



3) Grip the shaft end cover in a vise with the mounting face down. Examine the plug or the 2 check valves to be sure that they're tightly in place. Replacement is necessary only if parts are damaged. Remove with a screwdriver or a special check valve tool (see Tool List page 10).

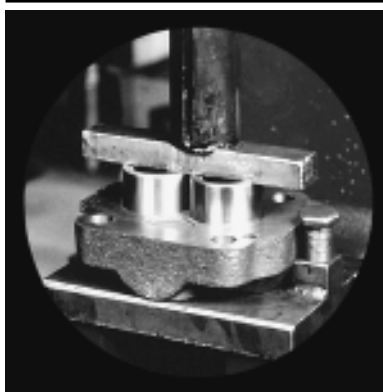


4) If plug or check valves are being replaced, screw in new parts tightly. Stake the plug with a prick punch at both ends of the screwdriver slot and around the edges. Screw the check valves in tightly with the tool. Peen edge of hole 1/32" to 1/16" with 1-1/2" diameter steel ball.

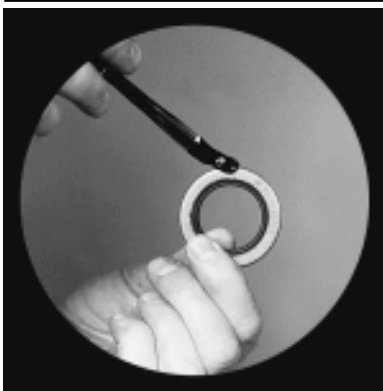


5) ASSEMBLY STEPS 5, 6, 7, 9 AND 11 APPLY TO THE SHAFT END COVER, BEARING CARRIERS, AND THE PORT END COVER.

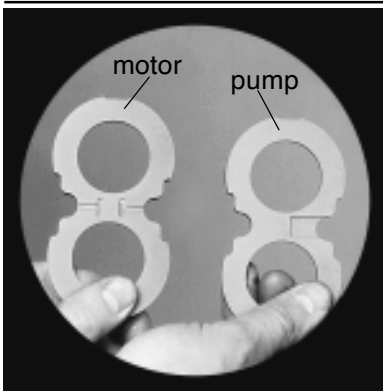
If the ring seals are being replaced, insert into the bottom of drive the gear bearing bore. The notch in the ring seal **MUST BE VISIBLE**. This is a check to be certain that the notched side is next to the bearing.



6) If any bearings have been removed from the shaft end cover, port end cover, or bearing carrier, replace the bearings by pressing them into the bearing bore with an arbor press.



7) Before inserting a new lip seal in the shaft end cover, coat the outer edge of the lip seal and its recess with Permatex Aviation Form-A-Gasket No. 3 Non-hardening Sealant™ or equivalent. 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 page 10). On the PGP030/031 series, make certain that the lip seal is fully seated in the recess. On the PGP050/051 series, do not attempt to bottom-out the seal; press it in only until it is flush with the face of the recess. Wipe off surplus sealant.



8) Check all thrust plates for wear. Replace if necessary (see page 9). Note that the thrust plates for pumps and motors are different. Pump thrust plates have a single relief pocket and must be installed with this groove on the high pressure side. Motor thrust plates are grooved on both sides.

For PGP031/051, the relief groove on all the unidirectional thrust plates must be towards the high pressure (outlet) side of the pump.

PGP030/050 series pump and motor plates resemble the motor plate illustration.



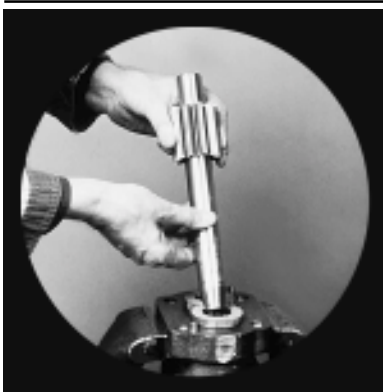
9) Grip the shaft end cover in a vise with the mounting face down. Cut 2 pocket seals 7/32" long from the pocket seal strip. Grease these pocket seals well and insert them into the middle slots on the reverse side of the thrust plate.



10) With the pocket seals facing down, place the thrust plate over the bearings in the shaft end cover. Tap thrust plate with a soft hammer to about 1/32" from the machined surface.



11) Cut 4 pocket seals approximately 1/4" long from the pocket seal strip. Insert one pocket seal into each of the slots in the thrust plate. Push each pocket seal all the way in so that it touches the roller bearings. Tap the thrust plate down firmly against the machined surface with a soft hammer. Use a sharp razor blade to trim the exposed end of the pocket seal square and flush with the thrust plate.



12) Insert the splined end of the drive shaft into the special steel sleeve (see Tool List page 10). Lightly grease the drive shaft and sleeve. Insert the integral gear and drive shaft with sleeve into the shaft end cover with a twisting motion. Be careful not to damage the double lip seal. Push down carefully until the gear rests against the thrust plate. Remove the steel sleeve. Insert the driven gear.



13) Grease the new gasket seals and insert them into the grooves in both sides of all gear housings. For the PGP031/051 - Examine all dowel pins. (See page 9.)* Before inserting a pin, make certain that the hole is clean and free from burrs. Start the pin into the hole gently and straight, tapping lightly with a soft hammer.



14) Slide the first section gear housing over the gears and tap it with a soft hammer until it rests tightly against the shaft end cover.

Be careful not to pinch the gasket seal. Squirt oil over the gears to provide initial lubrication when the pump is started.

For the PGP031/051-Line up the dowels with the matching holes. When the parts are parallel, squeeze them together or gently tap alternately over dowels with a plastic hammer until the parts become parallel and move smoothly together. Do not force.



15) With the thrust plates mounted on the bearing carrier (as in steps 9, 10, 11), position it on the gear housing so that the roller bearings receive the journals of the drive and driven gears. Make sure that the drain port in the bearing carrier is on the suction or inlet side if the unit is being built as a pump. (Motors do not have drain vents in the bearing carrier.) Make sure that the index marks are properly aligned.

Insert dowel pins (PGP031/051 only).
For multiple assemblies only.



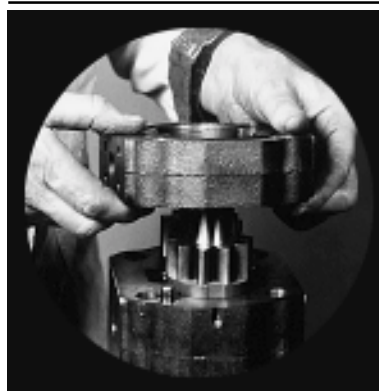
16) Insert the connecting shaft in the spline of the drive gear.

For multiple assemblies only



17) Insert the drive and the driven gears of the second section into their respective bearings. Make certain gears are in contact with the thrust plate face.

For multiple assemblies only.



18) Slide the second section gear housing over the gears and tap it tight against the bearing carrier with a soft hammer. Be careful not to pinch the gasket seal. Squirt oil over the gears to provide initial lubrication when pump is started.

For PGP031/051 line up the dowels and the holes in the 2 castings. When parts are parallel, squeeze them together or gently tap alternately over the dowels with a plastic hammer until parts move smoothly together. Do not force. Insert dowel pins (PGP031/051 only).
For multiple assemblies only



19) Place the port end cover over the gear journals and tap tightly against the gear housing. Be careful not to pinch the gasket seal. For PGP031/051 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 final seating.



20) Thread the 4 fasteners (cap screws and washers, or studs, washers, and nuts) into the shaft end cover and tighten alternately or cross-corner. Rotate the drive shaft with a 6" wrench to make certain there is no binding in the pump.



21) After the fasteners are tight and you are sure there is no internal binding, torque the diagonally opposite fasteners to 200 ft. lbs. (2400 in. lbs.).



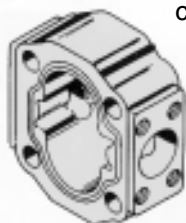
22) If the unit is equipped with an outboard bearing, guide the bearing into its recess in the shaft end cover. This is not a press fit. Insert the snap ring into its groove to retain the outboard bearing.

Guidelines for acceptable wear

Gear Housings

Wear in excess of .005" cutout necessitates replacement of the gear housing.

Place a straight-edge across the bore. If you can slip a .005" feeler gage 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 bearings wear, the cutout becomes more pronounced. Excessive cutout 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. Withdraw oil sample and check it and the tank for dirt.

Where cut-out is moderate, .005" or less, the gear housing is in good condition, and both ports are of the same size, the housing may be flipped over and reused.

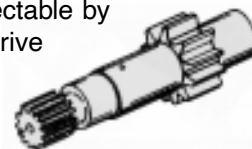
Gears

Any wear on the gear hubs detectable by touch, or in excess of .002" necessitates replacement. Scoring, grooving, or burring of the outside diameter of 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 areas or at the drive coupling. .002" wear is the maximum allowable.



Wear in the shaft seal areas 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, meaning the oil will bypass within the pump. The maximum wear allowable is .002".

Replace the thrust plates if they are scored, eroded or pitted. Check the center of the thrust plates where the gears mesh. Erosion here indicates oil contamination. Pitted thrust plates indicate cavitation or oil aeration. Discolored thrust plates indicate overheating, probably insufficient oil.



Dowel Pins

If either the dowel pin or dowel hole is damaged, the pin, 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 dowel in the hole or improper pin-to-hole fit.



Continued on the following page

Tool List**Series PGP 030/031 Series PGP 050/051***Guidelines for Acceptable Wear continued***Bearings**

If the gears are replaced; the bearings must also be replaced. Bearings should fit into the bore with a light press fit. A near, hand-fit is allowable.

Seals and Gaskets

Replace all of the rubber and polymer seals whenever disassembling the pump. Include all of the "O" rings, the pocket seals behind the thrust plates, the shaft seal, and the gasket seals.

Check Valves

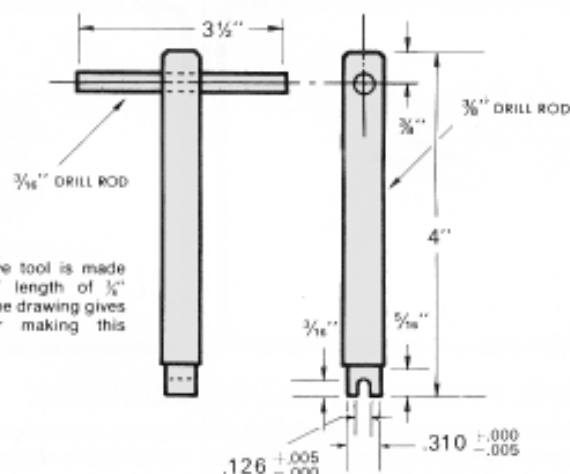
Examine the small check valves in the shaft end cover to make sure that they are intact and functioning. If there are no check valves here, make sure that the high pressure side of the shaft end cover is plugged.

**Tool List**

- Arbor press
 - Awl
 - 1-1/2" dia. steel ball
 - Bearing puller (Owatonna Tool Co. MD-956 or equivalent)
 - Clean, lintless cloths
 - Deburring tool (an old file with the cutting teeth ground off)
 - Machinists hammer
 - Soft hammer
 - Permatex Aviation Form-A-Gasket No. 3 Non-hardening Sealant™ or equivalent
 - Medium-grit, carborundum stone
 - Oil and grease
 - Snap-ring pliers
 - Prick punch
 - Sharp, razor blade
 - Scale (1/32" for graduations)
 - Small screwdriver
 - Torque wrench
 - Vise with 6" minimum open spread
 - Bar for lip seal installation
- Note: For P30/P31, use 1-3/4" dia. by 2 bar.
For P50/P51, use 2-1/2" dia. by 2" bar.
- Special steel sleeve

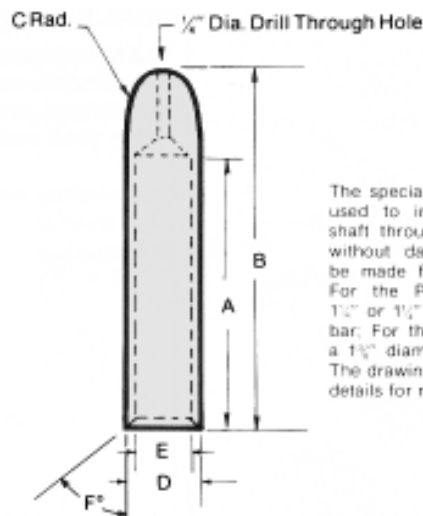
	A	B	C Radius	D Dia.	E Dia.	F° chamfer
P30/P31	3 3/8"	4 1/2"	3/8"	1.065 +.000 -.002	1.002 +.002 -.000	.015" × 45°
P50/P51	4 1/4"	5 3/8"	3/8"	1.290 +.000 -.002	1.250 +.002 -.000	.015" × 60°

All external surfaces must be free of scratches and burrs.



Check valve tool is made from a 4" length of 3/16" drill rod. The drawing gives details for making this handy tool.

Seal removal tool can be easily made from an old screwdriver. Heat the tip and bend as shown. Grind off the tip to fit the notch behind the shaft seal.



The special steel sleeve is used to insert the drive shaft through the lip seal without damage and can be made from bar stock. For the P30/P31, use a 1 1/2" or 1 3/4" diameter x 4 1/2" bar; For the P50/P51, use a 1 3/4" diameter x 5 1/2" bar. The drawing and chart give details for making this tool.

Lubrication and Oil Recommendations

All parts, with the exception of the outboard bearing, are lubricated by the hydraulic oil in the circuit. Particular attention must be paid to keep clean oil in the circuit system. Whenever there is a pump or motor failure, and there is reason to feel that metal particles may be in the system, the oil must be drained, the entire system flushed clean and any filter screens thoroughly cleaned or replaced. New oil should be supplied for the entire system. Oil suitable and recommended for use in circuits involving Parker's pumps and motors should meet the following specifications:

Viscosity:

- 50 SSU minimum @ operating temperature
7500 SSU maximum @ starting temperature
- 150 to 225 SSU @ 100° F. (37.8°C.) (generally)
44 to 48 SSU @ 210° F. (98.9° C.) (generally)

Approximate SSU @

Oil Grade	100° F. (37.8° C.)	210° F. (98.9° C.)
SAE 10	150	43
SAE 20	330	51

Viscosity Index: 90 minimum

Aniline Point: 175 minimum

Recommended Additives: Foam depressant, rust and oxidation inhibitors.

Other Desirable Characteristics:

- Stability of physical and chemical characteristics.
- High demulsibility (low emulsibility) for separation of water, air and contaminants.
- Resistant to the formation of gums, sludges, acids, tars and varnishes.
- High lubricity and film strength.

General Recommendations:

A good-quality hydraulic oil conforming to the characteristics listed above is essential to the satisfactory performance and long life of any hydraulic system.

Oil should be changed in regular schedules in accordance with the manufacturer's recommendations, and the system should also be periodically flushed.

Oil temperature in reservoir must not exceed 200° F., (93.3° C.) with a maximum temperature of 180° F. (82.2° C.) recommended. Higher temperatures will result in rapid oil deterioration.

Reservoir capacity should equal in gallons the pump output in gpm or the total gpm of all pumps, where there is more than one in the system.

Oil poured into the reservoir should pass through a 100 mesh screen. Pour only clean oil from clean containers into the reservoir. A 100 mesh screen may be used in the suction line leading to the pump. A suction filter should be of sufficient size to handle twice the pump capacity. It must be cleaned and checked regularly to avoid damage due to contamination and cavitation.

Normal Temperatures:

0° F. (-18° C.) to 100° F. (37.8° C.) Ambient
100° F. (37.8° C.) to 180° F. (82.2° C.) System. Be sure your oil is recommended for the temperatures you expect to encounter.

Cold Weather Operation:

Oils for use in cold weather should have a viscosity not exceeding 7500 SSU at the minimum start-up temperature. A pour point of at least 20° F. below start-up temperature is recommended. Start-up procedures should allow for a gradual warm-up until the oil reaches a reasonably fluid state.

Continued on the following page

Lubrication and Oil Recommendations continued

The Use of Other Fluids:

- Automatic Transmission Fluid (ATF): General experience here has been satisfactory; however, ATF oils are sometimes too expensive for normal use in hydraulic systems.
- Diesel Fuel or Kerosene (Coal Oil): Though sometimes used as dilutants for cold weather operations, these fluids are not recommended, as they are not sufficiently refined products.
- Fire Resistant Fluids: Of the several different types, only the inverted emulsion types may be used without changing to special seals, packing, gasket, hose, etc., compositions. Their use may materially reduce pump life. Experience indicates that the use of FR fluids can be disastrous unless certain precautions are followed. **DO NOT USE ANY FIRE RESISTANT FLUIDS OR NON-PETROLEUM OILS WITHOUT CONSULTING OUR TECHNICAL SERVICE DEPARTMENT.**
- These suggestions are intended as a guide only. **OBTAIN YOUR FINAL FLUID RECOMMENDATIONS FROM YOUR FLUID SUPPLIER.**

Recommended Start-up Procedure For New or Rebuilt Pump

Before installing a new or rebuilt pump, back off the main relief valve until the spring tension on the adjusting screw is relieved. This will avoid the possibility of immediate damage to the replacement unit in the event that the relief valve setting had been increased beyond the recommended operating pressure, prior to removing the old unit.

Before connecting any lines to the pump, fill all ports with clean oil to provide initial lubrication. This is particularly important if the unit is located above the oil reservoir.

After connecting the lines and mounting the replacement unit, operate the pump at least two minutes at no load and at low rpm (400 min.) During this break-in period, the unit should run free and not develop an excessive amount of heat. If the unit operates properly, speed and pressure can then be increased to normal operating settings.

Reset the main relief valve to its proper setting while the pump is running at maximum operating engine (motor) speed for the vehicle.

**ALWAYS USE AN ACCURATE GAUGE
WHEN ADJUSTING THE RELIEF VALVE
PRESSURE SETTING.**

Recommended Test Procedure

To be sure that there is an adequate supply of oil for the pump, maintain at least one gallon of oil for each gpm of pump capacity.

If one section of a tandem pump is being tested, make sure that all other sections not being tested are adequately supplied with oil. If any of the other sections run dry, or if the plugs are left in the ports, serious and permanent damage will result.

The oil should be a good-quality hydraulic oil rated at 150 SSU at 100° F., with the oil temperature held at 120° F. plus or minus 5°F. (Test procedures are described in detail in SAE handbooks; see Hydraulic Power Pump Test Procedure, SAE J745c.)

The feed line must be of adequate size with no more than 5" mercury vacuum adjacent to the pump inlet. As a rule, the feed line must provide a feed flow velocity not in excess of 8 feet per second.

Hot oil must not be fed into a cold pump. It may seize. Jogging the pump may prevent seizure.

Operate the pump at least two minutes at zero pressure and at moderate speed (not over 1500 rpm)

If the pump becomes hot to touch, it is binding and may seize. This doesn't happen often, but if it does, the pump will have to be disassembled and rebuilt, with extra care taken to remove burrs and to assure freedom from binding.

Gradually increase pressure on the pump, until the desired test pressure has been reached. This should take about five minutes.

Pump output flow should run close to rated catalog performance figures, which are averaged from testing several pumps. A 5% lower reading may be used as a rated minimum if new or relatively new parts have been used. Worn parts, which meet the guidelines for acceptable wear, (See page 9) may be used to

rebuild the pump, however, the performance rating may decrease. (A 10-15% lower rating can be expected.)

Many repairmen measure the output at normal operating speed and at zero pressure, then again at 1000 psi (or the operating pressure of the equipment), and allow a volume decrease approximating the listing below. This is a suggested reference, only which makes allowance for re-used parts.

PGP030/050 pumps are generally tested to 2000 psi maximum.

At test speeds other than 1800 rpm, gpm delivery will vary almost proportionately, but the same (drop-off) figures should be used.

Be sure to run the pump in the direction for which it was designed and built. Driving the pump in the wrong direction will build up pressure behind the shaft seal, damaging it and necessitating replacement.

Since it is rarely feasible to test motors on dynamometers, the practical procedure is to test them as pumps, running complete testing procedures in each direction.

After completing testing procedures, the pump is ready for installation and immediate duty operation on the equipment. Again, it must be remembered that to prevent seizure, hot oil must not be fed into a cold pump.

GPM DELIVERY at 1800 rpm 100 psi	GPM DROP OFF AT . . .			
	1000 psi/70 bar	1500 psi/105 bar	2000 psi/140 bar	2500 psi/175 bar
5 — 14	2 to 3	2½ to 3½	3 to 4	3½ to 4½
15 — 25	2½ to 3½	3 to 4	3½ to 5	4 to 5½
26 — 50	3 to 4	4 to 5	4 to 6	4½ to 6½

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Parker Hannifin Corporation

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