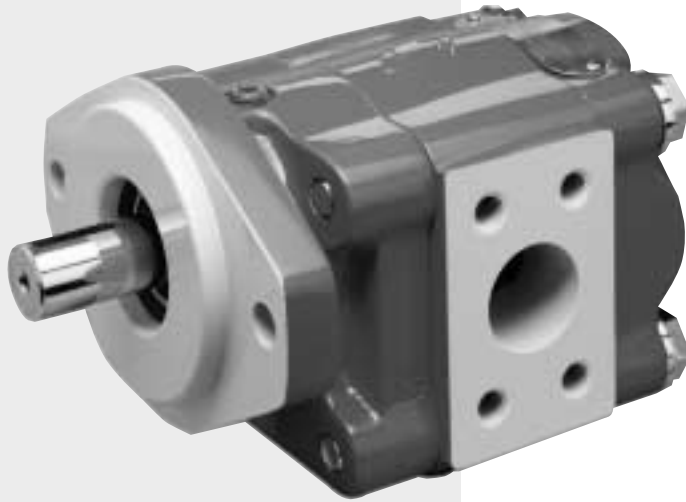




Service Manual
HY09-SM030/031/050/051/US

Service Manual PGP030/031 Series PGP050/051 Series

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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.

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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.

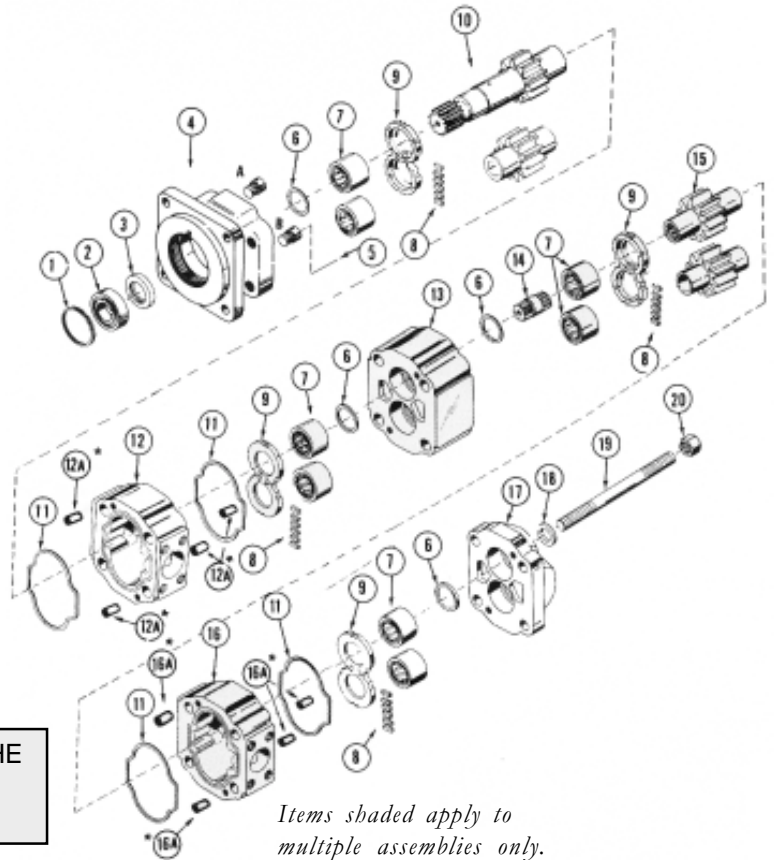
USE CAUTION IN GRIPPING ALL PARTS IN THE VISE TO AVOID DAMAGING MACHINED SURFACES.

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.



Items shaded apply to multiple assemblies only.

- 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.



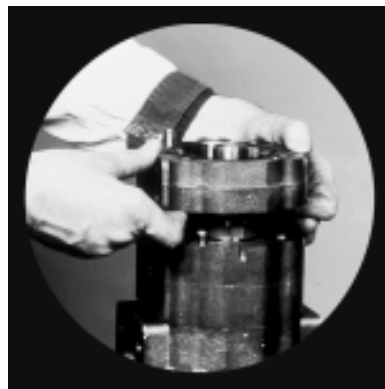
1) Mount the pump in a vise with the shaft end pointing down. Index mark all sections with a punch. Be sure to align these marks when reassembling.



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.*



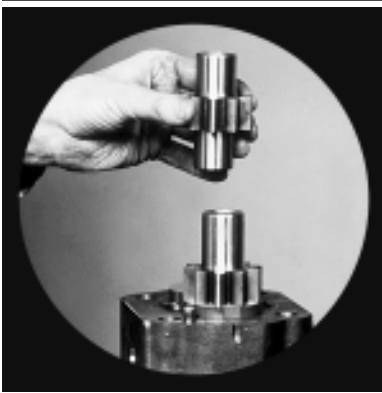
6) Lift or pry off the bearing carrier carefully to prevent damage to contact face and edges. For PGP031/051, pry the bearing carrier off the dowels from opposite sides. Take care not to damage the machined surfaces. Lift off the bearing carrier. *For multiple assemblies only.*



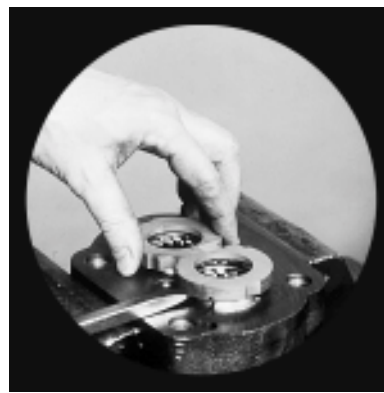
7) Remove the drive gear connecting shaft.
For multiple assemblies only.



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.



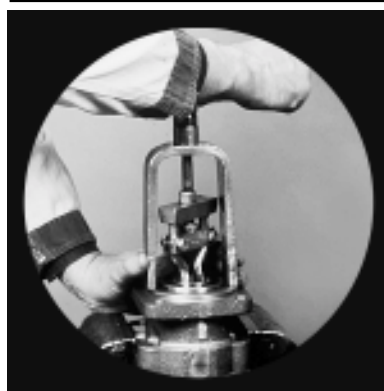
11) Examine all roller bearings for scoring, spalling, or pitting. If replacement is necessary, remove the bearings with a bearing puller.



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.

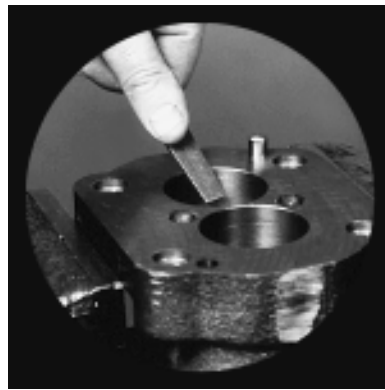


15) With the mounting face down, remove the double lip seal by inserting the special seal removal tool (see Tool List Pg. 10) into the notch between the double lip seal and the shaft end cover. Tap the seal out and discard.

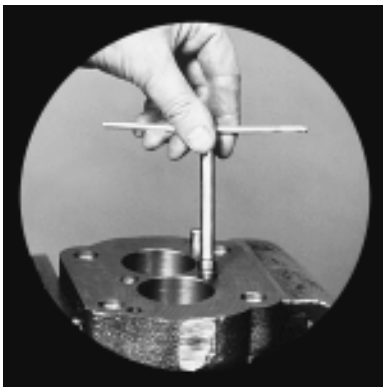
Start Assembly Here



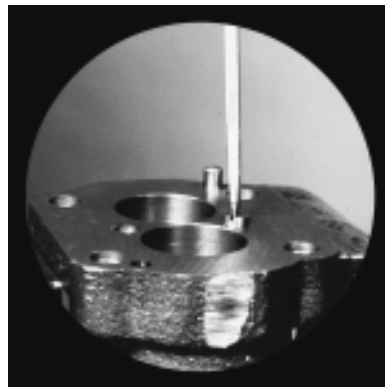
1) Stone off all machined surfaces with a medium-grit, carborundum stone.



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.



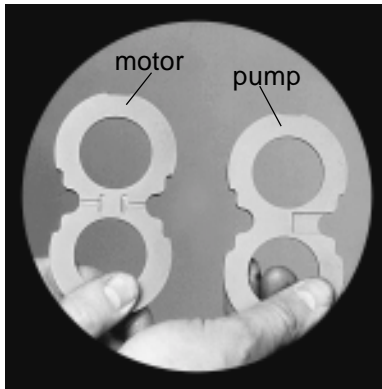
5) ASSEMBLY STEPS 5, 6, 7, 9 AND 11 APPLY TO THE SHAFT END COVER, BEARING CARRIERS, AND THE PORT END COVER.
If the ring seals are being replaced, insert into the bottom of drive the gear bearing bore. The notch in the ring seal **MUST BE VISIBLE**. This is a check to be certain that the notched side 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.



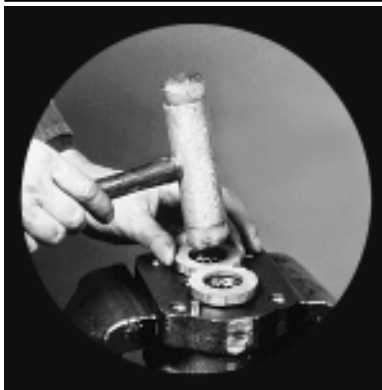
7) Before inserting a new lip seal in the shaft end cover, coat the outer edge of the lip seal and its recess with Permatex Aviation Form-A-Gasket No. 3 Non-hardening Sealant™ or equivalent. With the metal side of the lip seal up, press it into the mounting flange side of the shaft end cover with an 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.



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.

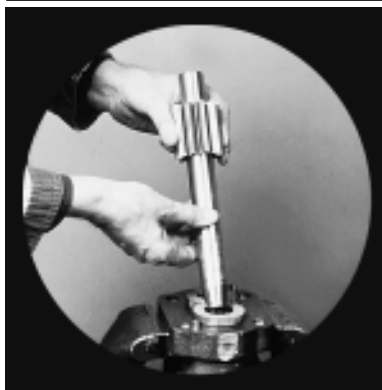


PGP030/050 series pump and motor plates resemble the motor plate illustration.

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.



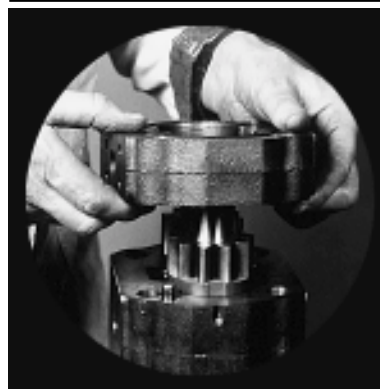
15) With the thrust plates mounted on the bearing carrier (as in steps 9, 10, 11), position it on the gear housing so that the roller bearings receive the journals of the drive and driven gears. Make sure that the drain port in the bearing carrier is on the suction or inlet side if the unit is being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



16) Insert the connecting shaft in the spline of the drive gear. *For multiple assemblies only*



Insert dowel pins (PGP031/051 only). *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.



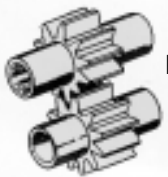
Pressure pushes the gears against the housing on the low pressure side. As the hubs and bearings wear, the cutout becomes more pronounced. Excessive cutout in a short period of time indicates excessive pressure or

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.

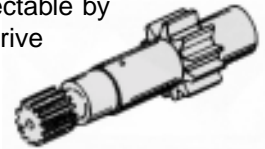
Gears

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

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.

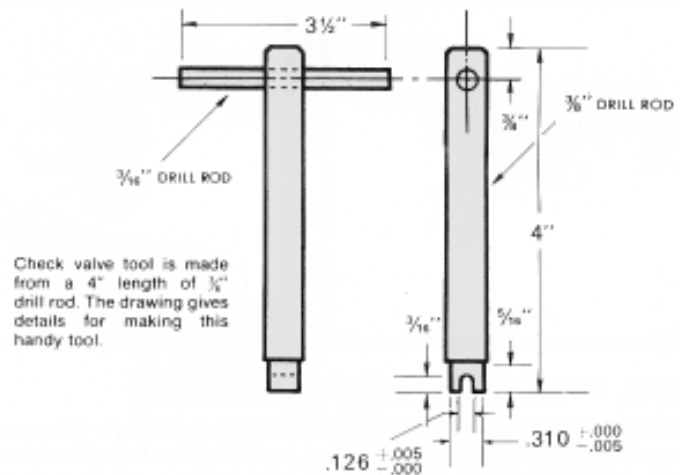
Check Valves

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.



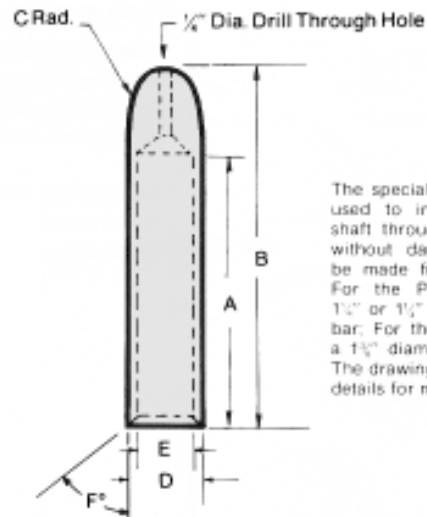
Tool List

- 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



Check valve tool is made from a 4" length of 3/8" 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.

	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.

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. (-1 8° 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	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

Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such items, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.**

NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGNS OR SPECIFICATIONS.

5. Limitation Of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter 'Events of Force Majeure'). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

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Commercial
Hydraulics



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Parker Hannifin Corporation

About Parker Hannifin Corporation

Parker Hannifin is a leading global motion-control company dedicated to delivering premier customer service. A Fortune 500 corporation listed on the New York Stock Exchange (PH), our components and systems comprise over 1,400 product lines that control motion in some 1,000 industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, and electromechanical motion-control solutions. Our Company has the largest distribution network in its field, with over 7,500 distributors serving nearly 400,000 customers worldwide.

Parker's Charter

To be a leading worldwide manufacturer of components and systems for the builders and users of durable goods. More specifically, we will design, market and manufacture products controlling motion, flow and pressure. We will achieve profitable growth through premier customer service.

Product Information

North American customers seeking product information, the location of a nearby distributor, or repair services will receive prompt attention by calling the Parker Product Information Center at our toll-free number: 1-800-C-PARKER (1-800-272-7537). In Europe, call 00800-C-PARKER-H (00800-2727-5374).

The Aerospace Group

is a leader in the development, design, manufacture and servicing of control systems and components for aerospace and related high-technology markets, while achieving growth through premier customer service.



The Climate & Industrial Controls Group

designs, manufactures and markets system-control and fluid-handling components and systems to refrigeration, air-conditioning and industrial customers worldwide.



The Fluid Connectors Group

designs, manufactures and markets rigid and flexible connectors, and associated products used in pneumatic and fluid systems.



The Seal Group designs, manufactures and distributes industrial and commercial sealing devices and related products by providing superior quality and total customer satisfaction.



The Hydraulics Group

designs, produces and markets a full spectrum of hydraulic components and systems to builders and users of industrial and mobile machinery and equipment.



The Filtration Group

designs, manufactures and markets quality filtration and clarification products, providing customers with the best value, quality, technical support, and global availability.



The Automation Group

is a leading supplier of pneumatic and electro-mechanical components and systems to automation customers worldwide.



The Instrumentation Group

is a global leader in the design, manufacture and distribution of high-quality critical flow components for worldwide process instrumentation, ultra-high-purity, medical and analytical applications.



Commercial Hydraulics



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