





FOREWORD

Headquartered in Sullivan, Illinois, Hydro-Gear is a world leader in the design, manufacture, and service of quality hydrostatic transaxles for the lawn and garden industry. The mission of our company is to be recognized by our customers and the industry as a world-class supplier and the quality leader in everything we do.

This Service and Repair Manual is designed to provide information useful in servicing the Hydro-Gear 6cc (0.37 cu in.) PC Series, the 10 cc (0.61 cu in.) PG Series, the 12 cc (0.73 cu in.) PJ Series, the 16 cc (0.98 cu in.) PR Series, and the 21 cc (1.28 cu in.) PW Series pumps.

Also included is a glossary of terms that are frequently used throughout the industry and in Hydro-Gear service publications. Understanding terminology is very important!

It is necessary, and good shop practice, that your service area be equipped with proper tools and the mechanics to be supplied with the latest information available. All repair procedures illustrated in this guide are suggested, but preferred methods of repair. Some repair procedures require that the pump be removed from the vehicle.

This is not a certification, test or study guide for a certification test. If a technician is interested in certification they should contact an agent representing the OPEESA (Outdoor Power Equipment and Engine Service Association) (860-767-1770) or their Hydro-Gear Distributor. Many distributors will be hosting certification testing. These study guides will cover most of the products and manufacturers in our industry.

For more information about Hydro-Gear or our products, please contact your Central Service Distributor, or call our Customer Service Department at (217) 728-2581.

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SECTION 1. DESCRIPTION AND OPERATION

INTRODUCTION

The purpose of this manual is to provide information useful in servicing the Hydro-Gear PC, PG, PE PJ, PK, PR. PW and PY Pumps. This manual includes the pump's general descriptions, hydraulic schematics, technical specifications, servicing and troubleshooting procedures for the pumps.

The P Series Pumps normally will not require servicing during the life of the vehicle in which it is installed. Should other servicing be required, the exterior of the pump will need to be thoroughly cleaned before beginning most procedures.

GENERAL DESCRIPTION

The P Series Pumps can be combined with wheel motors and other remotely located units. These pumps provide an infinitely variable speed range between zero and full displacement in both forward and reverse modes of operation.

The P Series Pumps are of the axial piston design, utilizing spherical nosed pistons. A compression spring, located inside each piston, holds the nose of the piston against a thrust bearing race.

The variable displacement pump features a cradle swashplate with a direct-proportional displacement control. Movement of the directional control shaft produces a proportional swashplate movement and a change in pump flow and/or direction.

Reversing the direction of the angle of the swashplate reverses the flow of oil from the pump and thus reverses the direction of motor output rotation.

A fixed displacement gerotor charge pump is provided in P Series Pumps. Oil from an external reservoir and filter is pumped into the closed loop by a charge pump. Fluid not required to replenish the closed loop flows either into the pump housing through a cooling orifice, or back to the charge pump inlet through the charge pressure relief valve.

Check or shock valves are included in the pump end cap to control the makeup oil flow for the system. The size and type of check valve can play an important role on the system pressure, response, and amount of heat generated, due to the recirculation of makeup oil flow. Shock valves are factory preset pressure regulating check valves. In some applications of the P Series Pumps, it is desirable to move the machine for short distances at low speeds without operating the engine. A screwtype bypass valve is utilized in the pumps to permit movement of the machine. The bypass valve is fully opened when unscrewed two (2) turns maximum. The bypass valve allows oil to be routed from one side of the pump/motor circuit to the other, thus allowing the motor to turn with minimal resistance. An increase in resistance will occur with movement at higher speeds. The bypass valve must be fully closed during normal operation.



WARNING

Actuating the bypass will result in the loss of hydrostatic braking capacity. The machine must be stationary, on a level surface and in neutral when actuating the bypass.

Additionally, some pumps may be equipped with an Auxiliary Pump. The Auxiliary incorporates the principles of the charge gerotor assembly and provides the capability of an external auxiliary flow for an alternate hydraulic circuit to operate accessories without loss of drive.

P Series



EXTERNAL FEATURES - PC SERIES



Figure 1. PC Pump with Standard Charge Pump



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EXTERNAL FEATURES - PG / PE SERIES



Figure 2. PG Pump With Standard Charge Pump



EXTERNAL FEATURES - PJ SERIES



Figure 3. PJ Pump with Standard Charge Pump



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EXTERNAL FEATURES - PK SERIES



Figure 4. PK Pump With Standard Charge Pump



EXTERNAL FEATURES - PR SERIES



Figure 4. PR Pump With Standard Charge Pump



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EXTERNAL FEATURES - PW / PY SERIES



Figure 5. PW / PY Pump With Standard Charge Pump



HYDRAULIC SCHEMATIC



Figure 6. PC, PG, PJ, PK and PR Pumps with Standard Charge Pump





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HYDRAULIC SCHEMATIC



Figure 8. PW / PY Series Pump With Standard Charge Pump



Figure 9. PW / PY Series Pump With Auxiliary Charge Pump



GRAPHICAL SCHEMATIC



Figure 10. P Series Pump With Standard Charge Pump

Figures 10 represents a graphical schematic of the P Series Pump with standard charge pump. Figure 10 provides a graphical illustration of the hydraulic oil circuit.

The input shaft and pump cylinder block are turned in one direction only by the engine/drive belt/pulley combination or direct drive gear box.

The oil is drawn through an external filter by the charge pump. The filter prevents contaminants within the reservoir from entering into the charge pump gerotor.

The charge pump supplies fluid to keep the closed loop pressurized, preventing cavitation and providing cooling oil flow for the system.

The charge relief valve is used to maintain charge at a predetermined pressure.

Output of the system oil flow is controlled by the direction and amount that the swashplate is angled. As the pump pistons compress, they force oil into one of two passageways ("A" or "B") in the system hydraulic circuit. Oil is supplied externally under pressure to an external load, (e.g., a vehicle wheel motor).

As the angle of the pump swashplate is increased, the amount of oil being pumped will increase and cause a higher speed output of the wheel motor. Reversing the angle of the swashplate will reverse the direction of the oil flow. During the operation of the pump, fluid is "lost" from the hydraulic loop through leak paths designed into the product for lubrication and cooling purposes (around pistons, under the rotating cylinder block, etc.). This "lost" fluid returns to the reservoir through the case drain. This fluid must be made up in the loop. The charge pump makes up this fluid loss.

The makeup flow is controlled (or directed) by the system check valves. The check valves are used to direct makeup fluid into the low pressure side of the closed loop. Each check valve will either be held open or closed, depending upon the direction of the vehicle operation: Closed in a pressurized system passage, open in a low pressure, "charged" system passage.





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TECHNICAL SPECIFICATIONS

Product Type	PC	PG/PE	PJ/PK	PR	PW/PY	PY 6cc Aux
Displacement						
in³/rev [cc/rev]	0.37 [6.1]	0.62 [10.2]	0.73 [12]	0.97 1.33 [16] [21.8]		.33 1.8]
Input Speed						
Minimum Loaded RPM			3	8600 800		
System Operating Pressure						
Continuous psi [bar]	750 [51]	11 1000 [75] 1250[86]				
Intermittent	1750 [120]					
Peak	1750 [120]	2100 [145]		2500 [172]		
psi [bar]	2500 172]	3500	[240]		3750 [260]	
Pump Performance @2400 rpm/1000 psi gpm [l/min] @3000 rpm/1000 psi gpm [l/min] @3600 rpm/1000 psi gpm [l/min]	3.6 [13.6] 4.5 [17.0] 5.4 [20.4]	6.1 [23.1] 7.6 [28.8] 9.2 [34.8]	7.1 [26.8] 8.9 [33.6] 10.8 [40.8]	9.6 [36.3] 12 [45.4] 14.4 [54.5]	13.1 16.4 19.6	[49.6] [62.1] [74.2]
Case Pressure Maximum @ Cold Start psi [bar Continuous - Max. psi [bar]						
Inlet Vacuum Maximum Continuous Inches Mercury	4					
Charge Pump Displacement(s)						
in³/rev [cc/rev]	0.13 [2.1]	0.11/0.13 [1.9/2.1]	0.19 [3.2]	0.13 [2.1	3/0.19 /3.2]	0.25 [4.1]
Auxiliary Pump Displacement in³/rev [cc/rev]	0.19[3.2] 0.37[6.1]			0.37 [6.1]		
Auxiliary Pump Relief Setting						
psi [bar]	650 950-1400 [45] [65.5-96.5]			950-1400 [65.5-96.5]		
Auxiliary Pump Performance @3200 rpm, 500 psi, 70 SUS [13 Cst] oil, & 180°F gpm	1.8-2.0 4.4-5.0			4.4-5.0		
[l/min]	[6.8-7.6] [16.6-18			[16.6-18.9]		
Control Torque Required to Stroke Pump [Approximate - 20°External Stroke Angle] Ib-in / 1000 psi [N-m / 70 bar] Ib-in / 500 psi [N-m / 35 bar]	75 [8.5] 55 [6.2]	8 [9 (35 9.6] 60 9.8]	95 [10.7] 75 [8.5]	1 [1 { [9	05 1.9] 35 0.6]
Pump Oil Temperature Maximum Intermittent (hottest point) °F [°C]	230 [110]					
Normal Operating Range °F [°C]	-10 to 200 I-23 to 931					
Fluid Viscosity Limits @ 230°F [110°C] Optimum SUS [cSt] Minimum SUS [cSt]	70 [13] 55 [9]					
Weight of Unit	7 [3.2]	8 [3.6]	12.65 [5.7]	12 [5.4]	14 [6.3]	17 [7.7]
Inlet Filtration Requirement						
Nominal micron				20		

Table 1: P Series Pump Technical Specifications

P Series



PRODUCT IDENTIFICATION

The label in Figure 11 is located on the pump housing. It identifies the model and configuration of the pump.



Figure 11. P Series Pump Configuration Label

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P Series

SECTION 2. SAFETY

This symbol points out important safety instructions which, if not followed, could endanger the personal safety and/or property of yourself and others. Read and follow all instructions in this manual before attempting maintenance on your P Series Pump. When you see this symbol - **HEED ITS WARNING.**



WARNING

POTENTIAL FOR SERIOUS INJURY

Inattention to proper safety, operation, or maintenance procedures could result in personal injury, or damage to the equipment. Before servicing or repairing the P Series Pump, read fully and understand the safety precautions described in this section.

PERSONAL SAFETY

Certain safety precautions must be observed while servicing or repairing the P Series Pump. This section addresses some of these precautions but must not be considered an all-inclusive source on safety information. This section is to be used in conjunction with all other safety material which may apply, such as:

- Other manuals pertaining to this machine
- · Local and shop safety rules and codes
- · Governmental safety laws and regulations

Be sure that you know and understand the equipment and the hazards associated with it. Do not place speed above safety.

Notify your supervisor whenever you feel there is any hazard involving the equipment or the performance of your job.

Never allow untrained or unauthorized personnel to service or repair the equipment.

Wear appropriate clothing. Loose or hanging clothing or jewelry can be hazardous. Use the appropriate safety equipment, such as eye and hearing protection, and safety-toe and slip-proof shoes.

Never use compressed air to clean debris from yourself or your clothing.

TOOL SAFETY

Use the proper tools and equipment for the task.

Inspect each tool before use and replace any tool that may be damaged or defective.

WORK AREA SAFETY

Keep the work area neat and orderly. Be sure it is well lit, extra tools are put away, trash and refuse are in the proper containers, and dirt or debris have been removed from the working areas of the machine.

The floor should be clean and dry, and all extension cords or similar trip hazards should be removed.

SERVICING SAFETY

Certain procedures may require the vehicle to be disabled in order to prevent possible injury to the servicing technician and/or bystanders.

The loss of hydrostatic drive line power may result in the loss of hydrostatic braking capability.

Some cleaning solvents are flammable. Use only approved cleaning materials: Do not use explosive or flammable liquids to clean the equipment.

To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Discard used cleaning material in the appropriate containers.

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SECTION 3. TROUBLESHOOTING

WARNING

Do not attempt any servicing or adjustments with the engine running. Use extreme caution while inspecting the drive belt assembly and all vehicle linkage!

Follow all safety procedures outlined in the vehicle owner's manual!

In many cases, problems with the P Series Pump are not related to a defective pump but are caused by slipping drive belts, partially engaged bypass valves, and loose or damaged control linkages. Be sure to perform all operational checks and adjustments outlined in Section 3 before assuming the pump is malfunctioning. Table 2 below provides a troubleshooting checklist to help determine the cause of operational problems.

Corrective Action			
RIVE/TRACK STRAIGHT			
Refer to vehicle manufacturer suggested pressure			
Repair, adjust or replace vehicle linkage			
Tighten pump bypass per External Maintenance step 9, page 17			
Check all external lines and connections to pump inlet			
UNIT IS NOISY			
Adjust input speed above 1800 rpm and below 3600 rpm			
Fill reservoir to proper level or change oil			
Reduce vehicle load			
Purge hydraulic system per Purging Procedures on page 18			
Tighten pump bypass per External Maintenance step 9, page 17			
Check all external lines and connections and filter to pump inlet			

Table 2. Pump Troubleshooting Checklist

P Series

Possible	Cause
----------	-------

Possible Cause	Corrective Action		
UNIT HAS NO/LOW POWER			
Engine speed low	Adjust to correct rpm setting		
Control linkage bent, loose or out of adjustment	Repair or replace vehicle linkage		
Drive belt slipping or pulley damaged	Repair or replace drive belt or pulley		
Oil level low or contaminated oil	Fill reservoir to proper level or change oil		
Excessive loading	Reduce vehicle load		
Bypass loose	Tighten pump bypass per External Maintenance step 9, page 17		
Air trapped in hydraulic system	Purge hydraulic system per Purging Procedures on page 18		
Inlet leak	Check all external lines and connections to pump inlet		
Inlet filter clogged	Replace inlet filter		
Suspected internal damage	Check pump by performing Flow Test on page 15		
UNIT OPERA	TING HOT		
Debris buildup	Remove debris from pump and fan		
Cooling fan or heat exchanger damaged	Repair or replace cooling fan or heat exchanger		
Oil level low or contaminated oil	Fill reservoir to proper level or change oil		
Excessive loading	Reduce vehicle load		
Air trapped in hydraulic system	Purge hydraulic system per Purging Procedures on page 18		
Inlet leak	Check all external lines and connections to pump inlet		
PUMP LEAKS OIL			
Damaged seals and gaskets	Remove debris, replace seals		
Air trapped in hydraulic system	Purge hydraulic system per Purging Procedures on page 18		

P Series



<u>P-SERIES FLOW TEST KIT INSTRUCTIONS - BLN-51334 April 2011</u> (This Instruction Sheet supersedes all previous flow testing instruction)

Description: P Series Flow Test Kit (Part Number 70661)

(Part Number 70661 Supersedes Part Numbers 70511 and BB-76810)

Purpose: The design purpose of the P Series Flow Test Kit is to allow the customer to isolate the pump from the wheel motor and determine if the pump is acceptable. The following information can be used to install and test the pump by simulating a wheel motor load.

WARNING CERTAIN PROCEDURES REQUIRE THE VEHICLE ENGINE TO BE OPERATED AND THE VEHICLE TO BE RAISED OFF

OF THE GROUND. TO PREVENT POSSIBLE INJURY TO

WARNING

DO NOT ATTEMPT ANY ADJUSTMENTS WITH THE ENGINE RUNNING. USE EXTREME CAUTION WHILE WORKING IN OR AROUND ALL VEHICLE LINKAGE!

INSTALLATION AND TESTING PROCEDURES:

1. Disconnect the system hoses at the wheel motor, or system hoses from the pump and connect the P Series Flow Test Kit. (Special care should be taken to prevent contamination debris from entering pump or wheel motor system ports).

Note: Using the Bi-Directional Flow Test Kit, determination of directional flow is not necessary. The flow meter may be connected in either direction into the forward and reverse high pressure system lines.

<u>CAUTION:</u> Ensure all fittings and hoses are attached securely. This test is being completed on the vehicle's high pressure system lines. Failure to perform this properly could result in bodily injury.

TESTING PROCEDURES:

- **1.** Raise the drive tires off the ground. Block the remaining tires on the ground to prevent accidental vehicle movement.
- 2. Open the restriction valve all the way.
- **3.** Make certain all external pump directional control stops are removed or backed off on the vehicle linkage to obtain full pump directional control arm travel.
- 4. Start the engine and engage the drive pulley if necessary.
- 5. Bring the engine to maximum operating speed.

(This should not exceed 3600 rpm input speed on the PC, PL, PG, PE, PJ and PK Series pumps) (This should not exceed 3400 rpm input speed on the PR Series pumps) (This should not exceed 2600 rpm input speed when testing the PW and PY Series pumps) Engine speed adjustment may be necessary to obtain 2600 rpm.

<u>CAUTION:</u> Damage to the flow meter and/or re-calibration may result from testing at input speeds that exceed 2600 rpm on the PW and 3400 rpm on the PR Pumps.

- **6.** With the directional control lever (on the vehicle) for the pump being tested, move the control arm in full forward motion. (It may be necessary to lock the control arm into full forward position to prevent false readings).
- **7.** Operate without any load for approximately 30 seconds to 1 minute. This allows the system oil temperature to rise.

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Note: Raising the system oil temperature will make a difference in the readings you receive. It has been determined that to complete this test accurately, the oil temperature must be near system operating temperatures. Suggested temperature range is 160°- 210°F (71.1° - 98.9°C).

- 8. On the PC, PG, PJ, PE, PK, PL, PR, PW and PY, tighten the flow meter restriction valve until the gauge reads 300 psi (21bar). Record the flow reading on the Bi-Directional Flow Meter.
- **9.** Increase the pressure to 1100 PSI (76 bar) for all models (PC, PG, PJ, PE, PK, PL, PR, PW and PY). Record the flow reading on the Bi-Directional Flow Meter.

10. The acceptable gpm "flow droop" or (difference) is:

PC	1.0 gpm (3.7 l/min)
PG/PL/PE	1.5 gpm (5.6 l/min)
PJ/PK	2.0 gpm (7.6 l/min)
PR	2.5 gpm (9.4 l/min)
PW/PY	2.5 gpm (9.4 l/min)

If the difference exceeds these values the pump would not be operating efficiently and should be repaired or replaced.

TEST EXAMPLE: PE/PG/PL



300 psi (21 bar) reading

7 gpm (26 l/min) (1st reading)





SECTION 4. SERVICE AND MAINTENANCE

NOTE: Any servicing dealer attempting a warranty repair must have prior approval before conducting maintenance of a Hydro-Gear product, unless the servicing dealer is a current authorized Hydro-Gear Service Center.

EXTERNAL MAINTENANCE

Regular external maintenance of a P Series Pump should include the following:

- 1. Check the vehicle operator's manual for the recommended load ratings. Insure the current application does not exceed load rating.
- 2. Check fluid level in reservoir in accordance with vehicle manufacturer's recommendations.

NOTE: After the oil has been drained and maintenance has been performed, clean oil should be poured directly into the pump inlet and high pressure ports prior to plumbing connections and pump start-up.

- Inspect the vehicle drive belt, idler pulley(s), and idler spring(s). Insure that belt slippage is not causing low input rpm to the pump.
- 4. Inspect all external plumbing for possible leaks or loose fittings. An air leak may be difficult to detect on the "suction side" or inlet line to the pump. Refer to Purging Procedures page 18.
- 5. Insure correct inlet filter(s) has been installed in accordance with the vehicle manufacturer recommendations.
- 6. Insure the reservoir is free of contaminants and is properly vented.
- Inspect the P Series Pump cooling fan (if applicable) for broken or distorted blades and remove any obstructions (grass clippings, leaves or dirt). Inspect oil cooler (if applicable) for damaged fins and debris.

- 8. Inspect the vehicle control linkage to the directional control arm on the P Series Pump. Also, insure the control arm is securely fastened to the trunnion arm.
- 9. Inspect the bypass on the P Series Pump to insure it is properly engaged for operation. If the bypass is not fully engaged (rotated fully clockwise) it will not function properly. For vehicle movement without engine power, the bypass may be backed out (2) turns maximum. This is only recommended for movement of short distances at low speeds.



WARNING

Loosening the bypass will result in loss of hydraulic braking capability.

SERVICE AND MAINTENANCE PROCEDURES

NOTE: Damage to P Series Pumps may result from external or internal contamination, heat from excess debris or lack of lubrication and over-pressurization of the hydrostatic system. Follow guidelines established in this manual and the vehicle manufacturer's recommendations.

All the service procedures presented on the following pages can be performed while the P Series Pump is mounted on the vehicle. Any servicing beyond those presented in this section must be performed after the pump has been removed from the vehicle.

FLUIDS

The fluids used in Hydro-Gear products have been carefully selected, and only equivalent, or better products should be substituted.

Typically, an engine oil with a minimum rating of 55 SUS (9.0 cSt) at 230° F (110° C) maximum operating temperature and an API classification of SJ/CD is allowed. Refer to the vehicle manufacturer for recommended oil.



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FLUID VOLUME AND LEVEL

Certain situations may require additional fluid to be added or even replaced. Refer to the vehicle manufacturer's recommendations for the proper fill location and level. After maintenance or oil change, follow purging procedures below and check the fluid level once the unit has been operated for approximately 1 minute.

FLUID CHANGE

In the event of oil contamination or degradation, oil addition or change may alleviate certain performance problems. Refer to the vehicle manufacturer's recommended oil change frequency. Refer to purging procedures below after changing fluids.

FILTERS

An inlet filter is required to insure that only clean fluid enters the system. Refer to the vehicle manufacture for approved filter replacement.

PURGING PROCEDURES

Due to the effects air has on efficiency in hydrostatic drive applications, it is critical that air is removed or purged from the system.

These purge procedures must be preformed anytime a hydrostatic system has been opened for maintenance or repair, or if any additional oil has been added to the system.

Air creates inefficiency because it has compression and expansion rates that are higher than that of oil.

Air trapped in the oil may cause the following symptoms:

- 1. Noisy operation.
- 2. Lack of power or drive after short-term operation.
- 3. High operation temperature and excessive expansion of oil.

Before starting, make sure the reservoir is at the proper oil level. If it is not, fill to the vehicle manufacturer's specifications.

The following procedures should be performed with the vehicle drive wheels off the ground, then repeated under normal operating conditions.



WARNING

POTENTIAL FOR SERIOUS INJURY

Certain procedures require the vehicle engine to be operated and the vehicle to be raised off of the ground. To prevent possible injury to the servicing technician and/or bystanders, insure the vehicle is properly secured.

- With the bypass valve open and the engine running, slowly move the directional control in both forward and reverse directions (5 to 6 times). As air is purged from the unit, the oil level in the reservoir will drop.
- 2. With the bypass valve closed and the engine running, slowly move the directional control in both forward and reverse directions (5 to 6 times). Check the oil level, and add oil as required after stopping engine.
- 3. It may be necessary to repeat steps 1 and 2 until all the air is completely purged from the system. When the P Series Pump moves forward and reverse at normal speed and the reservoir oil remains at a constant level, purging is complete.

Cleanliness is a key factor in the successful repair of pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals. Protect all exposed sealing areas and open cavities from damage and foreign material.

Upon removal, all seals, O-rings, and gaskets should be replaced. During installation, lightly lubricate all seals, O-rings, and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft machined features with plastic wrap or equivalent.

P Series



RETURN TO NEUTRAL SETTING



WARNING

POTENTIAL FOR SERIOUS INJURY

Inattention to proper safety, operation, or maintenance procedures could result in personal injury, or damage to the equipment. Before servicing or repairing the P Series Pump, fully read and understand the safety precautions described in this manual.

The return to neutral mechanism on the pump is designed to set the directional control into a neutral position when the operator releases the vehicle hand control. Follow the procedures below to properly adjust the return to neutral mechanism on the pump:

- 1. Confirm the pump is in the operating mode (bypass disengaged). Raise the vehicle's drive tires off the ground to allow free rotation.
- 2. Remove the Original Equipment Manufacturer's (OEM's) control linkage at the control arm.
- 3. Start the engine and increase the throttle to full engine speed.



WARNING

Do not attempt any servicing or adjustments with the engine running. Use extreme caution while inspecting the drive belt assembly and all vehicle linkage!

Follow all safety procedures outlined in the vehicle owner's manual.

- 4. Check for axle rotation. If the axle does not rotate, go to Step 5. If the axle rotates, go to Step 6.
- 5. Stop the vehicle's engine. Reattach and adjust the vehicle's linkage according to the vehicle owner's manual.
- 6. Note the axle directional movement. Stop the vehicle engine. Loosen the RTN adjustment screw until the control arm can be rotated. Rotate the control arm in the proper direction until neutral is obtained (motor shaft does not rotate). Tighten the RTN adjustment screw. Recheck according to steps 3 and 4. Refer to Figure 12.



Figure 17. P Series Pump RTN Adjustment



REPAIR - PC SERIES PUMP

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HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. **The item reference numbers in each illustration are for assembly instructions only.** See pages 34 and 35 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of ensuring satisfactory life on repaired pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs. Lip-type seals (shaft seals) are used on the input shaft and directional control shaft of each pump. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine. Upon removal, it is recommended that all seals, O-rings and gaskets be replaced.

During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear replacement parts.



TOOLS AND TORQUES

Miscellaneous	3/8-Inch Drive Ratchet and Sockets
P Series Service & Repair Manual	7/16-inch Socket
Torque Wrench	1/2-Inch Socket
Scribe, Paint Pen, or Marker	11/16-Inch Socket
Seal Hook with a Magnet	10-mm Socket
Flat Blade Screwdriver	Combination Wrenches
Pliers	7/16 Inch
Internal Snap Ring	1/2 Inch
Allen Wrenches	11/16 Inch
1/8 inch	10 mm
1/4 inch	
Table 1. Dequired T	

Table 1. Required Tools

Item # and/or Description	Torque
Case Drain (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
System Port (fitting torque)	370-470 lb-in (41.8-53.1 Nm)
Inlet (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
Fan Nut, Hex Lock 5/16-24 UNF	120-160 lb-in (13.5-18.1 Nm)
4, End Cap/Adapter Plate Bolts	180-220 lb-in (20.3-24.9 Nm)
10, Cap Screw	180-220 lb-in (20.3-24.9 Nm)
15, Bypass Valve	80-100 lb-in (9.2-11.5 Nm)
42A, 42B, Shock Valves/Check Plugs	180-240 lb-in (20.3-27.1 Nm)
44, System Charge Relief Kit (Aux Chg)	180-240 lb-in (20.3-27.1 Nm)
45, Aux Relief Valve Kit 56, Diagnostic Plug 66, Filter Cover Plug	180-240 lb-in (20.3-27.1 Nm) 84-120 lb-in (9.4-13.5 Nm) 55-85 lb-in (6.2-9.6 Nm) 200-275 lb-in (22 6-31 1 Nm)
103, Screw 5/16 x .875	200-240 lb-in (22.6-27.1 Nm)
106, Nut, Hex Lock 5/16-24 UNF	180-220 lb-in (20.3-24.9 Nm)
164, Plug, Metal 7/16-20	84-120 lb-in (9.4-13.5 Nm)

Table 2. PC Pump Torque Values

PC Series



PC SERIES PUMP REPAIR

REMOVAL, INSPECTION AND/OR REPLACEMENT OF RETURN TO NEUTRAL ASSEMBLY

Refer to Figure 1.

Prior to disassembly, note the position of the scissor arm brackets and the tab on the outer control arm bracket.

Disassembly

CAUTION: The spring used on the return to neutral linkage is under tension. To avoid possible injury, use care and proper protection during disassembly and assembly of the return to neutral linkage.

- 1. Loosen (but do not remove) the nut (106).
- 2. To relieve spring tension, carefully pry up on the outer scissor control arm until it releases from the tab on the outer control arm bracket.
- 3. Remove the spring (102), nut (106) washer (104) and outer scissor control arm bracket.
- 4. Remove bushing (101), washer (105), and the inner scissor control arm bracket.
- 5. Remove the outer control arm bracket, bolt (103), washer (104) and the inner return arm bracket.

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect bushing (101) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner return arm bracket, washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- Install the outer control arm bracket, washer (105) and bushing (101).
- 3. Install the inner scissor control arm bracket, washer (105), and outer scissor control arm bracket.
- 4. Install washer (104), and nut (106). Tighten to the correct torque value. See page 22.
- 5. Install the spring (102).



Figure 1. Return to Neutral Assembly



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CONTROL ARM

Refer to Figure 2.

Disassembly

- 1. Remove the nut (106), washer (104) and bushing (101).
- 2. Remove the outer control arm bracket.
- 3. Remove bolt (103), washer (104) and the inner control arm bracket.

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect bushing (101) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner control arm bracket, washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- Install the outer control arm bracket, bushing (101), washer (104) and nut (106). Tighten to the correct torque value. See page 22.



Figure 2. Standard Control Arm

REMOVAL, INSPECTION AND/OR REPLACEMENT OF FAN ASSEMBLY

Refer to Figure 3.

Disassembly

- 1. Remove the fan shroud (210) from the mounting bracket (209) by carefully pushing down on the shroud tabs.
- 2. Remove the nut (106) and fan assembly (90).
- 3. Remove the bolts (10) and bracket (209).

Inspection

Inspect the fan shroud (210), fan assembly (90) and mounting bracket (209) for damage.

Assembly

- 1. To install the mounting bracket (209), align and insert the bolts (10) into the bracket and charge pump cover. While holding the charge cover in place, tighten the bolts (10) per table 2, page 22.
- 2. Install the fan and washer assembly onto the shaft.
- 3. Install the nut (106) and tighten per table 2, page 22.
- 4. Install the fan shroud (210) onto the mounting bracket (209). Make sure that all shroud lock tabs are fully engaged in the mounting bracket slots.



Figure 3. Fan Assembly

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REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL

Refer to Figure 4.

Disassembly

- 1. Remove retaining ring (22) from housing.
- 2. Remove lip seal (20). Care must be taken to prevent damage to the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection

With seal removed inspect the spacer (21) and housing (1) bore for damage, corrosion or wear.

Assembly

- 1. Lubricate the new lip seal (20) inside diameter with petroleum jelly.
- 2. Wrap the input shaft (18) with plastic wrap to prevent damage to the inner surface of the lip seal (20).
- 3. Slide spacer (21) and seal (20) over shaft (18) so that lettering on the seal faces out.
- 4. Press the lip seal (20) into the housing bore. Insure the lip seal (20), shaft (18) or housing (1) bore do not become damaged. Remove the plastic wrap.
- 5. Install the retaining ring (22) into the housing (1) bore groove. Refer to Figure 4.



Figure 4. PC Pump Input Shaft Seal

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM SEAL

Refer to Figure 5.

Disassembly

- 1. Remove the RTN assembly or control arm.
- 2. Remove the retainer and lip seal (49) from the housing. Care must be taken to prevent damage to the housing trunnion bore, trunnion arm and sealing surface. Once removed the retainer and lip seal are not reusable.

Inspection

With the lip seal (49) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly

- 1. Lubricate the new lip seal (49) inside diameter with petroleum jelly.
- 2. Wrap the trunnion arm with plastic wrap to prevent damage to the inner surface of the lip seal (49).
- 3. Slide the lip seal (49) over the trunnion arm so that the lettering on the seal (49) faces out.
- 4. Press the lip seal (49) into the housing bore. Insure the seal (49), trunnion arm, and housing bore do not become damaged. Remove plastic wrap.
- 5. Install the retainer from (49) over the trunnion arm on top of the lip seal. Press into the trunnion seal bore in the housing until the retainer mates against the trunnion seal.
- 6. Install the RTN assembly or control arm.



Figure 5. Trunnion Arm Seal

PC Series



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REMOVAL, INSPECTION AND/OR REPLACEMENT OF SHOCK VALVES

Refer to Figure 6.

Perform disassembly, inspection and assembly on shock valve one side at a time. Some units vary in "A" side to "B" side configuration.

Disassembly

- 1. Remove the shock valve (42) with an 11/16-inch wrench.
- 2. Remove the shock valve spring and the shock valve from the end cap.

Inspection

Inspect the shock valve (42) and mating seat in the end cap for damage or foreign material.

Assembly

- 1. Position the pump so the shock valve port is horizontal.
- 2. Insert the shock valve spring and shock valve as one assembly into the check plug port. Tighten to the correct torque value. See Table 2, page 22 (Torque Values).
- 3. Repeat disassembly, inspection and assembly for the opposite port.



Figure 6. PC Pump Shock Valves

REMOVAL, INSPECTION AND/OR REPLACEMENT OF THE BYPASS

Refer to Figure 7.

Disassembly

- 1. Loosen the bypass valve (15) using a 7/16-inch wrench.
- 2. Remove the bypass (15) from the end cap.

Inspection

- 1. Inspect the bypass O-rings and mating seats in the end cap for damage or foreign material.
- 2. If damaged or worn, replace bypass (15).

Assembly

- 1. Position the pump so the bypass port is horizontal.
- Insert the bypass (15) into the bypass port of the end cap. Tighten to the correct torque value. See Table 2, page 22 (Torque Values).



Figure 7. PC Pump Bypass



REMOVAL, INSPECTION AND ASSEMBLY OF THE STANDARD OR THRU SHAFT CHARGE PUMP

Refer to Figure 8.

Disassembly

- 1. Prior to removal of the charge pump cover, place a mark on the cover and end cap for alignment at assembly.
- 2. Using a 1/2-inch wrench, loosen the charge pump cover bolts (10) from the end cap (2). While holding the charge cover (6) in place, remove the charge cover bolts (10).
- 3. Remove the charge cover, O-ring (8) and gerotor items (7). Carefully check for and remove the charge spring and charge ball (44).
- 4. For thru shaft charge pump, remove the shaft seal.

Inspection

- 1. Inspect the charge cover O-ring (8) and running surfaces for damage. Inspect the spring, check ball (44), and mating seat in the end cap (2) for damage or foreign material.
- 2. Inspect the charge cover bore for damage corrosion or wear.

NOTE: If the end cap (2) is to be removed from the housing, do not assemble the charge pump (6) until the end cap is installed on the housing.

NOTE: For thru shaft charge pump assembly, follow steps 1 thru 8. For standard charge pump, follow steps 3 thru 8.

Assembly

- 1. Lubricate the new shaft seal with petroleum jelly.
- 2. Press the shaft seal into the charge cover. Be careful not to damage the shaft seal or charge cover bore.
- Position the pump with the input shaft down, and the end cap (2) horizontal. Place the charge ball (44) in the end cap (2) charge passage so the ball mates to the end cap (2) charge ball seat. Place the charge spring, on top of the charge ball.
- 4. Insert the inner gerotor over input shaft (18).
- 5. Align the outer gerotor to fit over the inner gerotor.
- 6. Insert the O-ring (8) into the groove in the charge cover.
- 7. Position the charge cover and O-ring with the aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.
- Align and insert the charge pump cover bolts (10) into the end cap (2). Tighten to the correct torque value. See Table 2, page 22 (Torque Values).



Figure 8. PC Pump Standard or Thru Shaft Charge Pump

PC Series



REMOVAL, INSPECTION AND/OR REPLACEMENT OF AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 9.

Disassembly

- Prior to removal of the auxiliary pump, place a mark on the auxiliary pump (6), charge pump (7) and end cap (2) for alignment at assembly.
- 2. Use a 10 mm wrench to loosen the auxiliary pump bolts (10) from the end cap (2). While holding the auxiliary pump in place, remove the bolts (10).
- 3. Remove the auxiliary pump, gasket, O-ring (8) and charge pump (7). While removing the charge pump, be sure to retain the spring and ball (44A) housed in the end cap (2).
- 4. Remove the plug (66) from the filter cover (67).
- 5. Use a 7/8 inch wrench to remove the filter cover assembly (67) from the pump.
- 6. Remove the O-ring and filter (54).
- 7. Remove the charge relief valve assembly (44) and auxiliary relief valve assembly (45) from the auxiliary pump.

Inspection

- 1. With the auxiliary pump removed, inspect the pump running surfaces for wear or damage.
- 2. Inspect all O-rings, gasket and mounting seats.

3. Inspect the filter cover assembly threads and filter for wear, damage or foreign material.

Assembly

- Install the check ball, spring, and cap as one assembly (45) into the auxiliary relief valve port. Tighten to the correct torque value. See page 22.
- Install the poppet, spring and cap as one assembly (44) into the charge relief port. Tighten to the correct torque value. See page 22.
- 3. Install the filter (54) and O-ring into the filter cover assembly (67). Install the assembly (67) into the auxiliary pump and tighten. Install plug (66) into the filter cover (67).
- 4. Lay the PC pump (input shaft down), so the end cap is horizontal. Install the O-ring (8) into the charge pump (7).
- 5. Install the gasket onto the auxiliary pump.
- 6. Make sure that the ball and spring (44A) are seated in the end cap (2), then position the auxiliary pump and gasket with the aligning mark on the charge pump (7). Insure that the pump fully engages the alignment pins (69).
- 7. Align and insert the bolts (10) into the auxiliary pump. While holding the auxiliary pump and charge pump in place, tighten the bolts (10) per table, page 22.



Figure 9. PC Series Auxiliary Pump

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REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP

Refer to Figure 10.

Disassembly

- 1. Remove charge pump. (See page 27).
- Using a 10 mm wrench, loosen the end cap bolts (4) evenly.
- 3. Hold the end cap (2) in place and remove the four end cap bolts (4).
- 4. Slowly remove the end cap (2).
- 5. Remove housing gasket (5).

Inspection

- 1. Inspect the end cap (2) body for damage, nicks or unusual wear patterns. Replace if necessary.
- 2. Inspect the running surface (side that contacts the cylinder block) (31). The running surface may show evidence of minor abrasive rings, this is normal.

Grooving in the plate, or material transfer that is evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the end cap (2). 3. Replace the housing gasket (5) with a new gasket before assembly.

Assembly

- 1. Install housing gasket (5) into housing gasket seat of housing (1).
- 2. Lubricate the mating surface of the cylinder block (31) to end cap (2) with clean oil prior to installation.
- Install end cap (2). Before installing the four end cap bolts (4), push down on end cap (2) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install end cap bolts (4). Tighten to the correct torque value. See Table 2, page 22 (Torque Values)
- 4. Install the charge pump. (See page 27).



Figure 10. PC Pump End Cap



REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK

Refer to Figure 11.

Disassembly

- 1. Remove charge pump. (See page 27).
- 2. Remove end cap. (See page 29).
- 3. Tilt the pump on its side and drain remaining oil. Lift out the cylinder block assembly (25).
- 4. Remove the pistons, springs and piston seats.

Inspection

- Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.
- Inspect the piston springs for distortion or breaks. If necessary, replace with a new cylinder block kit.
- 3. Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.

Assembly

1. Apply a thin layer of clean oil to the pistons and springs.

- 2. Install piston seats into the end of the pistons.
- 3. Install springs into the pistons.
- 4. Install each piston, spring and seat assembly into the cylinder block.

NOTE: To assist in cylinder block installation, a rubber band can be placed around all of the pistons to hold them in position.

After the cylinder block is installed, cut the rubber band and remove it from the housing.

5. With the pump housing tilted on its side, install the cylinder block assembly (25) with pistons contacting the thrust bearing.

NOTE: To check if the cylinder block assembly is installed correctly, position the pump housing vertically and support the housing at the mounting flange. Push down on the cylinder block. The cylinder block must move up and down freely. If it does not, remove the cylinder block assembly and reinstall.

- 6. Install the end cap. (See page 29).
- 7. Install the charge pump. (See page 27).



Figure 11. PC Pump Cylinder Block Assembly

PC Series



REMOVAL, INSPECTION AND ASSEMBLY OF BLOCK SPRING AND THRUST BEARING

Refer to Figure 12.

Disassembly

- 1. Remove the block spring (29).
- 2. Remove the thrust bearing and races (34).

Inspection

- 1. Inspect and replace the block spring (29) if it is distorted or broken.
- 2. Inspect the running surface of the bearing races for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear.

Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly

- 1. Install thrust bearing and race assembly (34).
- 2. Install block spring (29).



Figure 12. PC Pump Block Spring and Thrust Bearing

REMOVAL, INSPECTION AND ASSEMBLY OF SWASHPLATE AND CRADLE BEARINGS

Refer to Figure 13.

Disassembly

Remove the swashplate (32).

Inspection

- Inspect the running surface of the bearing pocket of swashplate (32) for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This is normal wear. Inspect the cradle bearing side of the swashplate (32) for damage. Replace if necessary.
- 2. Inspect the cradle bearings attached to the inside of the housing (1) for normal wear patterns and placement, and insure they are staked securely in place. If the bearings are damaged, replace housing (1).

NOTE: The cradle bearings will have discoloration due to normal wear. Under normal circumstances, this will not warrant replacement.

Assembly

- Install swashplate (32) by holding trunnion arm's slot guide (38) with a flat tip screwdriver. Use the screwdriver to hold the slot guide in place while positioning the swashplate (32) onto the cradle bearing in the housing (1).
- 2. Rotate trunnion arm (37) to verify that the swashplate moves freely.



Figure 13. PC Pump Swashplate and Cradle Bearings





REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT

Refer to Figure 14.

Disassembly

- 1. Remove the retaining ring (22).
- 2. Remove the lip seal (20).
- 3. Remove the spacer (21).
- 3. Remove the shaft (18) and bearing (19) assembly (18) from the pump.

Inspection

- 1. Inspect the input shaft (18) for worn splines, surface damage, or keyway damage. Replace shaft assembly if necessary.
- 2. Inspect the bearing (19) for evidence of scoring, corrosion, or damage. If the bearing must be replaced, remove the retaining ring (23) and use a press or bearing puller to remove the bearing.
- 3. Inspect and replace the spacer (21) if it is bent or broken.
- 4. Inspect and replace the retaining ring (22) if it is bent or broken.

NOTE: Upon removal, all seals, O-rings and gaskets should be replaced.

Assembly

NOTE: If trunnion arm is to be removed, do not assemble input shaft until the trunnion arm is installed.

NOTE: During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

- 1. If removed, press bearing (19) onto shaft (18) tight against the shoulder of the shaft. Install retaining ring (23) onto the shaft (18).
- Install input shaft assembly (18) into the housing (1) bore. <u>Light</u> tapping with a rubber mallet may be necessary on the input shaft (18) once the bearing is aligned with the housing (1) bore. Verify that the shaft rotates smoothly.
- 3. Install spacer (21).
- 4. Install new lip seal (20) with the flat side of the seal toward the outside of the pump.
- 5. Remove the plastic wrap.
- 6. Install retaining ring (22).



Figure 14. PC Pump Input Shaft

PC Series



32
REMOVAL, INSPECTION AND INSTALLATION OF TRUNNION ARM

Refer to Figure 15.

Disassembly

- 1. Remove the slot guide (38).
- 2. Remove and discard the trunnion seal retainer and seal (49).
- 3. Remove the trunnion arm (37).

Inspection

NOTE: Upon removal, all seals, O-rings and gaskets should be replaced.

- 1. Inspect the trunnion arm (37) for wear or damage. Replace the trunnion arm if necessary.
- Check for excessive play between trunnion arm (37) and housing (1). Replace housing if necessary.

Assembly

 Install the trunnion arm (37) into the housing (1) bore. Rotate the trunnion arm to verify free movement.

NOTE: During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with plastic wrap. Remove the plastic wrap after the seal is installed.

- 2. Install a new seal and seal retainer (49).
- 3. Install slot guide (38).
- 4. To completely assemble the pump, refer to the assembly steps on pages 23-33. Begin with the trunnion arm assembly steps listed on page 33 and complete the assembly steps in reverse order working toward the front of the manual.



Figure 15. PC Pump Trunnion Arm

PC Series







ITEM LIST - PC SERIES Part numbers are not provided in this manual. See CD (BLN-51427) for part numbers.

No.	Description	No.	Description
1 2 4 5 6 7 8 10 15 18 19 20 21 22 23 25 29 32 34 37 38 42	Housing Kit End Cap Screw, Hex Flange, M8 x 1.25 Housing O-Ring Charge Pump Kit (Std. Charge) Charge Pump Kit (Std. Charge) Thru Shaft STD Gerotor Assy (0.11 cu in./rev) O-Ring Cap Screw, Hex, 5/16 - 18 x 1.0 Bypass Valve Kit (No Bleed Orifice) Pump Shaft Kit (1/2 in. Keyed w/Std. Charge) Pump Shaft Kit (1/2 in. Keyed, Thru Shaft w Std. Charge Pump Shaft Kit (1/2 in. Keyed, Thru Shaft w Std. Charge Pump Shaft Kit (9 tooth w/Std. Charge) Ball Bearing, 17 x 40 x 12 mm Lip Seal, 17 x 40 x 7 PTC Spacer Retaining Ring Retaining Ring Cylinder Block Kit Block Spring Swashplate Ball Thrust Bearing Trunnion Arm, Tapered Square Trunnion Arm, Double D Slot Guide Shock Valve Kit 2900 psi, (200 bar), No Orifice 2900 psi, (200 bar), 0.024 in. Orifice 2900 psi, (200 bar), 0.044 in. Orifice 2320 psi, (160 bar), 0.024 in. Orifice 2320 psi, (120 bar), 0.024 in. Orifice 2320 psi, (120 bar), 0.024 in. Orifice	44 45 49 54 55 56 66 67 69 80 90 100 101 102 103 104 105 106 110 209 210	Charge Relief Valve Kit (1/4 in. Plastic Ball and 50654 Spring) Auxiliary Relief Valve Kit Trunnion Seal/Retainer Kit Filter Kit Plate, Adapter (Gear AA) Plug, 5/16 - 24 Plug Filter Cover Pin, Straight Headless Fan Kit Overhaul Seal Kit Spacer, Return Spring, Extension Screw, 5/16 x 0.875 in. (PATCH) Washer, 0.34 x 0.88 x 0.06 in. Washer, Nylon Nut, Hex Lock, 5/16 - 24 UNF Return-to-Neutral Kit, Std. Return-to-Neutral Kit, CW Scissor Return-to-Neutral Kit, CCC Scissor Return-to-Neutral Kit, Shroud Bracket Shroud

PC Series



PC Series







REPAIR - PG AND PE SERIES PUMP

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HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. **The item reference numbers in each illustration are for assembly instructions only.** See pages 52 and 53 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of ensuring satisfactory life on repaired pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs. Lip-type seals (shaft seals) are used on the input shaft and directional control shaft of each pump. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine. Upon removal, it is recommended that all seals, O-rings and gaskets be replaced.

During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear replacement parts.



TOOLS AND TORQUES

Miscellaneous	3/8-Inch Drive Ratchet and Sockets
P Series Service & Repair Manual	1/2-inch Socket
Torque Wrench	9/16-inch Socket
Scribe, Paint Pen, or Marker	5/8-inch Socket
Seal Hook with a Magnet	10-mm Socket
Flat Blade Screwdriver	
	Combination Wrenches
Pliers	1/2 inch
Internal Snap Ring	9/16 inch
	5/8 inch
Allen Wrenches	7/8 inch
5mm	10 mm
3/16 inch	
1/4 inch	

Table 1. Required Tools

Item # and/or Description	Torque
Case Drain (fitting torgue)	200-250 lb-in (22.6-28.2 Nm)
System Port (fitting torque)	370-470 lb-in (41.8-53.1 Nm)
Inlet (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
Fan Nut, Hex Lock 5/16-24 UNF	180-220 lb-in (20.3-24.9 Nm)
4, End Cap Bolts	180-220 lb-in (20.3-24.9 Nm)
10, Cap Screw (Aux Pump and Shroud Bracket)	180-220 lb-in (20.3-24.9 Nm)
10, Cap Screw (Charge Pump Cover)	87-118 lb-in (9.8-13.3 Nm)
15, Bypass Valve	110-130 lb-in (12.4-14.7 Nm)
42A, 42B, Shock Valves/Check Plugs	180-240 lb-in (20.3-27.1 Nm)
44, System Charge Relief Kit (Aux Chg)	180-240 lb-in (20.3-27.1 Nm)
45, Aux Relief Valve Kit	180-240 lb-in (20.3-27.1 Nm)
56, Diagnostic Plug	84-120 lb-in (9.4-13.5 Nm)
66, Filter Cover Plug	55-85 lb-in (6.2-9.6 Nm)
67, Filter Cover	200-275 lb-in (22.6-31.1 Nm)
95, Screw, Socket Head Set	100-185 lb-in (11.3-20.9 Nm)
103, Screw 5/16 x .875	200-240 lb-in (22.6-27.1 Nm)
106, Bolt	180-220 lb-in (20.3-24.9 Nm)
107, Nut, Hex Lock 5/16-24UNF	180-220 lb-in (20.3-24.9 Nm)

Table 2. PG / PE Pump Torque Values



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PG AND PE SERIES PUMP REPAIR

REMOVAL, INSPECTION AND/OR REPLACEMENT OF RETURN TO NEUTRAL ASSEMBLY

Refer to Figure 1.

Prior to disassembly, note the position of the scissor arm brackets and the tab on the outer control arm bracket.

Disassembly

CAUTION: The spring used on the return to neutral linkage is under tension. To avoid possible injury, use care and proper protection during disassembly and assembly of the return to neutral linkage.

- 1. Loosen (but do not remove) the bolt (106)/ nut(107).
- 2. To relieve spring tension, carefully pry up on the outer scissor control arm until it releases from the tab on the outer control arm bracket.
- 3. Remove the spring (102), bolt (106)/nut (107) and washer (104).
- 4. Remove the scissor arm (99).
- 5. Remove the outer control arm bracket(94), bolt (103), washer (104) and the inner return arm bracket(98).

Inspection

- With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect scissor arm (99) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner return arm bracket(98), washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- 2. Install the inner scissor control arm(94)
- 3. Tighten washer (104), and nut (103) to the correct torque value. See page 38.
- 4. Install the scissor arm(99).
- 5. Install washer(104) and bolt (106)/nut(107) to the correct torque value. See page 38.
- 5. Install the spring (102).



Figure 1. PG / PE Pump Return to Neutral



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CONTROL ARM

Refer to Figure 2.

Disassembly

- 1. Remove the bolt (106), washer (104) and bushing (101).
- 2. Remove the outer control arm bracket.
- 3. Remove bolt (103), washer (104) and the inner control arm bracket.

Inspection

- With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect bushing (101) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner control arm bracket, washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- Install the outer control arm bracket, bushing (101), washer (104, and bolt (106). Tighten to the correct torque value. See page 38.



Figure 2. PG / PE Pump Standard Control Arm

REMOVAL, INSPECTION AND/OR REPLACEMENT OF FAN ASSEMBLY

Refer to Figure 3.

Disassembly

- 1. Remove the fan shroud (210) from the mounting bracket (209) by carefully pushing down on the shroud tabs.
- 2. Remove the nut (106) and fan assembly (90).
- 3. Remove the bolts (10) and bracket (209).

Inspection

Inspect the fan shroud (210), fan assembly (90) and mounting bracket (209) for damage.

Assembly

- 1. To install the mounting bracket (209), align and insert the bolts (10) into the bracket and charge pump cover. While holding the charge cover in place, tighten the bolts (10) per table 2, page 38.
- 2. Install the fan and washer assembly onto the shaft.
- 3. Install the nut (106) and tighten per table 2, page 38.
- 4. Install the fan shroud (210) onto the mounting bracket (209). Make sure that all shroud lock tabs are fully engaged in the mounting bracket slots.



Figure 3. PG / PE Pump Fan Assembly





REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL

Refer to Figure 4.

Disassembly

- 1. Remove retaining ring (22) from housing.
- 2. Remove lip seal (20). Care must be taken to prevent damage to the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection

1. With seal removed inspect the spacer (21), input shaft bearing (19) and housing (1) bore for damage, corrosion or wear.

Assembly

- 1. Lubricate the new lip seal (20) inside diameter with petroleum jelly.
- 2. Wrap the input shaft (18) with plastic wrap to prevent damage to the inner surface of the lip seal (20).
- 3. Slide seal (20) over shaft (18) so that lettering on the seal faces out.
- Press the lip seal (20) into the housing bore. Insure the lip seal (20), shaft (18) or housing (1) bore do not become damaged. Remove plastic wrap.
- 5. Install the retaining ring (22) into the housing (1) bore groove.



Figure 4. PG / PE Pump Input Shaft Seal

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM (CONTROL ARM) SEAL

Refer to Figure 5.

Disassembly

 Remove the retainer and lip seal (49) from the housing (1). Care must be taken to prevent damage to the housing trunnion bore, trunnion arm (37) and sealing surface. Once removed the retainer and lip seal is not reusable.

Inspection

1. With the lip seal (49) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly

- 1. Lubricate the new lip seal (49) with petroleum jelly.
- 2. Wrap the trunnion arm (37) with plastic wrap to prevent damage to the inner surface of the lip seal (49).
- 3. Slide the lip seal (49) over the trunnion arm (37) so that the lettering on the seal (49) faces out.
- Press the lip seal (49) into the housing bore (1). Insure the seal (49), trunnion arm (37), and housing bore do not become damaged. Remove the plastic wrap.
- 5. Install the retainer from (49) over the trunnion arm (37) on top of the lip seal (49). Press into the trunnion seal bore in the housing until the retainer mates against the trunnion seal.



Figure 5. PG / PE Pump Trunnion Arm Seal

PG / PE Series



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES

Refer to Figure 6.

Disassembly

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in "A" side to "B" side check configuration.

- 1. Remove the check valve (42) with an 1/4" allen wrench.
- 2. Remove the valve spring and poppet from the end cap (2).

Inspection

1. Inspect the poppets and mating seats in the end cap (2) for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 2, page 38 for torque values.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 6. PG / PE Pump Check Valves

REMOVAL, INSPECTION AND/ OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR'S) OR SHOCK VALVES

Refer to Figure 7.

Disassembly

Perform disassembly, inspection and assembly on SCR/shock valve one side at a time. Some units vary in "A" side to "B" side configuration.

- 1. Remove the SCR (42) with a 7/8" wrench or the shock valve (42) with an 11/16" wrench.
- Remove the check relief/shock valve spring and the check relief/shock valve from the end cap (2).

Inspection

1. Inspect the check relief or shock valve (42) and mating seat in the end cap (2) for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the system check relief spring and check relief or shock valve spring and shock valve as one assembly into the check plug port. Tighten to the correct torque value. See page 38.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 7. PG / PE Pump Shock Valves

PG / PE Series

REMOVAL, INSPECTION AND /OR REPLACEMENT OF THE BYPASS

Refer to Figure 8.

Disassembly

- 1. Loosen the bypass valve (15) using a 5/8" wrench.
- 2. Remove the bypass (15) from the end cap (2).

Inspection

- 1. Inspect the bypass O-rings and mating seats in the end cap (2) for damage or foreign materials.
- 2. If damaged or worn replace bypass (15)

Assembly

- 1. Lay the pump on its side, so the bypass port is horizontal.
- Insert the bypass (15) into the bypass port on the end cap (2). Tighten to the proper torque value. See page 38.



Figure 8. PG / PE Pump Bypass



REMOVAL, INSPECTION AND ASSEMBLY OF STANDARD OR THRU SHAFT CHARGE PUMP

Refer to Figure 9.

Disassembly

- 1. Prior to removal of the charge pump cover, place a mark on the cover and end cap for alignment at assembly.
- 2. Using a 1/2 inch wrench, or 5 mm allen wrench, loosen the charge pump cover bolts (10) from the end cap (2). While holding the charge cover in place, remove the charge cover bolts (10).
- 3. Remove the charge cover, O-ring and gerotor items (6). Carefully check for and remove the charge spring and charge ball (44).
- 4. For the Thru Shaft charge pump, remove the shaft seal.

Inspection

1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring, check ball (44), and mating seat in the end cap (2) for damage or foreign material.

NOTE: If the end cap (2) is to be removed from the housing, do not assemble the charge pump (6) until the end cap is installed on the housing.

2. Inspect the charge cover bore for damage, corrosion or wear.

Assembly

NOTE: For the Thru Shaft charge pump follow steps 1-8. For the Standard charge pump follow steps 3-8.

- 1. Lubricate the new shaft seal with petroleum jelly.
- 2. Press the shaft seal into the charge cover. Be careful not to damage the seal or charge cover bore.
- Position the pump with the input shaft down, and the end cap (2) horizontal. Place the charge ball (44) in the end cap (2) charge passage so the ball mates to the end cap (2) charge ball seat. Place the charge spring, on top of the charge ball.
- 4. Insert the inner gerotor over input shaft (18).
- 5. Align the outer gerotor to fit over the inner gerotor.
- 6. Insert the O-ring into the groove in the charge cover.
- 7. Position the charge cover and O-ring with the aligning mark on the end cap. Place the charge cover and O-ring with aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.
- Align and insert the charge pump cover bolts (10) into the end cap (2). Tighten to the correct torque value. See Table 2, page 38. (Torque Values.)



Figure 9. PG / PE Pump Standard or Thru Shaft Charge Pump

REMOVAL, INSPECTION AND/OR REPLACEMENT OF AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 10. **Disassembly**

- 1. Prior to removal of the auxiliary pump, place a mark on the auxiliary pump, charge pump (7) and end cap (2) for alignment at assembly.
- 2. Use a 10mm wrench to loosen the auxiliary pump bolts (10) from the end cap (2). While holding the auxiliary pump in place, remove the bolts (10).
- 3. Remove the auxiliary pump, gasket (75), O-ring (59) and charge pump (7). While removing the charge pump, be sure to retain the spring and ball (44A) housed in the end cap (2).
- 4. Remove the plug (66) from the filter cover (67).
- 5. Use a 7/8 inch wrench to remove the filter cover assembly (67) from the auxiliary pump.
- 6. Remove the O-ring and filter (54).
- Remove the charge relief valve assembly (44), plug (56) and auxiliary relief valve assembly (45) from the auxiliary pump.

Inspection

- 1. With the auxiliary pump removed, inspect the pump running surfaces for wear or damage.
- 2. Inspect all O-rings, gasket and mounting seats.

3. Inspect the filter cover assembly threads and filter for wear, damage or foreign material.

Assembly

- Install the check ball, spring, and cap as one assembly (45) into the auxiliary relief valve port. Tighten to the correct torque value. See page 38.
- 2. Install the plug (56). Tighten to the correct torque value. See page 38.
- 3. Install the poppet, spring and cap as one assembly into the charge relief port. Tighten to the correct torque value. See page 42.
- 4. Install the filter (54) and O-ring onto the filter cover assembly (67). Install the assembly (67) into the auxiliary pump and tighten. Install plug (66) into the filter cover (67).
- 5. Lay the PG pump (input shaft down), so the end cap is horizontal. Install the O-ring (59) into the charge pump (7).
- 6. Install the gasket (75) onto the auxiliary pump.
- 7. Make sure that the ball and spring (44A) are seated in the end cap (2), then position the auxiliary pump and gasket with the aligning mark on the charge pump (7). Insure that the pump fully engages the alignment pins (69).
- 8. Align and insert the bolts (10) into the auxiliary pump. While holding the auxiliary pump and charge pump in place, tighten the bolts (10) per table 2, page 38.



Figure 10. PG / PE Series Auxiliary Pump

PG / PE Series



REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP AND VALVE PLATE

Refer to Figure 11a and 11b.

Disassembly

- Using a 10 mm wrench, loosen the end cap bolts (4) evenly.
- 2. Keeping the end cap (2) held in place, remove the four end cap bolts (4).
- 3. Slowly remove the end cap (2).
- 4. Remove the valve plate (31).

NOTE: Not applicable in PE-series pumps.

- 5. Remove housing alignment pins (3).
- 6. Remove housing gasket (5).

Inspection

- 1. Inspect the end cap body (2) for damage, nicks or unusual wear patterns. Replace if necessary.
- 2. Inspect the running surface (side that contacts the cylinder block) of the valve plate (31). The running surface may show evidence of minor abrasive rings, this is normal.

NOTE: Grooving in the valve plate and or end cap, made evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the valve plate.

- 3. Inspect and replace alignment pins (3) if bent or distorted.
- 4. Replace the housing gasket (5) with a new gasket before reassembly.

Assembly

- 1. Install housing gasket (5) into housing gasket seat of housing (1).
- 2. Install alignment pins (3) into housing (1).
- Lubricate the valve plate prior to installation. Install valve plate (31) so the stamped letters "UP" on the valve plate are facing up toward the end cap.

NOTE: Not applicable in PE-series pumps.

- 4. Lubricate the end cap (2) face prior to installation in PE-series pumps.
- Install end cap (2). Before installing the four end cap bolts (4), push down on the end cap (2) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install end cap bolts (4). Tighten, reference Table 2, page 38 torque values.







REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK

Refer to Figure 12.

Disassembly

- 1. Tilt the pump on its side, drain remaining oil. Lift out the cylinder block assembly (25).
- 2. Remove the pistons, springs and piston seats.

Inspection

- Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.
- Inspect the piston springs for distortion or breaks. If necessary, replace with a new cylinder block kit.
- Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.



Figure 12. PG / PE Pump Cylinder Block

Assembly

- 1. Install piston seats into the end of the pistons.
- 2. Install springs into the pistons.
- 3. Install one at a time, pistons, springs and seats as one assembly into the cylinder block.
- 4. With the pump housing tilted on its side, install the cylinder block assembly (25) with pistons contacting the thrust bearing.

NOTE: To check that piston placement is correct, push downward on the cylinder block assembly (25). If this results in a spring action the block assembly has been installed correctly. If this cannot be accomplished, remove and reassemble the block assembly. Place a rubber band around the cylinder block pistons to hold them in position during installation. Then after installation cut the rubber band and remove it. Check cylinder block assembly for spring action.



REMOVAL, INSPECTION AND ASSEMBLY OF BLOCK SPRING, THRUST WASHER, AND THRUST BEARING

Refer to Figure 13.

Disassembly

- 1. Remove the block spring (29).
- 2. Remove the block thrust washer (30).
- 3. Remove the thrust bearing and race (34).

Inspection

- 1. Inspect and replace the block spring (29) and thrust washer (30) if they are distorted or broken.
- 2. Inspect the running surface of the bearing race for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear.

Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly

1. Install thrust bearing and race assembly (34).

NOTE: The difference in race thicknesses: The thin race seats into the swashplate (32). The thicker race will be installed toward the piston noses.

- 2. Install thrust washer (30).
- 3. Install block spring (29).



Figure 13. PG / PE Pump Block Spring and Thrust Bearing

REMOVAL, INSPECTION OF SWASHPLATE, INSPECTION OF CRADLE BEARINGS

Refer to Figure 14.

Disassembly

1. Remove the swashplate (32).

Inspection

- Inspect the running surface of the bearing pocket for damage (32), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This is normal wear. Inspect the cradle bearing side of the swashplate (32) for damage. Replace if necessary.
- 2. Inspect the cradle bearings attached to the inside of the housing (1) for normal wear patterns, placement, and insure they are staked securely in place. If damaged, replace housing (1).

NOTE: The cradle bearings will have discoloration due to normal wear. Under normal circumstances, this will not warrant replacement.

Assembly

- 1. Install swashplate (32) by holding trunnion arm's (37) slot guide (38) with the aide of a flat tip screwdriver. Use the screwdriver to hold the slot guide (38) in place while positioning the swashplate (32) onto the cradle bearing in the housing (1).
- 2. Rotate trunnion arm (37) to assure swashplate pivoting action.



Figure 14. PG / PE Pump Swashplate and Cradle Bearings

PG / PE Series

REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT

Refer to Figure 15.

Disassembly

- 1. Remove the retaining ring (22).
- 2. Remove the lip seal (20).
- 3. Remove the spacer (21).
- 4. Remove the shaft (18) from the pump.

Inspection

- 1. Inspect the input shaft (18) for worn splines, surface damage, or keyway damage. Replace shaft assembly if necessary.
- Inspect the bearing (19) for evidence of scoring, corrosion, or damage. Replace shaft assembly if necessary.
- 3. Inspect and replace the spacer (21) if it is bent or broken.
- 4. Inspect and replace the retaining ring (22) if it is bent or broken.

NOTE: Replace the input shaft seal (20) after removal.

NOTE: If trunnion arm is to be removed, delay reassembly of input shaft assembly.

Assembly

NOTE: Upon removal, it is recommended that all seals, O-rings and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

- Install input shaft assembly (18, 19, 23) into the housing (1) bore. Light tapping with a rubber mallet may be necessary on the input shaft (18) once the bearing is aligned with the housing (1) bore. Rotate the input shaft (18) to insure free movement.
- 2. Install spacer (21).
- 3. Install new lip seal (20).
- 4. Remove the plastic wrap.
- 5. Install retaining ring (22).



Figure 15. PG / PE Pump Input Shaft

PG / PE Series



REMOVAL AND INSPECTION OF TRUNNION ARM

Refer to Figure 16.

Disassembly

- 1. Remove the slot guide (38).
- 2. Remove and discard the trunnion seal retainer and seal (49).
- 3. Remove the trunnion arm (37).

Inspection

1. Inspect the trunnion arm (37) for wear or damage. Replace the trunnion arm if necessary.

Assembly

1. Install the trunnion arm (37) into the housing (1) bore. Rotate the trunnion arm to verify free movement.

NOTE: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft with plastic wrap. Remove the plastic wrap after the seal is installed.

- 2. Install a new seal and seal retainer (49).
- 3. Install the slot guide (38).
- 4. To completely reassemble the pump, refer to the assembly steps on pages 39-50. Begin with the trunnion arm assembly steps listed on page 54 and complete the assembly steps in reverse order working towards the front of the manual.



Figure 16. PG / PE Pump Trunnion Arm

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Figure 17. PG / PE Pump

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ITEM LIST - PG AND PE SERIES

Part numbers are not provided in this manual. See CD (BLN-51427) for part numbers.

No. Description

- 1 Housing Kit
- 2 End Cap Kit (W/Poppets, Standard Charge) End Cap Kit (W/ SCR'S, Standard Charge) End Cap Kit (W/ Poppets, Auxiliary Charge) End Cap Kit (W/ SCR'S, Auxiliary Charge) End Cap Kit (STD CHG) LH;SCR/HR: Poppet End Cap Kit (STD CHG) LH:Poppet/RH:SCR End Cap Kit (STD CHG) LH:SCR/RH:SCR End Cap Kit (AUX CHG) LH:SCR/RH:Poppet End Cap Kit (AUX CHG) LH:SCR/RHPoppet, Thru End Cap Kit (AUX CHG) UH:SCR/RHPoppet, Thru

End Cap Kit (AUX CHG) W/SCR;s, Thru End Cap Kit (AUX CHG) LH:Poppet/RH:SCR, Thru

- 3 Straight Headless Pin
- 4 Hex Flange Bolt M8-1.25 X 60 mm LG
- 5 Housing O-Ring
- 6 Charge Pump Kit (STD) Charge Pump Kit (STD CHG), Thru Aux Pump Kit (AL., 15T Splined, 2-7/16 SAE Ports) Aux Pump Kit (AL., 15T Splined, 3-7/16 SAE Ports)
- 7 STD Gerotor Assy (.11 cu. In/rev D-Drive) Auxiliary Gerotor & Housing Assembly
- 8 O-Ring
- 10 Socket Head Screw M6 x 1.0-20 mm Lg (STD Chg)
 - Hex Flange Bolt 8M-1.25 x 60 mm (Aux Chg) Cap Screw, Hex 5/16-18 x 1.00 (Thru Chg) Supplied with item # 2 only
- 15 Bypass Valve Kit (Blank) Bypass Valve Kit (0.031") Bypass Valve Kit (0.043")
- Pump Shaft Kit (Blind 15mm Keyway W/Std Chg)
 Pump Shaft Kit (Blind 15mm Keyway
 - W/Aux Chg) Pump Shaft Kit (9 Tooth W/Std Chg)
 - Pump Shaft Kit (9 Tooth W/Aux Chg)
 - Pump Shaft Kit (15mm Keyed, Std Chg, Thru) Pump Shaft Kit (9 Tooth Thru Chg)
- Pump Shaft Kit (Tapered)
- 19 Ball Bearing 17 X 40 X 12
- 20 Lip Seal 17 X 40 X 7 PTC
- 21 Spacer
- 22 Retaining Ring
- 25 Cylinder Block Kit
- 29 Block Spring
- 30 Block Thrust Washer
- 31 Valve Plate
- 32 Swashplate

PG / PE Series



- No. Description
- 34 Ball Thrust Bearing
- 35 Stud, Torque
- 37 Trunnion Arm Trunnion, RTN
- 38 Slot Guide
- 42 Check Valve Kit (blank Orifice) Check Valve Kit (0.024" Orifice) Check Valve Kit (0.031" Orifice) Check Valve Kit (0.044" Orifice) System Check / Relief Kit System Check Relief Kit (.031" Orifice) Shock Valve Kit
- 44 Charge Relief Valve Kit (1/4" Plastic Ball & 50654 Spring)
 Charge Relief Valve Kit (9/16" SAE Plug & 3101536 Spring)
- 45 Aux Relief Valve Kit (1/4" Steel Ball) Aux Relief Valve Kit (Aux Poppet)
- 49 Trunnion Seal/Retainer Kit
- 54 Auxiliary Filter Kit
- 56 Straight Thread Plug
- 59 O-Ring
- 64 Connector
- 66 5/16" SAE Plug
- 67 Filter Cover
- 69 Straight Headless Pin
- 75 Shim Charge Pump (.002 Red)
- 85 R-Ring 144
- 90 Hub / 6" Fan Kit Hub / 7" CCW Fan Kit Hub / 7" CW Fan Kit Hug / 7" Fan Kit
- 94 Control Arm
- 95 Screw, Soc Head
- 98 Return Arm
- 99 Inner Scissor Arm
- 100 Outer Scissor Arm
- 101 Spacer RTN
- 102 Spring, Extension
- 103 Screw, 5/16 x .875 (patch)
- 104 Washer .34 x .88 x .06
- 105 Washer, Nylon
- 106 Bolt
- 107 Nut, Hex
- 110 Kit, RTN, STD Kit, RTN, CW
 - Kit, RTN, CCW
- 111 Seal Kit
- 209 Shroud Bracket
- 210 Shroud

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HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. **The item reference numbers in each illustration are for assembly instructions only.** See pages 70 and 71 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of ensuring satisfactory life on repaired pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs. Lip-type seals (shaft seals) are used on the input shaft and directional control shaft of each pump. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine. Upon removal, it is recommended that all seals, O-rings and gaskets be replaced.

During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear replacement parts found listed in BLN-51427 (CD).

PJ Series



TOOLS AND TORQUES

3/8-Inch Drive Ratchet and Sockets
7/16-inch Socket
1/2-inch Socket
9/16-inch Socket
5/8-inch Socket
11/16-inch Socket
10-mm Socket
Combination Wrenches
7/16 inch
1/2 inch
9/16 inch
5/8 inch
11/16 inch
7/8 inch
10 mm

Table 1. Required Tools

Item # and/or Description	Torque
Case Drain (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
Inlet (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
4, End Cap/Adapter Plate Bolts 10, Cap Screw	180-220 lb-in (20.3-24.9 Nm) 180-220 lb-in (20.3-24.9 Nm)
15, Bypass Valve 42A 42B Shock Valves/Check Plugs	110-130 lb-in (12.4-14.6 Nm) 180-240 lb-in (20.3-27.1 Nm)
44, System Charge Relief Kit (Aux Chg)	180-240 lb-in (20.3-27.1 Nm)
56, Diagnostic Plug	180-240 lb-in (20.3-27.1 Nm) 84-120 lb-in (9.4-13.5 Nm)
66, Filter Cover Plug 67, Filter Cover	55-85 lb-in (6.2-9.6 Nm) 200-275 lb-in (22 6-31 1 Nm)
103, Screw 5/16 x .875	200-240 lb-in (22.6-27.1 Nm)
107, Nut, Hex Lock 5/16-24UNF	180-220 lb-in (20.3-24.9 Nm) 180-220 lb-in (20.3-24.9 Nm)

Table 2. PJ Pump Torque Values

PJ Series



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PJ SERIES PUMP REPAIR

REMOVAL, INSPECTION AND/OR REPLACEMENT OF RETURN TO NEUTRAL ASSEMBLY

Refer to Figure 1.

Prior to disassembly, note the position of the scissor arm brackets and the tab on the outer control arm bracket.

Disassembly

CAUTION: The spring used on the return to neutral linkage is under tension. To avoid possible injury, use care and proper protection during disassembly and assembly of the return to neutral linkage.

- 1. Loosen (but do not remove) the bolt (106)/nut (107).
- 2. To relieve spring tension, carefully pry up on the outer scissor control arm until it releases from the tab on the outer control arm bracket.
- 3. Remove the spring (102), bolt (106)/nut (107) and washer (104).
- 4. Remove the scissor arm (99).
- 5. Remove the outer control arm bracket(94), bolt (103), washer (104) and the inner return arm bracket(98).

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect scissor arm (99) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner return arm bracket(98), washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- 2. Install the inner scissor control arm(94)
- 3. Tighten washer (104), and nut (103) to the correct torque value. See page 74.
- 4. Install the scissor arm(99).
- 5. Install washer(104) and bolt (106)/nut (107) to the correct torque value. See page 74.
- 5. Install the spring (102).



Figure 1. PJ Pump Return to Neutral

PJ Series



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CONTROL ARM

Refer to Figure 2.

Disassembly

- 1. Remove the bolt (106)/nut (107), washer (104) and bushing (101).
- 2. Remove the outer control arm bracket.
- 3. Remove bolt (103), washer (104) and the inner control arm bracket.

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect bushing (101) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner control arm bracket, washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- Install the outer control arm bracket, bushing (101), washer (104, and bolt (106)/nut(107). Tighten to the correct torque value. See page 56.



Figure 2. PJ Pump Standard Control Arm

REMOVAL, INSPECTION AND/OR REPLACEMENT OF FAN ASSEMBLY

Refer to Figure 3.

Disassembly

- 1. Remove the fan shroud (210) from the mounting bracket (209) by carefully pushing down on the shroud tabs.
- 2. Remove the nut (106) and fan assembly (90).
- 3. Remove the bolts (10) and bracket (209).

Inspection

Inspect the fan shroud (210), fan assembly (90) and mounting bracket (209) for damage.

Assembly

- 1. To install the mounting bracket (209), align and insert the bolts (10) into the bracket and charge pump cover. While holding the charge cover in place, tighten the bolts (10) per table 2, page 56.
- 2. Install the fan and washer assembly onto the shaft.
- 3. Install the nut (106) and tighten per table 2, page 56.
- 4. Install the fan shroud (210) onto the mounting bracket (209). Make sure that all shroud lock tabs are fully engaged in the mounting bracket slots.



Figure 3. PJ Pump Fan Assembly

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REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL

Refer to Figure 4.

Disassembly

- 1. Remove retaining ring (22) from housing.
- 2. Remove lip seal (20). Care must be taken to prevent damage to the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection

With seal removed inspect the spacer (21) and housing (1) bore for damage, corrosion or wear.

Assembly

- 1. Lubricate the new lip seal (20) inside diameter with petroleum jelly.
- 2. Wrap the input shaft with plastic wrap to prevent damage to the inner surface of the lip seal (20).
- 3. Slide spacer (21) and seal (20) over the input shaft so that lettering on the seal faces out.
- Press the lip seal (20) into the housing bore. Insure the lip seal (20), input shaft or housing (1) bore does not become damaged.
- 5. Install the retaining ring (22) into the housing bore groove.



Figure 4. PJ Pump Input Shaft Seal

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM SEAL

Refer to Figure 5.

Disassembly

- 1. Remove the RTN assembly or control arm.
- 2. Remove the retainer and lip seal (49) from the housing. Care must be taken to prevent damage to the housing trunnion bore, trunnion arm and sealing surface. Once removed the retainer and lip seal are not reusable.

Inspection

With the lip seal (49) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly

- 1. Lubricate the new lip seal (49) inside diameter with petroleum jelly.
- 2. Wrap the trunnion arm with plastic wrap to prevent damage to the inner surface of the lip seal (49).
- 3. Slide the lip seal (49) over the trunnion arm so that the lettering on the seal (49) faces out.
- 4. Press the lip seal (49) into the housing bore. Insure the seal (49), trunnion arm, and housing bore do not become damaged. Remove the plastic wrap.
- 5. Install the retainer from (49) over the trunnion arm on top of the lip seal. Press into the trunnion seal bore in the housing until the retainer mates against the trunnion seal.
- 6. Install the RTN assembly or control arm.



Figure 5. PJ Pump Trunnion Arm Seal

PJ Series



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES

Refer to Figure 6.

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in "A" side to "B" side check configuration.

Disassembly

- 1. Remove the check valve (42) with an 1/4" allen wrench.
- 2. Remove the valve spring and poppet from the end cap.

Inspection

1. Inspect the poppets and mating seats in the end cap for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 2, page 56 for torque values.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 6. PJ Pump Check Valves

REMOVAL, INSPECTION AND/OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR'S) OR SHOCK VALVES

Refer to Figure 7.

Disassembly

Perform disassembly, inspection and assembly on SCR/shock valve one side at a time. Some units vary in "A" side to "B" side configuration.

- 1. Remove the SCR (42) with a 7/8" wrench or the shock valve (42) with an 11/16" wrench.
- 2. Remove the check relief/shock valve spring and the check relief/shock valve from the end cap.

Inspection

1. Inspect the check relief or shock valve (42) and mating seat in the end cap for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the system check relief spring and check relief or shock valve spring and shock valve as one assembly into the check plug port. Tighten to the correct torque value. See page 56.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 7. PJ Pump Shock Valves

REMOVAL, INSPECTION AND /OR REPLACEMENT OF THE BYPASS

Refer to Figure 8.

Disassembly

- 1. Loosen the bypass valve (15) using a 5/8" wrench.
- 2. Remove the bypass (15) from the end cap (2).

Inspection

- 1. Inspect the bypass O-rings and mating seats in the end cap (2) for damage or foreign materials.
- 2. If damaged or worn replace bypass (15)

Assembly

- 1. Lay the pump on its side, so the bypass port is horizontal.
- 2. Insert the bypass (15) into the bypass port on the end cap (2). Tighten to the proper torque value. See page 56.



Figure 8. PJ Pump Bypass





REMOVAL, INSPECTION AND ASSEMBLY OF STANDARD OR THRU SHAFT CHARGE PUMP

Refer to Figure 9.

Disassembly

- 1. Prior to removal of the charge pump cover, place a mark on the cover and end cap for alignment at assembly.
- 2. Using a 1/2 inch wrench, or 5 mm allen wrench, loosen the charge pump cover bolts (10) from the end cap (2). While holding the charge cover in place, remove the charge cover bolts (10).
- 3. Remove the charge cover, O-ring and gerotor items (6). Carefully check for and remove the charge spring and charge ball (44).
- 4. For the Thru Shaft charge pump, remove the shaft seal.

Inspection

1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring, check ball (44), and mating seat in the end cap (2) for damage or foreign material.

NOTE: If the end cap (2) is to be removed from the housing, do not assemble the charge pump (6) until the end cap is installed on the housing.

2. Inspect the charge cover bore for damage, corrosion or wear.

Assembly

NOTE: For the Thru Shaft charge pump follow steps 1-8. For the Standard charge pump follow steps 3-8.

- 1. Lubricate the new shaft seal with petroleum jelly.
- 2. Press the shaft seal into the charge cover. Be careful not to damage the seal or charge cover bore.
- Position the pump with the input shaft down, and the end cap (2) horizontal. Place the charge ball (44) in the end cap (2) charge passage so the ball mates to the end cap (2) charge ball seat. Place the charge spring, on top of the charge ball.
- 4. Insert the inner gerotor over input shaft (18).
- 5. Align the outer gerotor to fit over the inner gerotor.
- 6. Insert the O-ring (8) into the groove in the charge cover.
- 7. Position the charge cover and O-ring with the aligning mark on the end cap. Place the charge cover and O-ring with aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.
- Align and insert the charge pump cover bolts (10) into the end cap (2). Tighten to the correct torque value. See Table 2, page 56. (Torque Values.)



Figure 9. PJ Pump Standard or Thru Shaft Charge Pump

PJ Series

REMOVAL, INSPECTION AND/OR REPLACEMENT OF AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 10.

Disassembly

- 1. Prior to removal of the auxiliary pump, place a mark on the auxiliary pump, charge pump (7) and end cap (2) for alignment at assembly.
- 2. Use a 10mm wrench to loosen the auxiliary pump bolts (10) from the end cap (2). While holding the auxiliary pump in place, remove the bolts (10).
- Remove the auxiliary pump, gasket (75), O-ring (8) and charge pump (7). While removing the charge pump, be sure to retain the spring and ball (44A) housed in the end cap (2).
- 4. Remove the plug (66) from the filter cover (67).
- 5. Use a 7/8 inch wrench to remove the filter cover assembly (67) from the auxiliary pump.
- 6. Remove the O-ring and filter (54).
- 7. Remove the charge relief valve assembly (44) and auxiliary relief valve assembly (45) from the auxiliary pump.

Inspection

- 1. With the auxiliary pump removed, inspect the pump running surfaces for wear or damage.
- 2. Inspect all O-rings, gasket and mounting seats.

3. Inspect the filter cover assembly threads and filter for wear, damage or foreign material.

Assembly

- Install the check ball, spring, and cap as one assembly (45) into the auxiliary relief valve port. Tighten to the correct torque value. See page 56.
- 2. Install the poppet, spring and cap (44) as one assembly into the charge relief port. Tighten to the correct torque value. See page 56.
- Install the filter (54) and O-ring onto the filter cover assembly (67). Install the assembly (67) into the auxiliary pump and tighten. Install plug (66) into the filter cover (67).
- 4. Lay the PJ Pump (input shaft down), so the end cap is horizontal. Install the O-ring (8) into the charge pump (7).
- 5. Install the gasket (75) onto the auxiliary pump.
- 6. Make sure that the ball and spring (44A) are seated in the end cap (2), then position the auxiliary pump and gasket with the aligning mark on the charge pump (7). Insure that the pump fully engages the alignment pins (69).
- 7. Align and insert the bolts (10) into the auxiliary pump. While holding the auxiliary pump and charge pump in place, tighten the bolts (10) per table 2, page 56.



Figure 10. Auxiliary Pump

PJ Series



REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP

Refer to Figure 11.

Disassembly

- 1. Remove charge pump. (See page 62).
- Using a 10 mm wrench, loosen the end cap bolts (4) evenly.
- 3. Hold the end cap (2) in place and remove the four end cap bolts (4).
- 4. Slowly remove the end cap (2).
- 5. Remove housing gasket (5).

Inspection

- 1. Inspect the end cap (2) body for damage, nicks or unusual wear patterns. Replace if necessary.
- 2. Inspect the running surface (side that contacts the cylinder block) of the end cap (2). The running surface may show evidence of minor abrasive rings, this is normal.

Grooving in the end cap, or material transfer that is evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the end cap (2). 3. Replace the housing gasket (5) with a new gasket before assembly.

Assembly

- 1. Install housing gasket (5) into gasket seat of housing (1).
- 2. Lubricate the cylinder block (25) to end cap (2) mating surface with clean oil prior to installation.
- Install end cap (2). Before installing the four end cap bolts (4), push down on end cap (92) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install end cap bolts (4). Tighten to the correct torque value. See Table 2, page 56 (Torque Values).
- 4. Install the charge pump. (See page 62.)



Figure 11. PJ Pump End Cap

PJ Series



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REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK

Refer to Figure 12.

Disassembly

- 1. Remove charge pump. (See page 62).
- 2. Remove end cap. (See page 64).
- 3. Tilt the pump on its side and drain remaining oil. Lift out the cylinder block assembly (25).
- 4. Remove the pistons, springs and piston seats.

Inspection

- Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.
- 2. Inspect the piston springs for distortion or breaks. If necessary, replace with a new cylinder block kit.
- 3. Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.

Assembly

1. Apply a thin layer of clean oil to the pistons and springs.

- 2. Install piston seats into the end of the pistons.
- 3. Install springs into the pistons.
- 4. Install each piston, spring and seat assembly into the cylinder block.
- 5. With the pump housing tilted on its side, install the cylinder block assembly (25) with pistons contacting the thrust bearing.

NOTE: To check if the cylinder block assembly is installed correctly, position the pump housing vertically and support housing at the mounting flange. Push down on the cylinder block. The cylinder block must move up and down freely. If it does not, remove the cylinder block assembly. Place a rubber band around the cylinder block pistons to hold them in position during installation. Then after installation cut the rubber band and remove it. Check cylinder block assembly for spring action.

- 6. Install the end cap. (See page 64)
- 7. Install the charge pump. (See page 62)



Figure 12. PJ Pump Cylinder Block

PJ Series



REMOVAL, INSPECTION AND ASSEMBLY OF BLOCK SPRING AND THRUST BEARING

Refer to Figure 13.

Disassembly

- 1. Remove the block spring (29).
- 2. Remove the block thrust washer (30) and thrust bearing (34).

Inspection

- 1. Inspect and replace the block spring (29) if it is distorted or broken.
- 2. Inspect the running surface of the bearing races for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear.

Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly

- 1. Install thrust bearing and race assembly (34).
- 2. Install the block thrust washer (30).

NOTE: The difference in race thicknesses: The thin race seats into the swashplate (32). The thicker race will be installed toward the piston noses.

3. Install block spring (29).



Figure 13. Pump Block Spring and Thrust Bearing

REMOVAL, INSPECTION AND ASSEMBLY OF SWASHPLATE AND CRADLE BEARINGS

Refer to Figure 14.

Disassembly

1. Remove the swashplate (32).

Inspection

- Inspect the running surface of the bearing pocket of swashplate (32) for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This is normal wear. Inspect the cradle bearing side of the swashplate (32) for damage. Replace if necessary.
- 2. Inspect the cradle bearings attached to the inside of the housing (1) for normal wear patterns and placement, and insure they are staked securely in place. If the bearings are damaged, replace housing (1).

NOTE: The cradle bearings will have discoloration due to normal wear. Under normal circumstances, this will not warrant replacement.

Assembly

- Install swashplate (32) by holding trunnion arm's slot guide (38) with a flat tip screwdriver. Use the screwdriver to hold the slot guide in place while positioning the swashplate (32) onto the cradle bearing in the housing (1).
- 2. Rotate trunnion arm (37) to verify that the swashplate moves freely.



Figure 14. PJ Pump Swashplate and Cradle Bearings

PJ Series



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REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT

Refer to Figure 15.

Disassembly

- 1. Remove the retaining ring (22).
- 2. Remove the lip seal (20).
- 3. Remove the spacer (21).
- 4. Remove the shaft (18) and bearing (19) assembly from the pump.

Inspection

- 1. Inspect the input shaft (18) for worn splines, surface damage, or keyway damage. Replace shaft assembly if necessary.
- Inspect the bearing (19) for evidence of scoring, corrosion, or damage. If the bearing must be replaced, remove the retaining ring and use a press or bearing puller to remove the bearing.
- 3. Inspect and replace the spacer (21) if it is bent or broken.
- 4. Inspect and replace the retaining ring (22) if it is bent or broken.

NOTE: Upon removal, all seals, O-rings and gaskets should be replaced.

Assembly

NOTE: If trunnion arm is to be removed, do not assemble input shaft until the trunnion arm is installed.

NOTE: During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

- 1. If removed, press bearing (19) onto shaft (18) tight against the shoulder of the shaft. Install retaining ring onto the shaft (18).
- Install input shaft assembly (18) into the housing (1) bore. <u>Light</u> tapping with a rubber mallet may be necessary on the input shaft (18) once the bearing is aligned with the housing (1) bore. Verify that the shaft rotates smoothly.
- 3. Install spacer (21).
- 4. Install new lip seal (20) with the flat side of the seal toward the outside of the pump.
- 5. Remove the plastic wrap.
- 6. Install retaining ring (22).



Figure 15. PJ Pump Input Shaft

PJ Series



REMOVAL, INSPECTION AND INSTALLATION OF TRUNNION ARM

Refer to Figure 16.

Disassembly

- 1. Remove the slot guide (38).
- 2. Remove and discard the trunnion seal retainer and seal (49).
- 3. Remove the trunnion arm (37).

Inspection

- 1. Inspect the trunnion arm (37) for wear or damage. Replace the trunnion arm if necessary.
- Check for excessive play between trunnion arm (37) and housing (1). Replace housing if necessary.

Assembly

- 1. Install the trunnion arm (37) into the housing (1) bore. Rotate the trunnion arm to verify free movement.
- 2. Install a new seal and seal retainer (49).
- 3. Install slot guide (38).
- 4. To completely assembly the pump, refer to the assembly steps on pages 57-68. Begin with the trunnion arm assembly steps listed on page 68 and complete the assembly steps in reverse order working toward the front of the manual.



Figure 16. PJ Pump Trunnion Arm






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Figure 17. PJ Pump

PJ Series



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ITEM LIST - PJ SERIES Part numbers are not provided in this manual. See CD (BLN-51427) for part numbers.

No	Description	No.	Description
1	Housing Kit	34	Ball Thrust Bearing
2	End Cap Kit (W/Poppets, Standard Charge)	35	Stud, Torque
	End Cap Kit (W/ SCR'S, Standard Charge)	37	Trunnion Arm
	End Cap Kit (W/ Poppets, Auxiliary Charge)		Trunnion, RTN
	End Cap Kit (W/ SCR'S, Auxiliary Charge)	38	Slot Guide
	End Cap Kit (STD CHG) LH;SCR/HR: Poppet	42	Check Valve Kit (blank Orifice)
	End Cap Kit (STD CHG) LH:Poppet/RH:SCR		Check Valve Kit (0.024" Orifice)
	End Cap Kit (STD CHG) LH:SCR/RH:SCR		Check Valve Kit (0.031" Orifice)
	End Cap Kit (AUX CHG) LH:SCR/RH:Poppet		Check Valve Kit (0.044" Orifice)
	End Cap Kit (AUX CHG) LH:Poppet/RH:SCR		System Check / Relief Kit
	End Cap Kit (AUX CHG) LH:SCR/RHPoppet, Thru		System Check Relief Kit (.031" Orifice)
	End Cap Kit (AUX CHG) W/Poppets, Thru		Shock Valve Kit
	End Cap Kit (AUX CHG) W/SCR;s, Thru	44	Charge Relief Valve Kit (1/4" Plastic Ball
	End Cap Kit (AUX CHG) LH:Poppet/RH:SCR, Thru		& 50654 Spring)
3	Straight Headless Pin		Charge Relief Valve Kit (9/16" SAE Plug
4	Hex Flange Bolt M8-1.25 X 60 mm LG		& 3101536 Spring)
5	Housing O-Ring	45	Aux Relief Valve Kit (1/4" Steel Ball)
6	Charge Pump Kit (STD)		Aux Relief Valve Kit (Aux Poppet)
	Charge Pump Kit (STD CHG), Thru	49	Trunnion Seal/Retainer Kit
	Aux Pump Kit (AL., 15T Splined, 2-7/16 SAE	54	Auxiliary Filter Kit
	Ports)	55	Plate, Adapter (Gear A)
	Aux Pump Kit (AL., 15T Splined, 3-7/16 SAE	56	Straight Thread Plug
	Ports)	59	O-Ring
7	STD Gerotor Assy (.11 cu. In/rev D-Drive)	64	Connector
	Auxiliary Gerotor & Housing Assembly	66	5/16" SAE Plug
8	O-Ring	67	Filter Cover
10	Socket Head Screw M6 x 1.0-20 mm Lg (STD	69	Straight Headless Pin
	CHg)	75	Shim - Charge Pump (.002 - Red)
	Hex Flange Bolt 8M-1.25 x 60 mm (Aux Chg)	80	Pin, Straight Headless
	Cap Screw, Hex 5/16-18 x 1.00 (Thru Chg)	85	R-Ring - 144
	Supplied with item # 2 only	90	Hub / 6" Fan Kit
15	Bypass Valve Kit (Blank)		Hub / 7" CCW Fan Kit
	Bypass Valve Kit (0.031")		Hub / 7" CW Fan Kit
	Bypass Valve Kit (0.043")		Hug / 7" Fan Kit
18	Pump Shaft Kit (Blind 15mm Keyway	98	Return Arm
	W/Std Chg)	99	Inner Scissor Arm
	Pump Shaft Kit (Blind 15mm Keyway	100	Seal Kit
	W/Aux Chg)	101	Spacer RTN
	Pump Shaft Kit (9 Tooth W/Std Chg)	102	Spring, Extension
	Pump Snaft Kit (9 Tooth VV/Aux Cng)	103	Screw, 5/16 X .875 (patch)
	Pump Snaft Kit (15mm Keyed, Std Cng, Inru)	104	Washer .34 X .88 X .06
	Pump Snaft Kit (9 looth I nru Cng)	105	Washer, Nylon
40	Pump Snaft Kit (Tapered)	106	Bolt
19	ball bearing 17 X 40 X 12	107	INUL, THEX LOCK 5/10 - 24 UNF
20		110	
21	Spacer		
22	Retail III y RII y	200	NIL, KIN, UUV
25		209	
29	Diock Splilly Block Thrust Wesher	∠10	Shiouu
30	BIOCK INFUST WASHER		
32	Swasripiate		

PJ Series



PJ Series





REPAIR - PK SERIES PUMP

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HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. **The item reference numbers in each illustration are for assembly instructions only.** See pages 88 and 89 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of ensuring satisfactory life on repaired pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs. Lip-type seals (shaft seals) are used on the input shaft and directional control shaft of each pump. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine. Upon removal, it is recommended that all seals, O-rings and gaskets be replaced.

During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear replacement parts found listed in BLN-51427 (CD).

PK Series



TOOLS AND TORQUES

Miscellaneous	3/8-Inch Drive Ratchet and Sockets
P Series Service & Repair Manual	7/16-inch Socket
Torque Wrench	1/2-inch Socket
Scribe, Paint Pen, or Marker	9/16-inch Socket
Seal Hook with a Magnet	5/8-inch Socket
Flat Blade Screwdriver	11/16-inch Socket
	10-mm Socket
Pliers	
Internal Snap Ring	Combination Wrenches
	7/16 inch
Allen Wrenches	1/2 inch
5mm	9/16 inch
1/8 inch	5/8 inch
3/16 inch	11/16 inch
1/4 inch	7/8 inch
	10 mm

Table 1. Required Tools

Item # and/or Description

Case Drain (fitting torque) System Port (fitting torque) Inlet (fitting torque) 4, End Cap/Adapter Plate Bolts 10, Cap Screw 15, Bypass Valve 42A, 42B, Shock Valves/Check Plugs 44, System Charge Relief Kit (Aux Chg) 45, Aux Relief Valve Kit 56, Diagnostic Plug 66, Filter Cover Plug 67, Filter Cover 103, Screw 5/16 x .875 106, Bolt

Torque

200-250 lb-in (22.6-28.2 Nm) 370-470 lb-in (41.8-53.1 Nm) 200-250 lb-in (22.6-28.2 Nm) 180-220 lb-in (20.3-24.9 Nm) 180-220 lb-in (20.3-24.9 Nm) 110-130 lb-in (12.4-14.6 Nm) 180-240 lb-in (20.3-27.1 Nm) 180-240 lb-in (20.3-27.1 Nm) 180-240 lb-in (20.3-27.1 Nm) 84-120 lb-in (9.4-13.5 Nm) 55-85 lb-in (6.2-9.6 Nm) 200-275 lb-in (22.6-31.1 Nm) 200-240 lb-in (22.6-27.1 Nm) 180-220 lb-in (20.3-24.9 Nm)

Table 2. PK Pump Torque Values

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PK SERIES PUMP REPAIR

REMOVAL, INSPECTION AND/OR REPLACEMENT OF RETURN TO NEUTRAL ASSEMBLY

Refer to Figure 1.

Prior to disassembly, note the position of the scissor arm brackets and the tab on the outer control arm bracket.

Disassembly

CAUTION: The spring used on the return to neutral linkage is under tension. To avoid possible injury, use care and proper protection during disassembly and assembly of the return to neutral linkage.

- 1. Loosen (but do not remove) the bolt (106).
- 2. To relieve spring tension, carefully pry up on the outer scissor control arm until it releases from the tab on the outer control arm bracket.
- 3. Remove the spring (102), bolt(106) washer (104).
- 4. Remove the scissor arm (99).
- 5. Remove the outer control arm bracket(94), bolt (103), washer (104) and the inner return arm bracket(98).

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect scissor arm (99) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner return arm bracket(98), washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- 2. Install the inner scissor control arm(94)
- 3. Tighten washer (104), and nut (103) to the correct torque value. See page 74.
- 4. Install the scissor arm(99).
- 5. Install washer(104) and bolt (106) to the correct torque value. See page 74.
- 5. Install the spring (102).



Figure 1. PK Pump Return to Neutral

PK Series



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CONTROL ARM

Refer to Figure 2.

Disassembly

- 1. Remove the bolt (106), washer (104) and bushing (101).
- 2. Remove the outer control arm bracket.
- 3. Remove bolt (103), washer (104) and the inner control arm bracket.

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm (37) and trunnion arm seal (49).
- 2. Inspect bushing (101) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner control arm bracket, washer (104) and bolt (103).
- NOTE: Do not over tighten the bolt (103). The bracket must move freely.
- 2. Install the outer control arm bracket, bushing (101), washer (104, and bolt (106). Tighten to the correct torque value. See page 74.



Figure 2. PK Pump Standard Control Arm

REMOVAL, INSPECTION AND/OR REPLACEMENT OF FAN ASSEMBLY

Refer to Figure 3.

Disassembly

- 1. Remove the fan shroud (210) from the mounting bracket (209) by carefully pushing down on the shroud tabs.
- 2. Remove the nut (106) and fan assembly (90).
- 3. Remove the bolts (10) and bracket (209).

Inspection

Inspect the fan shroud (210), fan assembly (90) and mounting bracket (209) for damage.

Assembly

- To install the mounting bracket (209), align and insert the bolts (10) into the bracket and charge pump cover. While holding the charge cover in place, tighten the bolts (10) per table 2, page 74.
- 2. Install the fan and washer assembly onto the shaft.
- 3. Install the nut (106) and tighten per table 2, page 74.
- 4. Install the fan shroud (210) onto the mounting bracket (209). Make sure that all shroud lock tabs are fully engaged in the mounting bracket slots.



Figure 3. PK Pump Fan Assembly

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REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL

Refer to Figure 4.

Disassembly

- 1. Remove retaining ring (22) from housing.
- 2. Remove lip seal (20). Care must be taken to prevent damage to the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection

With seal removed inspect the spacer (21) and housing (1) bore for damage, corrosion or wear.

Assembly

- 1. Lubricate the new lip seal (20) inside diameter with petroleum jelly.
- 2. Wrap the input shaft with plastic wrap to prevent damage to the inner surface of the lip seal (20).
- 3. Slide spacer (21) and seal (20) over the input shaft so that lettering on the seal faces out.
- Press the lip seal (20) into the housing bore. Insure the lip seal (20), input shaft or housing (1) bore does not become damaged.
- 5. Install the retaining ring (22) into the housing bore groove.



Figure 4. PK Pump Input Shaft Seal

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM SEAL

Refer to Figure 5.

Disassembly

- 1. Remove the RTN assembly or control arm.
- 2. Remove the retainer and lip seal (49) from the housing. Care must be taken to prevent damage to the housing trunnion bore, trunnion arm and sealing surface. Once removed the retainer and lip seal are not reusable.

Inspection

With the lip seal (49) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly

- 1. Lubricate the new lip seal (49) inside diameter with petroleum jelly.
- 2. Wrap the trunnion arm with plastic wrap to prevent damage to the inner surface of the lip seal (49).
- 3. Slide the lip seal (49) over the trunnion arm so that the lettering on the seal (49) faces out.
- 4. Press the lip seal (49) into the housing bore. Insure the seal (49), trunnion arm, and housing bore do not become damaged. Remove the plastic wrap.
- 5. Install the retainer from (49) over the trunnion arm on top of the lip seal. Press into the trunnion seal bore in the housing until the retainer mates against the trunnion seal.
- 6. Install the RTN assembly or control arm.



Figure 5. PK Pump Trunnion Arm Seal

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REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES

Refer to Figure 6.

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in "A" side to "B" side check configuration.

Disassembly

- 1. Remove the check valve (42) with an 1/4" allen wrench.
- 2. Remove the valve spring and poppet from the end cap.

Inspection

1. Inspect the poppets and mating seats in the end cap for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 2, page 74 for torque values.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 6. PK Pump Check Valves

REMOVAL, INSPECTION AND/OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR'S) OR SHOCK VALVES

Refer to Figure 7.

Disassembly

Perform disassembly, inspection and assembly on SCR/shock valve one side at a time. Some units vary in "A" side to "B" side configuration.

- 1. Remove the SCR (42) with a 7/8" wrench or the shock valve (42) with an 11/16" wrench.
- 2. Remove the check relief/shock valve spring and the check relief/shock valve from the end cap.

Inspection

1. Inspect the check relief or shock valve (42) and mating seat in the end cap for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the system check relief spring and check relief or shock valve spring and shock valve as one assembly into the check plug port. Tighten to the correct torque value. See page 74.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 7. PK Pump Shock Valves



REMOVAL, INSPECTION AND /OR REPLACEMENT OF THE BYPASS

Refer to Figure 8.

Disassembly

- 1. Loosen the bypass valve (15) using a 5/8" wrench.
- 2. Remove the bypass (15) from the end cap (2).

Inspection

- 1. Inspect the bypass O-rings and mating seats in the end cap (2) for damage or foreign materials.
- 2. If damaged or worn replace bypass (15)

Assembly

- 1. Lay the pump on its side, so the bypass port is horizontal.
- 2. Insert the bypass (15) into the bypass port on the end cap (2). Tighten to the proper torque value. See page 74.



Figure 8. PK Pump Bypass





BUS

REMOVAL, INSPECTION AND ASSEMBLY OF STANDARD OR THRU SHAFT CHARGE PUMP

Refer to Figure 9.

Disassembly

- 1. Prior to removal of the charge pump cover, place a mark on the cover and end cap for alignment at assembly.
- 2. Using a 1/2 inch wrench, or 5 mm allen wrench, loosen the charge pump cover bolts (10) from the end cap (2). While holding the charge cover in place, remove the charge cover bolts (10).
- 3. Remove the charge cover, O-ring and gerotor items (6). Carefully check for and remove the charge spring and charge ball (44).
- 4. For the Thru Shaft charge pump, remove the shaft seal.

Inspection

1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring, check ball (44), and mating seat in the end cap (2) for damage or foreign material.

NOTE: If the end cap (2) is to be removed from the housing, do not assemble the charge pump (6) until the end cap is installed on the housing.

2. Inspect the charge cover bore for damage, corrosion or wear.

Assembly

NOTE: For the Thru Shaft charge pump follow steps 1-8. For the Standard charge pump follow steps 3-8.

- 1. Lubricate the new shaft seal with petroleum jelly.
- 2. Press the shaft seal into the charge cover. Be careful not to damage the seal or charge cover bore.
- Position the pump with the input shaft down, and the end cap (2) horizontal. Place the charge ball (44) in the end cap (2) charge passage so the ball mates to the end cap (2) charge ball seat. Place the charge spring, on top of the charge ball.
- 4. Insert the inner gerotor over input shaft (18).
- 5. Align the outer gerotor to fit over the inner gerotor.
- 6. Insert the O-ring (8) into the groove in the charge cover.
- 7. Position the charge cover and O-ring with the aligning mark on the end cap. Place the charge cover and O-ring with aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.
- Align and insert the charge pump cover bolts (10) into the end cap (2). Tighten to the correct torque value. See Table 2, page 74. (Torque Values.)



Figure 9. PK Pump Standard or Thru Shaft Charge Pump



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REMOVAL, INSPECTION AND/OR REPLACEMENT OF AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 10.

Disassembly

- 1. Prior to removal of the auxiliary pump, place a mark on the auxiliary pump, charge pump (7) and end cap (2) for alignment at assembly.
- 2. Use a 10mm wrench to loosen the auxiliary pump bolts (10) from the end cap (2). While holding the auxiliary pump in place, remove the bolts (10).
- Remove the auxiliary pump, gasket (75), O-ring (8) and charge pump (7). While removing the charge pump, be sure to retain the spring and ball (44A) housed in the end cap (2).
- 4. Remove the plug (66) from the filter cover (67).
- 5. Use a 7/8 inch wrench to remove the filter cover assembly (67) from the auxiliary pump.
- 6. Remove the O-ring and filter (54).
- 7. Remove the charge relief valve assembly (44) and auxiliary relief valve assembly (45) from the auxiliary pump.

Inspection

- 1. With the auxiliary pump removed, inspect the pump running surfaces for wear or damage.
- 2. Inspect all O-rings, gasket and mounting seats.

3. Inspect the filter cover assembly threads and filter for wear, damage or foreign material.

Assembly

- Install the check ball, spring, and cap as one assembly (45) into the auxiliary relief valve port. Tighten to the correct torque value. See page 74.
- 2. Install the poppet, spring and cap (44) as one assembly into the charge relief port. Tighten to the correct torque value. See page 74.
- Install the filter (54) and O-ring onto the filter cover assembly (67). Install the assembly (67) into the auxiliary pump and tighten. Install plug (66) into the filter cover (67).
- 4. Lay the PJ Pump (input shaft down), so the end cap is horizontal. Install the O-ring (8) into the charge pump (7).
- 5. Install the gasket (75) onto the auxiliary pump.
- 6. Make sure that the ball and spring (44A) are seated in the end cap (2), then position the auxiliary pump and gasket with the aligning mark on the charge pump (7). Insure that the pump fully engages the alignment pins (69).
- 7. Align and insert the bolts (10) into the auxiliary pump. While holding the auxiliary pump and charge pump in place, tighten the bolts (10) per table 2, page 74.



Figure 10. Auxiliary Pump



REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP

Refer to Figure 11.

Disassembly

- 1. Remove charge pump. (See page 62).
- Using a 10 mm wrench, loosen the end cap bolts (4) evenly.
- 3. Hold the end cap (2) in place and remove the four end cap bolts (4).
- 4. Slowly remove the end cap (2).
- 5. Remove housing gasket (5).

Inspection

- 1. Inspect the end cap (2) body for damage, nicks or unusual wear patterns. Replace if necessary.
- 2. Inspect the running surface (side that contacts the cylinder block) of the end cap (2). The running surface may show evidence of minor abrasive rings, this is normal.

Grooving in the end cap, or material transfer that is evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the end cap (2). 3. Replace the housing gasket (5) with a new gasket before assembly.

Assembly

- 1. Install housing gasket (5) into gasket seat of housing (1).
- 2. Lubricate the cylinder block (25) to end cap (2) mating surface with clean oil prior to installation.
- Install end cap (2). Before installing the four end cap bolts (4), push down on end cap (92) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install end cap bolts (4). Tighten to the correct torque value. See Table 2, page 74 (Torque Values).
- 4. Install the charge pump. (See page 80.)



Figure 11. PK Pump End Cap



REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK

Refer to Figure 12.

Disassembly

- 1. Remove charge pump. (See page 80.
- 2. Remove end cap. (See page 82).
- 3. Tilt the pump on its side and drain remaining oil. Lift out the cylinder block assembly (25).
- 4. Remove the pistons, springs and piston seats.

Inspection

- Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.
- 2. Inspect the piston springs for distortion or breaks. If necessary, replace with a new cylinder block kit.
- 3. Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.

Assembly

1. Apply a thin layer of clean oil to the pistons and springs.

- 2. Install piston seats into the end of the pistons.
- 3. Install springs into the pistons.
- 4. Install each piston, spring and seat assembly into the cylinder block.
- 5. With the pump housing tilted on its side, install the cylinder block assembly (25) with pistons contacting the thrust bearing.

NOTE: To check if the cylinder block assembly is installed correctly, position the pump housing vertically and support housing at the mounting flange. Push down on the cylinder block. The cylinder block must move up and down freely. If it does not, remove the cylinder block assembly. Place a rubber band around the cylinder block pistons to hold them in position during installation. Then after installation cut the rubber band and remove it. Check cylinder block assembly for spring action.

- 6. Install the end cap. (See page 82)
- 7. Install the charge pump. (See page 80)



Figure 12. PK Pump Cylinder Block

PK Series



REMOVAL, INSPECTION AND ASSEMBLY OF BLOCK SPRING AND THRUST BEARING

Refer to Figure 13.

Disassembly

- 1. Remove the block spring (29).
- 2. Remove the block thrust washer (30) and thrust bearing (34).

Inspection

- 1. Inspect and replace the block spring (29) if it is distorted or broken.
- 2. Inspect the running surface of the bearing races for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear.

Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly

- 1. Install thrust bearing and race assembly (34).
- 2. Install the block thrust washer (30).

NOTE: The difference in race thicknesses: The thin race seats into the swashplate (32). The thicker race will be installed toward the piston noses.

3. Install block spring (29).



Figure 13. Pump Block Spring and Thrust Bearing

REMOVAL, INSPECTION AND ASSEMBLY OF SWASHPLATE AND CRADLE BEARINGS

Refer to Figure 14.

Disassembly

1. Remove the swashplate (32).

Inspection

- Inspect the running surface of the bearing pocket of swashplate (32) for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This is normal wear. Inspect the cradle bearing side of the swashplate (32) for damage. Replace if necessary.
- 2. Inspect the cradle bearings attached to the inside of the housing (1) for normal wear patterns and placement, and insure they are staked securely in place. If the bearings are damaged, replace housing (1).

NOTE: The cradle bearings will have discoloration due to normal wear. Under normal circumstances, this will not warrant replacement.

Assembly

- Install swashplate (32) by holding trunnion arm's slot guide (38) with a flat tip screwdriver. Use the screwdriver to hold the slot guide in place while positioning the swashplate (32) onto the cradle bearing in the housing (1).
- 2. Rotate trunnion arm (37) to verify that the swashplate moves freely.



Figure 14. PK Pump Swashplate and Cradle Bearings

PK Series



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REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT

Refer to Figure 15.

Disassembly

- 1. Remove the retaining ring (22).
- 2. Remove the lip seal (20).
- 3. Remove the spacer (21).
- 4. Remove the shaft (18) and bearing (19) assembly from the pump.

Inspection

- 1. Inspect the input shaft (18) for worn splines, surface damage, or keyway damage. Replace shaft assembly if necessary.
- Inspect the bearing (19) for evidence of scoring, corrosion, or damage. If the bearing must be replaced, remove the retaining ring and use a press or bearing puller to remove the bearing.
- 3. Inspect and replace the spacer (21) if it is bent or broken.
- 4. Inspect and replace the retaining ring (22) if it is bent or broken.

NOTE: Upon removal, all seals, O-rings and gaskets should be replaced.

Assembly

NOTE: If trunnion arm is to be removed, do not assemble input shaft until the trunnion arm is installed.

NOTE: During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

- 1. If removed, press bearing (19) onto shaft (18) tight against the shoulder of the shaft. Install retaining ring onto the shaft (18).
- Install input shaft assembly (18) into the housing (1) bore. <u>Light</u> tapping with a rubber mallet may be necessary on the input shaft (18) once the bearing is aligned with the housing (1) bore. Verify that the shaft rotates smoothly.
- 3. Install spacer (21).
- 4. Install new lip seal (20) with the flat side of the seal toward the outside of the pump.
- 5. Remove the plastic wrap.
- 6. Install retaining ring (22).



Figure 15. PK Pump Input Shaft



REMOVAL, INSPECTION AND INSTALLATION OF TRUNNION ARM

Refer to Figure 16.

Disassembly

- 1. Remove the slot guide (38).
- 2. Remove and discard the trunnion seal retainer and seal (49).
- 3. Remove the trunnion arm (37).

Inspection

- 1. Inspect the trunnion arm (37) for wear or damage. Replace the trunnion arm if necessary.
- Check for excessive play between trunnion arm (37) and housing (1). Replace housing if necessary.

Assembly

- 1. Install the trunnion arm (37) into the housing (1) bore. Rotate the trunnion arm to verify free movement.
- 2. Install a new seal and seal retainer (49).
- 3. Install slot guide (38).
- 4. To completely assembly the pump, refer to the assembly steps on pages 75-86. Begin with the trunnion arm assembly steps listed on page 86 and complete the assembly steps in reverse order working toward the front of the manual.



Figure 16. PK Pump Trunnion Arm

PK Series





PK Series



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Figure 17. PK Pump

PK Series



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ITEM LIST - PK SERIES Part numbers are not provided in this manual. See website for part numbers.

No. Description	No. Description
1 Housing Kit	34 Ball Thrust Bearing
2 End Cap Kit (W/Poppets, Standard Charge)	35 Stud, Torque
End Cap Kit (W/ SCR'S, Standard Charge)	37 Trunnion Arm
End Cap Kit (W/ Poppets, Auxiliary Charge)	Trunnion, RTN
End Cap Kit (W/ SCR'S, Auxiliary Charge)	38 Slot Guide
End Cap Kit (STD CHG) LH;SCR/HR: Poppet	42 Check Valve Kit (blank Orifice)
End Cap Kit (STD CHG) LH:Poppet/RH:SCR	Check Valve Kit (0.024" Orifice)
End Cap Kit (STD CHG) LH:SCR/RH:SCR	Check Valve Kit (0.031" Orifice)
End Cap Kit (AUX CHG) LH:SCR/RH:Poppet	Check Valve Kit (0.044" Orifice)
End Cap Kit (AUX CHG) LH:Poppet/RH:SCR	System Check / Relief Kit
End Cap Kit (AUX CHG) LH:SCR/RHPoppet, Thru	System Check Relief Kit (.031" Orifice)
End Cap Kit (AUX CHG) W/Poppets, Thru	Shock Valve Kit
End Cap Kit (AUX CHG) W/SCR:s, Thru	44 Charge Relief Valve Kit (1/4" Plastic Ball
End Cap Kit (AUX CHG) LH:Poppet/RH:SCR, Thru	& 50654 Spring)
3 Straight Headless Pin	Charge Relief Valve Kit (9/16" SAE Plug
4 Hex Flange Bolt M8-1.25 X 60 mm LG	& 3101536 Spring)
5 Housing O-Ring	45 Aux Relief Valve Kit (1/4" Steel Ball)
6 Charge Pump Kit (STD)	Aux Relief Valve Kit (Aux Poppet)
Charge Pump Kit (STD CHG), Thru	49 Trunnion Seal/Retainer Kit
Aux Pump Kit (AL., 15T Splined, 2-7/16 SAE	54 Auxiliary Filter Kit
Ports)	55 Plate, Adapter (Gear A)
Aux Pump Kit (AL., 15T Splined, 3-7/16 SAE	56 Straight Thread Plug
Ports)	59 O-Ring
7 STD Gerotor Assy (.11 cu. In/rev D-Drive)	64 Connector
Auxiliary Gerotor & Housing Assembly	66 5/16" SAE Plug
8 O-Ring	67 Filter Cover
10 Socket Head Screw M6 x 1.0-20 mm Lg (STD	69 Straight Headless Pin
CHg)	75 Shim - Charge Pump (.002 - Red)
Hex Flange Bolt 8M-1.25 x 60 mm (Aux Chg)	80 Pin, Straight Headless
Cap Screw, Hex 5/16-18 x 1.00 (Thru Chg)	85 R-Ring - 144
Supplied with item # 2 only	90 Hub / 6" Fan Kit
15 Bypass Valve Kit (Blank)	Hub / 7" CCW Fan Kit
Bypass Valve Kit (0.031")	Hub / 7" CW Fan Kit
Bypass Valve Kit (0.043")	Hug / 7" Fan Kit
18 Pump Shaft Kit (Blind 15mm Keyway	98 Return Arm
W/Std Chg)	99 Scissor Arm
Pump Shaft Kit (Blind 15mm Keyway	100 Seal Kit
W/Aux Chg)	101 Spacer RTN
Pump Shaft Kit (9 Tooth W/Std Chg)	102 Spring, Extension
Pump Shaft Kit (9 Tooth W/Aux Chg)	103 Screw, 5/16 x .875 (patch)
Pump Shaft Kit (15mm Keyed, Std Chg, Thru)	104 VVasher .34 x .88 x .06
Pump Shaft Kit (9 looth Thru Chg)	105 Washer, Nylon
Pump Shaft Kit (Tapered)	106 BOIT
$\begin{array}{c} 19 \text{Ball Bearing 17 X 40 X 12} \\ 20 \text{Lin Soci 47 X 40 X 7 DTC} \end{array}$	
20 LIP Seal 17 X 40 X / PTC	
21 Spacer	KII, KIN, UUV
22 Retail III y RII y 25 Oulinder Pleak Kit	209 SHIUUU DIAUKEL 210 Shroud
20 Diale Spring	
29 Block Thrust Washer	
32 Swasholate	
JZ Swasi piale	

PK Series



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REPAIR - PR SERIES PUMP

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HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. The item reference numbers in each illustration are for assembly instructions only. See pages 106 and 107 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of ensuring satisfactory life on repaired pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs. Lip-type seals (shaft seals) are used on the input shaft and directional control shaft of each pump. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine. Upon removal, it is recommended that all seals, O-rings and gaskets be replaced.

During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear replacement parts found listed in BLN-51427 (CD).

PR Series



TOOLS AND TORQUES

Miscellaneous	3/8-Inch Drive Ratchet and Sockets
P Series Service & Repair Manual	1/2-inch Socket
Torque Wrench	9/16-inch Socket
Scribe, Paint Pen, or Marker	5/8-inch Socket
Seal Hook with a Magnet	10-mm Socket
Flat Blade Screwdriver	
	Combination Wrenches
Pliers	1/2 inch
Internal Snap Ring	9/16 inch
	5/8 inch
Allen Wrenches	7/8 inch
5mm	10 mm
3/16 inch	
1/4 inch	

Table 1. Required Tools

Item # and/or Description	Torque
Case Drain (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
System Port (fitting torque)	370-470 lb-in (41.8-53.1 Nm)
Inlet (fitting torque)	200-250 lb-in (22.6-28.2 Nm)
Fan Nut, Hex Lock 5/16-24 UNF	160-220 lb-in (18.1-24.9 Nm)
42A, 42B, Shock Valves/Check Plugs	180-240 lb-in (20.3-27.1 Nm)
45, Aux Relief Valve Kit	180-240 lb-in (20.3-27.1 Nm)
49, Aux Bypass/Check Kit	180-240 lb-in (20.3-27.1 Nm)
50, Bypass Valve	110-130 lb-in (12.4-14.7 Nm)
56, Screw	180-220 lb-in (20.3-24.9 Nm)
58, Hex Screw	255-300 lb-in (28.8-33.9 Nm)
67, Filter Cover	200-275 lb-in (22.6-31.1 Nm)
102, Cap Screw, Socket Head M8 x 1.25 x 25	180-220 lb-in (20.3-24.9 Nm)
107, Screw, 5/16-24 x .75	200-240 lb-in (22.6-27.1 Nm)
151, Diagnostic Plug	85-120 lb-in (9.6-13.5 Nm)
156, Filter Cover Plug	55-85 lb-in (6.2-9.6 Nm)

Table 2. PR Pump Torque Values

PR Series

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PR SERIES PUMP REPAIR

REMOVAL, INSPECTION AND/OR REPLACEMENT OF RETURN TO NEUTRAL ASSEMBLY

Prior to disassembly, note the position of the scissor arm brackets and the tab on the outer control arm bracket.

See Figure 1.

Disassembly

CAUTION: The spring used on the return to neutral linkage is under tension. To avoid possible injury, use care and proper protection during disassembly and assembly of the return to neutral linkage.

- 1. Loosen (but do not remove) the bolt (102).
- 2. To relieve spring tension, carefully pry up on the outer scissor control arm until it releases from the tab on the outer control arm bracket.
- 3. Remove the spring (108), bolt (102), washer (99) and outer scissor arm bracket (103).
- 4. Remove bushing (106), washers (109), and the inner scissor arm bracket (104).
- 5. Remove the outer control arm bracket (101), bolt (107), washer (99), and inner control arm bracket (105).

Inspection

- With the arm control linkage removed, inspect the trunnion arm (13) and trunnion arm seal (12).
- 2. Inspect bushing (106) and all other linkage parts for damage, corrosion or wear.

Assembly

- Install the inner return arm bracket (105), washer (99) and bolt (107).
- NOTE: Do not over tighten the bolt (107). The bracket must move freely.
- 2. Install the outer control arm bracket (101), washer (109) and bushing (106).
- 3. Install the inner scissor control arm bracket (104), washer (109), and outer scissor control arm bracket (103).
- 4. Install washer (99), and bolt (102). Tighten to the correct torque value. See page 92
- 5. Install the spring (108).



Figure 1. PR Pump Return to Neutral



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CONTROL ARM

Refer to Figure 2.

Disassembly

- 1. Remove the bolt (102), washer (99) and bushing (106).
- 2. Remove the outer control arm bracket (101).
- 3. Remove bolt (107), washer (99) and the inner control arm bracket (105).

Inspection

- With the arm control linkage removed, inspect the trunnion arm (13) and trunnion arm seal (12).
- 2. Inspect bushing (106) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner return arm bracket (105), washer (99) and bolt (107).
- NOTE: Do not over tighten the bolt (107). The bracket must move freely.
- Install the outer control arm bracket (101), bushing (106), washer (99), and bolt (102). Tighten to the correct torque value. See page 92.



Figure 2. PR Pump Standard Control Arm

REMOVAL, INSPECTION AND/OR REPLACEMENT OF FAN ASSEMBLY

Refer to Figure 3.

Disassembly

- 1. Remove the fan shroud (210) from the mounting bracket (209) by carefully pushing down on the shroud tabs.
- 2. Remove the fan nut and fan assembly (90).
- 3. Remove the bolts (56) and bracket (209).

Inspection

Inspect the fan shroud (210), fan assembly (90) and mounting bracket (209) for damage.

Assembly

- 1. To install the mounting bracket (209), align and insert the bolts (56) into the bracket and charge pump cover. While holding the charge cover in place, tighten the bolts (56) per table 2, page 92.
- 2. Install the fan and washer assembly onto the shaft.
- Install the fan nut and tighten per table 2, page 92.
- 4. Install the fan shroud (210) onto the mounting bracket (209). Make sure that all shroud lock tabs are fully engaged in the mounting bracket slots.



Figure 3. PR Pump Fan Assembly

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REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL

Refer to Figure 4.

Disassembly

- 1. Remove retaining ring (3) from housing (15).
- 2. Remove lip seal (6). Care must be taken to prevent damage to the housing bore, shaft sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection

 With the lip seal (6) removed, inspect the spacer (4), shaft bearing (5) and housing (15) bore.

Assembly

- 1. Lubricate the new lip seal (6) with petroleum jelly.
- 2. Wrap the input shaft (1) with plastic wrap to prevent damage to the inner surface of the lip seal (6).
- 3. Slide the seal (6) over shaft (1) so that lettering on the seal (6) faces out.
- Press the lip seal (6) into the housing (15) bore. Insure seal (6), shaft (1) or housing (15) bore do not become damaged.
- 5. Remove the plastic wrap.
- 6. Install the retaining ring (3) into the housing (15) bore groove.

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM (CONTROL ARM) SEAL

Refer to Figure 5.

Disassembly

 Remove the retainer and lip seal (12) from the housing (15). Care must be taken to prevent damage to the housing trunnion bore, trunnion arm (13) and sealing surface. Once removed the retainer and lip seal is not reusable.

Inspection

1. With the lip seal (12) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly

- 1. Lubricate the new lip seal (12) with petroleum jelly.
- 2. Wrap the trunnion arm (13) with plastic wrap to prevent damage to the inner surface of the lip seal (12).
- 3. Slide the lip seal (12) over the trunnion arm (13) so that the lettering on the seal (12) faces out.
- Press the lip seal (12) into the housing bore (15). Insure the seal (12), trunnion arm (13), and housing bore do not become damaged. Remove the plastic wrap.
- 5. Install the retainer from (12) over the trunnion arm (13) on top of the lip seal (12). Press into the trunnion seal bore in the housing until the retainer mates against the trunnion seal.



Figure 4. PR Pump Input Shaft Seal

PR Series



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REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES

Refer to Figure 6.

Disassembly

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in "A" side to "B" side check configuration.

- 1. Remove the check valve (42) with an 1/4" allen wrench.
- 2. Remove the valve spring and poppet from the end cap (25).

Inspection

1. Inspect the poppets and mating seats in the end cap (25) for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 2, page 92 for torque values.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 6. PR Pump Check Valves

REMOVAL, INSPECTION AND/ OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR'S) OR SHOCK VALVES

Refer to Figure 7.

Disassembly

Perform disassembly, inspection and assembly on SCR/shock valve one side at a time. Some units vary in "A" side to "B" side configuration.

- 1. Remove the SCR (42) with a 7/8" wrench or the shock valve (42) with an 11/16" wrench.
- Remove the check relief/shock valve spring and the check relief/shock valve from the end cap (25).

Inspection

1. Inspect the check relief or shock valve (42) and mating seat in the end cap (25) for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the system check relief spring and check relief or shock valve spring and shock valve as one assembly into the check plug port. Tighten to the correct torque value. See page 92.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 7. PR Pump Shock Valves

PR Series

REMOVAL, INSPECTION AND /OR REPLACEMENT OF THE BYPASS

Refer to Figure 8.

Disassembly

- 1. Loosen the bypass valve (50) using a 5/8" wrench.
- 2. Remove the bypass (50) from the end cap (25).

Inspection

- 1. Inspect the bypass O-rings and mating seats in the end cap (25) for damage or foreign materials.
- 2. If damaged or worn replace bypass (50).

Assembly

- 1. Lay the pump on its side, so the bypass port is horizontal.
- 2. Insert the bypass (50) into the bypass port on the end cap (25). Tighten to the proper torque value. See page 92.



Figure 8. PR Pump Bypass





REMOVAL, INSPECTION AND ASSEMBLY OF STANDARD OR THRU SHAFT CHARGE PUMP

Refer to Figure 9.

Disassembly

- 1. Prior to removal of the charge pump cover, place a mark on the cover and end cap for alignment at assembly.
- Using a 1/2 inch wrench loosen the charge pump cover bolts (56) from the end cap (2). While holding the charge cover in place, remove the charge cover bolts (56).
- 3. Remove the charge cover, O-ring (39) and gerotor items (41). Carefully check for and remove the charge spring and charge ball (44).
- 4. For the Thru Shaft charge pump, remove the shaft seal.

Inspection

1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring, check ball (44), and mating seat in the end cap for damage or foreign material.

NOTE: If the end cap (2) is to be removed from the housing, do not assemble the charge pump (40) until the end cap is installed on the housing.

2. Inspect the charge cover bore for damage, corrosion or wear.

Assembly

NOTE: For the Thru Shaft charge pump follow steps 1-8. For the Standard charge pump follow steps 3-8.

- 1. Lubricate the new shaft seal with petroleum jelly.
- 2. Press the shaft seal into the charge cover. Be careful not to damage the seal or charge cover bore.
- 3. Position the pump with the input shaft down, and the end cap (25) horizontal. Place the charge ball (44) in the end cap (25) charge passage so the ball mates to the end cap (25) charge ball seat. Place the charge spring, on top of the charge ball.
- 4. Insert the outer gerotor over input shaft.
- 5. Align the outer gerotor to fit over the inner gerotor.
- 6. Insert the O-ring (39) into the groove in the charge cover.
- 7. Position the charge cover and O-ring (39) with the aligning mark on the end cap (25). Place the charge cover and O-ring with aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.
- 8. Align and insert the charge pump cover bolts (56) into the end cap (25). Tighten to the correct torque value. See Table 2, page 92. (Torque Values.)



Figure 9. PR Pump Standard or Thru Shaft Charge Pump

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REMOVAL, INSPECTION AND/OR REPLACEMENT OF AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 10.

Disassembly

- 1. Prior to removal of the auxiliary pump, place a mark on the auxiliary pump, charge pump (41) and end cap (25) for alignment at assembly.
- 2. Use a 10mm wrench to loosen the auxiliary pump bolts (56) from the end cap (25). While holding the auxiliary pump in place, remove the bolts (56).
- 3. Remove the auxiliary pump, gasket, O-ring (39) and charge pump (41). While removing the charge pump, be sure to retain the spring and ball (44) housed in the end cap (25).
- 4. Remove the plug (156) from the filter cover (67).
- 5. Use a 7/8 inch wrench to remove the filter cover assembly (67) from the auxiliary pump.
- 6. Remove the O-ring and filter (54).
- 7. Remove the charge relief valve assembly (49) and auxiliary relief valve assembly (45) from the auxiliary pump.

Inspection

1. With the auxiliary pump removed, inspect the pump running surfaces for wear or damage.

- 2. Inspect all O-rings, gasket and mounting seats.
- 3. Inspect the filter cover assembly threads and filter for wear, damage or foreign material.

Assembly

- Install the check ball, spring, and cap as one assembly (45) into the auxiliary relief valve port. Tighten to the correct torque value. See page 92.
- 2. Install the poppet, spring and cap as one assembly (49) into the charge relief port. Tighten to the correct torque value. See page 92.
- Install the filter (54) and O-ring onto the filter cover assembly (67). Install the assembly (67) into the auxiliary pump and tighten. Install plug (156) into the filter cover (67). See page 92 for the correct torque value.
- 4. Lay the PR pump (input shaft down), so the end cap is horizontal. Install the O-ring (39) into the charge pump (41).
- 5. Install the gasket onto the auxiliary pump.
- 6. Make sure that the ball and spring (44) are seated in the end cap (25), then position the auxiliary pump and gasket with the aligning mark on the charge pump (41). Insure that the pump fully engages the alignment pins (69).
- 7. Align and insert the bolts (56) into the auxiliary pump. While holding the auxiliary pump and charge pump in place, tighten the bolts (56) per table 2, page 92.



Figure 10. PR Series Auxiliary Pump

PR Series



REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP AND VALVE PLATE

Refer to Figure 11.

Disassembly

- 1. Using any combination of two, 9/16" wrenches or 9/16" socket and ratchet drive, loosen the end cap bolts (58) evenly.
- 2. Keeping the end cap (25) held in place, remove the four end cap bolts (58).
- 3. Slowly remove the end cap (25).
- 4. Remove the valve plate (29).

NOTE: This step is only applicable on PR series pumps built prior to 0216Pxxxxx.

- 5. Remove housing alignment pins (26).
- 6. Remove housing gasket (28).

Inspection

- 1. Inspect the end cap (25) body for damage, nicks or unusual wear patterns. Replace if necessary.
- Inspect the running surface (side that contacts the cylinder block) of the valve plate (29) and/ or end cap (25). The running surface may show evidence of minor abrasive rings, this is normal.

NOTE: Grooving in the valve plate and/or end cap, made evident when the surface is checked by dragging a fingernail across it, would be cause for replacement of the valve plate.

- 3. Inspect and replace alignment pins (26) if bent or distorted.
- 4. Replace the housing O-ring (28) with a new O-ring before reassembly.

Assembly

- Install O-ring (28) into the O-ring seat of housing (15).
- 2. Install alignment pins (26) into housing (15).
- 3. Lubricate the valve plate prior to installation. Install valve plate (29) so the bronze side of the valve plate is facing down toward the cylinder block.

NOTE: This step is only applicable on PR series pumps built prior to 0216Pxxxxx.

- 4. On pumps built without a valve plate, lubricate the end cap (25) prior to installation.
- Install end cap (25). Before installing the four end cap bolts (58), push down on the end cap (25) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install and torque end cap bolts (58). Reference Table 2, page 92 (torque values).



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PR Series

REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK

Refer to Figure 12.

Disassembly

- 1. Tilt the pump on its side, drain remaining oil. Lift out the cylinder block assembly (38).
- 2. Remove the pistons, springs and piston seats.

Inspection

1. Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns.

The running surface may show evidence of minor abrasion. This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.

- Inspect the piston springs for distortion or breaks. If necessary, replace with a new cylinder block kit.
- Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.



- 1. Install piston seats into the end of the pistons.
- 2. Install springs into the pistons.
- 3. Install one at a time, pistons, springs and seats as one assembly into the cylinder block.
- 4. With the pump housing tilted on its side, install the cylinder block assembly (38) with pistons contacting the thrust bearing.

NOTE: To check that piston placement is correct, push downward on the cylinder block assembly (38). If this results in a spring action the block assembly has been installed correctly. If this cannot be accomplished, remove and reassemble the block assembly. Place a rubber band around the cylinder block pistons to hold them in position during installation. Then after installation cut the rubber band and remove it. Check cylinder block assembly for spring action.



Figure 12. PR Pump Cylinder Block



REMOVAL, INSPECTION AND ASSEMBLY OF BLOCK SPRING, THRUST WASHER, AND THRUST BEARING

Refer to Figure 13.

Disassembly

- 1. Remove the block spring (20).
- 2. Remove the thrust washer (19).
- 3. Remove the thrust bearing and race (17).

Inspection

- 1. Inspect and replace the block spring (20) and thrust washer (19) if they are distorted or broken.
- 2. Inspect the running surface of the bearing race for damage, nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear.

Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly

1. Install thrust bearing and race assembly (17).

NOTE: The difference in race thicknesses: The thin race seats into the swashplate. The thicker race will be installed toward the piston noses.

- 2. Install thrust washer (19).
- 3. Install block spring (20).



Figure 13. PR Pump Block Spring and Thrust Bearing

REMOVAL, INSPECTION OF SWASHPLATE, INSPECTION OF CRADLE BEARINGS

Refer to Figure 14.

Disassembly

1. Remove the swashplate (31).

Inspection

- Inspect the running surface of the bearing pocket for damage (31), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This is normal wear. Inspect the cradle bearing side of the swashplate (31) for damage. Replace if necessary.
- 2. Inspect the cradle bearings attached to the inside of the housing (15) for normal wear patterns, placement, and insure they are staked securely in place. If damaged, replace housing (15).

NOTE: The cradle bearings will have discoloration due to normal wear. Under normal circumstances, this will not warrant replacement.

Assembly

- Install swashplate (31) by holding trunnion arm's (13) slot guide (14) with a flat tip screwdriver. Use the screwdriver to hold the slot guide (14) in place while positioning the swashplate (31) onto the cradle bearing in the housing (15).
- 2. Rotate trunnion arm (13) to assure swashplate pivoting action.



Figure 14. PR Pump Swashplate and Cradle Bearings

PR Series



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REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT

Refer to Figure 15.

Disassembly

- 1. Remove the retaining ring (3).
- 2. Remove the lip seal (6).
- 3. Remove the spacer (4).
- 4. Remove the shaft assembly (1).

Inspection

- 1. Inspect the input shaft (1) for worn splines, damage, or keyway damage. Replace shaft assembly if necessary.
- 2. Inspect the bearing (5) for evidence of scoring, corrosion, or damage. Replace shaft assembly if necessary.
- 3. Inspect and replace the spacer (4) if it is bent or broken.

NOTE: Replace the input shaft seal (6) after removal.

4. Inspect and replace the retaining ring (3) if it is bent or broken.

NOTE: If trunnion arm is to be removed, delay reassembly of input shaft assembly.

5. Inspect and replace the thrust spring (20) and thrust washer (19) if they are distorted or broken.

Assembly

NOTE: Upon removal, it is recommended that all seals, O-rings and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

- Install input shaft assembly (1) into the housing (15) bore. Light tapping with a rubber mallet may be necessary on the input shaft (1) once the bearing is aligned with the housing bore (15). Rotate the input shaft (1) to insure free movement.
- 2. Install spacer (4).
- 3. Install new lip seal (6).
- 4. Install retaining ring (3).



Figure 15. PR Pump Input Shaft

PR Series



REMOVAL AND INSPECTION OF TRUNNION ARM

Refer to Figure 16.

Disassembly

- 1. Remove and discard the trunnion seal retainer and seal (12).
- 2. Remove the slot guide (14).
- 3. Remove the trunnion arm (13).

Inspection

1. Inspect the trunnion arm (13) for wear or damage. Replace the trunnion arm if necessary.

Assembly

- Install the trunnion arm (13) into the housing (15) bore. Rotate the trunnion arm to verify free movement.
- 2. Install a new seal and seal retainer (12).
- 3. Install the slot guide (14).
- 4. To completely reassemble the pump, refer to the assembly steps on pages 93-104. Begin with the trunnion arm assembly steps listed on page 90 and complete the assembly steps in reverse order working towards the front of the manual.

NOTE: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft with plastic wrap. Remove the plastic wrap after the seal is installed.



Figure 16. PR Pump Trunnion Arm

PR Series

BIBUS

BIBUS s.r.o. +420 547 125 300 www.bibus.cz
PR Series







Figure 17. PR Pump

PR Series



ITEM LIST - PR SERIES

Part numbers are not provided in this manual. See CD (BLN-51427) for part numbers.

No.	Description	No.	Description
1	Pump Shaft Kit (19T spline)		Shock Valve Kit (.031" orifice)
	Pump Shaft Kit (17 mm keved)		Shock Valve Kit (044" orifice)
	Pump Shaft Kit (17 mm keyed thru taper)		
	Pump Shaft Kit (double tapered thru shaft)	44	Charge Relief Kit (1/4" plastic ball & spring)
З	Petaining Ping		Charge Relief Kit (1/4" plastic ball & spring)
1	Spacer		Charge Relief Kit (w/ 0/16" SAE valve plug
4 5	Shaft Ball Boaring		40-70 psi)
5	Shall Dali Dealling		Charge Poliof Kit (w / 0/16" SAE valve plug
10	LIP Seal 17 A 47 A 0 PTCINT		75 105 poi)
12			Charge Bolief Kit (w/ 1/2" SAE volve plug
13	ITUINION AIM Slot Quide		40.70 poi)
14			40-70 pSi) Charge Delief Kit (w/ $1/2$ " SAE velve plug
15	Housing Kil		125 1650 poil
1/	Plack Thrust Wesher	15	155-1050 psi) Aux Daliaf Valva Kit
19	Block Infust washer	40	
20	Block Spring	49 50	Aux bypass/Check Kit
25	End Cap Kit (w/poppets & std cng)	50	Bypass Valve Kit (Dialik Office)
20	End Cap Kit (w/poppets & aux crig)		Bypass Valve Kit (.031 office)
20	PIII O Dina	E۸	Auxiliant Eilton Kit
28	O-Ring Velve Blete	04 56	Auxiliary Filler Nil Socket Hd Can Sarow (M8 x 1.25.25mm
29	Variable Sweebelete	00	Socket Hu Cap Sciew (No X 1.25-25)
31	Variable Swashpiate	E0	Hav Screw Flanged Hd (M10 x 1 50 65 mm)
38	Cylinder Block Kit (16cc)	00 60	Mounting Brooket
39	O-Ring D. Ding (111)	67	
40	R-Ring (-144)	67	Filler Cover
40	Charge Pump Kit (.19 std spilled)	09	Dowel Pill
	Charge Pump Kit (CM/ Iron Aux, 40, 70 pai	90	Fall Kil
	001" ahim)	99 100	
	.001 SHIII) Charge Dump Kit (CM/ Irop Aux, 125,165	100	Seal Kil
	charge Fullip Kit (CVV-IIOII Aux, 155-165	101	Sorow
	μsi, 001" chim)	102	Outor Sciesor Arm
	Charge Pump Kit (CCW/ Iron Aux, 70,70	103	Inner Scissor Arm
		104	Return Arm
	$(0.1)^{\circ}$ shim)	105	Spacer
	Charge Pump Kit (ALAux, 7/16 SAE port	100	Screw
	$40-70 \text{ psi}$ 001° shim	108	Spring
	Charge Pump Kit ($\Delta I \Delta u v 7/16 S \Delta F$ nort	100	Washer
	75-105 nsi 001" shim)	110	Return Kit
41	Gerotor Assembly (13 cu in /rev)	149	Plug
-	Gerotor Assembly (19 cu in /rev)	150	Plug
	Aux Gerotor & Hsg Assembly (0.19 cu in /	151	Plug
	rev)	152	Plug
42	Check Valve Kit (blank orifice)	153	Plug
74	Check Valve Kit (0 24" orifice)	156	Plug
	Check Valve Kit (0.21° orifice)	158	Plug
	Check Valve Kit (044" orifice)	168	Connector
	Shock Valve Kit (blank orifice)	209	Shroud Bracket
	Shock Valve Kit (024" orifice)	210	Shroud

PR Series



PR Series





REPAIR - PW / PY SERIES PUMP

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HOW TO USE THIS MANUAL

Each assembly is provided with an exploded view showing the parts involved. The item reference numbers in each illustration are for assembly instructions only. See pages 124 and 125 for part names and descriptions. A complete exploded view and item list of the pump is provided at the end of this section.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of ensuring satisfactory life on repaired pumps. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs. Lip-type seals (shaft seals) are used on the input shaft and directional control shaft of each Pump. These seals can be replaced without major disassembly of the unit. However, replacement of these seals generally requires removal of the pump from the machine. Upon removal, it is recommended that all seals, O-rings and gaskets be replaced.

During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of the seals by covering the shaft with a cellophane (plastic wrap, etc.) material.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found at the end of this manual. Use only original Hydro-Gear replacement parts found listed in BLN-51427 (CD).

PW / PY Series



TOOLS AND TORQUES

Miscellaneous	3/8-Inch Drive Ratchet and Sockets	
P Series Service & Repair Manual	1/2-inch Socket	
Torque Wrench	9/16-inch Socket	
Scribe, Paint Pen, or Marker	5/8-inch Socket	
Seal Hook with a Magnet	10-mm Socket	
Flat Blade Screwdriver		
	Combination Wrenches	
Pliers	1/2 inch	
Internal Snap Ring	9/16 inch	
	5/8 inch	
Allen Wrenches	7/8 inch	
5mm	10 mm	
3/16 inch		
1/4 inch		

Table 1. Required Tools

Item # and/or Description	Torque
Case Drain (fitting torque)	370-470 lb-in (41.8-53.1 Nm)
System Port (fitting torque)	370-470 lb-in (41.8-53.1 Nm)
Inlet (fitting torque)	370-470 lb-in (41.8-53.1 Nm)
Fan Nut, Hex Lock 3/8-24 UNF	180-220 lb-in (20.3-24.9 Nm)
42A, 42B, Shock Valves/Check Plugs	180-240 lb-in (20.3-27.1 Nm)
44, Charge Relief Kit	180-240 lb-in (20.3-27.1 Nm)
45, Aux Relief Valve Kit	180-240 lb-in (20.3-27.1 Nm)
49, Aux Bypass/Check Kit	180-240 lb-in (20.3-27.1 Nm)
50, Bypass Valve	110-130 lb-in (12.4-14.7 Nm)
56, Screw	180-220 lb-in (20.3-24.9 Nm)
58, Housing Bolt	255-300 lb-in (28.8-38.9 Nm)
66, Steel Plug	55-85 lb-in (6.2-9.6 Nm)
67, Filter Cover	200-275 lb-in (22.6-31.1 Nm)
70, Relief Valve	180-240 lb-in (20.3-27.1 Nm)
79, Pan Head Screw	100-130 lb-in (11.2-14.6 Nm)
158, Plug 9/16	110-150 lb-in (12.4-16.9 Nm)
166, Plug	6-12 lb-in (.6-1.3 Nm)
167, Plug	6-12 lb-in (.6-1.3 Nm)
Screw, Socket Hd.Control Arm 5/16-24 x .75	200-240 lb-in (22.6-27.1 Nm)
Screw, Socket Hd. RTN M8 x 1.25 x 25	180-220 lb-in (20.3-24.9 Nm)

Table 2. PW / PY Pump Torque Values

PW / PY Series



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PW / PY SERIES PUMP REPAIR

REMOVAL, INSPECTION AND/OR REPLACEMENT OF RETURN TO NEUTRAL ASSEMBLY

Prior to disassembly, note the position of the scissor arm brackets and the tab on the outer control arm bracket.

See Figure 1.

Disassembly

CAUTION: The spring used on the return to neutral linkage is under tension. To avoid possible injury, use care and proper protection during disassembly and assembly of the return to neutral linkage.

- 1. Loosen (but do not remove) the bolt (112).
- 2. To relieve spring tension, carefully pry up on the outer scissor control arm until it releases from the tab on the outer control arm bracket.
- 3. Remove the spring (18), bolt (112) washer (109) and outer scissor arm bracket (113).
- 4. Remove bushing (116), washer (119), and the inner scissor control arm bracket (114).
- 5. Remove the outer control arm bracket (111), bolt (117), washer (109), and inner control arm bracket (115).

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm and trunnion arm seal.
- 2. Inspect bushing (116) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner control arm bracket (115), washer (109) and bolt (117).
- NOTE: Do not over tighten the bolt (117). The bracket must move freely.
- 2. Install the outer control arm bracket (111), washer (119) and bushing (116).
- 3. Install the inner scissor arm bracket (114), washer (119), and outer scissor arm bracket (113).
- 4. Install washer (109), and bolt (112). Tighten to the correct torque value. See page 110.
- 5. Install the spring (18).



Figure 1. PW / PY Pump Return to Neutral



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CONTROL ARM

Refer to Figure 2.

Disassembly

- 1. Remove the bolt (112), washer (109) and bushing (116).
- 2. Remove the outer control arm bracket (111).
- 3. Remove bolt (117), washer (109) and the inner control arm bracket (115).

Inspection

- 1. With the arm control linkage removed, inspect the trunnion arm and trunnion arm seal.
- 2. Inspect bushing (116) and all other linkage parts for damage, corrosion or wear.

Assembly

- 1. Install the inner return arm bracket (115), washer (109) and bolt (117).
- NOTE: Do not over tighten the bolt (117). The bracket must move freely.
- Install the outer control arm bracket (111), bushing (116), washer (109) and bolt (112). Tighten to the correct torque value. See page 110.



Figure 2. PW / PY Pump Standard Control Arm

REMOVAL, INSPECTION AND/OR REPLACEMENT OF FAN ASSEMBLY

Refer to Figure 3.

Disassembly

- 1. Remove the fan shroud (210) from the mounting bracket (209) by carefully pushing down on the shroud tabs.
- 2. Remove the fan nut and fan assembly (90).
- 3. Remove the bolts (56) and bracket (209).

Inspection

Inspect the fan shroud (210), fan assembly (90) and mounting bracket (209) for damage.

Assembly

- To install the mounting bracket (209), align and insert the bolts (56) into the bracket and charge pump cover. While holding the charge cover in place, tighten the bolts (56) per table 2, page 110.
- 2. Install the fan and washer assembly onto the shaft.
- 3. Install the fan nut and tighten per table 2, page 110.
- 4. Install the fan shroud (210) onto the mounting bracket (209). Make sure that all shroud lock tabs are fully engaged in the mounting bracket slots.



Figure 3. PW / PY Pump Fan Assembly

PW / PY Series

REMOVAL, INSPECTION AND/OR REPLACEMENT OF INPUT SHAFT SEAL

Refer to Figure 4.

Disassembly

- 1. Remove retaining ring (3) from housing (15).
- 2. Remove lip seal (6). Care must be taken to prevent damage to the housing bore, shaft, sealing surface, or bearing. Once removed, the seal is not reusable.

Inspection

 With the lip seal (6) removed, inspect the spacer (4), shaft bearing (5) and housing (15) bore.

Assembly

- 1. Lubricate the new lip seal (6) with petroleum jelly.
- 2. Wrap the input shaft (1) with plastic wrap to prevent damage to the inner surface of the lip seal (6).
- 3. Slide the seal (6) over shaft (1) so that lettering on the seal (6) faces out.
- Press the lip seal (6) into the housing (15) bore. Insure seal (6), shaft (1) or housing (15) bore do not become damaged. Remove the plastic wrap.
- 5. Install the retaining ring (3) into the housing (15) bore groove.



Figure 4. PW / PY Pump Input Shaft Seal

REMOVAL, INSPECTION AND/OR REPLACEMENT OF TRUNNION ARM (CONTROL ARM) SEAL

Refer to Figure 5.

Disassembly

 Remove the retainer and lip seal (12). Care must be taken to prevent damage to the housing trunnion bore, trunnion arm (13) and sealing surface. Once removed the retainer and lip seal (12) is not reusable.

Inspection

1. With the lip seal (12) removed, inspect the area for corrosion and wear. Inspect the trunnion bore area sealing surface for damage or wear.

Assembly

- 1. Lubricate the new lip seal (12) with petroleum jelly.
- 2. Wrap the trunnion arm (13) with plastic wrap to prevent damage to the inner surface of the lip seal (12).
- 3. Slide the lip seal (12) over the trunnion arm (13) so that the lettering on the seal (12) faces out.
- Press the lip seal (12) into the housing bore (15). Insure the seal (12), trunnion arm (13), and housing bore do not become damaged. Remove the plastic wrap.
- 5. Install the retainer over the trunnion arm (13) on top of the lip seal (12). Press into the trunnion seal bore in the housing (15).



Figure 5. PW / PY Pump Trunnion Arm Seal



REMOVAL, INSPECTION AND/OR REPLACEMENT OF CHECK VALVES

Refer to Figure 6.

Disassembly

Perform disassembly, inspection and assembly on check valves one side at a time. Some units vary in "A" side to "B" side check configuration.

- 1. Remove the check valve (42) with an 1/4" allen wrench.
- 2. Remove the valve spring and poppet from the end cap (25).

Inspection

1. Inspect the poppets and mating seats in the end cap (25) for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the check plug, spring and poppet (42) as one assembly into the check plug port. Tighten, reference Table 2, page 110 for torque values.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 6. PW / PY Pump Check Valves

REMOVAL, INSPECTION AND/ OR REPLACEMENT OF SYSTEM CHECK RELIEFS (SCR'S) OR SHOCK VALVES

Refer to Figure 7.

Disassembly

Perform disassembly, inspection and assembly on SCR/shock valve one side at a time. Some units vary in "A" side to "B" side configuration.

- 1. Remove the SCR (42) with a 7/8" wrench or the shock valve (42) with an 11/16" wrench.
- 2. Remove the check relief/shock valve spring and the check relief/shock valve from the end cap (25).

Inspection

1. Inspect the check relief or shock valve (42) and mating seat in the end cap (25) for damage or foreign material.

Assembly

- 1. Lay the pump on its side, so the check plug port is horizontal.
- 2. Insert the system check relief spring and check relief or shock valve spring and shock valve as one assembly into the check plug port. Tighten, reference Table 2, page 110, for torque values.
- 3. Repeat disassembly, inspection and assembly for the opposite port side.



Figure 7. PW / PY Pump Shock Valves

PW / PY Series

REMOVAL, INSPECTION AND /OR REPLACEMENT OF THE BYPASS

Refer to Figure 8.

Disassembly

- 1. Loosen the bypass valve (50) using a 5/8" wrench.
- 2. Remove the bypass (50) from the end cap (25).

Inspection

- 1. Inspect the bypass O-rings and mating seats in the end cap (25) for damage or foreign materials.
- 2. If damaged or worn replace bypass (50)

Assembly

- 1. Lay the pump on its side, so the bypass port is horizontal.
- 2. Insert the bypass (50) into the bypass port on the end cap (25). Tighten, reference Table 2, page 110, torque values.



Figure 8. PW / PY Pump Bypass



PW / PY Series

REMOVAL, INSPECTION AND ASSEMBLY OF STANDARD OR THRU SHAFT CHARGE PUMP

Refer to Figure 9.

Disassembly

- 1. Prior to removal of the charge pump cover, place a mark on the cover and end cap for alignment at assembly.
- Using a 1/2 inch wrench loosen the charge pump cover bolts (56) from the end cap (25). While holding the charge cover in place, remove the charge cover bolts (56).
- 3. Remove the charge cover, O-ring (39) and gerotor items (41). Carefully check for and remove the charge spring and charge ball (44).
- 4. For the thru shaft charge pump, remove the shaft seal (37). After serial date code 3076PXXXX all thru shaft charge covers will have a retaining ring (327) holding the shaft seal (37) in place.

Inspection

- 1. Inspect the charge cover O-ring and running surfaces for damage. Inspect the spring, check ball (44), and mating seat in the end cap (25) for damage or foreign material.
- 2. Inspect the charge cover bore for damage, corrosion or wear.

NOTE: If the end cap (25) is to be removed from the housing, do not assemble the charge pump (40) until the end cap is installed on the housing.

Assembly

For the Thru Shaft charge pump follow steps 1-8. For the Standard charge pump follow steps 3-8.

- 1. Lubricate the new shaft seal with petroleum jelly.
- 2. Press the shaft seal into the charge cover. Be careful not to damage the seal or charge cover bore.
- 3. Position the pump with the input shaft down, and the end cap (25) horizontal. Place the charge ball (44) in the end cap (25) charge passage so the ball mates to the end cap (25) charge ball seat. Place the charge spring (44), on top of the charge ball.
- 4. Insert the inner gerotor over input shaft.
- 5. Align the outer gerotor to fit over the inner gerotor.
- 6. Insert the O-ring (39) into the groove in the charge cover.
- 7. Position the charge cover and O-ring (39) with the aligning mark on the end cap (25). Place the charge cover and O-ring with aligning mark on the end cap. Place the charge cover and O-ring as one piece over the charge spring (44) and gerotor assembly. Insure the spring fits into the charge cover spring retaining groove.
- 8. Align and insert the charge pump cover bolts (56) into the end cap (25). Tighten to the correct torque value. See Table 2, page 110. (Torque Values.)



Figure 9. PW / PY Pump Standard or Thru Shaft Charge Pump



REMOVAL, INSPECTION AND/OR REPLACEMENT OF AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 10.

Disassembly

- 1. Prior to removal of the auxiliary pump, place a mark on the auxiliary pump, charge pump (41) and end cap (25) for alignment at assembly.
- 2. Use a 10mm wrench to loosen the auxiliary pump bolts (56) from the end cap (25). While holding the auxiliary pump in place, remove the bolts (56).
- 3. Remove the auxiliary pump, gasket, O-ring (39) and charge pump (41). While removing the charge pump, be sure to retain the spring and ball (44A) housed in the end cap (25).
- 4. Remove the plug (66) from the filter cover (67).
- 5. Use a 7/8 inch wrench to remove the filter cover assembly (67) from the pump.
- 6. Remove the O-ring and filter (54).
- 7. Remove the charge relief valve assembly (44) and auxiliary relief valve assembly (45) from the auxiliary pump.

Inspection

1. With the auxiliary pump removed, inspect the pump running surfaces for wear or damage.

- 2. Inspect all O-rings, gasket and mounting seats.
- 3. Inspect the filter cover assembly threads and filter for wear, damage or foreign material.

Assembly

- Install the check ball, spring, and cap as one assembly (45) into the auxiliary relief valve port. Tighten to the correct torque value. See page 110.
- 2. Install the poppet, spring and cap as one assembly (44) into the charge relief port. Tighten to the correct torque value. See page 110.
- 3. Install the filter (54) and O-ring into the filter cover assembly (67). Install the assembly (67) into the auxiliary pump and tighten. Install the plug (66) into the filter cover (67).
- 4. Lay the PW pump (input shaft down), so the end cap is horizontal. Install the O-ring (39) into the charge pump (41).
- 5. Install the gasket onto the auxiliary pump.
- 6. Make sure that the ball and spring (44A) are seated in the end cap (25), then position the auxiliary pump and gasket with the aligning mark on the charge pump (7). Insure that the pump fully engages the alignment pins (69).
- 7. Align and insert the bolts (56) into the auxiliary pump. While holding the auxiliary pump and charge pump in place, tighten the bolts (56) per table 2, page 110.



Figure 10. PW / PY Series Auxiliary Pump



REMOVAL, INSPECTION AND/OR REPLACEMENT OF 6CC PISTON AUXILIARY PUMP (IF EQUIPPED)

Refer to Figure 11.

Disassembly

- 1. Prior to removal of the 6cc piston auxiliary pump (40), mark the auxiliary pump, charge pump (41) and end cap (25) for correct alignment at assembly.
- 2. Remove the rotating cap (78) and O-ring (77).
- 3. Remove the thrust bearing (76).
- 4. Remove the cylinder block assembly (72-75).
- 5. Remove the portblock (40).
- 6. Remove the gerotor (41), O-ring (39), charge ball and spring (44A).
- 7. Remove the relief valve (70) from port block (40).

Inspection

- 1. Inspect bearing areas on (78) and O-ring.
- 2. Inspect thrust bearing (76) see page 121 figure 14.
- 3. Inspect cylinder block assembly (72-75) see page 120 figure 13.

- 4. Inspect running face on portblock (40). Grooving in the portblock, made evident when the surface is checked by dragging a fingernail across the surface, would be cause for replacement.
- 5. Inspect gerotor (41), O-ring (39) and end cap(25).

Assembly

- 1. After the endcap (25) has been installed on the pump housing (15). Position the pump with the input shaft down, and the end cap (25) horizontal. Place the charge ball (44) in the end cap (25) charge passage so the ball mates to the end cap (25) charge ball seat. Place the charge spring (44), on top of the charge ball.
- 2. Insert the gerotor (41) over input shaft.
- 3. Install the portblock (40) paying attention to the orientation marks made before disassembly. Tighten to the correct torque value. See Table 2, page 110. (Torque Values.)
- 4. Install cylinder block.
- 5. Install the rotating cap (78). Tighten to the correct torque value. See Table 2, page 110. (Torque Values.)





REMOVAL, INSPECTION AND ASSEMBLY OF THE END CAP AND VALVE PLATE

Refer to Figure 12.

Disassembly

- 1. Using any combination of two, 9/16" wrenches or 9/16" socket and ratchet drive, loosen the end cap bolts (58) evenly.
- 2. Keeping the end cap (25) held in place, remove the four end cap bolts (58).
- 3. Slowly remove the end cap (25).
- 4. Remove the valve plate (29).

NOTE: This step is only applicable on PW series pumps built prior to 0216Pxxxxx.

- 5. Remove housing alignment pins (26).
- Remove housing gasket (28).

Inspection

1. Inspect the end cap (25) and/or valve plate (29) for damage, nicks or unusual wear patterns.

NOTE: Grooving in the valve plate and/or end cap, made evident when the surface is checked by dragging a fingernail across the surface, would be cause for replacement of the valve plate and/or end cap.

- 2. Inspect and replace alignment pins (26) if bent or distorted
- 3. Replace the housing O-ring (28) with a new O-ring before reassembly.

Assembly

- 1. Install housing O-ring (28) into O-ring seat of housing (15).
- 2. Install alignment pins (26) into housing (15).
- Lubricate the valve plate prior to installation. 3. Install valve plate (29) with the bronze side down, contacting the cylinder block.

NOTE: This step is only applicable on PW series pumps built prior to 0216Pxxxxx.

- 4. On pumps built without a valve plate, lubricate the end cap prior to installation.
- 5 Install end cap (25). Before installing the four end cap bolts (58), push down on the end cap (25) verifying alignment and insuring that the cylinder block pistons spring back and forth. Install end cap bolts. Tighten, per Table 2, page 110, torque values.



PW / PY Series



REMOVAL, INSPECTION AND ASSEMBLY OF THE CYLINDER BLOCK

Refer to Figure 13.

Disassembly

- 1. Tilt the pump on its side, drain remaining oil. Lift out the cylinder block assembly (38).
- 2. Remove the pistons, springs and piston seats.

Inspection

1. Inspect the running surface of the cylinder block and piston ends for damage, nicks or unusual wear patterns.

The running surface may show evidence of minor abrasion. This will be normal wear. If grooved or smeared, replace with a new cylinder block assembly.

- Inspect the piston springs for distortion or breakage. If necessary, replace with a new cylinder block kit.
- Inspect the piston seats. Residual oil may cause these to remain stuck to the inside of the pistons.



Figure 13. PW / PY Pump Cylinder Block

Assembly

- 1. Install piston seats into the end of the pistons.
- 2. Install springs into the pistons.
- 3. Install one at a time, pistons, springs and seats as one assembly into the cylinder block.
- 4. With the pump housing tilted on its side, install the cylinder block assembly (38) with pistons contacting the thrust bearing.

NOTE: To check that piston placement is correct, push downward on the cylinder block assembly (38). If this results in a spring action the block assembly has been installed correctly. If this cannot be accomplished, remove and reassemble the block assembly. Place a rubber band around the cylinder block pistons to hold them in position during installation. Then after installation cut the rubber band and remove it. Check for cylinder block assembly for spring action.



REMOVAL, INSPECTION AND ASSEMBLY OF THRUST BEARING

Refer to Figure 14.

Disassembly

1. Remove the thrust bearing and race (17).

Inspection

 Inspect the running surface of the bearing race for damage (17), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This will be normal wear. Inspect the bearings for free movement. Inspect the bearing cage for distortion or damage. Replace if necessary.

Assembly

1. Install thrust bearing and race assembly (17).

NOTE: The difference in race thicknesses: The thin race seats into the swashplate. The thicker race will be installed toward the piston noses.



Figure 14. PW / PY Pump Thrust Bearing

REMOVAL, INSPECTION AND ASSEMBLY OF SWASHPLATE AND CRADLE BEARINGS

Refer to Figure 15.

Disassembly

1. Remove the swashplate (31).

Inspection

- Inspect the running surface of the bearing pocket for damage (31), nicks or unusual wear patterns. The running surface may show evidence of minor abrasion. This is normal wear. Inspect the cradle bearing side of the swashplate (31) for damage. Replace if necessary.
- 2. Inspect the cradle bearings attached to the inside of the housing (15) for normal wear patterns, placement, and insure they are staked in place. If damaged, replace housing (15).

NOTE: The cradle bearings will have discoloration due to normal wear. Under normal circumstances, this will not warrant replacement.

Assembly

- Install swashplate (31) by holding trunnion arm's (13) slot guide (14) with a flat tip screwdriver. Use the screwdriver to hold the slot guide (14) in place while positioning the swashplate (31) onto the cradle bearing in the housing (15).
- 2. Rotate trunnion arm (13) to assure swashplate pivoting action.



Figure 15. PW / PY Pump Swashplate and Cradle Bearings

PW / PY Series



REMOVAL, INSPECTION AND ASSEMBLY OF INPUT SHAFT

Refer to Figure 16.

Disassembly

- 1. Remove the retaining ring (3).
- 2. Remove the lip seal (6).
- 3. Remove the spacer (4).
- 4. Remove the shaft assembly (1).

Inspection

- 1. Inspect the input shaft (1) for worn splines, damage, or keyway damage. Replace shaft assembly if necessary.
- 2. Inspect the bearing (5) for evidence of scoring, corrosion, or damage. Replace shaft assembly if necessary.
- 3. Inspect and replace the spacer (4) if it is bent or broken.

NOTE: Replace the input shaft seal (6) after removal.

4. Inspect and replace the retaining ring (3) if it is bent or broken.

NOTE: If trunnion arm is to be removed, delay reassembly of input shaft assembly.

 Inspect and replace the thrust spring (20) and thrust washer (19) if they are distorted or broken.

Assembly

NOTE: Upon removal, it is recommended that all seals, O-rings and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also, protect the inner diameter of seals by covering the shaft with plastic wrap.

- Install input shaft (1) assembly into the housing (15) bore. Light tapping with a rubber mallet may be necessary on the input shaft (1) once the bearing is aligned with the housing bore (15). Rotate the input shaft (1) to insure free movement.
- 2. Install spacer (4).
- 3. Install new lip seal (6). Remove the plastic wrap.
- 4. Install retaining ring (3).



Figure 16. PW / PY Pump Input Shaft

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REMOVAL AND INSPECTION OF TRUNNION ARM

Refer to Figure 17.

Disassembly

- 1. Remove trunnion seal retainer and seal (12).
- 2. Remove the slot guide (14).
- 3. Remove the trunnion arm (13).

Inspection

1. Inspect the trunnion arm (13) for wear or damage. Replace the trunnion arm if necessary.

Assembly

 Install the trunnion arm (13) into the housing (15) bore. Rotate the trunnion arm to verify free movement.

NOTE: Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft with plastic wrap. Remove the plastic wrap after the seal is installed.

- 2. Install a new seal and seal retainer.
- 3. Install the slot guide (14).
- 4. To completely reassemble the pump, refer to the assembly steps on pages 111-122. Begin with the trunnion arm assembly steps listed on page 122 and complete the assembly steps in reverse order working towards the front of the manual.



Figure 17. PW / PY Pump Trunnion Arm

PW / PY Series







Figure 17. PW / PY Pump

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PW / PY Series

ITEM LIST - PW / PY SERIES

Part numbers are not provided in this manual.

No. Description

- 1 Pump Shaft Kit (19T spline) Pump Shaft Kit (closed key) Pump Shaft Kit (thru shaft spline) Pump Shaft Kit (tapered thru shaft) Pump Shaft Kit (shaft - thru pump) Retaining Ring
- 4 Spacer
- 5 Shaft Ball Bearing
- 6 Lip Seal 17 X 47 X 8 PTCN1
- 10 Trunnion Seal Retaining Ring
- 12 Lip Seal 15 X 27 X 7
- 13 Trunnion Arm
- 14 Slot Guide
- 15 Housing Kit
- 17 Thrust Ball Bearing Assembly
- 19 Block Thrust Washer
- 20 Block Spring
- End Cap Kit (w/poppets)
 End Cap Kit (w/poppets , .078" cooling ori fice)
 End Cap Kit (w SCR'S)
 End Cap Kit (Aux w/ poppets)
 - End Cap Kit (Aux w/ SCR's)
 - End Cap Kit (Aux w/ LH:SCR and
 - RH:poppet) End Cap Kit (w/LH:poppet and RH:SCR)
- 26 Pin
- 28 O-Ring
- 29 Valve Plate
- 31 Variable Swashplate
- 38 Cylinder Block Kit
- 39 O-Ring R-Ring (-144)
- 40 Charge Pump Kit (0.19 std splined) Charge Pump Kit (0.13 std splined) Charge Pump Kit (0.13 std thru shaft) Charge Pump Kit (0.13 std spline, clear zinc cover)
 Charge Pump Kit (CW - splined Aux, 40-70 psi)
 Charge Pump Kit (CW - splined Aux,
 - 135-165 psi) Charge Dump Kit (CC)M, oplined A
 - Charge Pump Kit (CCW splined Aux, 40-70 psi)
 - Charge Pump Kit (AL Aux, 7/16 SAE port, 40-70 psi)

No. Description

Charge Pump Kit (AL Aux, 7/16 SAE port, 75-105 psi) Charge Pump Kit (6cc Aux)

- 41 Gerotor Assembly (0.19 in³/rev) Aux Gerotor & HSG Assembly (0.19 in³/rev) Gerotor Assembly (0.13 in³/rev)
- 42 Check Valve Kit (.031") Check Valve Kit (.044") Shock Valve Kit (blank) System Check/Relief Kit
- 44 Charge Relief Kit (w 1/2" SAE valve plug, 40-70 psi)
 Charge Relief Kit (w 1/2" SAE valve plug, 135-165 psi)
 Charge Relief Kit (w/ 9/16" SAE valve plug)
 Charge Relief Kit (w/ 9/16" SAE valve plug 75-105 psi)
 Charge Relief Kit (w/ 7/32" plastic ball & spring)
 Charge Relief Kit (w/ 1/4" plastic ball & spring)
 45 Aux Relief Valve Kit
- 49 Aux Bypass/Check Kit
- 50 Bypass Valve Kit (blank) Bypass Valve Kit (.031")
- 54 Auxiliary Filter Kit
- 56 Hex Screw, 5/16 18 X 1.0 Hex Hd Cap Screw, 5/16 - 18 X 2.5
- 58 Hex Screw, Flanged Head
- 59 Hex Flange Nut
- 60 Mounting Bracket
- 66 Plug
- 67 Filter Cover
- 69 Pin
- 85 Overhaul Seal Kit
- 110 Return Kit
- 168 Connector
- 209 Shroud Bracket210 Shroud















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