

## Piston Pumps Service Procedure



P2 / P3 Series Variable Volume Piston Pumps



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#### **Definitions**

**NOTE:** A NOTE provides key information to make a procedure easier or quicker to complete.

**CAUTION:** A CAUTION refers to procedure that must be followed to avoid damaging the Pump or other system

components.

WARNING: A WARNING REFERS TO PROCEDURE THAT MUST BE FOLLOWED FOR THE SAFETY OF THE

EQUIPMENT OPERATOR AND THE PERSON INSPECTING OR REPAIRING THE PUMP.

#### **Disclaimer**

This Service Manual has been prepared by Parker Hannifin for reference and use by mechanics who have been trained to repair and service hydraulic pumps and systems on commercial and noncommercial equipment applications. Parker Hannifin has exercised reasonable care and diligence to present accurate, clear and complete information and instructions regarding the techniques and tools required for maintaining, repairing and servicing the complete line of Parker P2 & P3 Pump Units. However, despite the care and effort taken in preparing this general Service Manual, Parker **makes no warranties** that (a) the Service Manual or any explanations, illustrations, information, techniques or tools described herein are either accurate, complete or correct as applied to a specific Pump unit, or (b) any repairs or service of a particular Pump unit will result in a properly functioning Pump unit.

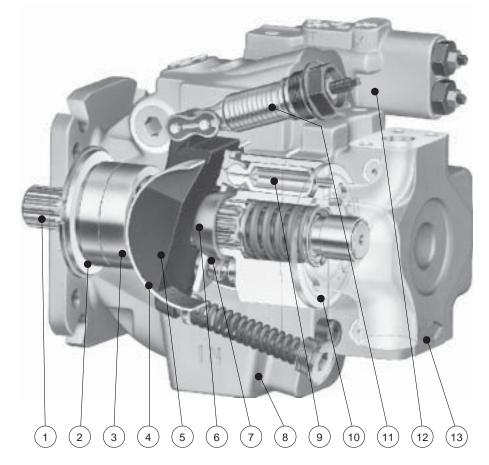
If inspection or testing reveals evidence of abnormal wear or damage to the Pump unit or if you encounter circumstances not covered in the Manual, STOP – CONSULT THE EQUIPMENT MANUFACTURER'S SERVICE MANUAL AND WARRANTY. DO NOT TRY TO REPAIR OR SERVICE A PUMP UNIT WHICH HAS BEEN DAMAGED OR INCLUDES ANY PART THAT SHOWS EXCESSIVE WEAR UNLESS THE DAMAGED AND WORN PARTS ARE REPLACED WITH ORIGINAL PARKER REPLACEMENT AND SERVICE PARTS AND THE UNIT IS RESTORED TO PARKER SPECIFICATIONS FOR THE PUMP UNIT.

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular Pump unit to (a) inspect the unit for abnormal wear and damage, (b) choose a repair procedure which will not endanger his/her safety, the safety of others, the equipment, or the safe operation of the Pump, and (c) fully inspect and test the Pump unit and the hydraulic system to insure that the repair or service of the Pump unit has been properly performed and that the Pump and hydraulic system will function properly.



### **Pump Design Features**

#### **P2 Series**



Note:

Picture illustrates P2-060 & P2-075 construction.

(Torque Control Option not shown).

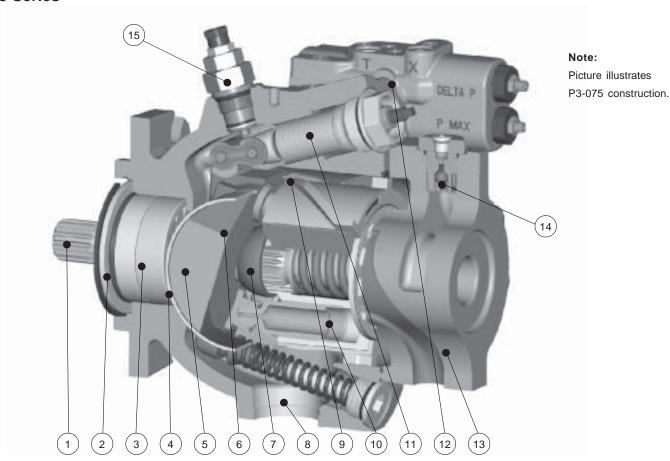
- 1. Input shaft
- 2. Seal carrier with shaft seal
- 3. Spherical roller bearing
- 4. Saddle bearing
- 5. Swashplate
- 6. Ball seat
- 7. Retainer
- 8. Housing
- 9. Piston with piston shoe
- 10. Valve plate
- 11. Servo piston
- 12. Control
- 13. Rear cover

### P2 Series Piston Pump features include:

- New functionality adds value Parker's line of variable piston pumps are compact, with a low noise level and a high selfpriming speed. Our new pump line also boasts a unique port layout and generates less pressure pulsations than previous designs.
- Compact and easy to install Attaching this pump to your machinery is easy because of its compact design and unique port layout. Normally it will not require an offset gearbox, which will lower the total installation cost.
- Less noise to insulate The rigid housing design, combined with the reduced pressure ripple, decreases airborne as well as hydraulic generated noise. These features will significantly reduce the need for costly insulation.
- Reliable High self-priming speed and the reduced pressure ripple increase the service life of the pump while lowering maintenance costs of the system.
- Flexible The modular design of the P2 line will readily accommodate future control variations.
  - Adjustable maximum displacement stop is standard.
  - Inlet and outlet gage ports are standard.



#### P3 Series



- 1. Input shaft
- 2. Seal carrier with shaft seal
- 3. Spherical roller bearings
- 4. Saddle bearing
- 5. Swashplate

- 6. Slipper retainer
- 7. Ball seat
- 8. Housing
- 9. Impeller
- 10. Piston assembly
- 11. Servo piston
- 12. Compensator control
- 13. Rear cover
- 14. Air bleed
- 15. Torque control cartridge

#### P3 Series Piston Pump features include:

- All the same advantages of the P2 Series, namely a reliable, compact package with very low noise levels.
- Because of the unique built in impeller, P3 offers significantly higher self priming speeds than competitive designs and the capability to operate the pump successfully at high elevations, without the need for pressurized reservoirs.
- · Unique port layout with both operating ports on the same side of the pump, resulting in more accessible plumbing.
- Built in air bleed valve for automatic priming of the pump at start up.



# Piston Pump Service Procedure **P2 / P3 Series**

#### Introduction

This service manual has one purpose: to guide you in maintaining, troubleshooting, and servicing the P2 & P3 series piston pumps.

Material in this manual is organized so you can work on the Pump and get results without wasting time or being confused. To get these results, you should read this entire manual before you begin any work on the Pump. This manual also contains troubleshooting information and checklist. If you must service the Pump, the checklist will help you to determine where the problem may be.

The three-column format of the Disassembly and Inspection, and Assembly sections will make it easier for you to conduct work on the Pump. Column 1 gives a brief key for each procedure. Column 2 explains in detail the procedure you should follow. Column 3 illustrates this procedure with photographs. Read all material carefully and pay special attention to the notes, cautions, and warnings.

Pages with the various pump sizes exploded assembly view are provided several places in this manual. The

component part names and item numbers assigned on these exploded assembly views correspond with names and item numbers (in parentheses) used in the disassembly and assembly procedures set forth in this manual.

Service part list charts are also provided in this manual with the part names and exploded view item numbers cross referenced to Parker service part numbers.

Service parts are available through the Original Equipment Manufacturer or Parker approved P2 & P3 Distributors.

As you gain experience in servicing the Pump, you may find that some information in this manual could be clearer or more complete. If so, let us know about it. Do not try to second guess the manual. If you are stuck, contact us. Servicing the Pump should be a safe and productive procedure, in order for the unit to deliver the reliable, long-life operation engineered into it.



### **Troubleshooting Guide**

NOTE: Before troubleshooting any system problem, check service literature published by the equipment and/or component manufacturers. Follow their instructions, if given, for checking any component other than the Pump unit.

### **Preparation**

Make your troubleshooting easier by preparing as follows:

- · work in a clean, well-lighted place;
- · have proper tools and materials nearby;
- have an adequate supply of clean petroleum-based solvent.

WARNING: SINCE SOLVENTS ARE FLAMMABLE, BE EXTREMELY CAREFUL WHEN USING ANY SOLVENT, EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.

WARNING: WEAR EYE PROTECTION AND BE SURE TO COMPLY WITH OSHA AND OTHER MAXIMUM AIR PRESSURE REQUIREMENTS.

## **Preliminary Checks**

Hydraulic systems are often trouble-free. Hence, the problem an operator complains of could be cause by something other than the hydraulic components.

Thus, once you have determined that a problem exists, start with the easy-to-check items, such as:

- parts damaged from impact that were not properly repaired, or that should have been replaced; and
- improper replacement parts used in previous servicing
- mechanical linkage problems such as binding, broken, or loose parts or slipping belts

## **Hydraulic Components**

If you think the problem is caused by a hydraulic component, start by checking the easy-to-reach items.

Check all hoses and lines for cracks, hardening, or other signs of wear. Reroute any usable hoses that are kinked, severely bent, or that rest against hot engine parts. Look for leaks, especially at couplings and fittings. Replace any hoses or lines that don't meet system flow and pressure ratings.

Next, go to the reservoir and filter or filters. Check fluid level and look for air bubbles. Check the filter(s). 20/18/14 filtration is recommended per ISO 4406.

Visually check other components to see if they are loosely mounted, show signs of leaks, or other damage or wear.

Excessive heat in a hydraulic system can create problems that can easily be overlooked. Every system has its limitation for the maximum amount of temperature. After the temperature is attained and passed, the following can occur:

- · oil seal leaks
- loss of efficiency
- · pump loss of efficiency
- pump failure
- · hoses become hard and brittle
- hose failure

A normal temperature range means an efficient hydraulic system. Consult the manuals published by equipment and/or component manufacturers for maximum allowable temperature and hydraulic tests that may be necessary to run on the performance of the hydraulic components. The pump is not recommended for hydraulic systems with maximum temperatures above 70°C (158°F).

Normal working temperatures are  $0^{\circ}$  -  $70^{\circ}$ C (-32° - 158°F).

Maximum case drain temperature is 90°C (194°F).



#### **Trouble** Cause Remedy Oil Leakage 1. Hose fittings loose, worn or Check & replace damaged fittings or "O" Rings. Torque to damaged. manufacturers specifications. 2. Oil seal rings deteriorated by Replace oil seal rings by disassembling Pump unit. excess heat. 3. Bolt loose or its sealing area (a) Loosen then tighten single bolt to deteriorated by corrosion. torque specification. (b) Replace bolt. Shaft seal worn or damaged. (a) If pump is single shaft seal option: - Remove seal carrier from pump. - Remove damaged seal from seal carrier. - If shaft is worn, install new seal in the inner position. - Reinstall seal carrier. (b) If pump is dual shaft seal option: - Remove seal carrier from pump. - If shaft is damaged or worn, replace shaft and seals. - If shaft is not damaged, replace seals and reinstall seal carrier. NOTE: Check fluid leaking from housing weep hole to better determine which seal has failed. If pump is leaking hydraulic fluid the inboard seal has failed. If the pump is leaking transmission fluid the outboard seal has failed. No Flow from 1. Pump not installed correctly. Check proper drive rotation. Make sure pump shaft is turning (i.e. drive coupling is engaged). Check for Pump (If pump does not prime in sources of suction leaks, inlet flange tight? 30 seconds STOP!) Pinched o-rings? 2. Pump not getting oil. Make sure reservoir is full of oil. 1. Flow has an unrestricted path **Can't Build Any** Is it an open circuit to the reservoir. **Pressure** Can only build a Is compensator setting backed out? If load sense, 1. Pump control settings too low. few hundred PSI is there a load sense pressure signal? Is the (20-30 bar) system relief valve vented? 2. Control is malfunctioning. Assure orifices in control are not plugged. Assure control spools/springs are assembled correctly. If non-torque control pump, assure m 6x6 set screw is installed in torque control feed port. 3. Internal leakage in cylinders, Repair component. valves, motors or pumps.

CAUTION: If the hydraulic system fluid becomes overheated [in excess of 90°C (194°F), seals in the system can shrink, harden or crack, thus losing their sealing ability.



### **Troubleshooting Checklist**

Trouble	Cause	Remedy	
Pump won't compensate	Control is malfunctioning.	Clean orifices in control of contamination. Confirm orifice and plugs are properly assembled.  If torque control pump, is saturation orifice in place.	

### **Tools and Materials Required for Servicing**

- · Clean, petroleum-based solvent
- · Vise with soft jaws
- Air pressure source
- Arbor press
- Screw driver
- Breaker bar
- Torque wrench-(Nm) ft lbs: Range: 0-425 Nm
- · Adjustable crescent wrench
- Fluid mineral oil ISO VG 32 @ 40°C
- · Clean corrosion resistant grease, oil or petroleum jelly.
- Hex bits and Allen Keys (or T-handle).

Metric: 3mm, 5mm, 6mm, 8mm, 10mm, 12mm and 14mm

SAE: 1/8", 5/32", 3/16", 3/8", 1/2", 9/16" and 5/8"

· Sockets (deepwall)

Metric: 17mm, 19mm, 32mm or 36 mm and 38 mm

SAE: 9/16" and 1"

- Internal snapring pliers: small and large
- Box end wrench: 13mm (1/2"), 17mm deep offset
- · Pencil magnet
- Loctite 242

CAUTION: Mixing greases that have different bases can be detrimental to bearing life.



## **Technical Information**

CO	NI	<b>/</b>	PC		NIC
LU	IN V		$\sigma$	IUI	CV

mm	INCHES	
0.4	.0157	
0.8	.0314	
1.0	.0393	
1.2	.0472	
1.6	.0629	
2.0	.0787	
3.0	.1181	
4.0	.1574	
5.0	.1968	
10.0	.3936	
15.0	.5905	
20.0	.7873	
25.0	.9842	
25.4	1.000	

Torque Chart							
Nm	ft lbs	Nm	ft lbs	Nm	ft lbs	Nm	ft lbs
2.0	1.48	30.0	22.12	75.0	55.32	250.0	184.39
4.0	2.95	35.0	25.81	80.0	59.00	300.0	221.27
5.0	3.68	40.0	29.50	85.0	62.69	350.0	258.15
10.0	7.37	45.0	33.19	90.0	66.38	400.0	295.02
11.0	8.11	50.0	36.87	95.0	70.06	450.0	331.90
12.0	8.85	55.0	40.56	100.0	73.76		
13.5	10.0	60.0	44.25	125.0	92.19		
20.0	14.75	65.0	47.94	150.0	110.63		
25.0	18.43	70.0	51.63	200.0	147.51		

### **Temperature**

°C = 0.56 (°F -32)

°F = 1.8 (°C +32)

#### **Pressure**

1 PSI = .06896 Bar

1 Bar = 14.5 PSI

#### Length

1 inch = 0.0394 x 1 mm

 $1mm = 25.4 \times 1 \text{ inch}$ 

### **Torque**

 $1 \text{ Ft-Lb} = 0.738 \times 1 \text{ N-m}$ 

 $1 \text{ In-Lb} = 8.85 \times 1 \text{ N-m}$ 

1 N-m = 0.113 x 1 In-Lb



#### **Technical Information**

#### **SERVICE NOTES:**

- \* Use a clean lubricant (compatible with the working fluid) on all pump components during assembly.
- \* Thoroughly clean the reservoir, suction lines, suction strainer, drain lines, etc. before re-installing the pump. Most premature pump failures occur when contaminants from a previous failure have not been completely removed from the system, or cause for previous failure is still present (i.e. water in oil, filter bypassing, etc.).
- \* Always fill the case with the clean fluid before starting a new or service pumps (fill as high as inlet port will allow on a P3 style pump). For flooded suction, purge air from suction lines by cracking the inlet fitting or vent/ gage plug on pump body. This should prevent an airlock condition and allow for faster priming. Starting the pump slowly by jogging (or turning over engine without allowing it to start) will help the pump prime and makes it easier to determine when priming has occurred. Plumb P3 style pump air bleed directly to tank if pump is mounted above tank.
- \* Check for proper shaft rotation if there is a possibility it may have changed during a system rebuild.
- \* Start pump with an open circuit whenever possible. Reduce the compensator to its minimum setting during start-up. Cycle the pump on and off stroke while increasing the compensator to its required setting. This will assist in break-in of new components and help purge air from the case.



### **Disassembly and Inspection**

## **Preparation Before Disassembly**

- Before you disassemble the Pump unit or any of its components read this entire manual. It provides important information on parts and procedures you will need to know to service the P2 or P3 Pump.
- Determine whether the Pump you are about to disassemble is the P2 or P3 Pump Series so you can follow those
  procedures that pertain to that Series Pump. The first two letters of the "spec" number on the Pump identification
  tag is the Series designation.
- Refer to "Tools and Materials Required for Services" section for tools and other items required to service the Pump and have them available.
- Thoroughly clean off all outside dirt, especially from around fittings and hose connections, before disconnecting and removing the Pump.
- · Remove coupling shaft connections and hose fittings and immediately plug port holes and fluid lines.
- · Remove rust or corrosion from coupling shaft..
- Remove the Pump from system, drain it of fluid and take it to a clean work surface.
- Plug all ports and wash complete pump and remove any remaining outside dirt, rust and corrosion.
- Clean and dry the Pump before you start to disassemble the unit.
- As you disassemble the Pump clean all parts, except seals, in clean petroleum-based solvent, and blow them
  dry.

WARNING: petroleum-base solvents are flammable. Be extremely careful when using any solvent. Even a small explosion or fire could cause injury or death.

WARNING: WEAR EYE PROTECTION AND BE SURE TO COMPLY WITH OSHA OR OTHER MAXIMUM AIR PRESSURE REQUIREMENTS.

CAUTION: Never steam or high pressure wash hydraulic components. Do not force or abuse closely fitted parts.

- · Keep parts separate to avoid nicks and burrs.
- Discard all seals and seal rings as they are removed from the Pump. Replace all seals, seal rings and any damaged or worn parts with genuine Parker or OEM approved service parts.



Place pump in a vise.

Place pump into foot mounting bracket or a soft jawed vise, if foot mount is not available. If using a vise clamp firmly the pilot flange with shaft pointing down. See figure 1

**WARNING** 

WARNING: IF THE PUMP IS NOT FIRMLY HELD IN THE VICE, IT COULD BE DISLODGED DURING THE SERVICE PROCEDURES, CAUSING INJURY.



Figure 1

Remove Cover Bolts

 Once the cover bolts are loosen remove pump from vise and set unit on a clean workbench. See figure 2.

NOTE:

If bushing is damaged the shaft journal may be damaged as well. If journal is damaged, replacement of the shaft assembly will be necessary.

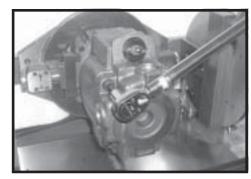


Figure 2

**Remove Cover** 

2. Check port plate for erosion, scoring, scratching, or an out of flat condition. If port plate is damaged, replace it. Check bushing for excessive wear, if bushing is damaged replace cover assembly. See figures 3 & 4.

NOTE:

Cover is pre-loaded by the rotating group and may seperate from the housing on its own. If not, tap the cover away from the housing using a dead blow hammer. Do Not pry cover off with a screwdriver as damage to the scaling surface may occur.



Figure 3



Figure 4



### P2 / P3 Series

#### Remove Rotating 3. Group

**NOTE** 

Inspect the barrel face for any scoring or scratching. Inspect barrel for worn or damaged splines. Inspect the piston slippers for smearing, scratching or rolling. Remove the pistons from barrel, inspect each piston and piston bore for scoring and galling. Inspect the ball seat and slipper retainer for scoring and galling. If any component is damaged, replace rotating group. (P3 Barrel shown) See figure 5.



On a P3075, if the impeller is damaged,

replace barrel assembly.

Figure 5



Figure 6

and seal carrier assembly

Remove snap ring 4. Look for any damage such as nicks, cuts or heat damage to seal and o-rings around the O.D. of the seal carrier. See figures 7 & 8.

**NOTE** 

If damage to shaft seal has occurred make sure to check mating surface on shaft. If shaft is damaged, replace with new seal in inner location for single shaft applications. Pump with dual shaft seals replace both shaft seals and shaft.



Figure 7

### Remove shaft snap ring.

Remove snap ring that retains the shaft and bearing assembly in the pump housing. Be careful not to scratch bearing bore when removing snap ring. If snap ring scratches the bearing bore during removal of the o-rings on the seal carrier may be cut when the pump is reassembled resulting in a leaking pump.



### P2 / P3 Series

#### **Remove Shaft**

6. Remove shaft and inspect all splines of the shaft for excessive wear or damage. Check rear cover bushing journal and shaft seal journal for excessive wear. Inspect rollers in the bearing for damage or pitting. If there are any defects in these areas discard and replace with new components. If pump has the single shaft seal option a new seal may be used in the inner position if the shaft seal journal in that location has not been damaged. If the pump has the dual shaft seal option and is damaged replace the shaft. See figure 8.

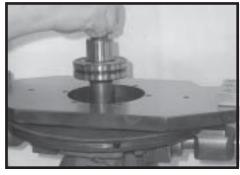


Figure 8

#### **NOTE**

Check and make sure bearing has not spun in the bearing bore, if so housing must be replaced.

## Remove Torque Control, if present

If pump has torque control, remove torque control cartridge and check for any damage to o-rings. Check ball in torque control travel seat. If damaged, replace torque control - link piston may also need to be replaced if it is worn. See figure 9.



Fiaure 9

## Remove bias spring plug

 Remove bias spring plug, spring and spring guide. Check the cone in spring guide for excessive wear or galling. Check for any damage to the o-rings such as cuts, nicks or heat damage. See figure 10.



Figure 10

### Remove Max Volume Assembly

 Remove maximum volume assembly and check for any excessive wear on the maximum volume stop and also any damage to the o-ring. See figure 11.



If maximum volume stop is adjusted or removed while servicing the pump, resetting of pump displacement will be necessary.



Figure 11



## Remove Servo Piston

9. Remove servo piston and check for excessive scoring or galling to the bore or on the piston itself. Check to make sure that all three seals rings are not damaged. Make note to how many shims are under the servo piston. Pump must be rebuilt using the same number of shims. See figure 12.



Figure 12

## Remove swash plate

10. Remove the swash plate, check the swash plate journals and slipper running face for any scratching or galling. If pump has a torque control option check the link piston for excessive wear. If a groove is present replace link piston. Chain link must be tight in both the link piston and swashplate. If excessive clearance is present, replace swashplate assembly. See figure 13.

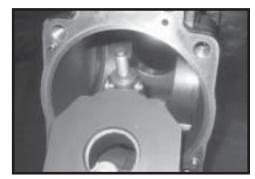


Figure 13

### Remove saddle bearing and stepped pins

 Remove both saddle bearing and stepped pins. If bearings have excessive wear replace with new components. See figures 14.

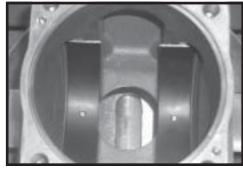


Figure 14

### Remove 4 Compensator Mounting Bolts

 Remove compensator assembly and check the o-rings for any damage and replace if necessary. See figure 15.



Figure 15



## Reference Exploded Assembly View

Replace all seals and seal rings with new ones. Each time you reassemble the pump unit lubricate all seals and o-rings with petroleum jelly or light mineral based grease before assembly.

Note:

Seals and o-rings are part of the complete seal kit. Parts should be available through most OEM part distributors or Parker approved Pump Distributors. Contact your local dealer for availability.

Wash all parts in clean petroleum-based solvents before assembly. Blow them dry with compressed air. Remove any paint chips from mating surfaces of the cover, housing and sealing areas.

**WARNING** 

Since they are flammable, be extremely careful when using any solvent. Even a small explosion or fire could cause injury or death.

**WARNING** 

Wear eye protection and be sure to comply with OSHA or other maximum air pressure

requirements.

Note:

For ease of installation and assembly do not clamp in foot mount or vise until cover assembly installation requires torque of bolts for rear cover assembly.

Wash housing and install on fixture

Wash housing and dry.

Install Saddle Bearing

1. Install stepped pins and saddle bearings in housing, Locate hole in saddle bearing over stepped pin. See figure 17.



Figure 16



Figure 17



### **Pump Assembly**

#### **Install Shims**

2. Install shims onto link piston and keep link piston threads dry and free from oil. See figure 18.



Figure 18

Install Swash Plate 3. Lubricate saddle bearing with hydraulic oil and install swash plate assembly into housing. See figure 19.



Figure 19

#### **Servo Piston** Assembly

4. If seal rings were removed from servo piston reinstall making sure that the three seal rings split are 90 degrees apart from each other. Check to ensure ends of seal rings are not overlapped. If so, adjust seal rings so they are properly aligned and no sharp edges are noticeable by touch. See figure 20.



Figure 20

#### NOTE

Threads of servo piston and link piston must be clean and free of oil prior to assembly. Apply one drop of Loctite 242 to third interior thread of servo piston. See figure 21.

Wipe excess loctite off bottom of servo piston and make sure loctite will not run out of servo piston in the servo bore of the pump housing.



Figure 21



Installation of
Servo Piston

Apply light film of oil to exterior of servo piston. Install servo piston into servo bore. Align the link piston by hand and thread the servo piston onto link piston. DO NOT over tighten. Torque servo piston to proper value. See figure 22.

**NOTE** 

DO NOT use excessive oil. Be careful to keep oil out of the interior threads of the servo piston and off of the threads on the link piston.

**NOTE** 

Step 6 & 7 MUST be performed in the following order or damage to the servo bore may occur.

**Install Servo** Plug

Thread servo plug assembly into servo bore and torque servo plug. See figure 23.



Figure 22



Figure 23

and Plug

**Install Bias Spring** 7. Insert bias spring onto spring guide and bias spring plug. Install in housing making sure spring guide seats properly on swash plate wear pin. Torque bias spring plug. See figure

**NOTE** 

Mineral based grease may be used to keep spring guide from falling out of bias spring.



Figure 24

8. Install shaft assembly into housing. Shaft bearing is a slip fit and should slide easily to the bottom of the bore DO NOT hammer. See figure 25.

**NOTE** 

Shaft bearing is a spherical bearing and outer race can rotate off of rollers. Make sure outer race is properly aligned before installing shaft.

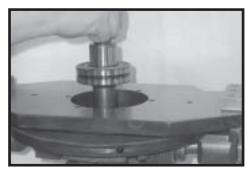


Figure 25



### **Pump Assembly**

#### Install Shaft Seal Carrier

 Install shaft seal carrier assembly into housing behind shaft assembly. Shaft seal lip must be lubricated with grease before installing shaft assembly. See figure 26.

#### **NOTE**

Be careful not to roll the lip of the shaft seal when installing the seal carrier.

If the shaft is keyed, remove key before install seal carrier.

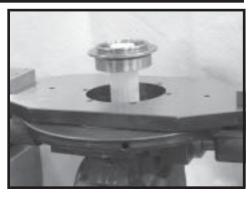


Figure 26

### Install Snap Ring

10. Insert snap ring.

#### **NOTE**

It may be necessary to tap the snap ring down against the seal carrier with a small hammer and flat nosed punch in order to compress the seal carrier o-ring and seat the snap ring.

## Install O-Ring Plugs

11. Install all o-ring plugs in housing and torque.

## Installation of Rotating Group

 Lubricate swash plate surface with hydraulic fluid install rotating group over shaft, line up the spline, and seat rotating group against swash plate. (P3 Barrel shown) See figure 27.



Figure 27

Installation of Housing/Cover Assembly

13. Apply grease to o-ring and install into housing. See figure 28.



Figure 28



### **Pump Assembly**

14. Obtain cover assembly and check to ensure oring has been installed in cover and port plate is in proper position and is flat on the cover. Apply hydraulic oil to bushing in rear cover and place rear cover assembly onto pump. See figure 29.

#### **NOTE**

When installing rear cover be careful to keep proper alignment to keep from gouging the bushing.

On a P2060 or a P2075, the outlet on the rear cover is oriented toward the servo piston.

On a P3075, the outlet in the cover must be oriented on the same side of the pump as the housing inlet.



Figure 29

## Install Cover Bolts

15. Insert cover bolts, tighten evenly and torque. When torquing, always use crisscross pattern and repeat torque on first bolt. If any o-ring plugs were removed from rear cover reinstall and torque. See figures 30.

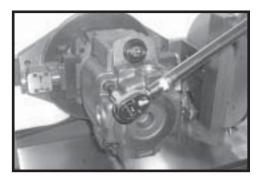


Figure 30

#### **NOTE**

On a P3075, if the airbleed was removed from the rear cover, reinstall and torque. See figure 31.

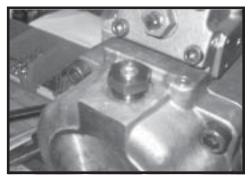


Figure 31



#### **NOTE**

The airbleed comes in a standard position from the factory but can be installed in any of three locations in the rear cover to meet plumbing needs. If the airbleed is moved to another location, the o-ring plug from that port must be installed in the port vacated by the airbleed. Both the airbleed and o-ring plug must be torqued to specified amount before operating the pump.

If any o-ring plugs were removed from rear cover, reinstall and torque.

## Installation of Compensator

16. Attach compensator with four screws and torque. When torquing, always use diagonal pattern and repeat torque on first bolt. Make sure all four o-rings are present on compensator mounting face. See figure 32.



Figure 32

#### Install Torque Conrol

If pump is fitted with the torque control option, install torque control port and torque. See figure 33.



Figure 33

#### **Pressure Test**

17. To verify correct assembly and installation of seals, pessure test the pump. Block off all ports and apply air pressure to pump case as detailed on page 112. Air leak test. See figure 34.

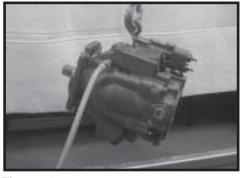


Figure 34



Place pump in a vise.

Place pump into foot mounting bracket or a soft jawed vise, if foot mount is not available. If using a vise clamp firmly the pilot flange with shaft pointing down.

#### **WARNING**

WARNING: IF THE PUMP IS NOT FIRMLY HELD IN THE VICE. IT COULD BE DIS-LODGED DURING THE SERVICE PROCE-**DURES, CAUSING INJURY.** 



Figure 35

## (P3 only)

**Remove Airbleed** 1. Remove the airbleed from the ripple chamber port in the rear cover. Use a drip pan to catch the oil that has been retained in the ripple chamber. Check o-rings for damage. See figure 36.



Figure 36

#### Remove O-ring **Plugs**

2. Remove the o-ring plugs from the ripple chamber port on the rear cover. There is one plug on a P2 pump and two plugs on a P3 pump. Use a drip pan to catch the oil that has been retained in the ripple chamber. Check o-rings for damage.



3. Once the cover bolts are loosened, it may be easier for disassembly to remove pump from vise and set unit on a clean workbench. See figure 37.



Cover is pre-loaded by the rotating group and may separate from the housing on its own. If not, tap the cover away from the housing using a dead blow hammer. Do Not pry cover off with a screwdriver as damage to the sealing surface may occur.

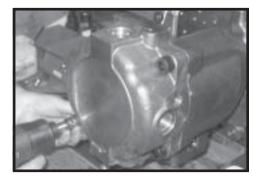


Figure 37



### Disassembly and Inspection 105/145

#### **Remove Cover**

Check port plate for erosion, scoring, scratching, or an out of flat condition. If port plate is damaged, replace it. Check bushing for excessive wear, if bushing is damaged replace cover assembly. See figure 38.

#### **NOTE**

If bushing is damaged the shaft journal may be damaged as well. If journal is damaged, replacement of the shaft assembly will be necessary.

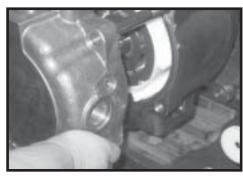


Figure 38

#### **Destroke Pump**

5. Using calipers, measure the distance from the top of the volume adjustment screw to the top of the seal nut and record this dimension. Resetting the volume screw to the height during pump reassembly will return the pump to the factory set displacement. Remove seal nut and turn volume adjustment screw in (clockwise) until last thread is flush with the top of the servo cover plate. See figure 39.



Figure 39

#### Remove Impeller (P3 Only)

6. For a P3105, slide impeller off of barrel. For a P3145, remove the six shoulder bolts from the barrel/impeller face and slide the impeller off of barrel. See figure 40.

#### NOTE:

If impeller does not slide freely off barrel, remove the barrel and impeller as one unit in the next step. Once the barrel is out of the pump use a dead blow hammer and lightly tap on the back side of the impeller and remove it from the barrel.



Figure 40

#### **Remove Barrel**

7. Inspect the barrel for any scoring or scratching to the barrel face and for worn or damaged splines. Inspect the piston bores for scoring or galling. If any of the bronze sleeves are damaged or cracked, replace barrel. See figure 41.



Figure 41



### Disassembly and Inspection 105/145

Remove the 4 screw from the slipper retainer hold down plates 8. Remove the two fixed clearance hold down plates. Inspect hold down plates for wear or galling. If hold down plates worn more than 0.1mm, replace. See figure 42.



Figure 42

Remove the pistons/slipper retainer

9. Inspect the piston slippers for smearing, scratching or rolling. Inspect pistons for galling or scratching. Inspect slipper retainer for an out of flat condition or wear. If any component is damaged replace the rotating group. See figure 43.



Figure 43

and Seal carrier assembly

Remove snap ring 10. Look for any damage such as nicks, cuts or heat damage to seal and o-rings around the O.D. of the seal carrier. See figure 44.

**NOTE** 

If damage to shaft seal has occurred make sure to check mating surface on shaft. If shaft is damaged replace the shaft seal with a new seal in the inner location for single shaft applications. For pumps with dual shaft seals replace both shaft seals and shaft.



Figure 44



## Remove Shaft Snap Ring

11. Remove snap ring that retains the shaft and bearing assembly in the pump housing. Be careful not to scratch bearing bore when removing snap ring. If snap ring scratches the bearing bore during removal of the o-rings on the seal carrier may be cut when the pump is reassembled resulting in a leaking pump. Remove shaft and inspect all splines of the shaft for excessive wear or damage. Check rear cover bushing journal and shaft seal journal for excessive wear. Inspect rollers in the bearing for damage or pitting. If any defects are present in these areas discard and replace with new components. If pump has the single shaft seal options a new seal may be used in the inner position if the shaft seal journal in that location has been damaged. If the pump has the dual shaft seal option replace the shaft and bearing assembly. See figure 45.



Figure 45

#### **NOTE**

Check and make sure bearing has not spun in the bearing bore, if the bearing has spun replace the housing.

 Turn volume adjustment screw out (counter clockwise) until it comes to a hard stop. DO NOT use an air gun to do this.

## Remove torque control

13. If pump has torque control, remove torque control cartridge and check for any damage to o-rings and backup rings. If the o-rings and backup rings are damaged, replace them. See figure 46.

Check ball in torque control travel seat. If it is damaged replace torque control - link piston may be also needed to be replaced.

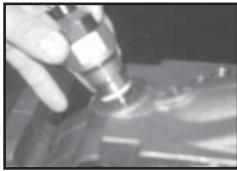


Figure 46

## Remove bias spring

14. Remove bias spring plug, spring and spring guide check the cone in spring guide for excessive wear or galling. Check for any damage to the o-rings such as cuts, nicks or heat damage. If any components are damaged, replace. See figure 47.



Figure 47



### Disassembly and Inspection 105/145

### Remove Max Volume Cover Assembly

15. Loosen and remove the four bolts retaining the maximum volume assembly and remove assembly. Check for any excessive wear on the maximum volume stop and any damage to the o-rings. See figure 48.

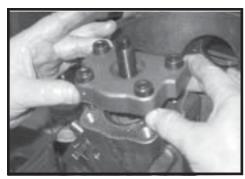


Figure 48

## Remove Servo Piston

Unthread the servo piston and check for excessive scoring or galling to the bore on the piston. Check to make sure that all three seal rings are not damaged or broken. See figure 49.



Figure 49

### Remove Swashplate Retaining Pins (145 only)

 Remove the swashplate retaining pins and check for damage to the o-rings. Replace orings if necessary. See figure 50.



Figure 50

## Remove swashplate

17. Remove the swashplate check the swashplate journals and slipper running face for any scratching or galling. If pump has a torque control option check the link piston for excessive wear. If a groove is present, rotate link piston 180 degrees and reinstall. If pump has previously been serviced and a groove is present on both sides, replace link piston. Chain link must be tight in both the link piston and swashplate. If excessive end play is present, replace swashplate assembly. Check wear pin for wear or galling. If it is worn, replace swashplate assembly. See figure 51.

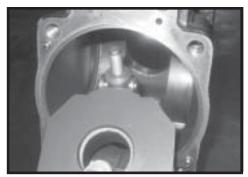


Figure 51



## Disassembly and Inspection 105/145

## Remove Saddle Bearings

18. Remove both saddle bearings and both stepped pins. If bearings have excessive wear replace with new components. See figure 52.

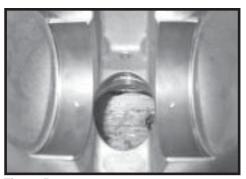


Figure 52

## Remove Compensator

Remove compensator assembly and check the o-rings for any damage and replace if necessary. See figure 53.



Figure 53

## Remove o-ring plugs

19. Remove all remaining o-ring plugs in the housing and replace all o-rings during assembly.



## Reference Exploded Assembly View

Replace all seals and seal rings with new ones. Each time you reassemble the pump unit lubricate all seals and o-rings with petroleum jelly or light mineral based grease before assembly.

**NOTE** 

Seals and o-rings are part of the complete seal kit. Parts should be available through most OEM part distributors or Parker approved Pump distributors. (Contact your local deal for availability).

Wash all parts in clean petroleum-based solvents before assembly. Blow them dry with compressed air. Remove any chips from mating surfaces of the cover housing and sealing areas.

**WARNING** 

WARNING: SINCETHEY ARE FLAMMABLE, BE EXTREMELY CAREFUL WHEN USING SOLVENT. EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.

WARNING: WEAR EYE PROTECTION AND BE SURE TO COMPLY WITH OSHA OR OTHER MAXIMUM AIR PRESSURE REQUIREMENTS.

**NOTE** 

For ease of assembly do not clamp in foot mount or vise until cover assembly installation requires torque of bolts and ripple chamber plugs for rear cover assembly.

**Wash Housing** 

1. Wash housing and dry.

Install Saddle Bearings

 Installed stepped pins and saddle bearings in housing. Locate hole in saddle bearing over the small diameter of the stepped pin. See figure 54.



Figure 54



#### Install swashplate

 Lubricate saddle bearings with hydraulic oil and install swashplate assembly into housing. It is very important to keep the link piston threads dry and free from oil. See figure 55.

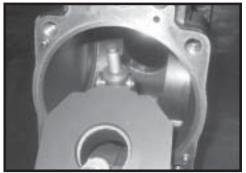


Figure 55

# Install swashplate retaining pins (145 only)

 Install swashplate retaining pins and torque.
 Nose of pin fits in the slot on the side of the swashplate. See figure 56.



Figure 45

## Install seal rings on servo piston

4. If the seal rings were removed from servo piston reinstall then making sure that the three seal ring split are 90 degrees apart from each other. Check to ensure the ends of the seal rings are not overlapped. If so, adjust seal rings so they are properly aligned and no sharp edges are noticeable by touch. See figure 57.



Figure 57

**NOTE** 

Make sure the threads of servo piston and link piston are clean and free of oil prior to assembly. Apply one drop of loctite 242 to interior threads of servo piston.

NOTE

Wipe excess Loctite off bottom of servo piston and make sure the Loctite will not run out of servo piston into the servo bore or pump housing.



5. Apply light film of oil to exterior of servo piston. Install servo piston into servo bore. Wipe excess oil from hands and align the link piston by hand and thread the servo piston onto link piston. DO NOT tighten servo piston above specified torque. Damage to the chain link may occur. See figure 58.



DO NOT use excessive oil. Be careful to keep oil out of the interior threads of the servo piston and off of the threads on the link piston.



Figure 58



**NOTE** 

Steps 6 & 7 MUST be performed in the following order or damage to the servo bore may occur.

Install servo cover 6.

Install servo cover onto servo bore and torque the four cap screws. Make sure all orings are in place before installing. See figure 59.

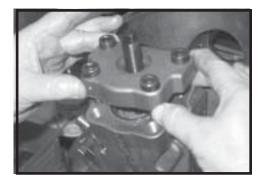


Figure 59

Install bias spring 7.

Insert bias spring onto spring guide and bias spring plug. Install in housing making sur spring guide seats properly on swash plate wear pin. Compress bias spring while threading the servo plug in the bore. Be careful not to cross threads. Torque bias spring plug. See figure 60.

**NOTE** 

**NOTE** 

Mineral based grease may be used to keep spring guide from falling out of bias spring.



Figure 60

Install shaft and snap ring 8. Install shaft assembly into housing. Shaft bearing is a slip fit and should slide easily to the bottom of the bore DO NOT hammer. Install snap ring into bearing bore. Be careful not to scratch the bearing bore with the snap ring. If it is scratched, the o-rings on the outside of the seal carrier may not seal resulting in a leaking pump. See figure 61.

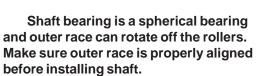




Figure 61

**Install Snap Ring** 



Figure 62



#### Install seal carrier 9

Install shaft carrier assembly into housing behind shaft assembly. Shaft seal lip and orings must be lubricated with grease before installing shaft assembly. See figure 63.

#### **NOTE**

Be careful not to roll the lip of the shaft seal over when installing the seal carrier.

Insert snap ring.

#### **NOTE**

It may be necessary to tap the snap ring down against the seal carrier with a small hammer and flat nosed punch in order to compress the seal carrier o-ring and seat the snap ring.

Install all o-ring plugs in housing and torque.

#### **NOTE**

If pump does not have a torque control and the M6x6 set screw was removed from the torque control feed port, the set screw must be reinstalled before installing oring plug.

#### **Destroke pump**

 Turn volume adjustment screw in clockwise until last thread is flush with servo cover. See figure 64.

#### NOTE

11. If barrel spring, washers, snap ring were removed from the barrel, reinstall. Insert pistons into slipper retainer. Lubricate swash plate surface with hydraulic fluid install rotating group over shaft, line up the spline, and seat rotating group against swash plate.

#### Install Fixed Clearance Holddown Plates

12. Before installing hold-down shoes, make sure all piston slippers are seated against the swashplate. To do this, using two screwdrivers on either side of the barrel push the slipper retainer back until it comes to a hard stop and all the slippers are flat against the swashplate. If this is not done, damage to the slippers can occur when the hold down shoes are installed.

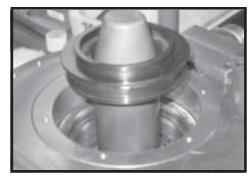


Figure 63



Figure 64



Apply loctite to the four cap screws, install the hold-down shoes, and properly torque the cap screws. Before torquing bolts make sure the slipper retainer is properly seated beneath the flange of both hold-down plates. See figure 65.

#### **NOTE**

Make sure bolts and threaded holes in swashplate are clean and free of oil before applying Loctite and installing hold-down shoes.

Figure 65

## Reset volume adjusting

13. Adjust volume screw full counter clockwise and install seal nut. Adjust the volume screw clockwise to the distance that was measured from the end of the screw to the top of the seal nut during disassembly. Torque seal nut. This will reset the pump at the same displacement as it was originally factory set. Airgun should not be used.

Apply grease to cover o-rings and install into housing. See figure 66.



Figure 66

#### Install cover

14. Obtain cover assembly and check to ensure o-ring has been installed in cover and port plate is in proper position and is flat on the cover. Apply hydraulic oil to bushing in rear cover and place rear cover assembly onto pump.

NOTE: When installing rear cover be careful to keep proper alignment to keep from gouging the bushing.

Insert cover bolts, tighten evenly and torque. When torquing, always use crisscross pattern and repeat torque on first bolt. See figure 67.



Figure 67

## Install airbleed (P3 only)

**NOTE** 

15. Install the airbleed in the same port it was removed from and torque. The standard position for the airbleed is the port next to the volume adjustment screw. However, it may be installed in any of the three ripple chamber ports.

If any o-ring plugs were removed from the rear cover reinstall and torque. See figure 68.

It is very important that the o-ring plugs and the airbleed (P3 only) in the ripple chamber of the rear cover are torqued properly, otherwise o-ring failure can occur.

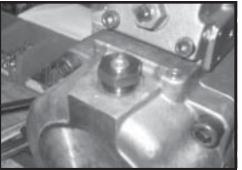


Figure 68



## Pump Assembly 105/145

## Install compensator

16. Attach compensator with four screws and torque. When torquing, always use diagonal pattern and repeat torque on first bolt. Make sure all four o-rings are present on compensator mounting face. See figure 69.



Figure 69

## Install torque control

17. If pump is fitted with torque control option, install torque control into torque control port and torque. See figure 70.



Figure 70

#### **Pressure Test**

18. To verify correct assembly and installation of seals, pressure test pump. Block off all ports and apply air pressure to pump case as detailed on page 112. See figure 71.

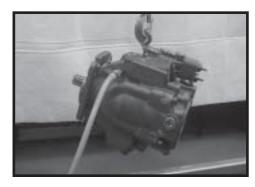


Figure 71



#### **Final Checks**

### **Final Checks**

- Pressurize the Pump with 2 bar (29 psi). dry air or nitrogen and submerge in solvent to check for external leaks.
- Use test stand if available, to check operation of the Pump.

## **Hydraulic Fluid**

Premium hydraulic fluid with a normal operating viscosity range between 15 - 40 cSt (80 - 100 SUS). Maximum viscosity is 1000 cSt (4600 SUS) for short periods. Minimum viscosity is 10 cSt (60 SUS) for short periods. Oil should have maximum antiwear properties, rust and oxidation inhibitors.

CAUTION: Do not mix oil types. Any mixture, or an unapproved oil, could deteriorate the seals. Maintain the proper fluid level in the reservoir. When changing fluid, completely drain old oil from the system. It is suggested also that you flush the system with clean oil.

#### **Filtration**

For maximum pump and system component life, fluid contamination should be limited to 20/18/14 according to ISO 4406. Due to the nature of variable volume pumps, pump inlet conditions, types of fluids and duty cycles must be considered before specifying suction filtration. Contact Parker Representative for assistance.

## **Oil Temperature**

Normal working fluid temperature in tank  $0^{\circ}$  -  $70^{\circ}$ C (+32°F + 158°F) Maximum operating case drain/control drain temperature  $90^{\circ}$ C (+194°F) Cold start temperature -40°C (-40°F)



## Tips for Maintaining the Pump Hydraulic System

- Do not combine case drains or control drains with any other pressure, return, or case return lines. Plumb directly tank, overpressurization of pump case will shorten pump life or cause component failure.
- Adjust fluid level in reservoir as necessary.
- Encourage all operators to report any malfunction or accident that may have damaged the hydraulic system or component.
- Do not remove or circumvent any pump control lock outs.
- Do not attempt to weld any broken Pump component. Replace the component with original equipment only.
- Do not cold straighten, hot straighten, or bend any Pump part.
- Prevent dirt or other foreign matter from entering the hydraulic system. Clean the area around and the filler caps before checking oil level.
- Investigate and correct any external leak in the hydraulic system, no matter how minor the leak.
- Comply with manufacturer's specifications for cleaning or replacing the filter.

CAUTION: Do not weld, braze, solder or any way alter any Pump component.

CAUTION: Maximum operating pressure must not exceed recommended Pump pressure capacity.

CAUTION: Always carefully inspect any system component that may have been struck or damaged during operation or in an accident. Replace any component that is damaged or that is questionable.

CAUTION: Do not force any coupling onto the Pump coupling shaft as this could damage the unit internally.

Parker extends close technical cooperation and assistance. If problems occur which you cannot solve, please contact your local Parker approved Distributor or Parker Technical Support. Our phone number and fax number and address are on the back cover of this manual.

Before adjusting pump differential or torque control settings contact factory.













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- 7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the

- right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.
- 8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property, Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.
- 9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.
- 10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter 'Intellectual Property Rights'). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights. If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.
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- 12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

9/91-P





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