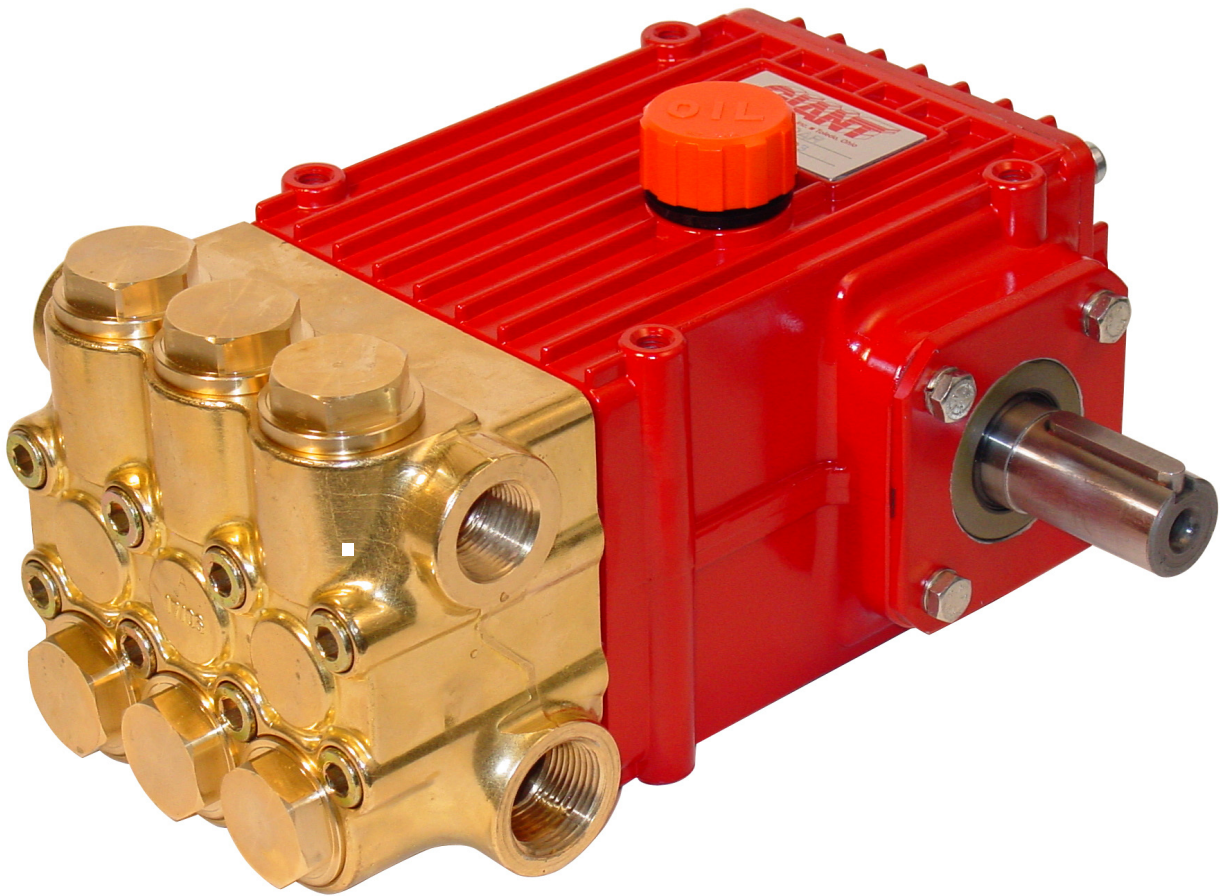


Models

P450, P451, P452 & P456

Triplex Ceramic
Plunger Pump
Operating Instructions/
Repair and Service Manual



GIANT
Performance Under Pressure

Updated 04/15

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INSTALLATION INSTRUCTIONS

Installation of the Giant Industries, Inc., pump is not a complicated procedure, but there are some basic steps common to all pumps. The following information is to be considered as a general outline for installation. If you have unique requirements, please contact Giant Industries, Inc. or your local distributor for assistance.

1. The pump should be installed flat on a base to a maximum of a 15 degree angle of inclination to ensure optimum lubrication.
2. The inlet to the pump should be sized for the flow rate of the pump with no unnecessary restrictions that can cause cavitation. Teflon tape should be used to seal all joints. If pumps are to be operated at temperatures in excess of 160° F, it is important to insure a positive head to the pump to prevent cavitation. **NPSH values must be observed.** Maximum input pressure 145 PSI (10 bar) and maximum suction head -4.35 PSI (-0,3 bar). Make sure that suction pulsation is sufficiently dampened - water column resonance must be avoided.
3. The discharge plumbing from the pump should be properly sized to the flow rate to prevent line pressure loss to the work area. It is essential to provide a safety bypass valve between the pump and the work area to protect the pump from pressure spikes in the event of a blockage or the use of a shut-off gun.
4. Use of a dampener is necessary to minimize pulsation at drive elements, plumbing, connections, and other system areas. The use of a dampener with Giant Industries, Inc. pumps is optional, although rec-

ommended by Giant Industries, Inc. to further reduce system pulsation. Dampeners can also reduce the severity of pressure spikes that occur in systems using a shut-off gun. A dampener must be positioned downstream from the unloader.

5. Crankshaft rotation on Giant Industries, Inc. pumps should be made in the direction designated by the arrows on the pump crankcase. Reverse rotation may be safely achieved by following a few guidelines available upon request from Giant Industries, Inc. Required horsepower for system operation can be obtained from the charts on pages 3 - 5.

6. Before beginning operation of your pumping system, remember: Check that the crankcase and seal areas have been properly lubricated per recommended schedules.

Important! If the pump is not used for a long period of time, it is possible the seals (23) could become hard or brittle thus causing the pump to leak when put into operation. If this is the case, we recommend these seals be replaced every 4 years. Do not run the pump dry for extended periods of time. Cavitation will result in severe damage. Always remember to check that all plumbing valves are open and that pumped media can flow freely to the inlet of the pump.

Important! If there is **danger of frost**, the water in the pump and in the pump fittings (particularly the unloader valve) must be emptied. The second discharge port can also be used and the pump run "dry" for 1-2 minutes for this purpose.

Finally, remember that high pressure operation in a pump system has many advantages. But, if it is used carelessly and without regard to its potential hazard, it can cause serious injury.

IMPORTANT OPERATING CONDITIONS

Failure to comply with any of these conditions invalidates the warranty.

1. Prior to initial operation, add oil to the crankcase so that oil level is between the two lines on the oil dipstick. DO NOT OVERFILL.

Use SAE 80-90W or Giant's p/n 01154

Crankcase oil should be changed after the first 50 hours of operation, then at regular intervals of 500 hours or less depending on operating conditions.

2. Pump operation must not exceed rated pressure, volume, or RPM. A pressure relief device must be installed in the discharge of the system.

3. Acids, alkalines, or abrasive fluids cannot be pumped unless approval in writing is obtained before operation from Giant Industries, Inc.

4. Run the pump dry approximately 10 seconds to drain the water before exposure to freezing temperatures.

Important! If there is a **danger of frost**, the water in the pump and the pump fittings (particularly the unloader valve) must be emptied. The second discharge port can also be used and the pump run "dry" for 1-2 minutes for this purpose.

Specifications Model P450

	U.S.	(Metric)
Volume	Up to 5.5 GPM	(20.8 LPM)
Discharge Pressure	Up to 5075 PSI	(350 bar)
Inlet Pressure	-4.35 to 145 PSI	(-.3 to 10 bar)
Stroke.....	0.787"	(20mm)
RPM	Up to 1450 RPM	
Plunger Diameter	0.708"	(18mm)
Temperature of Pumped Fluids.....	Up to 158° F	(70° C)
Inlet Ports.....		(2) 1/2" BSP
Discharge Ports		(2) 1/2" BSP
Manifold Material.....		Bronze
Shaft Rotation	Top of pulley towards manifold	
Crankshaft Diameter	1.102"	(28mm)
Key Width.....	0.315"	(8mm)
Shaft Mounting.....		Either side ¹
Weight.....	39.7 lbs.....	(18 kg)
CrankcaseCapacity	30.4 fl.oz.	(0.9 liters)
NPSHR	28.5 Foot of Head	8.7 Meters of head

Consult the factory for special requirements that must be met if the pump is to operate beyond one or more of the limits specified above.

NOTES:

In order to drive the pump from the side opposite the present shaft extension, simply remove the valve casing from the crankcase and rotate the pumps 180 degrees to the desired position. Be certain to rotate the seal case (item #20) as well, so that the weep holes are down at the six o'clock position. Exchange the oil fill and the oil drain plugs, also. Refer to the repair instructions as necessary for the proper assembly sequence.

P450 HORSEPOWER REQUIREMENTS					
RPM	GPM	2000 PSI	3000 PSI	4000 PSI	5075 PSI
920	3.5	4.8	7.2	9.6	12.2
1050	4.0	5.5	8.3	11.0	14.0
1185	4.5	6.2	9.3	12.4	15.8
1315	5.0	6.9	10.3	13.8	17.5
1450	5.5	7.6	11.4	15.2	19.3

HORSEPOWER RATINGS:

The rating shown are the power requirements for the pump. Gas engine power outputs must be approximately twice the pump power requirements shown above.

We recommend a 1.15 service factor be specified when selecting an electric motor as the power source. To compute specific pump horsepower requirements, use the following formula:

$$HP = (GPM \times PSI) / 1450$$

SPECIAL NOTE:

The theoretical gallons per revolution (gal/rev) is 0.00379. To find specific outputs at various RPM, use the formula:
 $GPM = 0.00379 \times RPM$

Specifications

Model P451/P452

	U.S.	(Metric)
Volume	Up to 5.8 GPM	(22.0 LPM)
Discharge Pressure	Up to 5075 PSI	(350 bar)
Inlet Pressure	-4.35 to 145 PSI	(-.3 to 10 bar)
Stroke	0.72"	(18.2mm)
RPM	Up to 1725 RPM	
Plunger Diameter	0.708"	(18mm)
Temperature of Pumped Fluids	Up to 158° F	(70° C)
Inlet Ports		(2) 1/2" BSP
Discharge Ports		(2) 1/2" BSP
Manifold Material (P451)		Bronze
Manifold Material (P452)		Brass
Shaft Rotation	Top of pulley towards manifold	
Crankshaft Diameter	1.102"	(28mm)
Key Width	0.315"	(8mm)
Shaft Mounting	Either side ¹	
Weight	38.3 lbs.	(17.4 kg)
Crankcase Capacity	30.4 fl.oz.	(0.9 liters)
NPSHR	28.5 Feet of Head	8.7 Meters of Head

Consult the factory for special requirements that must be met if the pump is to operate beyond one or more of the limits specified above.

NOTES:

In order to drive the pump from the side opposite the present shaft extension, simply remove the valve casing from the crankcase and rotate the pumps 180 degrees to the desired position. Be certain to rotate the seal case (item #20) as well, so that the weep holes are down at the six o'clock position. Exchange the oil fill and the oil drain plugs, also. Refer to the repair instructions as necessary for the proper assembly sequence.

P451/452 HORSEPOWER REQUIREMENTS					
RPM	GPM	2000 PSI	3000 PSI	4000 PSI	5075 PSI
920	3.1	4.3	6.4	8.6	10.9
1050	3.5	4.8	7.2	9.7	12.3
1185	4.0	5.5	8.3	11.0	14.0
1315	4.4	6.1	9.1	12.1	15.4
1725	5.8	8.0	12.0	16.0	20.3

HORSEPOWER RATINGS:

The rating shown are the power requirements for the pump. Gas engine power outputs must be approximately twice the pump power requirements shown above.

We recommend a 1.15 service factor be specified when selecting an electric motor as the power source. To compute specific pump horsepower requirements, use the following formula:

$$HP = (GPM \times PSI) / 1450$$

SPECIAL NOTE:

The theoretical gallons per revolution (gal/rev) is 0.00336. To find specific outputs at various RPM, use the formula:

$$GPM = 0.00336 \times RPM$$

Specifications Model P456

	U.S.	(Metric)
Volume	Up to 5.8 GPM	(22.0 LPM)
Discharge Pressure (Continuous).....	Up to 4350 PSI	(300 bar)
Discharge Pressure (Intermittent).....	Up to 5075 PSI.....	(350 bar)
Inlet Pressure.....	-4.35 to 145 PSI	(-.3 to 10 bar)
Stroke.....	0.72"	(18.2mm)
RPM	Up to 1725 RPM	
Plunger Diameter	0.708"	(18mm)
Temperature of Pumped Fluids.....	Up to 158° F	(70° C)
Inlet Ports.....	(2) 1/2" BSP	
Discharge Ports	(2) 1/2" BSP	
Manifold Material.....	Forged Brass	
Shaft Rotation	Top of pulley towards manifold	
Crankshaft Diameter	1.102"	(28mm)
Key Width.....	0.315"	(8mm)
Shaft Mounting.....	Either side ¹	
Weight.....	38.3 lbs.....	(17.4 kg)
CrankcaseCapacity.....	30.4 fl.oz.	(0.9 liters)
NPSHR	28.5 Feet of Head	8.7 Meters of Head

Consult the factory for special requirements that must be met if the pump is to operate beyond one or more of the limits specified above

NOTES:

In order to drive the pump from the side opposite the present shaft extension, simply remove the valve casing from the crankcase and rotate the pumps 180 degrees to the desired position. Be certain to rotate the seal case (item #20) as well, so that the weep holes are down at the six o'clock position. Exchange the oil fill and the oil drain plugs, also. Refer to the repair instructions as necessary for the proper assembly sequence.

P456 HORSEPOWER REQUIREMENTS					
RPM	GPM	2000 PSI	3000 PSI	4350 PSI	5075* PSI
920	3.1	4.3	6.4	9.3	10.9
1050	3.5	4.8	7.2	10.5	12.3
1185	4.0	5.5	8.3	12.0	14.0
1315	4.4	6.1	9.1	13.2	15.4
1725	5.8	8.0	12.0	17.4	20.3

*Intermittent Duty Only

SPECIAL NOTE:

The theoretical gallons per revolution (gal/rev) is 0.00336. To find specific outputs at various RPM, use the formula:

$$\text{GPM} = 0.00336 \times \text{RPM}$$

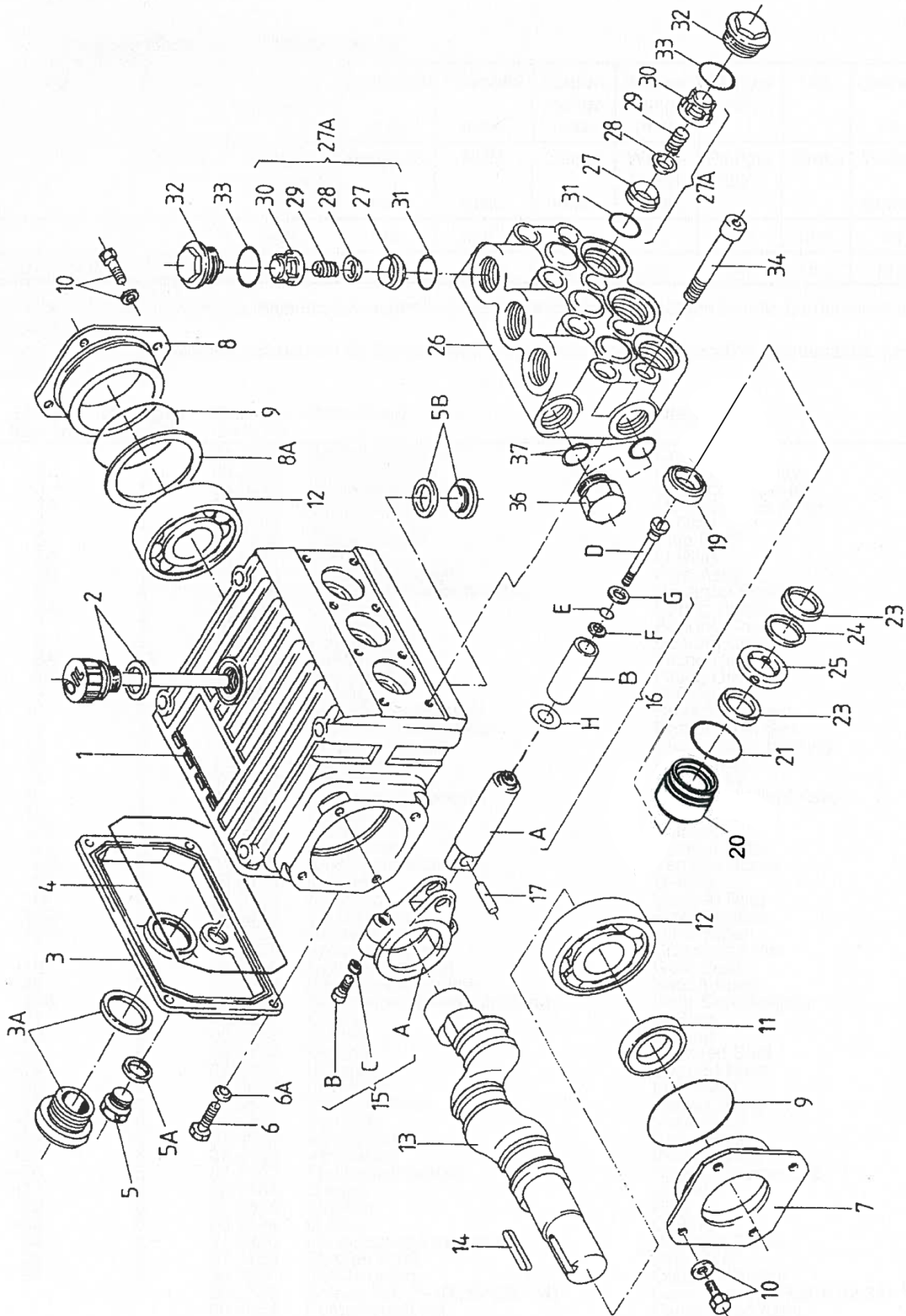
HORSEPOWER RATINGS:

The rating shown are the power requirements for the pump. Gas engine power outputs must be approximately twice the pump power requirements shown above.

We recommend a 1.15 service factor be specified when selecting an electric motor as the power source. To compute specific pump horsepower requirements, use the following formula:

$$\text{HP} = (\text{GPM} \times \text{PSI}) / 1450$$

EXPLODED VIEW - P450/P451/P452/P456



P450/P451/P452/P456 SPARE PARTS LIST

<u>ITEM</u>	<u>PART</u>	<u>DESCRIPTION</u>	<u>QTY.</u>	<u>ITEM</u>	<u>PART</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	08377	Crankcase	1	16H	06431	Oil Scraper	3
2	08378	Oil Fill Plug with Gasket	1	17	06790	Crosshead Pin	3
3	06479	Crankcase cover	1	19	05444	Oil Seal	3
3A	07186	Oil Sight Glass w/ Gasket	1	20	05534	Seal Case	3
4	08380	O-Ring	1	21	07266	O-Ring	3
5	07109	Oil Drain Plug	1	23	08477*	V-Sleeve, 18mm	6
5A	06015	O-Ring for Oil Drain Plug	1	24	07929	Pressure Ring	3
5B	08092	Plug with Gasket	1	25	08402	Weep Return Ring	3
6	01010	Screw	4	26	05574	Manifold - Brass (P452, P456)	1
6A	01011-0400	Spring Washer	4	26	08470	Manifold - Bronze (P450, P451)	1
7	05290	Bearing Cover Open	1	27A	05543	Valve Assy.	6
8	05291	Bearing Cover Closed	1	27	05541	Valve Seat	6
8A	05292	Shim	3	28	05542	Valve Plate	6
8B	05293	Shim (May not be present)	1	29	07906	Valve Spring	6
9	01016	O-Ring	2	30	07907	Valve Spring Retainer	6
10	07114	Screw with Washer	8	31	07770	O-Ring	6
11	07459	Radial Shaft Seal	1	32	05544	Plug	6
12	05350	Taper Roller Bearing	2	32	08406	Plug (P450, P451)	6
13	04336	Crankshaft		33	05545	O-Ring (P452, P456)	6
		(P451, P452, P456)	1	33	07489	O-Ring (P450, P451)	6
13	08475	Crankshaft (P450)	1	34	08484	Hexagon Screw (P452, P456)	8
14	08091	Fitting Key	1	34	08396	Hexagon Screw (P450, P451)	8
15	08390	Connecting Rod Assembly	3	36	13434	Plug, 1/2" BSP	2
16	05484	Plunger Assy., 18mm		37	06272	Copper Washer	2
		(Items 16A-16H)	3				
16A	05352	Plunger Base	3				
16B	08397	Plunger Pipe, 18mm	3				
16D	08399	Tension Screw	3				
16E	07023	O-Ring	3				
16F	07203	Backup Ring	3				
16G	07258	Copper Washer	3				

*Important! If the pump is not used for a long period of time, it is possible the seals (23) could become hard or brittle thus causing the pump to leak when put into operation. If this is the case, we recommend these seals be replaced every 4 years.

REPAIR KITS

Plunger Packing Kit - # 09141

<u>Item</u>	<u>Part#</u>	<u>Description</u>	<u>Qty</u>
21	07266	O-Ring	3
23	08477	V-Sleeve	6
24	07929	Pressure Ring	3

Oil Seal Kit - #09641

<u>Item</u>	<u>Part #</u>	<u>Description</u>	<u>Qty</u>
19	05444	Oil Seal	3

Valve Assembly Kit - P456

09644

<u>Item</u>	<u>Part #</u>	<u>Description</u>	<u>Qty</u>
27A	05543	Valve Assembly, Complete	6
33	05545	O-Ring	6

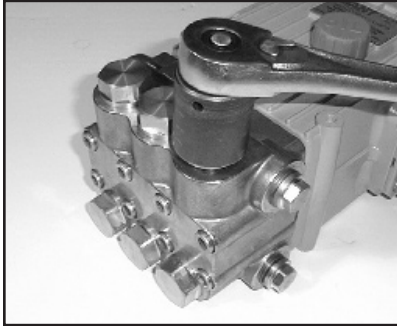
Valve Assembly Kit - P450/P451/P452

09770

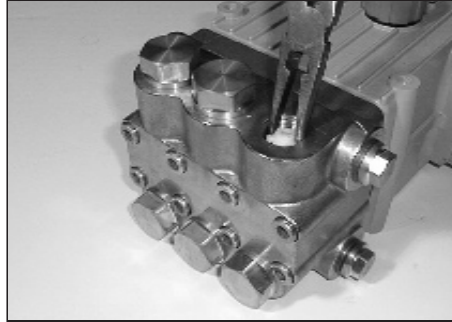
<u>Item</u>	<u>Part #</u>	<u>Description</u>	<u>Qty</u>
27A	05543	Valve Assembly, Complete	6
33	07489	O-Ring	6

REPAIR INSTRUCTIONS - P450/P451/P452/P456

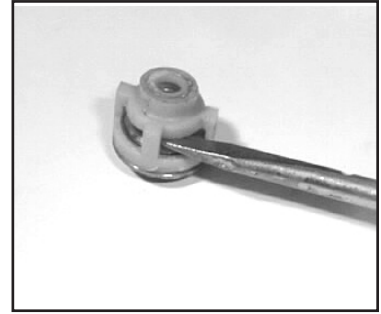
Note: Always take time to lubricate all metal and nonmetal parts with a light film of oil before reassembly. This step will ensure proper fit, at the same time protecting the pump nonmetal parts (i.e., the elastomers) from cutting and scoring.



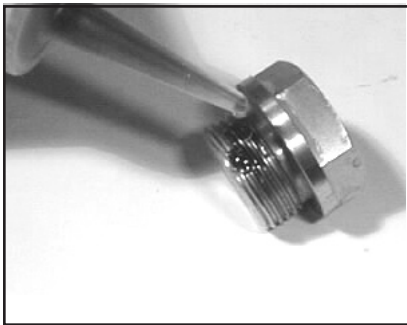
- 1) With a socket wrench, remove the three discharge valve plugs and three inlet valve plugs (32). Inspect the o-ring (33) for wear and replace if damaged.



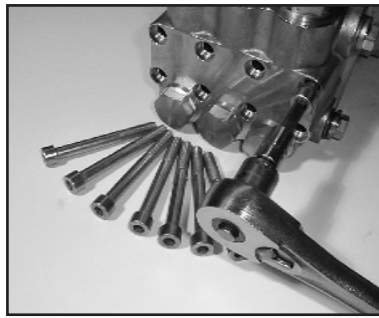
- 2) Using needle nose pliers, remove the inlet and discharge valve assemblies (27A). Note: It may become necessary to remove the valve seat (27) from the valve casing using a slidehammer.



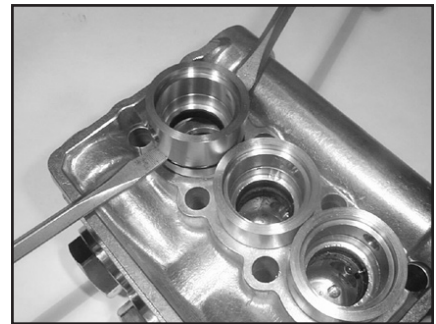
- 3) By inserting a small screwdriver between the valve seat (27) and the valve spring retainer (30), the valve assembly can be separated.



- 4) Remove the o-ring (31). Inspect all parts for wear and replace as necessary. Apply one drop of loctite 243 to the valve plugs (32) and tighten to 107 ft. lbs. (145 Nm).



- 5) Use a 8mm allen wrench to remove the 8 socket head cap screws (34). Carefully slide the valve casing (26) out over the plungers.



- 6) Remove seal adaptors (20) and weep return rings (25) from the valve casing.



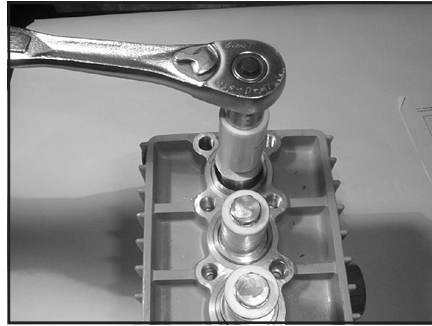
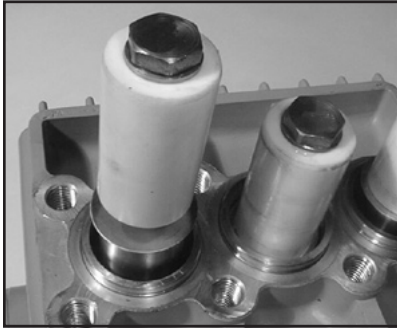
- 7) Remove the pressure rings (24) and v-sleeves (23) from the valve casing (26).



- 8) Remove the weep grooved seal (23) out of the seal adaptor (20). Check O-rings (21).

IMPORTANT! The grooved seal (23) on the high-pressure side is to be fitted carefully into the valve casing (26) using a screwdriver. Under no circumstances must the seal surface in the valve casing or the seal lip be damaged.

REPAIR INSTRUCTIONS - P450/P451/P452/P456



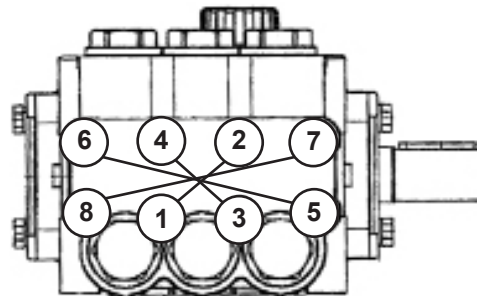
IMPORTANT! Care must be taken that glue does not get between the plunger pipe (16B) and centring sleeve (16C). The plunger pipe should not be strained by eccentric tightening of the tension screw or through damage to front surface of plunger, otherwise it is liable to fracture.

- 9) Check surfaces of plunger (16). Damaged surfaces cause accelerated seal wear. Deposits of all kinds must be removed from the plungers.

IMPORTANT! Plunger surfaces are not to be damaged. If there are lime deposits in the pump, care must be taken that the drip-return bore in parts (25) and (26) ensure trouble-free drip-return.

- 10) If the plunger pipe (16B) is worn, remove tension screw (16D) and remove along with plunger pipe (16B). Check and clean plunger surface (16A), check oil scraper (16H). Cover thread of tension screw (16D) with a thin film of Loctite and tighten carefully to 21 ft.-lbs. (28 Nm).

- 11) After installation of high pressure seals (23), place seal adaptor (20) with weep seals & pressure ring installed, weep return ring (25) and high pressure weep return ring (24) over plungers. Slide valve casing over plungers and seat firmly. Replace the 8 socket head cap screws (34) and tighten to 30 ft.-lbs. (40 Nm) in a crossing pattern (as shown to the right).



TORQUE SPECIFICATIONS - P450/P451/P452/P456

<u>Position</u>	<u>Item#</u>	<u>Description</u>	<u>U.S</u>	<u>Metric</u>
15	08390	Screw with Washer	97 in.-lbs.	11 Nm
16D	08399	Tension Screw	248 in.-lbs.	28 Nm
32	05544/08406	Plug	125 ft.-lbs.	170 Nm
34	08484	Hexagon Screw	30 ft.-lbs.	40 Nm

Gear End

If oil leaks where the plunger (16) extends from the crankcase (1), the oil seals (19) and plungers (16) must be examined and replaced if necessary. Remove oil plug (5) and drain oil; remove crankcase cover (3). Remove valve casing (26), and seal case (20). Then remove plunger pipes (16B) and oil scrapers (16H) as described above.

IMPORTANT! Before removing connecting rods be aware of their position on the crankshaft so as to return them to the same location and orientation when re-assembling.

Remove screws from connecting rods (15), separate the back connecting rod half from the crankshaft and the front connecting rod half. The connecting rod halves must be kept as pairs - do not mix them up. Push connecting rod shaft as far as possible into the crosshead guide. Remove screws (10) and pry bearing covers (7,8) off gently with a screwdriver.

Carefully remove crankshaft (13) by threading it through the connecting rods (15), making sure not to bend the connecting rods. Remove and disassemble connecting rods and plungers (16) paying close attention not to damage the plungers. Pry out oil seal (19) using a screwdriver. Examine plunger surfaces (16A) and replace if necessary.

To re-assemble, first press the oil seal (19) into the crankcase. Then insert connecting rods with plungers remembering their original location. Thread in the crankshaft (13). Replace bearing cover (7) and o-ring (9) together with the radial shaft seal (11) and roller bearing (12) and fix in place with screws (10). Replace roller bearing (12), bearing cover (8) and o-ring (9). Adjust the clearance by fitting shims (8A) under the bearing cover as required to ensure that the crankshaft (13) turns easily without play being felt. Finally, mount connecting rod halves on crankshaft matching them with other half and tighten screws (15) to 97 in-lb (11 Nm). Replace crankcase cover (3) and o-ring (4). When remounting the valve casing (26), tighten hexagon socket screws (34) to 30 ft.-lb (40 Nm).

To Move Crankshaft to Opposite Side

Remove the valve casing (26) and seal case (20). Then rotate the crankcase 180°. Interchange the oil plug ((5B) with oil dipstick (2). Rotate the crankcase cover (3) 180°. Remount the valve casing together with the seal casing and the seal adapters (20). **Make sure that the seal adapters are rotated in order that the bores face downwards.**

Contact Giant Industries for service school information.

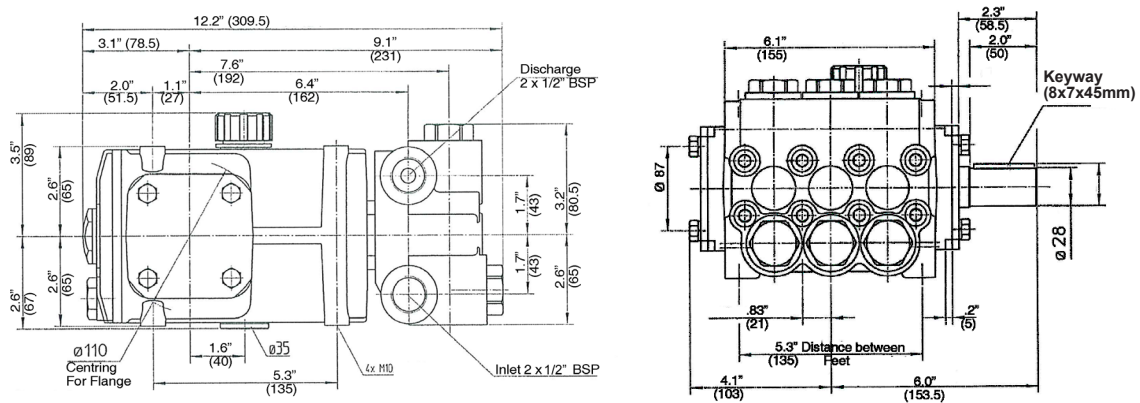
Phone: (419) 531-4600

PUMP SYSTEM MALFUNCTION

<u>MALFUNCTION</u>	<u>CAUSE</u>	<u>REMEDY</u>
The Pressure and/or the Delivery Drops	Worn packing seals Broken valve spring Belt slippage Worn or Damaged nozzle Fouled discharge valve Fouled inlet strainer Worn or Damaged hose Worn or Plugged relief valve on pump Cavitation Unloader	Replace packing seals Replace spring Tighten or Replace belt Replace nozzle Clean valve assembly Clean strainer Repair/Replace hose Clean, Reset, and Replace worn parts Check suction lines on inlet of pump for restrictions Check for proper operation
Water in crankcase	High humidity Worn seals	Reduce oil change interval Replace seals
Noisy Operation	Worn bearings Cavitation	Replace bearings, Refill crankcase oil with recommended lubricant Check inlet lines for restrictions and/or proper sizing
Rough/Pulsating Operation with Pressure Drop	Worn packing Inlet restriction Accumulator pressure Unloader Cavitation	Replace packing Check system for stoppage, air leaks, correctly sized inlet plumbing to pump Recharge/Replace accumulator Check for proper operation Check inlet lines for restrictions and/or proper size
Pressure Drop at Gun	Restricted discharge plumbing	Re-size discharge plumbing to flow rate of pump
Excessive Leakage	Worn plungers Worn packing/seals Excessive vacuum Cracked plungers Inlet pressure too high	Replace plungers Adjust or Replace packing seals Reduce suction vacuum Replace plungers Reduce inlet pressure
High Crankcase Temperature	Wrong Grade of oil Improper amount of oil in crankcase	Giant oil is recommended Adjust oil level to proper amount

Preventative Maintenance Check List & Recommended Spare Parts List						
Check	Daily	Weekly	50 hrs	Every 500 hrs	Every 1500 hrs	Every 3000 hrs
Oil Level/Quality	X					
Oil Leaks	X					
Water Leaks	X					
Belts, Pulley		X				
Plumbing					X	
Recommended Spare Parts						
Oil Change (p/n 01154)			X	X		
Seal Spare Parts (1 kit/pump) (see page 7 for kit list)					X	
Oil Seal Kit (1 kit/pump) (see page 7 for kit list)					X	
Valve Spare Parts (1 kit/pump) (see page 7 for kit list)						X

P450/P451/P452/P456 Dimensions - in (mm)



GIANT INDUSTRIES LIMITED WARRANTY

Giant Industries, Inc. pumps and accessories are warranted by the manufacturer to be free from defects in workmanship and material as follows:

1. For portable pressure washers and self-service car wash applications, the discharge manifolds are guaranteed for the life of the pump. Our other pump parts, used in portable pressure washers and in car wash applications, are warranted for five years from the date of shipment for all pumps used in NON-SALINE, clean water applications.
2. One (1) year from the date of shipment for all other Giant industrial and consumer pumps.
3. Six (6) months from the date of shipment for all rebuilt pumps.
4. Ninety (90) days from the date of shipment for all Giant accessories.

This warranty is limited to repair or replacement of pumps and accessories of which the manufacturer's evaluation shows were defective at the time of shipment by the manufacturer. The following items are NOT covered or will void the warranty:

1. Defects caused by negligence or fault of the buyer or third party.
2. Normal wear and tear to standard wear parts.
3. Use of repair parts other than those manufactured or authorized by Giant.
4. Improper use of the product as a component part.
5. Changes or modifications made by the customer or third party.
6. The operation of pumps and or accessories exceeding the specifications set forth in the Operations Manuals provided by Giant Industries, Inc.

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