



Village Marine 3P20 Pump

Part Number: 95-0015

3P20 Pump

High Pressure Titanium Pumps

Installation, Operation & Maintenance

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



ENGINEERING YOUR SUCCESS.

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INTRODUCTION

Aqua Pro Pumps "Titan Series" High Pressure Pumps are the product of our years of experience in the water treatment industry, and have been specifically designed and engineered for corrosive and high-pressure applications. Your new Aqua Pro Pump is made with dependable and proven technology to meet your highest demands.

SPECIFICATIONS

Specifications subject to change without notice.

Pump type:	Reciprocating Plunger
Number of Plungers:	3
Bore:	1.259"
Stroke:	1.516"
Oil Capacity:	3.6 Qts.
Oil Type:	Village Marine Tec. High Pressure Pump Oil (Part No. 85-0050-quart size)
Maximum Inlet pressure:	Flooded to 60 PSI
Maximum Fluid Temperature:	120 degrees Fahrenheit (82 degrees Celsius)

Model Number	GPM	Inlet Port Size	Discharge Port Size	Dimensions L x W x H	Weight	Shaft
3P20	10-25	1.5" MS16142-24	1" MS16142-16	18.5"x 14.5" x 9"	117 lbs.	Ø1.625

INITIAL START-UP INFORMATION

WARNING

This is a positive displacement pump. A properly designed pressure relief safety valve must be installed in the discharge piping. Failure to install such a relief mechanism could result in personal injury or damage to the pump or system. Aqua Pro Pumps does not assume any liability or responsibility for the operation of a customer's high-pressure system.

The performance of the pump depends on the entire fluid system and will operate best with the proper installation of plumbing, operation, and maintenance of the pump.

LUBRICATION

It is recommended that pump be filled with Village Marine Tec's specially blended high pressure pump oil. To check the oil level, ensure the pump has stopped running. Observe oil level through the sight glass in the crankcase cover. The oil should be level with the mark on the sight glass (Fig.1).

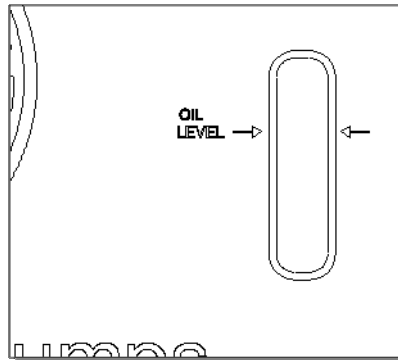


Fig. 1: Oil Level Sight Glass Detail.

NOTE

Change the original oil in the pump after 50 hours of operation. After the initial oil change, the oil should be changed at 500-hour service intervals.

PUMP FLOW DESIGN

For application design purposes this pump is rated for 20 GPM at 816 RPM. To drive the pump to give the desired discharge volume for your specific application, equation 2.1 is to be used.

$$\text{Desired Pump RPM} : \frac{\text{Rated GPM}}{\text{Rated RPM}} = \frac{\text{"Desired" GPM}}{\text{"Desired" RPM}} \quad (2.1)$$

PULLEY SELECTION

It is essential that an appropriate pulley size be selected to meet your application needs. Based on the required pump discharge volume (in GPM), the correct pulley size can be selected using equation 2.2.

CAUTION

Pulley size should not exceed the maximum pump RPM rating.

$$\text{Pulley Size} : \frac{\text{Motor Pulley O.D.}}{\text{Pump RPM}} = \frac{\text{Pump Pulley O.D.}}{\text{Motor RPM}} \quad (2.2)$$

MOTOR SELECTION

To ensure desired pump output, the motor or engine driving the pump must possess sufficient horsepower to maintain full RPM when the pump is under load. Using equation 2.3, an appropriate electric motor can be sized for the application. This motor sizing approach is based on pump discharge volume and maximum pump discharge pressure. The constant in the equation accounts for drive and system losses, and implies a mechanical efficiency of 85%. Consult the manufacturer of a gas or diesel engine for selection of the proper engine size. Refer to Table 1 for sample horsepower applications.

$$\text{HP Required} : \frac{\text{GPM} \times \text{PSI}}{1460} = \text{Electric Brake HP} \quad (2.3)$$

Table 1: Approximate Horsepower Required

HP Required		Working Pressure [PSI]		
Flow [GPM]	Speed [RPM]	800	1000	1200
25	1020	13.7	17.1	20.6
20	816	11	13.7	16.4
15	612	8.2	10.3	12.3
10	408	5.5	6.9	8.2

MOUNTING THE PUMP

The pump should be located as close to the source of supply as possible. Mount the pump on a rigid, horizontal surface allowing easy access for crankcase oil draining. The pump should also be mounted in such a way that inspection can be done with ease. To minimize piping stresses, use appropriately sized and pressure rated flexible hoses at the inlet and discharge ports.

Ensure drive belt is adequately sized for system and shaft bearings. Pulley alignment is critical to the proper operation of the system. To check for proper alignment, place a straight edge, square, or rule against the pulleys to make sure they are in line. Proper alignment of the drive pulleys will minimize crankshaft bearing and belt wear. Over tensioning of the drive belt may cause pump crankshaft bearing damage.

If the pump will be in service in an environment with a high debris presence or humidity, it is recommended that the pump be enclosed. Do not store or operate in excessively high temperature areas without proper ventilation.

DISCHARGE PLUMBING

CAUTION

Start system with all valves open or with minimal flow restriction to avoid deadhead overpressure conditions and severe damage to the pump or system. Discharge regulating devices should be at minimum pressure setting at start-up.

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In installations utilizing a Pulsation Dampening device, the device should be mounted directly to the discharge line. Consult a dampening device manufacture for optimum pre-charge.

A reliable pressure gauge should be installed near the discharge outlet of the manifold. This is extremely important for adjusting pressure-regulating devices; and when appropriate, for sizing of the nozzle or restricting orifice. The pump is rated for a maximum pressure, which is the pressure measured at the discharge manifold of the pump.

A pressure relief or unloader valve must be installed to prevent over-pressure in the event the discharge or down-stream plumbing becomes restricted or is shut off. Severe damage to the pump will result if this condition occurs without a relief valve in the line.

CAUTION

FAILURE TO INSTALL A SAFETY RELIEF VALVE WILL VOID THE WARRANTY ON THE PUMP.

On fittings not using o-ring seals, use PTFE liquid sparingly, or tape to connect accessories or plumbing. Do not wrap tape beyond the last thread to prevent tape from becoming lodged in the pump or accessories. This condition will cause a malfunction of the pump or system.

PUMPED FLUIDS

Some fluids may require a flush between operations or before storing. For pumping fluids other than water, contact your supplier or Village Marine Tec.

CAUTION

DO NOT RUN PUMP WITH FROZEN FLUID. DO NOT RUN PUMP DRY.

STORAGE

For extended storage or between uses in cold climates, drain all pumped fluids from pump and flush with antifreeze solution to prevent freezing and damage to the pump.

INLET CONDITION CHECKLIST

Review this checklist before operation of system. It is critical that all factors are carefully considered and met.

INLET SUPPLY

Inlet supply should be adequate to accommodate the maximum flow being delivered by the pump.

1. Open inlet valve and turn on supply to avoid starving the pump.

CAUTION

DO NOT RUN PUMP DRY.

2. Avoid closed loop systems, especially with high temperature, ultra-high pressure or large volumes. Conditions vary with regulating/unloader valve.
3. Low vapor pressure fluids, such as solvents, require positive heads to assure adequate inlet supply.
4. Higher viscosity fluids require that the pump be flooded to 60 PSI to assure adequate inlet supply.
5. Higher temperature fluids tend to vaporize and require positive heads to assure adequate inlet supply.
6. When using an inlet supply reservoir, size it to provide adequate supply of fluid to accommodate 6-10 minutes retention time at the rated GPM (however, a combination of system factors can change this requirement). Provide adequate baffling in the tank to eliminate air bubbles and turbulence. Install diffusers on all return lines to the tank.

INLET LINE SIZE

Inlet line size should be adequate to avoid starving the pump. Pump suction should never operate in a vacuum.

1. Line size must be a minimum of one size larger than the pump inlet fitting. Minimize the use of thick walled fittings, tees, 90-degree elbows, or valves in the inlet line of the pump to reduce the risk of flow restriction, vacuum, and cavitation.
2. The inlet line MUST be a FLEXIBLE hose, NOT a rigid pipe, and REINFORCED ON SUCTION SYSTEMS to avoid collapsing.
3. The simpler the inlet plumbing, the less the potential for problems. It is recommended to keep the length, number of joints, and the number of inlet accessories to a minimum.
4. Use pipe sealant as appropriate to ensure airtight positive sealing pipe joints.

INLET PRESSURE

Inlet pressure should be between flooded (zero) to 60 PSI.

1. High RPM, high temperatures, low vapor pressures, or high viscosity reduces inlet pressure. The pump may require a pressurized inlet to maintain adequate inlet supply.
2. Optimum pump performance and service life is obtained with 20 PSI (1.4 BAR) inlet pressure. With adequate inlet plumbing, most pumps will perform with flooded suction. Maximum inlet pressure is 60 PSI (5 BAR).
3. After prolonged storage, the pump should be purged of air to facilitate priming. With the pump shut off, disconnect the discharge port and allow fluid to pass through pump, then reconnect the discharge port.

INLET ACCESSORIES

Inlet accessories are designed to protect against over-pressurization, to control inlet flow, contamination or temperature, and provide ease of servicing.

1. An inlet/supply shut-off valve is recommended to facilitate maintenance.
2. A standpipe can be used in some applications to help maintain a positive head in the inlet line.
3. Inspect and clean the inlet filters on a regular schedule, if applicable.
4. A vacuum/pressure gauge should be installed to monitor the inlet pressure. A gauge should be mounted as close to the pump inlet as possible. Short term, intermittent cavitation will not register on a standard gauge.
5. All accessories should be sized to avoid restricting the inlet flow.
6. All accessories should be compatible with the solution being pumped to prevent premature failure or malfunction.

PREVENTIVE MAINTENANCE SCHEDULE

The Required Maintenance Schedule specifies how often you should have your pump inspected and serviced. It is essential that your pump be serviced as scheduled to retain its high level of safety, dependability, and performance. Not performing these tasks could result in catastrophic failure.

TASKS	DAILY	WEEKLY	FIRST 50 HRS.	EVERY 500 HRS.	EVERY 1500 HRS.	EVERY 10000 HRS.
INSPECTION TASKS						
Clean Filters*	X					
Water Leaks	X					
Oil Level	X					
Pulley		X				
Belts		X				
Inspect Plumbing		X				
SERVICE TASKS						
Pump Oil			X	X		
Crankcase Rebuild Kit					X	
Manifold Rebuild Kit					X	
Crankshaft Bearings						X

* If applicable for system

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MAINTENANCE RECORD

Keep record of all maintenance below to ensure maintenance is performed. Note trends and increase maintenance as necessary.

HOURS	RECOMMEND SERVICE	ACTIONS / NOTES	ACTUAL HOURS	SIGNATURE	DATE
50	Oil				
500	Oil				
1000	Oil				
1500	Rebuild Kits, Oil				
2000	Oil				
2500	Oil				
3000	Rebuild Kits, Oil				
3500	Oil				
4000	Oil				
4500	Rebuild Kits, Oil				
5000	Oil				
5500	Oil				
6000	Rebuild Kits, Oil				
6500	Oil				
7000	Oil				
7500	Rebuild Kits, Oil				
10000	Crankshaft Bearing, Oil				

*Replace HP seal **only** in case of failure (see low-pressure troubleshooting, pg.9). Hours are for reference only (for maintenance planning purposes).

** Oil changes are mandatory at the specified hour intervals.

TROUBLESHOOTING

Use the troubleshooting table below. If problems persist, contact your dealer.

PROBLEM	PROBABLE CAUSE	SOLUTION
Low Pressure	Belt Slippage	Make sure the correct belt is used. If the correct belt is used and the belt is slipping, then tighten. Replace belt if worn.
	Leaky discharge hose	Check connections. Replace hose if worn or cracking.
	Pressure gauge inoperative or not registering correctly.	Check pressure with new gauge and replace as needed.
	Air leak in inlet plumbing	Use PTFE liquid or tape to seal the threads. Make certain that the PTFE does not go beyond the last thread. Doing so may damage the pump.
	Inlet suction strainer clogged or improperly sized	Clear the obstruction, or use adequate size for inlet pump connection and fluid being pumped.
	Relief valve stuck, partially plugged or improperly sized	Clean and reset relief valve to system pressure and correct bypass. Check supply tank for contamination.
	Worn or dirty valves	Clean valve or replace with a rebuild kit.
	Worn high-pressure seals; abrasives in pump fluid, severe cavitation; inadequate water supply; stressful inlet conditions.	Replace seals with rebuild kit. Install and maintain proper filter, check line size and flow available to pump

Pulsation pump runs extremely rough, pressure low	Faulty pulsation dampener (if a pulsation dampener has been installed.)	Check pre-charge. Check manufacturer's literature on recommended pressure.
	Restricted inlet, or air entering inlet plumbing	Be sure that inlet hose is the proper size. Check filters and clean as needed. Check fittings and use PTFE liquid or tape for airtight connection.
	Valve or spring damage	Clean or replace valve and spring, check inlet supply tank for contamination
	Seal damage	Replace seals.

Slight water leakage from under the manifold	Possible Condensation	No fix needed.
	Worn low pressure seals	Replace seals with rebuild kit, check inlet pressure and inspect ceramic plunger for damage.

Excessive oil leak between crankcase and pumping section (1 drop every 15 min)	Worn crankcase oil seals	Replace crankcase oil seals.
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PROBLEM	PROBABLE CAUSE	SOLUTION
Oil leaking from crankshaft area	Worn crankshaft oil seal	Replace damaged oil seals.
	Bad bearing	Replace bearing.
	Cut or worn o-ring on bearing case	Replace o-ring on bearing cap.

Water in crankcase	Humid air condensing into water inside the crankcase	Change oil every three months or 500 hours
	Worn or improperly installed crankcase oil seals	Replace seals; follow proper installation procedure.
	Excessive water leaking through Low Pressure Seals	Replace seals.

Excessive play in the end of the crankshaft	Worn bearing	Replace bearing.
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Oil leaking in the rear portion of the crankcase	Damaged or improperly installed crankcase cover, crankcase cover o-ring, drain-plug, or drain-plug o-ring.	Replace crankcase cover o-ring or drain-plug o-ring.
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Loud knocking noise in pump	Pulley loose on crankshaft	Check key and tighten setscrew.
	Restricted Inlet	Clear obstruction or replace valve.
	Worn bearing, connecting rod or crankshaft.	Consult supplier for crankcase servicing.
	Worn belts	Replace belts.

Frequent or premature failure of the seals	Running pump dry	NEVER RUN THE PUMP WITHOUT WATER.
	Abrasive material in the fluid being pumped	Install proper filtration on pump inlet plumbing.
	Excessive temperature of pumped fluid (120 degrees F max.)	Reduce fluid inlet temperature to specifications.

PROBLEM	PROBABLE CAUSE	SOLUTION
Strong surging at the inlet and low pressure	Foreign particles in the inlet or discharge valve or worn inlet or discharge valves	Check for smooth surfaces on inlet and discharge valve seats. If signs of wear or damage are present return to factory for service.
		Check supply tank for contamination, regularly clean filter. Do not pump abrasive fluid.
	Restricted fluid flow	Check the Inlet Conditions Checklist.

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SERVICE

An authorized technician should perform all services.

CAUTION

Ensure pump is disconnected from the motor or any driving devices. Service the pump in a clean, dirt-free environment.

Pump rebuild kits are available for seal overhauls. Contact your dealer for ordering information.

INTRODUCTION

All tasks should be performed in a clean environment, free from dust and debris. It is imperative that the utmost cleanliness be maintained during the rebuild of your Aqua Pro Pump. The numbers following the parts are callout numbers. They correspond to the parts shown in the figures and in the assembly drawings at the end of the manual.

READ THE INSTRUCTIONS COMPLETELY BEFORE ATTEMPTING TO PERFORM ANY SERVICE.

Before assembling, clean all parts to make free of oil, grease, dirt, and lint. Use a lint-free cloth to wipe any part of the pump.

NOTE

A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated. Only silicon grease (PN. 21-1122) should be used on all o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

TOOLS NEEDED

Table 2: Tool List For Pump Service

3/16" Allen Wrench	Wrench Hex Jaw
1/4" Allen Wrench	Pick
9/16" Socket/ Socket Wrench or Combination Wrench	Pry-bar
15/16" Socket/ Socket Wrench or Combination Wrench	Snap Ring Pliers
1" Socket/ Socket Wrench or Combination Wrench	Torque Wrench (50 ft.-lb.)
1-1/2" Socket/ Socket Wrench or Combination Wrench	Seal Insertion Tool (PN 91-7228)
Flat-Head Screwdriver	Weep Ring Removal Tool (PN 91-7230)
Phillips-head Screwdriver	Oil Seal Removal Tool (PN 91-7231)
Tap M7 X 1.0	Die M7 X 1.0

DETACHING THE MANIFOLD FROM THE CRANKCASE

You will need these tools and parts to do the following:

- 15/16" Socket/ Socket Wrench or Combination Wrench
- Pry-bar

Remove the 2 manifold nuts (53), see Fig.13, with a 15/16" socket wrench or Combination Wrench. Loosen the manifold assembly by prying off the manifold using the slots in the crankcase as shown in Fig. 2. Set the manifold assembly aside in a clean work area. If the manifold assembly locating dowel pins (50) fall out, reinsert them into the manifold alignment pin hole.

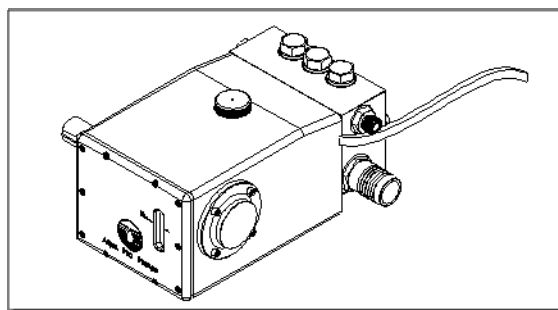


Fig. 2: Manifold Assembly Removal

SERVICING THE CRANKCASE

The following are the procedures for servicing the crankcase assembly using the 3P20 Crankcase Rebuild Kit (PN. 70-0624). The manifold assembly must be detached from the crankcase to do the following service.

PLUG, OIL DRAIN, O-RING REPLACEMENT

You will need these tools and parts to do the following:

- 1" Socket/ Socket Wrench
- Pick
- O-Ring, Drain Plug (4): PN. 30-1286
- Anti-Seize Lubricant: PN. 85-0094
- Silicon Grease Lubricant: PN. 21-1122

Remove the oil drain plug with a 1" wrench and drain the crankcase oil. Clean the drain plug (5), and remove the o-ring (4) with the aide of the pick if necessary. Replace the o-ring with the new one supplied with kit. Apply anti-seize lube to the threads of the drain plug (5) and reinstall.

OIL SEAL REPLACEMENT

You will need these tools and parts to do the following:

- 9/16" Socket/ Socket Wrench
- Torque Wrench
- Seal, Oil, Plunger Rod (6): PN. 70-3062
- Washer, Plunger Retainer (31): PN. 70-3017
- O-Ring, Plunger Retainer (30): PN. 70-3411
- Ring, Back-Up, Plunger Retainer (29): PN. 70-3019
- Slinger Barrier (25): PN. 70-3023
- Washer, Keyhole (26): PN. 70-3022
- Ceramic Lubricant: PN. 85-0087
- Silicone Grease Lubricant: PN. 21-1122
- Red Loctite # 262

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- Lint-free Cloths
- Seal Removal Tool: PN. 91-7231

Remove the seal retainer (33) and set aside, see Fig.6. Remove the plunger retainer nut (32) with a 9/16" wrench and set aside. Remove the plunger retainer washer (31), and back-up ring(29), Fig.5, and remove the ceramic plunger (27). Remove the keyhole washer (26), then remove the slinger (25), see Fig.4. Using the seal removal tool in Fig.3, drive the screws into the plunger rod oil seal(6) and use the lanyard(provided with tool) to remove the seal from the crankcase bore. Inspect the seal retainer washers for damage; if none evident then reuse; if damage is evident consult the factory.

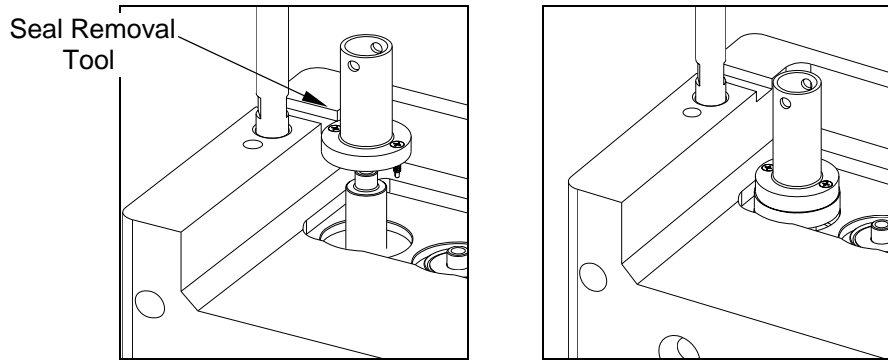


Fig. 3: Oil Seal Removal View

NOTE

A light coating of silicon grease (PN. 21-1122) should be used on all new o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

Insert new plunger rod oil seal (6) into crankcase ensuring that the seal is fully seated. Place slinger (25) onto the plunger rod (8), followed by the keyhole washer (26) as shown in Fig. 4. Chase the thread of the plunger rod and the retainer stud with the tap and die to ensure the removal of any left over loctite prior to reassembly.

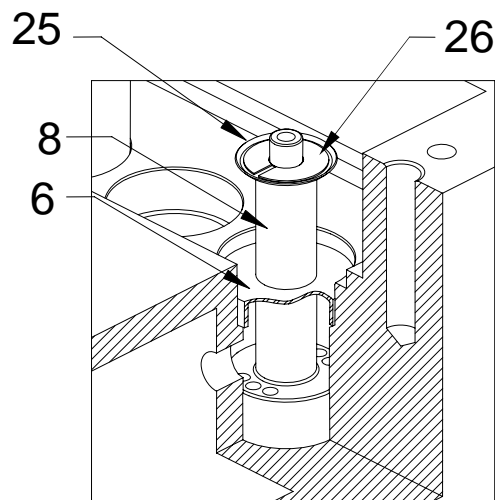


Fig. 4: Plunger Assembly View

NOTE

Examine the ceramic plungers (27), Fig. 6, for cracks, heavy scoring, or unusual wear. If there is a problem, contact the factory.

Slide ceramic plungers (27) onto plunger rod, and insert the new plunger retainer washer (31) into the plunger. Clean the plunger retaining nuts (32), Fig. 5. With the aid of a pick remove the plunger retainer back-up ring (29) and the plunger retainer o-ring (30). Replace the o-ring (30) and back-up ring (29) with the new one supplied in the kit as shown in Fig. 5.

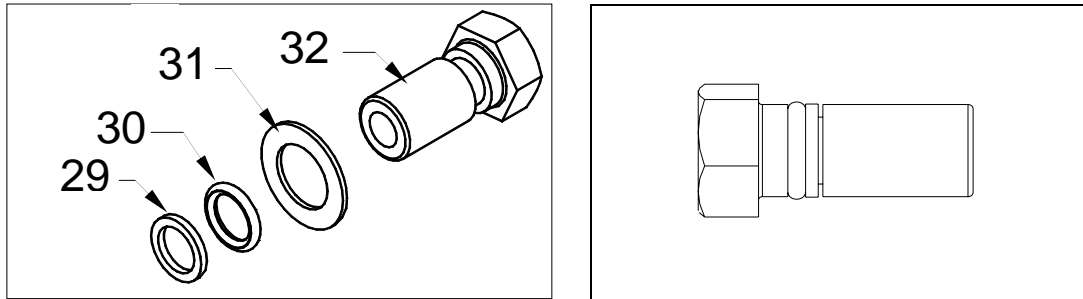


Fig. 5: Plunger Retaining Nut Assembly

Apply Red Loctite # 262 to retainer stud (28) threads. Reinstall the plunger retainer nut (32) and torque to 100 in. lb. using a 9/16" socket.

NOTE

Be careful not to get the red loctite on any other components. Failure to use loctite on the retainer stud and nut could lead to a catastrophic failure of the pump.

Apply Aqua Pro's special Ceramic Lubricant (PN. 90-1604) to the ceramic plungers (27). Slide the seal retainer over the ceramic plungers (27). Make sure that the flanged side is in close proximity to the manifold assembly, and that the hole is oriented downward ensuring that the seal retainer has adequate water drainage. Slide manifold assembly over plungers and reinstall manifold nuts (53).

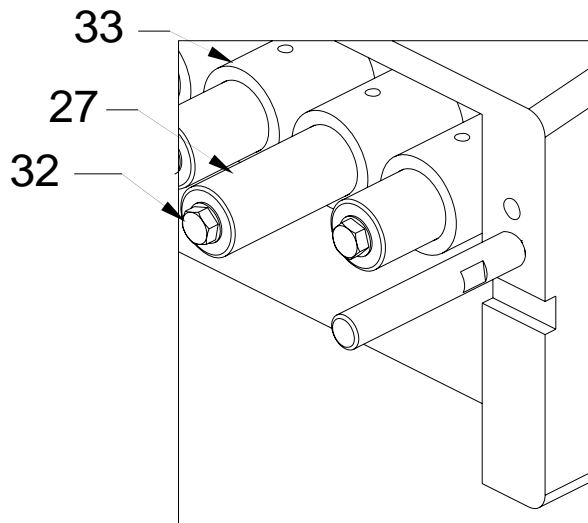


Fig. 6: Seal Retainer

BEARING SIDE PLATE O-RING/SEAL REPLACEMENT

You will need these tools and parts to do the following:

- 1/4" Allen Wrench
- Pick
- Seal, Oil, Crankshaft (16): PN. 70-3043
- O-Ring, Bearing Side Plate (15): PN. 70-3037

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- Silicon Grease Lubricant: PN. 21-1122
- Anti-Seize Lubricant: PN. 85-0094

Remove the 4 socket head cap screws (17) with a 1/4" Allen Wrench from each of bearing side plate (13), (14). With the aide of a pick remove the o-rings from the grooves and remove the crankshaft oil seal (16) from the pulley side bearing cap (14).

CAUTION

Crankshaft oil seal is press fit at the factory, so care is to be exercised during removal to prevent any damage to sealing surface.

NOTE

A light coating of silicon grease (PN. 21-1122) should be used on all new o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

Press new crankshaft oil seal (16) into pulley side bearing cap (14), install o-ring (15) in o-ring groove on the crankshaft bearing caps (13) and (14), and reinstall caps on pump.

NOTE

A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

Install the 4 socket head cap screws (17) onto each of the bearing side plates and tighten with a 1/4" Allen Wrench.

COVER, CRANKCASE O-RING REPLACEMENT

In this procedure you will replace the o-rings on the crankcase cover as provided in the rebuild kit.

You will need these tools and parts to do the following:

- 3/16" Allen Wrench
- Phillips-head Screwdriver
- Pick
- Silicone Grease Lubricant: PN. 21-1122
- Red Loctite # 262
- Anti-Seize Lubricant: PN. 85-0094

Unscrew the 10 crankcase cover screws (24) with the 3/16" Allen wrench. Remove the 6 sight glass retaining screws (23) with the Phillips-head screwdriver. Remove the sight glass retaining frame (22) and the sight glass (21). With the aide of the pick remove the sight glass o-ring (20), and remove the crankcase cover o-ring (18).

NOTE

A light coating of silicon grease (PN. 21-1122) should be used on all new o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

Install the new sight glass o-ring (20) and the crankcase cover o-ring (18) provided with the rebuild kit.

NOTE

A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

Install the sight glass (21) and the sight glass frame (22). Apply Red Loctite # 262 to the 6 sight glass retaining screws (23) and tighten. Reinstall the crankcase cover(19) and tighten the 10 crankcase cover screws (24) with the 3/16" Allen wrench in the sequence shown in Fig. 7.

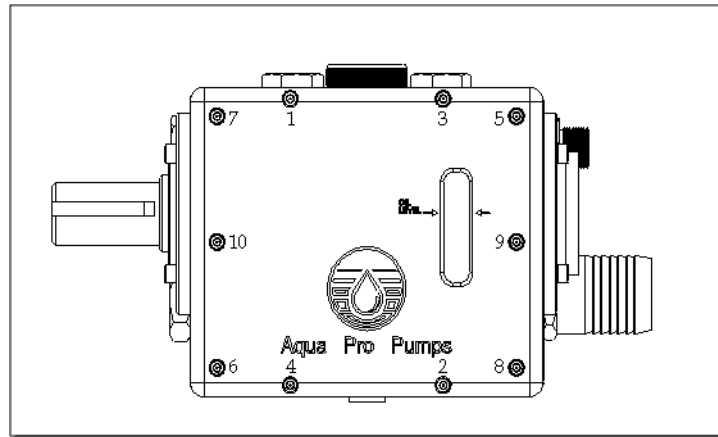


Fig. 7: Bolt tightening sequence

CRANKSHAFT BEARING, CONNECTING ROD-PISTON ASSEMBLY SERVICE

It is recommended that any service to the crankshaft bearings (12) or to the connecting rod-piston assembly be done by the factory. Due to the high precision required, only factory trained personnel are recommended for this service.

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SERVICING THE MANIFOLD

The following are the procedures for servicing the manifold assembly using the 3P20 Manifold Rebuild Kit (PN. 70-0624). The manifold assembly must be detached from the crankcase to do the following service.

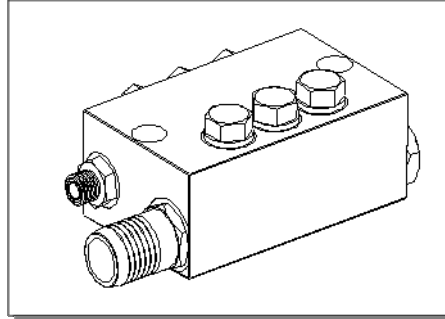


Fig. 8: Manifold Assembly

ADAPTER O-RING REPLACEMENT

You will need these tools and parts to do the following:

- Wrench Hex Jaw
- Pick
- O-Ring, Inlet Plug Adapter (43): PN. 70-3002
- O-Ring, Discharge Plug Adapter (45): PN. 70-3074
- Silicone Grease Lubricant: PN. 21-1122
- Anti-Seize Lubricant: PN. 85-0094

Remove the Inlet/Discharge/Plug, (46),(47),(48), and (49) adapters from the manifold assembly with the hex jaw wrench. With the aide of a pick remove the o-rings (45) and (43) from each of the adapters.

NOTE

A light coating of silicon grease (PN. 21-1122) should be used on all new o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

Install the new o-rings, (45) and (43) provided with the kit onto each of the adapters.

NOTE

A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

Reinstall each of the adapters onto the manifold assembly, then tighten adapter with hex jaw wrench.

VALVE ASSEMBLY SERVICING

You will need these tools and parts to do the following:

- 1 1/2" Socket Wrench or Combination Wrench
- Pick
- Spring, Valve (42): PN. 70-7049
- Assembly, Valve (41): PN. 70-3004
- O-Ring, Valve Plug (43): PN. 70-3002
- Silicone Grease Lubricant: PN. 21-1122

- Anti-Seize Lubricant: PN. 85-0094
- Lint-Free Cloths

NOTE

Valves may be serviced while the manifold assembly is attached to the crankcase assembly.

If manifold assembly has been removed from the crankcase assembly, place the assembly on a clean work surface. Remove all of the valve plug assemblies from the manifold assembly using a 1 1/2" socket wrench or combination wrench. Remove the valve (41) from the assembly, followed by the valve spring (42). With the aide of a pick remove the o-ring (43) from the valve plug.

NOTE

Valve plugs (44) will be reused.

A light coating of silicon grease (PN. 21-1122) should be used on all new o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

Clean and inspect all valve plugs (44) prior to reassembly. If there is a problem, contact your dealer. Once all valve plugs (44) are clean and dry, install new valve plug o-ring (43) onto valve plug (44). Install the valve spring (42) onto the valve plug (44). Press the valve (41) onto the valve spring (42). Complete valve assembly shown in Fig. 9.

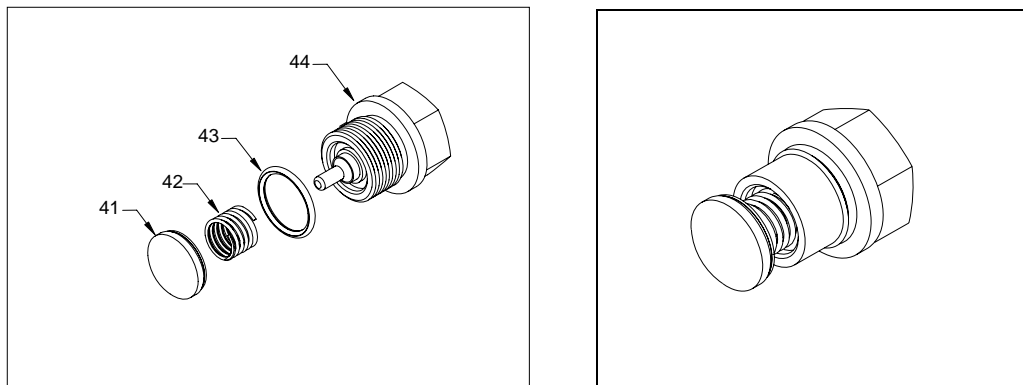


Fig. 9: Valve Assembly

NOTE

A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

Inspect the manifold (34) for debris or other fouling and clean if necessary. Inspect the valve seat surface in the manifold. If there is a problem, contact your dealer. Reinstall all the valve plug assemblies with a 1 1/2" socket wrench or combination wrench and tighten.

MANIFOLD SEAL SERVICING

NOTE

Pump manifold assembly must be detached from the crankcase assembly to service the seals.

You will need these tools and parts to do the following:

- Snap Ring Pliers
- Tool, Weep Ring Extractor: PN. 91-7230
- Tool, Seal Insertion: PN. 91-7228
- Flat screw driver
- Seal, HP (36): PN. 70-2502
- Ring, Snap (38): PN. 70-3009
- Ring, Weep (37): PN. 70-3008
- Seal, LP (40): PN. 70-2501
- Silicone Grease Lubricant: PN. 21-1122
- Lint-Free Cloths

For manifold seal servicing purposes the manifold must be placed with the valve plugs sitting on a flat surface and the plunger bores facing upward. This will facilitate service technician access to the seals for removal and installation, as shown in Fig. 10.

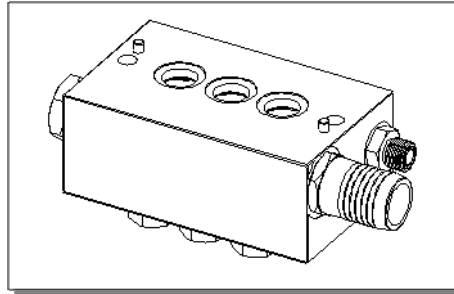


Fig. 10: Orientation for Manifold Seal Servicing

With a flat screw driver remove the low-pressure seal (40). Manually remove the low-pressure seal spacer (39). With the snap ring pliers remove the snap ring (38). Using the weep ring extracting tool, remove the weep ring (37) as shown in Fig. 11.

NOTE

Extraction of the rings is accomplished by inserting tool in relaxed state into the inner diameter of the rings, then tightening the expansion bolt to grip the ring.

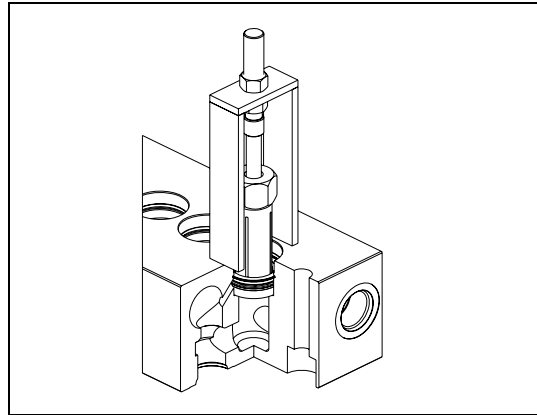


Fig. 11: Weep Ring Extraction

With a flat screwdriver remove the high-pressure seals (36). Manually remove the high-pressure seal spacer (35).

You must clean and inspect the following parts for re-use:

- Spacer, High-Pressure Seal (35): PN. 70-0407
- Spacer, Low-Pressure Seal (39): PN. 70-3010

Insert the high-pressure seal spacer (35) into the bore.

NOTE

A light coating of silicon grease (PN. 21-1122) should be used on all new o-rings and seals. Use of any other type of grease may result in o-ring or seal failure.

Insert the high-pressure seal (36) into the bore until the seal is fully seated on the high-pressure seal spacer (35), using the seal insertion tool. See Fig. 12 for high-pressure seal installation view.

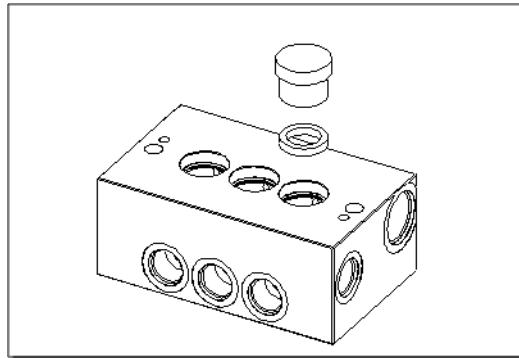


Fig. 12: High-Pressure Seals Installation View

Insert the weep ring (37) into the bore after the installation of the high-pressure seals (36), using the driver from the seal insertion tool. Install the snap ring (38) using the snap ring pliers.

NOTE

Ensure that the snap ring (38) is fully seated in the snap ring groove before continuing.

3P20 Titan Series

High Pressure Titanium Positive Displacement Pump

Insert the low-pressure seal spacer (39), then install the new low-pressure seal (40). The manifold seal servicing is complete.

ATTACHING THE MANIFOLD TO THE CRANKCASE

You will need these tools and parts to do the following:

- 15/16" Socket/ Socket Wrench or Combination Wrench
- Dead Blow Hammer
- Manifold Nut (53): PN. 70-1305
- Ceramic Lubricant: PN. 85-0087
- Anti-Seize Lubricant: PN. 85-0094

If a crankcase seal rebuild was not performed at this time then ensure that the dowel locating pins (50) are pressed into their corresponding hole. Ensure that ceramic lubricant is applied to the ceramic plunger assemblies and that the seal retainers are installed with the flange located away from the crankcase assembly.

NOTE

A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

Align manifold assembly to crankcase assembly as shown in Fig. 13 and tighten the two manifold nuts (53) with a 15/16" socket wrench or combination wrench, torque to 90 ft-lbs.

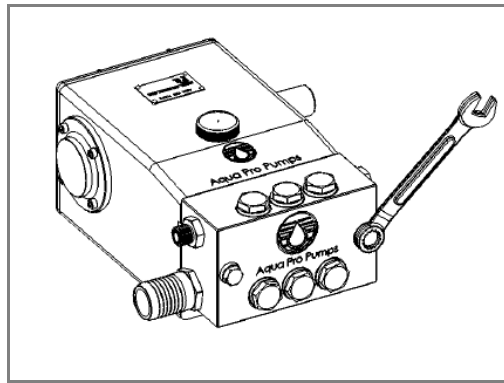
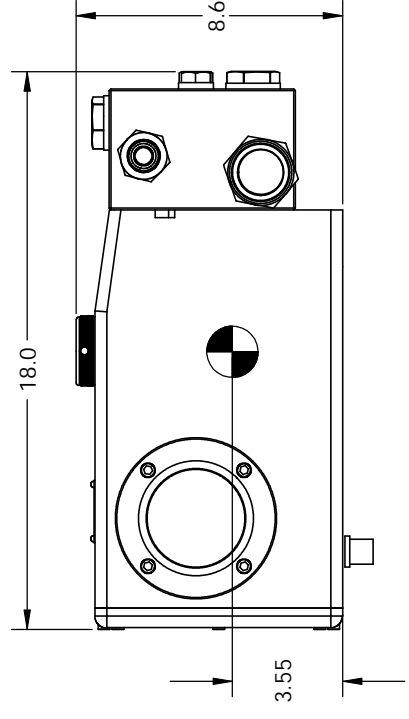
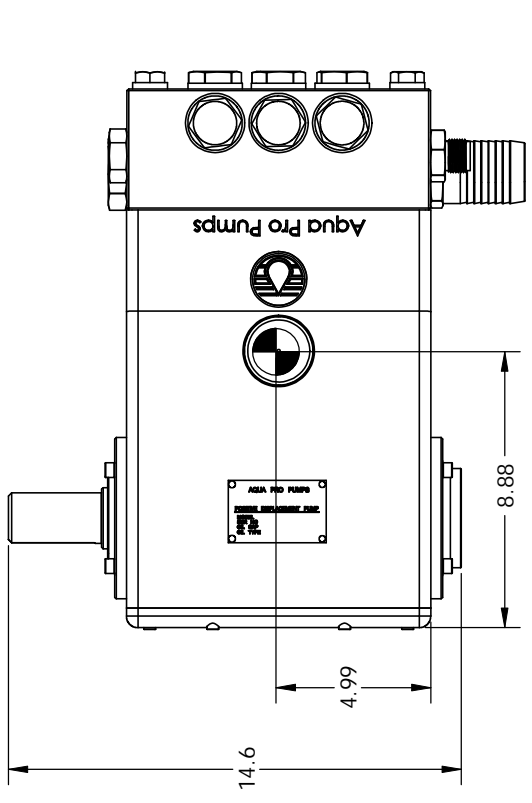


Fig. 13: Pump Assembly Orientation View

1 2 3 4

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE		
A	SHEETS 2 AND 3 HAVE BEEN REVISED	4/21/10	CC
B	REVISE SHEETS 2 & 3	6/14/12	TH TOD

- NOTES:
- 1) WEIGHT OF PUMP: 117 LBS
 - 2) PUMP MANUFACTURER: VILLAGE MARINE TEC. CAGE CODE: 62144
 - 3) THE PUMP SHALL BE RATED AT 20 GPM (± 0.5) GPM AT A SHAFT SPEED OF 900 RPM. THE PUMP SHALL WITHSTAND A HYDROSTATIC TEST OF 1800 PSI WITHOUT ANY LEAKAGE, DAMAGE OR LOSS OF FUNCTION. EACH PUMP SHALL BE PERFORMANCE TESTED.
 - 4) THE FLUID PORTS FOR THE PUMP SHALL BE STRAIGHT THREAD BOSSES IAW MS16142. THE INLET SHALL BE SIZED FOR A MS16142-24 IPS AND THE OUTLET SIZED FOR A MS16142-16 IPS. THE DISCHARGE AND SUCTION PLUGS SHALL BE SUPPLIED WITH THE PUMP AND WITH O-RINGS.
 - 5) LABEL PLATE DATA:
 AQUA PRO PUMPS
 2000 W. 135TH ST GARDENA, CA 90249 (CAGE 62144)
 (310)516-9911
 POSITIVE DISPLACEMENT PUMP
 MODEL 3P20
 SER. NO.
 OIL CAP 4 OTS (APPROX)
 OIL TYPE (SEE OWNERS MANUAL)
 6) PUMP SHAFT ROTATION IS REVERSIBLE.



4	3	2	1	SHT	REVISION	STATUS OF SHEETS
-	A	B	B	B	B	B

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES PER ANSI Y14.5 M & M & MIL-STD-100	
DECIMALS	ANGULAR
X-.020	0°-30°
XX-.010	FRACTIONAL
XXX-.005	± 1/32
MATERIAL	
WEIGHT LBS	
FINISH	
DRAWN	
CHECKED	
APPROVED	
DATE	DATE
DATE	DATE



TITLE	
ASSEMBLY, 3P20 MAIN	
SIZE	DWG NO
B	70-2030
SCALE	1:8
SHEET	1 OF 4

1 2 3 4

D

C

B

A

D

C

B

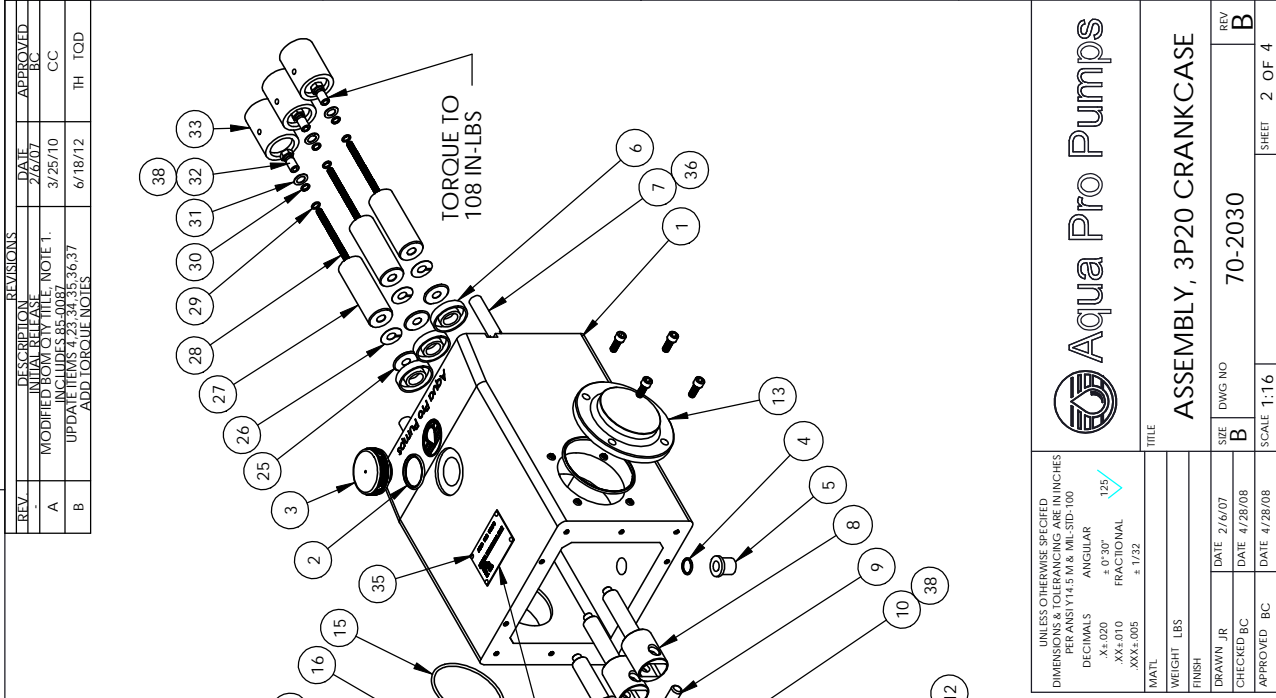
A

- NOTES:
 1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
 70-3083 ASSY, CRANKCASE, 3P20 TITAN SERIES
 70-0624 KIT, REBUILD, CRANKCASE, 3P20
 2) PART NUMBERS 85-0087 AND 21-1122 ARE NOT
 SHOWN IN DRAWING
 3) APPLY A THIN LAYER OF SILICONE GREASE
 (ITEM 37) TO ALL O-RINGS BEFORE ASSEMBLING.

ITEM	PART NUMBER	DESCRIPTION	QTY (70-3083)	QTY KIT (70-0624)
38	90-0223	LOCKTITE 262	AR	AR
37	21-1122	SILICONE GREASE	AR	AR
36	85-0087	ANTISIEZE	AR	AR
35	90-2695	RIVET	4	-
34	90-2645	PLATE, IDENTIFICATION	1	-
33	70-3012	RETAINER, SEAL	3	-
32	70-3016	NUT, PLUNGER RETAINER	3	-
31	70-3017	WASHER, PLUNGER RETAINER	3	3
30	70-3411	O-RING, PLUNGER	3	3
29	70-3019	RING, BACK-UP, SPLIT	3	3
28	70-3020	STUD, M7X1.0, 3.40, PLUNGER	3	-
27	70-3021	PLUNGER, CERAMIC	3	-
26	70-3022	WASHER, KEYHOLE	3	-
25	70-3023	SLINGER, PLUNGER	3	-
24	86-0151	SCREW, REAR COVER	10	-
23	10-5026	SCREW, SIGHT GLASS, PAN, PHIL., 10-32, .63, 18-8	6	-
22	70-3060	FRAME, SIGHT GLASS	1	-
21	70-3039	SIGHTGLASS, OIL, 3P20/5P100	1	-
20	70-3040	O-RING, SIGHT GLASS	1	1
19	70-6099	COVER, CRANKCASE, TITAN SERIES 3P20	1	-
18	70-6102	O-RING, BACK COVER	1	1
17	86-0256	SCREW, SIDE CAP	8	-
16	70-3043	SEAL, OIL, CRANKSHAFT	1	1
15	70-3037	O-RING, BEARING, CAP	2	2
14	70-3042	CAP, BEARING, PULLEY	1	-
13	70-3053	CAP, BEARING, CLOSED	1	-
12	70-0609	BEARING, CRANKSHAFT	2	-
11	70-1302	CRANKSHAFT, 3P20	1	-
10	70-3028	ASSY, ROD, CONNECTING	3	-
9	70-3027	PIN, DOWEL	3	-
8	70-0344M	ASSEMBLY, PLUNGER ROD	3	-
7	70-3006	STUD, MANIFOLD RETAINING	2	-
6	70-3062	SEAL, OIL, PLUNGER, 3P20/5P50	3	3
5	70-3046	ADAPTER, OIL DRAIN X .25 FNPT	1	-
4	70-6002	O-RING, PLUG, OIL DRAIN	1	1
3	70-3044	CAP, OIL FILLER	1	-
2	70-6029	O-RING, OIL FILLER CAP	1	1
1	70-1300	CRANKCASE, TITAN SERIES 3P20	1	-

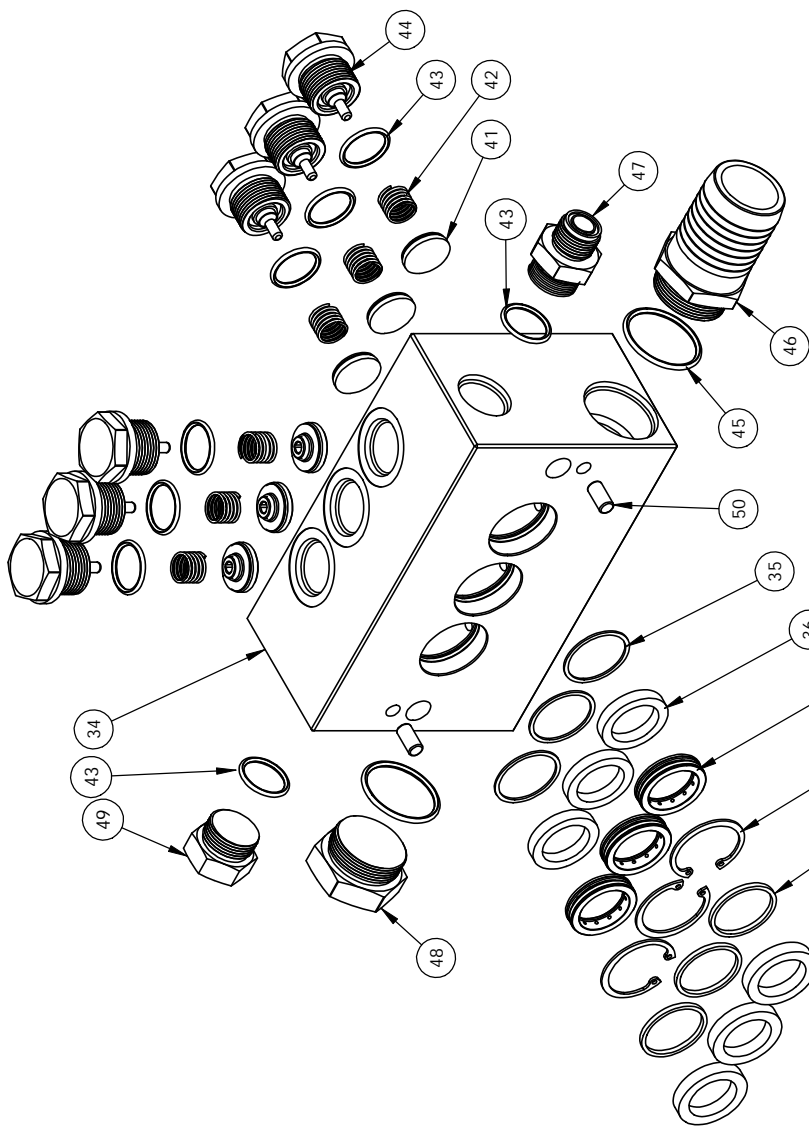
REV.	DESCRIPTION	DATE	APPROVED
A	MODIFIED BOM TO TITLE, NOTE 1. INCLUDES 85-0087	3/25/10	CC
B	UPDATE ITEMS 4, 23, 34, 35, 36, 37. ADD TORQUE NOTES	6/18/12	TH, TOD

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES PER ANSI Y14.5 M & M, UNLESS NOTED OTHERWISE		Aqua Pro Pumps	
DECIMALS	ANGULAR	TITLE	
X-.020	± .30°	ASSEMBLY, 3P20 CRANKCASE	
XX-.010	FRACTIONAL	SCALE	1:16
XXX-.005	± 1/32	SHEET	2 OF 4
MATL	WEIGHT LBS	REV	
FINISH		B	
DRAWN JR	DATE 2/6/07	DWG NO	
CHECKED BC	DATE 4/28/08	70-2030	
APPROVED BC	DATE 4/28/08	REV	
		B	



NOTES:
 1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
 70-6122 ASSY, MANIFOLD, 3P20 TITAN SERIES
 70-0623 KIT, REBUILD, MANIFOLD, 3P20
 2) PART NUMBERS 85-0087 AND 21-1122 ARE NOT
 SHOWN IN DRAWING

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	-	-
A	UPDATED PARTS - PUMP VALVE WEEP RING	3/16/2010	CC
B	BALLOON O-RINGS (43) @ ITEMS 47 & 49	6/20/12	TH TOD



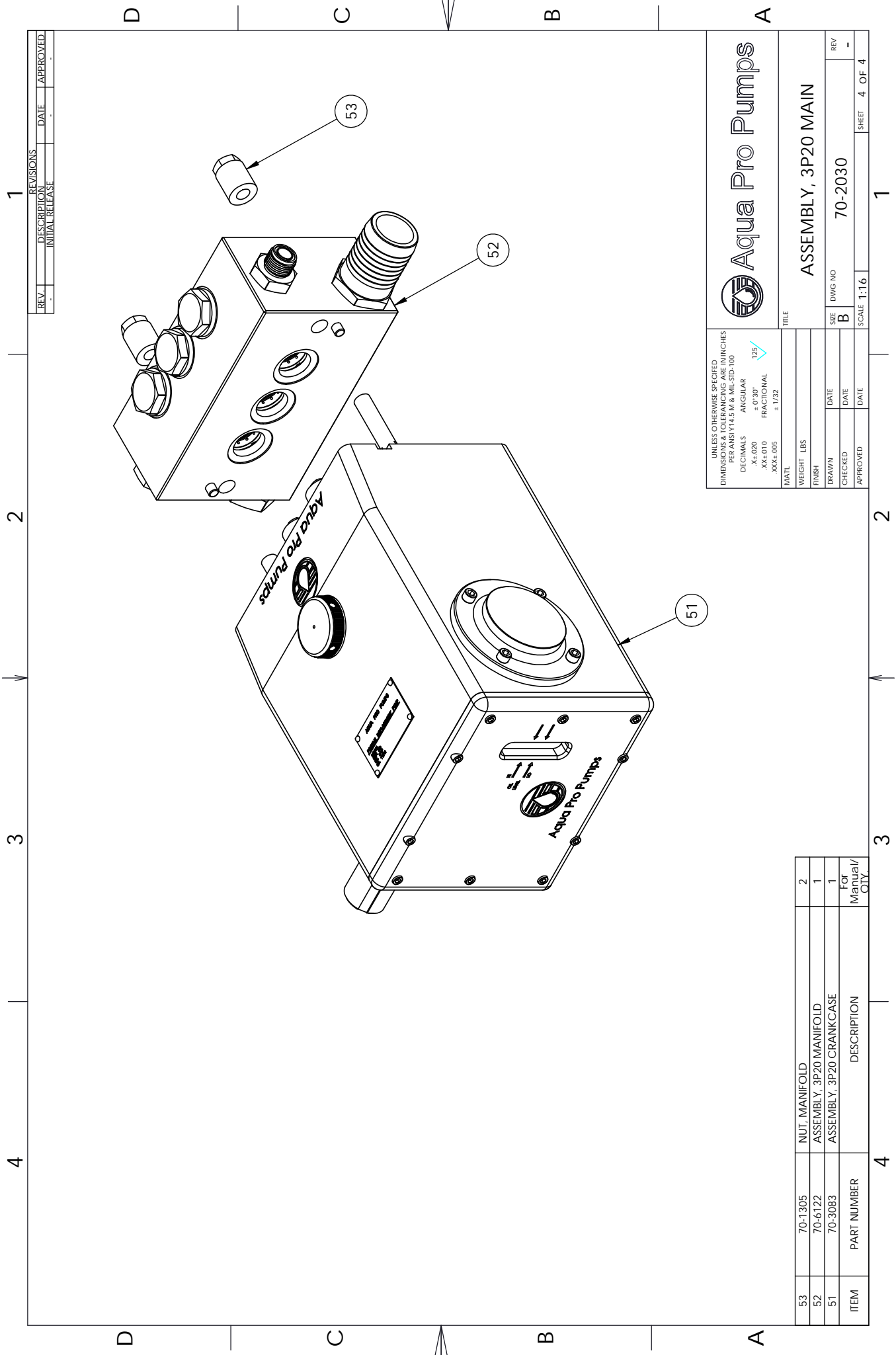
UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 PER ANSI Y14.5 M & M I.S.D. 100
 DECIMALS .0005
 ANGULAR ± .01°
 XX ± .010
 FRACTIONAL ± 1/32



TITLE
ASSEMBLY, 3P20 MANIFOLD

SCALE	1:12	SHEET	3 OF 4
SIZE	B	DWG NO	70-2030
DATE		REV	B
CHECKED		DATE	
APPROVED		DATE	

ITEM	PART NUMBER	DESCRIPTION	QTY (70-6122)	QTY KIT (70-0623)
52	21-1122	SILICONE GREASE	-	1
51	85-0087	ANTISEIZE	-	1
50	70-3050	PIN, DOWEL	2	-
49	70-3066	PLUG, MS18229-16, TI	1	-
48	70-3065	PLUG, MS18829-24	1	-
47	70-3059	ADIR, FACE SEAL	1	-
46	70-3064	ADIR, 2.0 HB, MS18229-24	1	-
45	70-3074	O-RING, APTIR, INLET	2	2
44	70-3001	PLUG, VALVE, MS18229-16	6	-
43	70-3002	O-RING, VALVE	8	8
42	70-7049	SPRING, VALVE, 3P20/5P50	6	6
41	70-3004	VALVE PUMP, 3P20/5P50	6	6
40	70-2501	SEAL, LOW PRESSURE	3	3
39	70-3010	SPACER, LOW PRESSURE SEAL	3	3
38	70-3009	RING, RETAINING, 3P20/5P50	3	3
37	70-3008	ASSEMBLY, WEEP RING, 3P20/5P50	3	3
36	70-2502	SEAL, HIGH PRESSURE	3	3
35	70-0407	RING, SPACER, HP SEAL	3	3
34	70-1301	MANIFOLD, TITAN SERIES 3P20	1	-



REV.	DESCRIPTION	DATE	APPROVED
	INITIAL RELEASE		

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN INCHES
 PER ANSI Y14.5 M & Y14.5-100
 DECIMALS ANGULAR 125 ✓
 X-.020 ±.030"
 XX-.010 FRACTIONAL
 XXX-.005 ± 1/32



TITLE		ASSEMBLY, 3P20 MAIN	
WEIGHT	LBS	DATE	
FINISH		CHECKED	
DRAWN		APPROVED	
SIZE	DWG NO	DATE	
B	70-2030	70-2030	
SCALE	1:16	SHEET	4 OF 4

ITEM	PART NUMBER	DESCRIPTION	QTY
53	70-1305	NUT, MANIFOLD	2
52	70-6122	ASSEMBLY, 3P20 MANIFOLD	1
51	70-3083	ASSEMBLY, 3P20 CRANKCASE	1
		For Manual/	