Part Number: 95-0024 REV C – April 2019

The Little Wonder Modular

145-180 GPD
530-681 LPD

Installation, Operation & Maintenance

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

Parker

ENGINEERING YOUR SUCCESS.

Revision History

Revision	Description	Date
A	Initial Release	May 2017
B	Cleaning Procedure Update	June 2018
C	Various Design Updates	April 2019

The following are the types of flags used in this technical manual. They designate safety related items and important operational instructions and should be given special attention when they appear in the text:

WARNING	Text formatted in this manner concerns an operating procedure or practice that, if not strictly observed, can result in injury to personnel or loss of life.
CAUTION	Text formatted in this manner concerns an operating procedure or practice that, if not strictly observed, can result in damage to or destruction of equipment.
NOTE	Text formatted in this manner concerns an operating procedure or

MODEL: _____

SERIAL NUMBER: _____

DATE OF PURCHASE: _____

PURCHASED FROM: _____

INVOICE #: _____

VESSEL NAME: _____

INSTALLED BY: _____

DATE OF INITIAL START-UP: _____

Village Marine LWM Series Modular Watermaker

145-180 GPD – 530-681 LPD

Compact and reliable supply of fresh water. For sailboats and other marine applications.

The Little Wonder (LWM) Series reverse osmosis desalination systems are the preferred choice for boaters who require small, low power watermakers.

The units are simple to install and easy to operate. Ideal for applications where space and power are limited. The quality components that go into the LWM units ensure safety and years of reliable service.

Village Marine LWM 145-180

Contact Information:

Parker Hannifin Corporation
Water Purification
2630 E. El Presidio Street
Carson, CA 90810

phone 310 608 5600
fax 310 608 5692
waterpurification@parker.com

Website:
www.parker.com/waterpurification

Sales:
waterpurification@parker.com

Tech Support:
watertech@parker.com

Features & Benefits:

- Available for 12V, 24V, 110V, 220V power supplies as shown
- 5 micron cleanable prefilter
- Powder coated mounting brackets included
- Control manifold pressure regulator ensures consistent pressure and prevents over or under pressurization of the unit. Adjustable to allow operation in brackish or fresh water
- Acrylic flowmeter to monitor production
- High quality spiral wound TFC reverse osmosis membranes
- Magnetic drive boost pump
- Stainless steel glycerin filled pressure gauges
- High pressure pump impervious to the corrosive sea water environment and designed for maximum efficiency

Parker

ENGINEERING YOUR SUCCESS.

Key Feature

Optional salinity monitor and diversion valve system for water quality assurance.

Salinity monitor and diversion valve

P/N 90-0081 12V
P/N 90-0114 24V
P/N 90-0115 110V
P/N 90-0116 220V

Specifications

Model	Part Number	Electrical Supply Volts / Ph / Hz / Amps	Capacity GPH-m^3 / D	Weight lbs. / kg
LWM-145	90-8200 90-8622	12 V/15 Amps 24V/7.5 Amps	6/23	150/68
LWM-180**	90-8512 90-8596	12 V/22 Amps 24 V/11 Amps	7.5/28.4	225/102
	90-8516 90-8515	110/1/60/6.6 230/1/50/3.3	7.5/28.4	275/125

*Membrane elements are sold separately
**All system requires 2 x 33-3001 per system

Spares and Consumables

Part Number	Description
85-0050	Pump Oil
33-0117	5 micron Filter
33-0311	Carbon Flush Filter
33-3000	Membrane Element LWM 145
33-3001	Membrane Element LWM 180**
33-3038	Membrane Element LWM 145***
90-0005	Filter Housing O-Ring
99-6881	Filter Wrench
70-6181	HP Pump Service Kit

Part Number	Description
90-2512	Membrane O-Ring Kit
40-0241	Salinity Probe
85-0102	Cleaning Kit
85-0103	Preservation Kit
70-6181	Kit, Pump, Routine Service
99-1990A	Digital Handheld TDS Meter
70-0036	Belt, Models 145
70-0168	Belt, Models 200

**All system requires 2 x 33-3001 per system
***This used for spares only single 40" vessel.

To maintain peak performance always use genuine Parker Village Marine replacement parts. W the right to change our specifications or standards without notice.

WARNING: This product can expose you to chemicals including Di(2-ethylhexyl) phthalate (DEHP), which is known to the state of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

© 2019 Parker Hannifin Corporation

ENGINEERING YOUR SUCCESS.

LWM series Seawater Desalinator is a single-pass purification system that uses reverse osmosis (RO) to produce potable water from seawater. Product water with salt concentrations of < 500 ppm are achieved by removing approximately 99% of the dissolved salt in seawater.

1. INSTALLATION

The RO unit should be installed in a dry, sheltered location protected from direct weather. Drainage should be provided beneath the RO unit to allow standing water to drain when performing maintenance or repair.

Refer to the Plumbing Diagram for arrangement and connection hose sizes. All connections up to and including the boost pump must be below water line. If necessary, the three-way flushing valve may be disconnected from the flushing filter to get the valve below waterline. The pre-filter, the HP pump and the membrane rack can all be above the waterline as indicated in the diagram below.

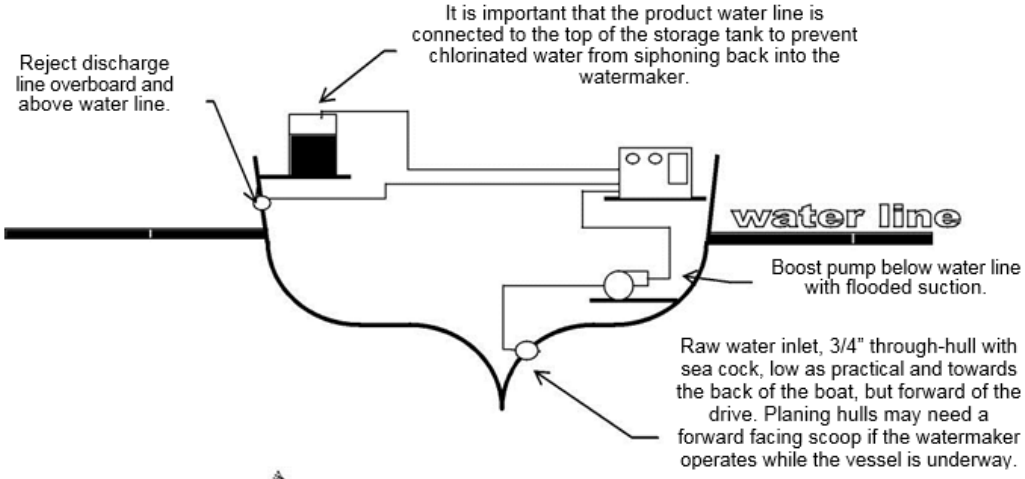


Figure 1.0: LWM - Basic Installation Diagram.

NOTE

Standard maximum head pressure:
- 12/24 vdc 10.6ft - 3.3 m/4.5 psi - .31 bar
- 110/220 41ft - 13m/ 17.7 psi - 1.22 bar

Need more lift pressure up to 16ft - 4 4.9m/ 50 psi - 3.44 bar with 6.1 add amp use part number 12124016SF 24V / 12124015SF 12V

1.1. INSTALLATION PROCESS

Locate or create a 1/2” dedicated through-hull for the feedwater intake of the RO unit. The through-hull must be attached with a ball valve (seacock), and optionally a sea strainer.

CAUTION

The Little Wonder MODULAR **SHOULD NOT SHARE** a through-hull feedwater intake. Parker Hannifin recommends the Little Wonder HAVE its **OWN** dedicated through-hull, to properly feed water into the RO. Avoid connecting the inlet piping to any water line which services an engine or other equipment. Air could be drawn through the unit causing damage to the RO unit’s pumps, as well as VOIDING the RO unit’s warranty with Parker.

1.1.1. TO CONNECT PLUMBING

Refer to the EXPANDED detailed Little Wonder MODULAR plumbing diagram.

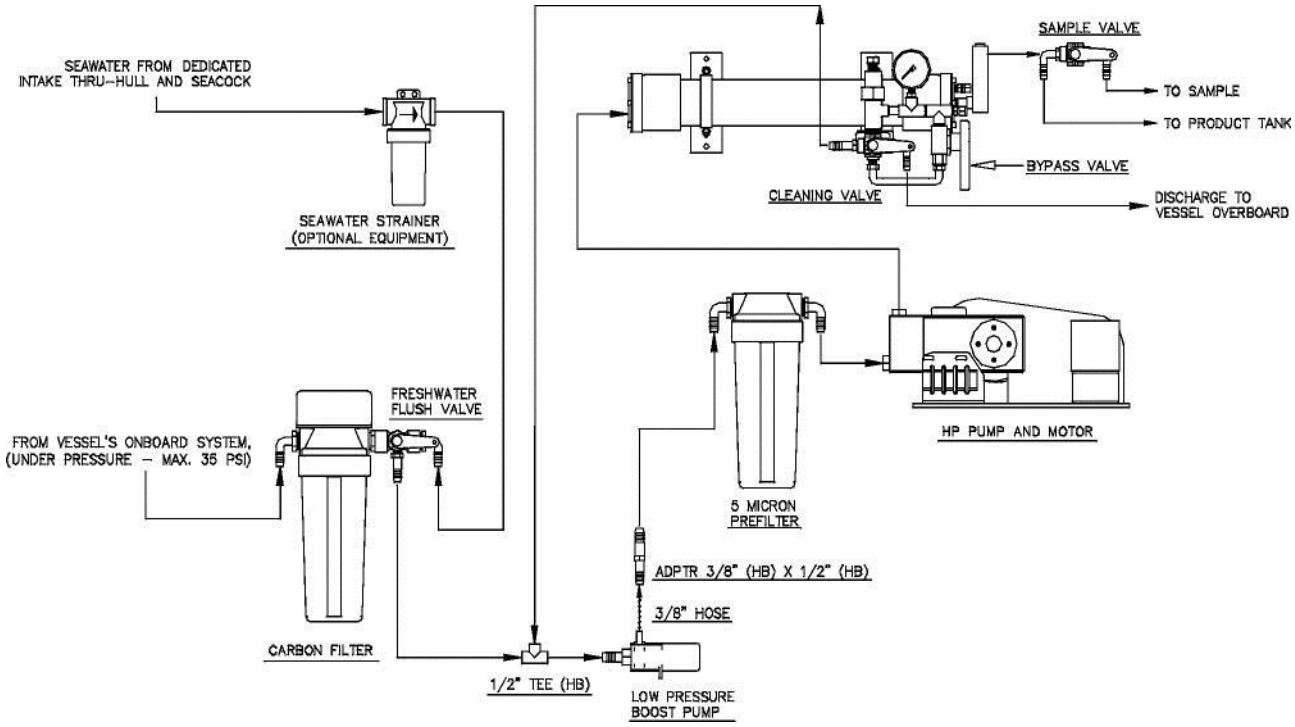


Figure 1.1: Little Wonder MODULAR Plumbing Diagram.

1.1.2. FEEDWATER INTAKE

Step 1: Mount the sea strainer **BELOW** the vessel's waterline.

Step 2: Mount the three-way manual Freshwater Flush Valve (attached to Carbon Filter Housing) **BELOW** waterline. Refer to Figure 1.2 for a view of the carbon filter and freshwater flush valve.

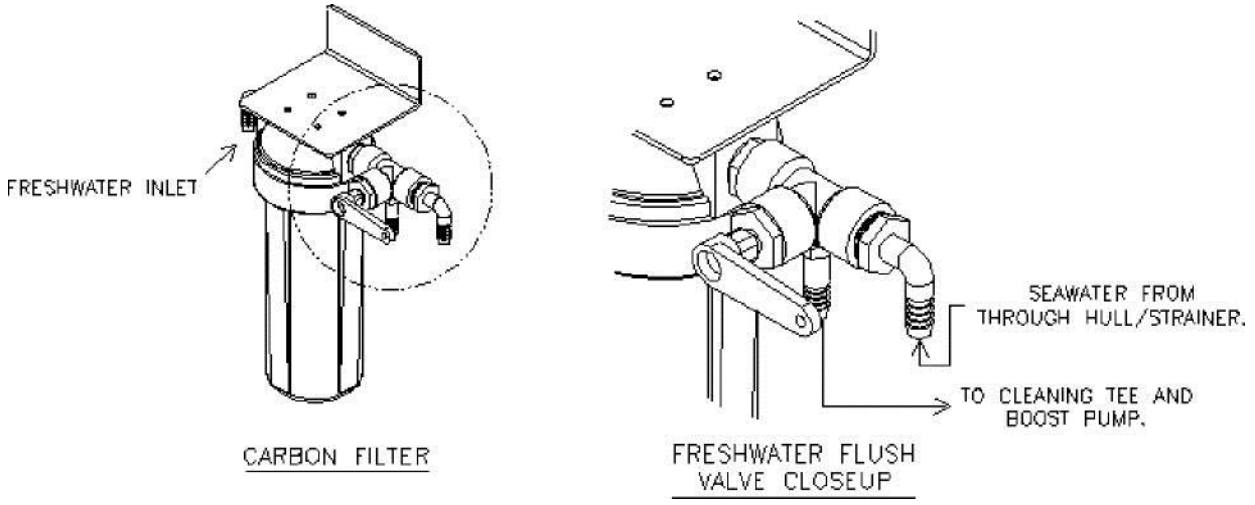


Figure 1.2: Carbon Filter with Freshwater Flush Valve – Isometric Views.

NOTE

Parker Hannifin recommends the Manual Freshwater Flush Assembly be installed BELOW waterline. However, the valve can be removed from the filter housing and relocated below waterline, leaving the filter housing ABOVE waterline. A hose can be plumbed from the filter housing to the valve. This way the seawater feed does not go above waterline to avoid trapping air and creating a priming problem.

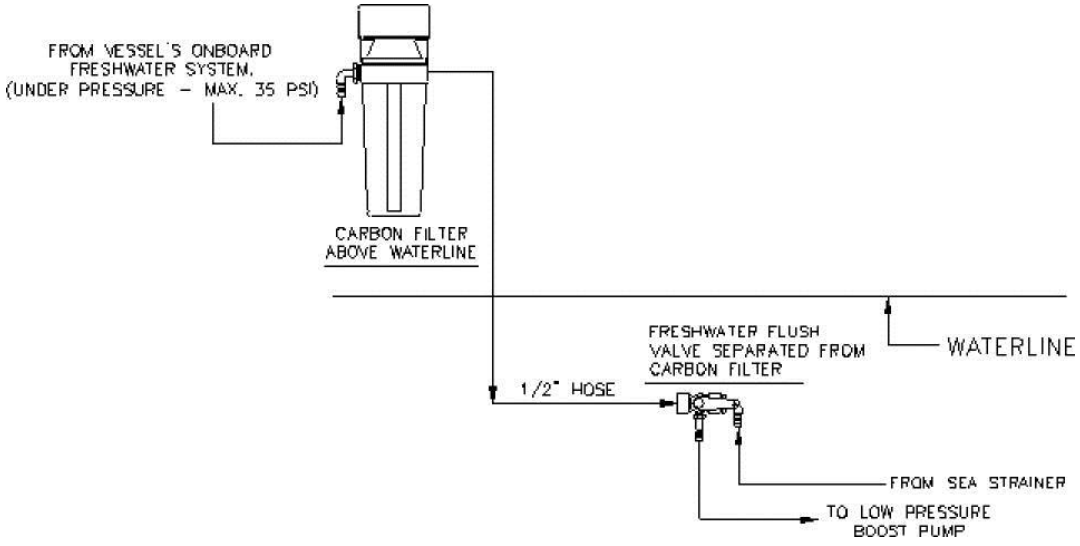


Figure 1.3: Carbon Filter with Freshwater Flush Valve – Isometric Views.

Step 3: Figure 1.3: Connecting the Carbon Filter Outlet to the Separated Freshwater Flush Valve. Connect 1/2" diameter PVC hoses to connect all the feed water components up to the high- pressure pump. Note the boost pump outlet is a 3/8" diameter barb fitting. Use a short section of 3/8" hose and jump to 1/2" diameter using the step size adaptor supplied.

1.1.3. BRINE DISCHARGE

Locate a convenient spot in the boat to install an overboard discharge through-hull with an 1/2" diameter. Discharge line is required to be **ABOVE** waterline, refer to Figure 1.1. If connecting to a common drain, tee in from above so that backflow contamination to the watermaker from other drains is not possible.

1.1.4. PRODUCT WATER AND SAMPLE WATER

Connect a 1/4" diameter PVC hose (or potable water hose) from the product elbow off the back of the product flowmeter to a sample valve (Refer to Figure 1.4). On both outlets of the sample valve, connect a 1/4" inner diameter PVC hose (or potable water hose), one hose for product water sampling and the other hose for feeding the ship's Freshwater Tank. The product tank hose off of the sample valve is to be fed into the top of the product tank, to prevent any possible backflow (refer to Figure 1.1).

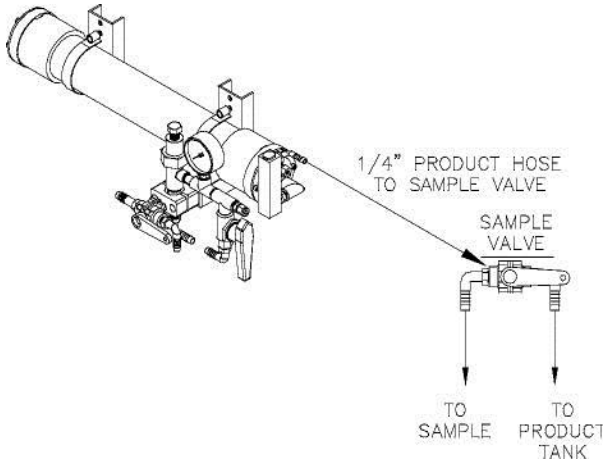


Figure 1.4: Little Wonder MODULAR Sample Valve Connection.

NOTE

If a fitting connection cannot be made to the top of the Freshwater Tank, tee into the Deck Water Fill.

Leave enough hose length to RUN the sample hose portion to a sink, bilge, or overboard, to sample the water.

Parker Hannifin recommends running the sample line to a galley sink and installing a dedicated water spigot, free flowing, always open (i.e. a 'cane shaped' fixture as used in a manual galley pump). This allows easy sampling at a sink, a drain overboard and the capability to fill extra water bottles, while your Little Wonder produces water for all purposes.

1.1.5. FRESHWATER FLUSH

Tap into your boat's freshwater pressure system (Tee into the cold pressurized side) with a 1/2" diameter hose to the carbon flush filter. If the freshwater pressure on board is above 35 psi, install a pressure regulator.

CAUTION

Inlet and discharge interconnecting lines should be constructed of a NON-FERROUS material. Examples of some suitable materials are PVC, copper-nickel, 316 stainless steel pipe or a reinforced non-collapsing hose. Ferrous piping introduces iron that will foul the membranes prematurely.

NOTE

Avoid connecting the seawater source to a water line that services any other piece of equipment. Air could be drawn through the RO unit causing damage to the RO unit's pumps. Cross contamination is also possible. The best practice is a dedicated through hull for the watermaker, with a separate seacock and strainer.

Connect electrical power to the watermaker. Select the circuit breaker size of at least 50% more than the operating amps shown on the serial number tag. 110 VAC 60 hertz units need a three-wire supply, black, white and green for hot, common and ground respectively. 220 VAC 60 hertz units need a four-wire supply, black, blue, white and green for hot, hot, neutral and ground respectively - bring a separate neutral from the generator if necessary. 230 VAC 50 hertz units need a three-wire supply, black, white and green for hot, hot, and earth respectively. Connect power to the main terminal block in the electrical enclosure following the above wire colors.

CAUTION

Strictly observe all applicable electrical codes and regulations governing the installation and wiring of electrical equipment. Typical codes specify the type and size of conduit, wire diameter and class of wire insulation depending upon the amperage and environment. The power supply should always be of a greater service rating than the requirements of the RO unit. Never connect the RO unit to a line that services another electrical device, the RO unit should have its own breaker.

WARNING

Disconnect electrical power to RO unit prior to servicing the watermaker

TURN OFF ALL ELECTRICAL POWER FOR USE WITH THE RO UNIT PRIOR TO CONNECTING TO THE RO POWER SOURCE. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONS HANDLING THE UNIT.

Adhere to all electrical codes and regulations governing the installation and wiring of electrical equipment. Typical codes specify the type and size of conduit, wire diameter, and class or wire insulation depending upon the amperage and environment.

NOTE

The power supply should always be of greater service rating than the requirements of the RO unit. This will assure proper voltage even if power supply voltage is slightly less than required. Never connect the RO unit to a line that services another electrical device. THE RO UNIT SHOULD HAVE ITS OWN INDEPENDENT POWER SUPPLY.

Step 1: Verify all power switches and power sources are in the ***OFF*** position.

Step 2: Connect power source wire (Positive +) to line side on RO unit's breaker.

Step 3: **AC POWERED 110V/220V Little Wonder MODULAR:**
Connection will be from the separate control box supplied to the onboard circuit breaker panel. Parker recommends use of a 15-amp fuse or circuit breaker.

DC POWERED 12V Little Wonder MODULAR:
12 VDC units require 6-gauge wire and a 25-amp fuse or circuit breaker. Connect RO unit's power supply red wire (Positive +) from load side of unit's breaker, to power input on the **Little Wonder MODULAR's** terminal strip.

Step 4: Connect a negative black wire from the ground bus bar behind main breaker panel to negative power source input on unit.

Step 5: With the DC units, connect the boost pump wires red and black to the same terminals at the side of the high-pressure pump.

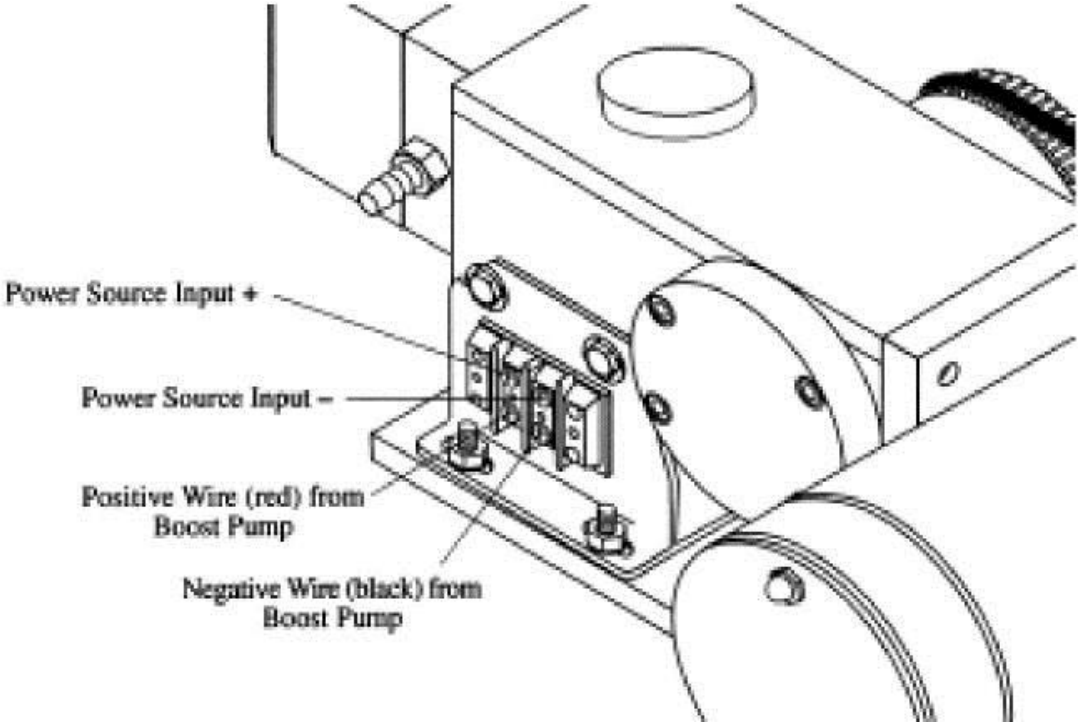


Figure 1.5: LTM (DC UNIT) Electrical Interface View

2. START UP AND OPERATING PROCEDURE

1) Check the HP pump oil level by observing sight gauge located on the pump. Open the raw saltwater supply to the unit at the through-hull. Also ensure that the flushing valve is in the saltwater position with the valve handle pointing away from the carbon flushing filter. The product sample valve should be in the "sample" position, not directed to tank.

2) Verify the bypass valve (black handle) is open, counterclockwise.

3) Start the LP pump, verify the filter pressure gauge shows >5 psi indicating the system is primed with water.

4) Start the HP pump. Water should now be flowing through the system and discharging through the overboard reject line. Often installations will connect both pumps to the same circuit breaker. This arrangement is acceptable; however, it is still prudent to confirm the pumps are primed and running correctly. Remember, there is no safety switch for low flow, and pump damage will occur if running dry.

5) Slowly close the bypass valve, and confirm that the membrane pressure gauge registers 800 psi. The high-pressure setting can be adjusted by the regulator set screw on the high-pressure manifold on top of the instrument panel.

6) After 2 minutes of operation, confirm the salinity by taste test or by hand meter at the sample valve. Once it is acceptable, turn the sample valve to direct water to your storage tank. A digital salinity monitor and automatic diversion valve is available as an option.

7) Now, would be a good opportunity to record the pressures, flow and salinity on the Operation Log.

8) For shutdown, reverse the steps. First open the black bypass valve. Then shut down the HP and LP pumps. Turn the product sample valve back to sample position. If you are unsure if the watermaker will be restarted in a day or so, now is time to flush the watermaker to keep the membranes fresh while idle, please see the next section. Bacteria and biological growth increases, the longer stagnant water is in contact with the membranes, so the flushing is advised whenever the unit will be idle. Once flushed, the flush should be repeated once every one or two weeks, if the idle period continues. For extended periods, see the section on pickling or preserving the watermaker.

3. MAINTENANCE

The service life of most system equipment is directly related to the raw water inlet conditions. Improper maintenance will also significantly reduce the life expectancy of the major unit components (such as the membranes, filters and pumps), as well as the reliability of the unit as a whole. Under normal conditions, and with proper maintenance, a reverse osmosis membrane (which is the major consumable item) should have an effective service life

The RO unit must be cleaned when product water production output drops by 20%.

	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually	As Required	Labor Hours (approximate)
Clean/inspect micron pre-filter			•					0.5
Replace filter(s)*				•				0.5
Clean membranes							•	2.0
Replace Membranes							•	1.0
Check pump oil level			•					0.1
Change pump oil**						•		0.5
Lubricate pump motor						•		0.5

Table 3.0: Maintenance Task Chart.

* Parker pre-filter cartridges can be rinsed with freshwater and be reused up to 3 times.
** Change pump oil after first 50 hours of RO use. After the first oil change at 50 hours, change the pump oil every 500 hours thereafter or once annually which ever interval comes first.

4. FRESHWATER FLUSH / SHORT TERM STORAGE

Ideally, the system performs optimally when the RO unit is used regularly. The likelihood of bacterial and biological growth in the membranes increases, when stagnant seawater (in extended periods) is in contact with the membranes. A freshwater flush procedure is necessary to prevent clogging and growth of organic contaminants in the RO system and its membranes. This method pushes out older stagnant seawater (saltwater) out of the membranes and replaces it with freshwater (non-saltwater), leaving less chance of fouling the membranes. The freshwater flush procedure should be used when the unit will be placed idle or in "stand by" condition for more than several days OR idle for three days in hot, tropical climates. Although they do not attack the membranes or other system components directly, high concentrations of biological matter can block enough of the product water channels to cause a reduction of as much as 40% of the total system capacity.

CAUTION

Perform a freshwater flush to the RO unit with non-chlorinated fresh water only. Exposing the membranes to chlorinated water will cause irreversible damage and void the RO unit warranty. The freshwater flush system uses a carbon filter inline before the system to consume the chlorine that may be present from the dock water.

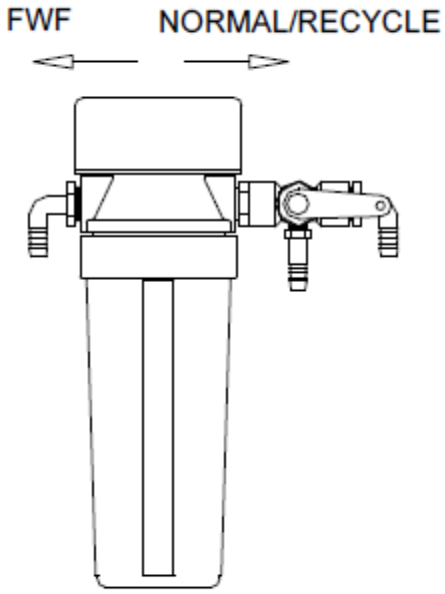


Figure 4.0: LWM - Fresh Water Flush Assembly.

4.1. TO FLUSH THE LWM UNITS

1) Verify all power switches and power sources are turned **OFF**.

2) Verify the High-Pressure Bypass Valve is fully open
.

3) Turn the gray Fresh Water Flush Valve to **FWF**.

4) Turn on the breaker at the main breaker panel for two minutes.

5) Turn off the breaker at the main breaker panel.

6) Turn the gray Fresh Water Flush Valve to **NORMAL/RECYCLE** position.

7) Leave RO unit in standing condition, for up to three weeks. Then re-flush or preserve.

8) To restart the LWM, refer to instructions in Start-Up.

4.2. MEMBRANE CLEANING

The membrane elements require occasional service; it is recommended to clean the membranes only when dirty. Basic procedure for all cleaning and preservative treatments is similar; a specific chemical solution is circulated through the system for a pre-determined length of time.

NOTE

All cleaning and preservation procedures should be performed with NONCHLORINATED freshwater to optimize performance of cleaning process.

NOTE

Allow your unit's product water to run with product to DUMP for the first 30 minutes after cleaning or upon startup after preservation.

Part #	Description	Cartridge
85-0102	Cleaning Chemical #1 Cleaning Chemical #2	Cartridge (Blue Stripe) Cartridge (Red Stripe)
85-0103	Preservative Chemical #3	Cartridge (Green Stripe)

Table 4.0: Chemical Cartridge Requirements

4.2.1. CLEANING CHEMICALS

CAUTION

Cleaning chemical #1 is an alkaline detergent, used to remove oil, grease, biological matter, and grime from the surface of the RO membranes. See warning label on side of package and observe all safety precautions on label.

CAUTION

Cleaning chemical #2 is an acid, a mineral scale remover. See warning label on side of package and observe all safety precautions on label.

WARNING

THE USE OF CHEMICALS OR CLEANING METHODS OTHER THAN THOSE OUTLINED IN THIS MANUAL WILL VOID THE RO UNIT WARRANTY. NON-IONIC SURFACTANTS USED FOR MEMBRANE CLEANING OR ANY OTHER CHEMICALS NOT APPROVED IN WRITING BY PARKER, WILL VOID THE RO UNIT WARRANTY.

4.2.2. WHEN TO CLEAN

Chemically clean the RO, when product water output drops below 80% of original production. The frequency of this occurring varies greatly upon feed water. Membrane fouling will occur with normal use.

NOTE

Product water output depends on feedwater temperature, pressure and salinity. Product water output reductions from these factors are normal and may not indicate need for membrane cleaning.

STEPS FOR CLEANING CHEMICALS #1, #2, AND #3 (CARTRIDGE FORM)

CLEANING PROCEDURE

1. Fresh water flush system for 7 minutes.
2. Remove Pre-filter and replace with cleaning cartridge filter (Chemical #1 – Blue Stripe), then fill housing with unchlorinated water. Screw housing back into place.
3. Fully open the High-Pressure Bypass Valve for Cleaning Mode.
4. Open cleaning valve at bottom of manifold.
5. Turn product sample valve to center of product and reject.
6. Start R.O. unit running booster pump only.
7. Close fresh water flush valve, putting valve handle in center.
8. Allow the cleaning to run for 30 minutes.
9. Turn system off.
10. Remove cleaning cartridge and replace with 5-micron pre-filter.
11. Close cleaning valve at bottom of manifold.
12. Turn fresh water flush valve to sea water position.
13. The system is ready to run like normal. (Allow system to run for 5 minutes to flush out all cleaning chemical.)
14. If necessary, use Cleaning Chemical #2 (Red Stripe), repeat Step 1 – 9.
15. Return R.O. to Normal Conditions.
16. Record production flow rate before and after cleaning to determine effectiveness.

PRESERVATION PROCEDURE:

1. Fresh water flush system for 7 minutes.
2. Remove Pre-filter and replace with preservative cartridge filter (Chemical #3 – Green Stripe), then fill housing with unchlorinated water. Screw housing back into place.
3. Fully open the High-Pressure Bypass Valve for preservative recirculating.
4. Open cleaning valve at bottom of manifold.
5. Turn product sample valve to center of product and reject.
6. Start R.O. unit running booster pump only.
7. Close fresh water flush valve, putting valve handle in center.
8. Allow the preservative to run for 30 minutes.
9. Turn system off.
10. Remove preservative cartridge from pre-filter housing, then replace filter housing bowl to filter housing top empty.
11. Leave all valves in position they are in now.
12. Unit is now preserved.

NOTE

For resuming normal RO operation (“unpreserving” or “unpickling”), install a 5-micron filter into pre-filter housing and fill it with UNCHLORINATED WATER, Begin system Start-Up Procedures.

NOTE

If RO unit storage time is to exceed four months, then it is NECESSARY to Flush (Push Out) the existing chemical out of the unit and represerve at EVERY FOUR MONTH INTERVAL.

5. OIL CHANGE PROCEDURE

An oil change is recommended after the first 50 hours of RO use. Subsequent oil changes are to be performed every 500-hour intervals OR changed annually. Change oil any time moisture is detected or if oil is cloudy. For additional pump information, refer to MANUFACTURER'S LITERATURE in back of this manual.

WARNING

DO NOT RUN PUMP WITHOUT OIL IN THE CRANKCASE.

Step 1: Turn off all power sources and switches.

Step 2: Before changing the oil, obtain a container (i.e. tray or catch basin) to collect the oil drainage.

Step 3: Remove the oil plug (Refer to Figure 5.1) and direct the oil to a catch basin. Allow the oil to drain empty.

Step 4: Reconnect the oil plug or oil drain stopper. Then unscrew the oil cap and refill oil to fill line (located on HP Pump sight glass). Check for leaks and re-secure oil cap.

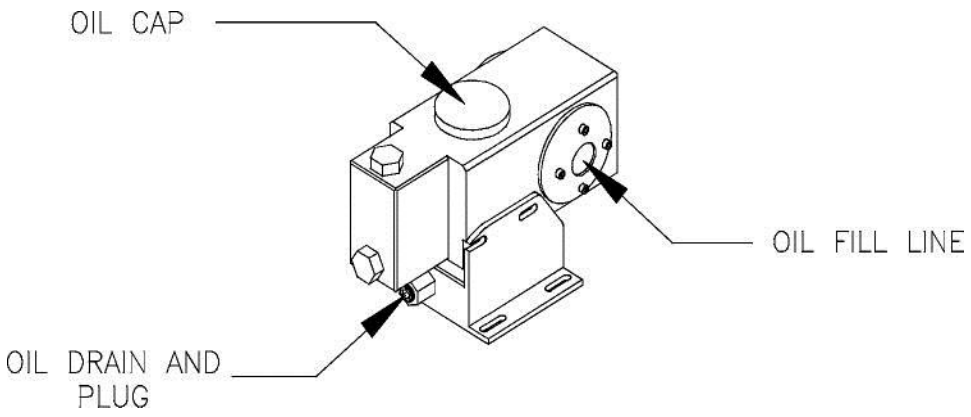


Figure 5.0: High Pressure Pump Service Locations

OPERATION LOG

We encourage operators to keep a simple operation log for the watermaker. Even occasional entries will help in troubleshooting. It is especially important to record performance after the first 3 hours after installation, so the baseline is known.

Date	Filter Pressure	Membrane Pressure	Product Flow	Water Quality TDS (ppm)	Water Temp,	Comments

6. OPERATION

6.1. TO START THE LITTLE WONDER MODULAR UNIT

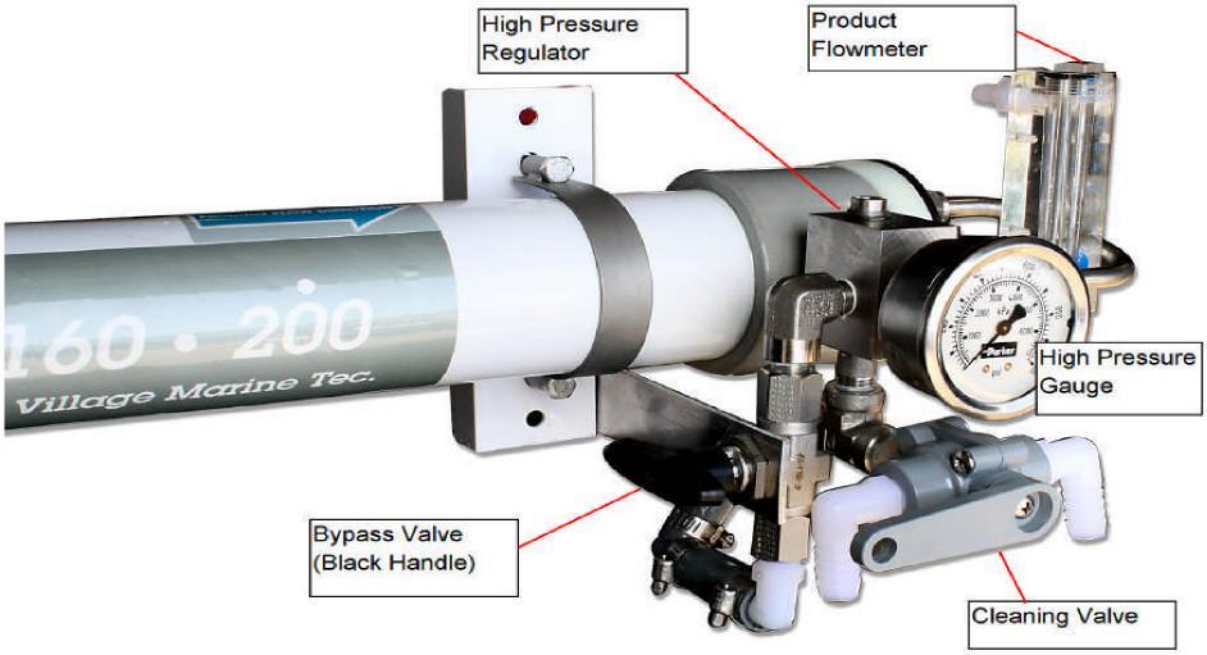


Figure 6.1: Little Wonder MODULAR Instrument Detail.

Step 1: Turn the sample valve to **SAMPLE** position to direct the flow of water to the sample line.

Step 2: Turn the High-Pressure Bypass Valve (Black Valve) to **CLEANING** position, counterclockwise, to release air trapped within the system.

Verify the Cleaning Valve (Gray Valve) is positioned to **NORMAL** discharge, allowing brine water to flow overboard. Also check the gray Freshwater Flush Valve (Refer to Figure 2.3) is positioned for seawater intake, **NOT** freshwater.

CAUTION

Failure to open the high-pressure bypass valve could result in hydraulic shock to the system.

Step 3: Verify the seawater intake is open at the through-hull. Start-up time can be expedited by filling the pre-filter housing by temporarily turning the flush valve to freshwater position before the RO unit is turned on.

Step 4: **AC POWERED 110V/220V Little Wonder MODULAR Models:**

Turn Power Switch **ON** located on the unit's supplemental control box, to start RO. Start the LP Booster pump first, then the HP Pump.

DC POWERED 12V Little Wonder MODULAR Models:

Switch **ON** the breaker at the main breaker panel to power up the unit.

Step 5: Upon initial start-up inspect all plumbing connections in the unit for leakage. Varying temperatures during shipment may cause plumbing connections to seep when starting the RO unit for the first time. Secure the unit and repair any leaks before proceeding. Once the leaks are repaired, open the raw water source and restart the unit.

Step 6: Verify brine discharge is flowing overboard. If so, gradually turn the High-Pressure Bypass Valve (Black Valve) to **NORMAL/RO** position. The High-Pressure Regulator is factory set at 800 psi. If High-Pressure Gauge does not read 800 psi, slowly tighten or loosen in small increments the screw atop the High-Pressure Regulator and adjust to a reading of 800 psi. For location of High-Pressure Regulator, refer to Figure 4.1.

NOTE

If the RO unit is used for other than seawater purification (in freshwater or brackish water applications), reduce pressure as necessary to achieve product flow no greater than 120% of design flow to avoid membrane damage.

WARNING

RO HIGH-PRESSURE PRODUCTION SHOULD **NEVER EXCEED 950 PSI**, DOING SO RISKS DAMAGE TO THE RO UNIT **VOIDING** FACTORY WARRANTY.

NOTE

At initial start-up of RO unit, keep the product water diverted out of the water storage tank. IF the unit is filled with preservative storage solution, production must be diverted AT LEAST 10 MINUTES to clear preservative solution from system.

Step 7: With the Sample Valve at **SAMPLE** position, taste the water quality or test it with a hand-held test meter. If quality is good, turn the Sample Valve over to **PRODUCT** direction, routing the product water into the vessel's storage tank.

Step 8: Check the RO unit for water leakage periodically at the initial start-up. Observe Product Flow meter. Record the product flow after 3 and 24 hours of operation (use the start-up sheet provided).

6.2. TO SHUT DOWN THE UNIT

Step 1: As the RO unit operates, turn the High-Pressure Bypass Valve (Black Valve) to **CLEANING POSITION**. This will release the high-pressure within the RO system.

Step 2: **AC POWERED 110V/220V Little Wonder Models**:

Turn the HP pump off, then the booster pump, off at the control box. Then turn OFF your breaker at the main breaker panel.

DC POWERED 12V Little Wonder MODULAR Models:

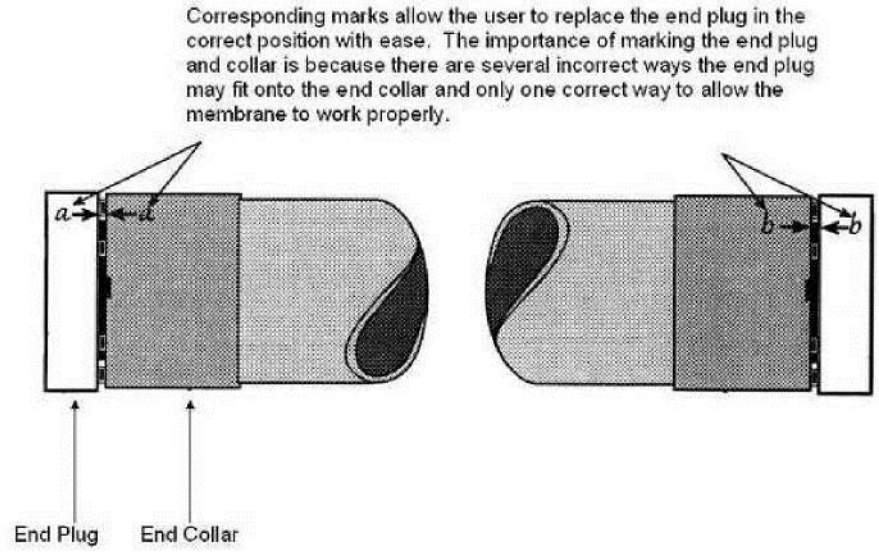
Turn **OFF** your breaker at the main breaker panel.

The RO unit may be left int his “stand-by” condition with seawater for one day. If the RO unit will be out of service for extended time periods, please refer to the Maintenance section of this manual for flushing instructions.

6.3. PRESSURE VESSEL AND MEMBRANES - DISASSEMBLY

Step 1: Disconnect plumbing from pressure vessel for disassembly. Remove the pressure vessels to a workbench to continue.

Step 2: Remove the six fasteners and cap ring holding each end plug with an Allen wrench. Place a mark on each end plug to be removed, place a corresponding mark on each end collar. This will ensure proper orientation during assembly. See bulletin at the back of the manual for part numbers of the individual components.



Step 3: Locate the screwdriver slots located on opposite sides of the pressure vessel end collar. Place an appropriately sized slot screwdriver in each slot. Twist both screwdrivers until the end plug breaks loose from the pressure vessel. A prying motion on both sides of the end plug with the screwdrivers will quickly remove it. Use this procedure for both end caps. Push or pull the membrane element out of the pressure vessel tube.

CAUTION

Never force a membrane out of a pressure vessel by applying pressure on the product water tube (center tube), as this will damage the membrane. If membrane is difficult to remove, use a 2” diameter plastic pipe (PVC) to apply pressure on the protected end of the membrane.

Step 4: Note which end of the pressure vessel the brine seal was installed at. The brine seal is a black u-cup seal on the membrane outer diameter near one end. This is the feed end of the pressure vessel. When reinstalling the RO membrane, the brine seal must be located at the feed end of the pressure vessel.

6.4. PRESSURE VESSEL AND MEMBRANES - REASSEMBLY

Step 1: Inspect all O-Rings; product O-Rings, end plug O-Rings, and Brine Seal. Replace seals if there is visible damage. The product water O-Rings are internal O-Rings, inside the center hole in the end cap.

Step 2: Lubricate O-Rings and entrances to pressure vessel with glycerin or silicone lubricant. Locate discharge end of pressure vessel. Install discharge end plug by lining up with the holes of the pressure vessel, paying attention to the reference mark. Position end cap ring and insert fasteners by hand.

CAUTION

Never use any type of lubricant containing petroleum oil. Oil can damage your unit and reduce membranes performance.

Step 3: Align the membrane so the end without the brine seal enters the feed end of the pressure vessel first. Slide membrane into pressure vessel until resistance is felt. Continue applying pressure until the product water tube sits into the end plug.

Step 4: Install the remaining end plug (align end plug holes with mounting holes properly), use the reference mark made in Step 2 for correct assembly. Tighten the six fasteners for each end cap. Install the vessels and reconnect plumbing.

NOTE

Do not apply Teflon tape or sealant to straight thread fittings such as those used on High-Pressure hose ends.

7. TROUBLESHOOTING

Below is a list of frequently encountered operational problems and some guidelines and troubleshooting checks. This section can only be a guide to solving potential problems with the RO unit and does not contain all possible malfunctions. The best troubleshooting tool is your knowledge of the RO gained through experience. Situations not covered in this section may be resolved by contacting Parker Hannifin via phone calls and e-mail.

1. Check for proper valve configuration. Make sure the cleaning valve is in the overboard “Normal” position. Confirm by checking water is flowing overboard through the brine discharge. Flow should be about 1 quart per minute.

2. Always check for loose connections or broken wires when checking electrical parts. Check for good voltage at the high-pressure pump motor; and if it is low then follow back with the voltmeter until the loose connection is found.

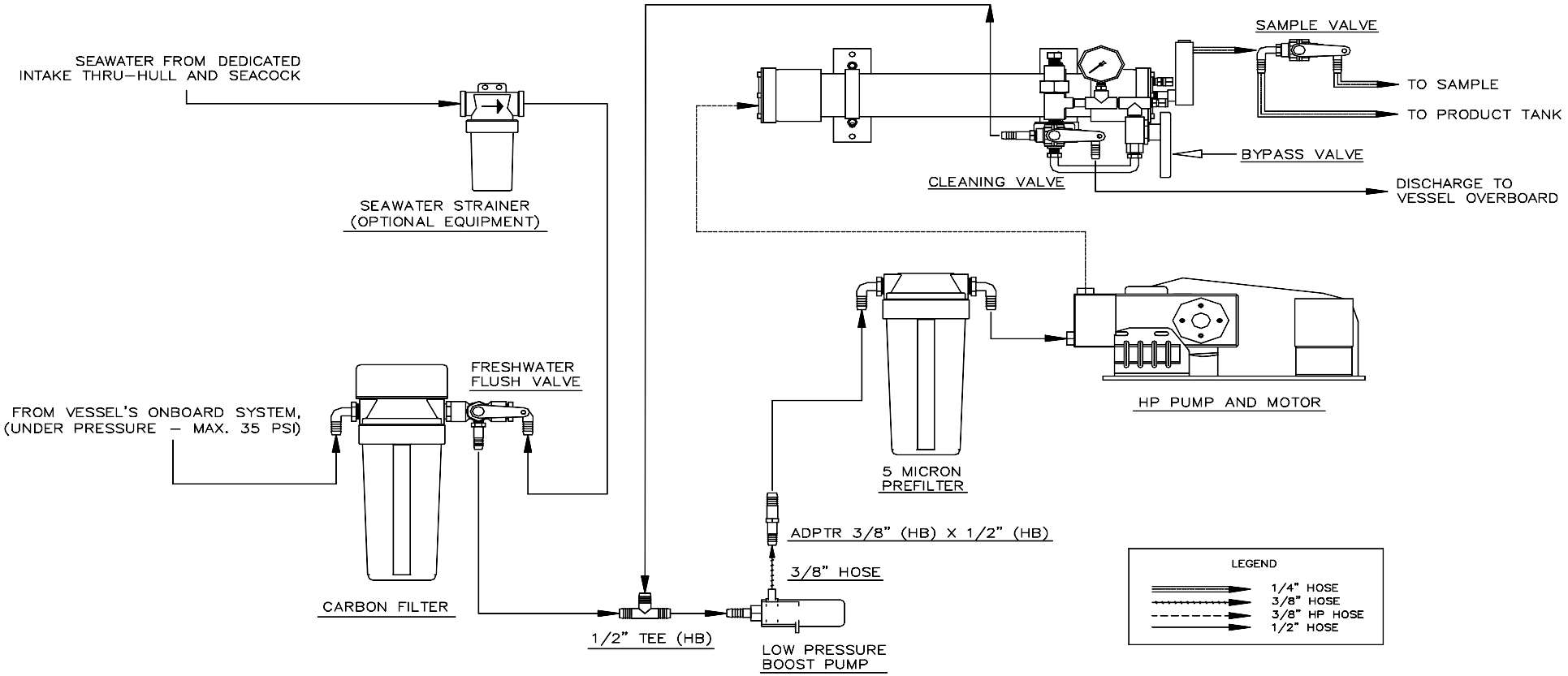
3. Confirm that a free sea water feed is supplied.
   A) The through-hull is clear of trash or kelp.
   B) Seacock is open.
   C) Sea strainer is clear.
   D) Boost pump is running.
   E) 5-micron filter is clean.

4. To flush the unit, the black handled Bypass Valve is in **CLEANING** position, but the gray handled Cleaning Valve must be in the **NORMAL** position. During flush, water must be flowing overboard through the brine discharge.

5. Low production GPH may be caused by cool seawater. Poor salt rejection may be caused by warm and/or salty seas. Do not interpret environmental factors as equipment problems.

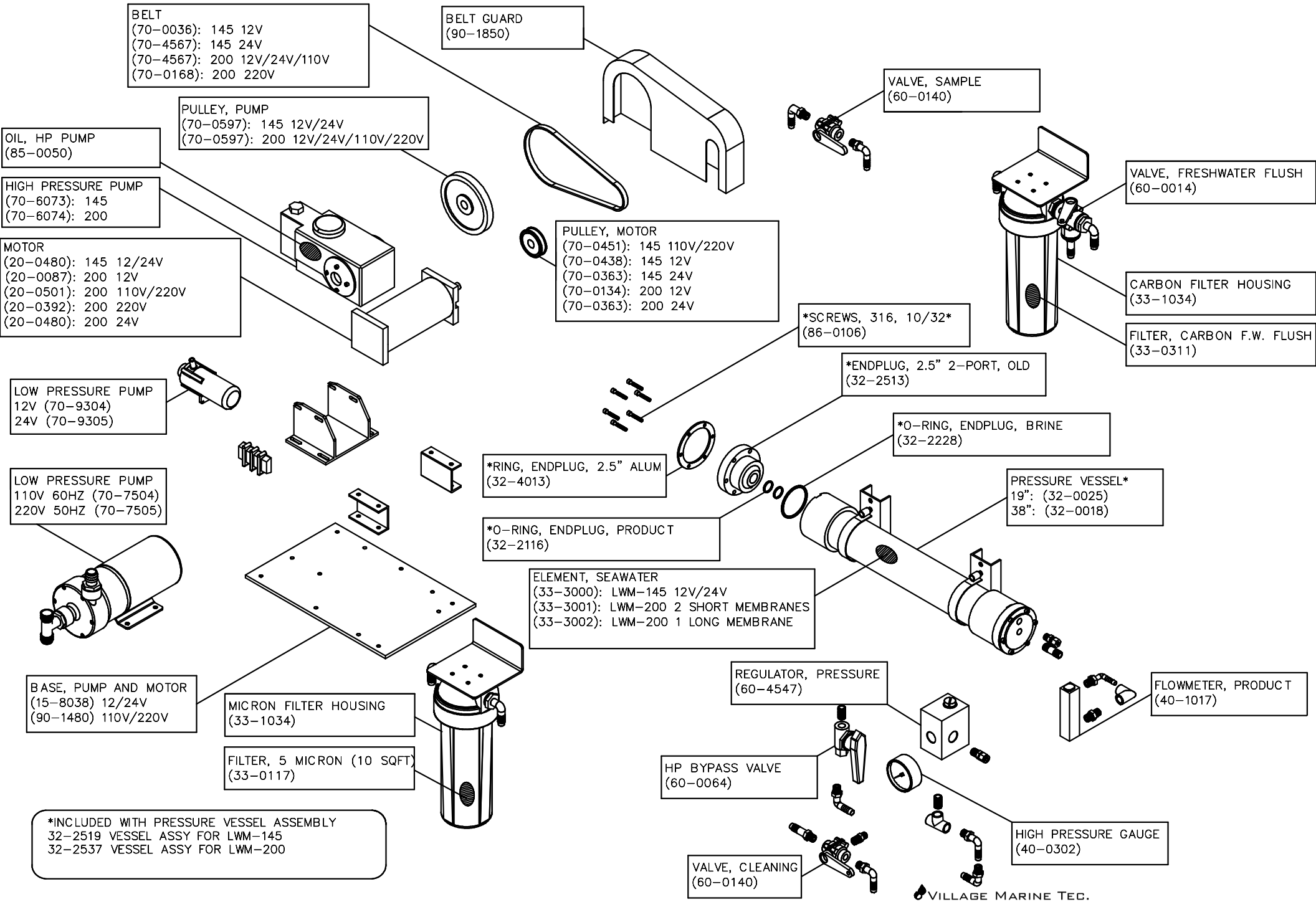
8. PLUMBING DIAGRAMS

Little Wonder Modular Plumbing Diagram



Village Marine Tec.
Freshwater From the Sea
July-2004

Little Wonder Modular 145-200 - Main Parts Reference



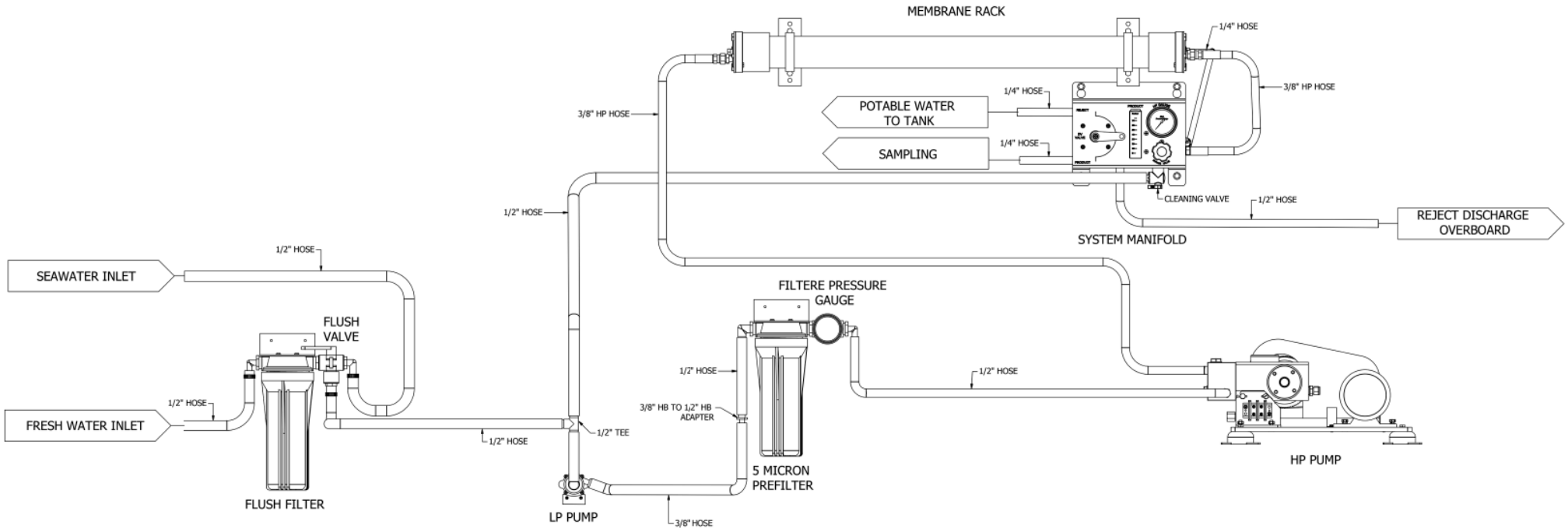
Village Marine Tec.

Freshwater From the Sea

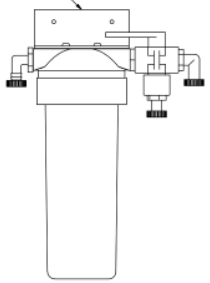
March 2013

SYSTEM UPGRADE
AS OF 3/1/2016

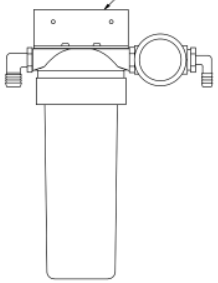
LWM-145 TO LWM-200 PLUMBING DIAGRAM



Fresh Water Flush Filter Assembly p/n 90-1288
Replacement Element p/n 33-0311
Replacement O-Ring p/n 85-0102
Flush valve p/n 60-0014



Pre-filter Assembly p/n 90-3272
Replacement Element p/n 33-0117
Replacement O-Ring p/n 85-0102
Filter Pressure Gauge, p/n 40-0300

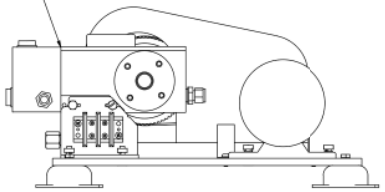


HP Pump
Model 145, 12V/24V p/n V153020005
Model 200, 12V p/n V153020006
Model 200, 24V p/n V153020005
Model 200, 110/1/60 p/n V153020004
Model 200, 230/1/50 p/n V153020008

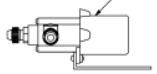
Pumps p/n 70-6073 70-6074
-Kit, Pump, Routine Service, p/n 70-6181
-Kit, Pump, Rebuild, Crankcase, p/n 70-6113
-Kit, Pump, Rebuild, Manifold, p/n 70-6079

Pump Pulley p/n 70-0597

Motor Pulley
-Models 145/200 GPD, 12V p/n 70-0134
-Models 145/200 GPD, 24V p/n 70-0363
-Model 200 GPD, 110/1/60 p/n 70-0451
-Model 200 GPD, 230/1/50 p/n 70-0438



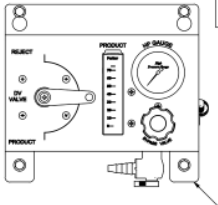
LP Pump
Low Pressure Mag Drive Pump 12V p/n V016020001
Low Pressure Mag Drive Pump 24V p/n V016020002
Low Pressure Mag Drive Pump 110/1/60 p/n 70-1500
Low Pressure Mag Drive Pump 230/1/50 p/n 70-1500
Kit, Rebuild, Pump Assy 110/1/60 & 230/1/50 p/n 70-1502-K01



Belt
-Model 145 GPD p/n 70-0036
-Model 200 GPD p/n 70-0168

Pump Oil, p/n 85-0050

See Bulletin for
Pressure Vessel
Parts, back of manual

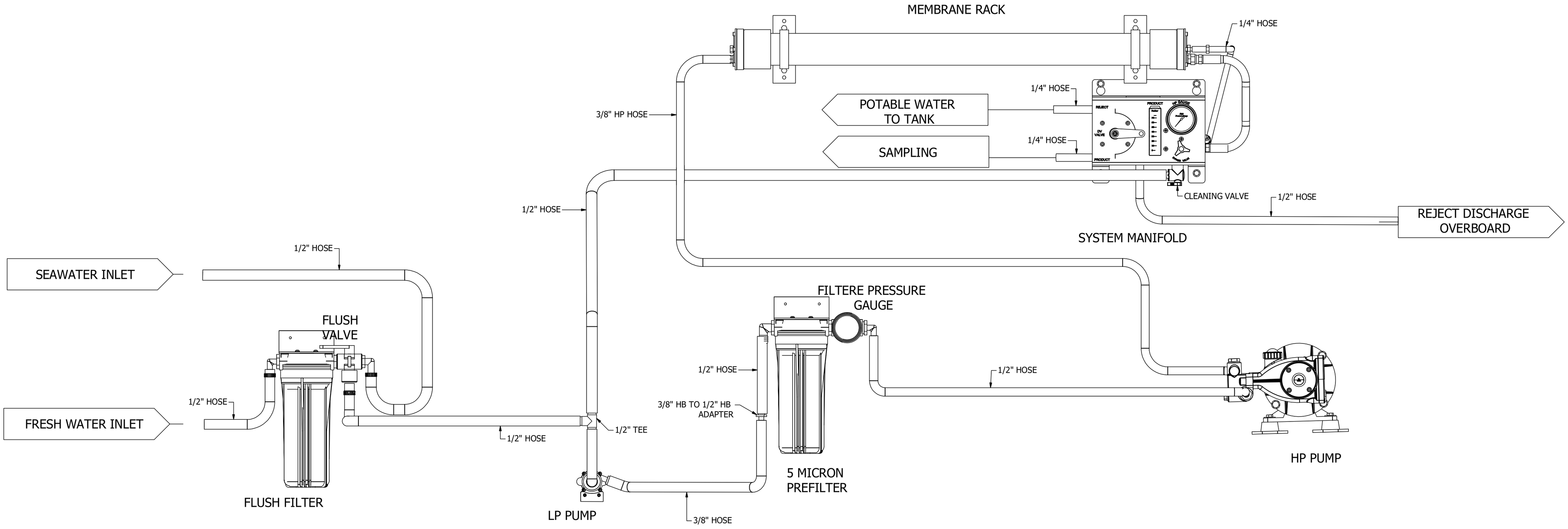


Membrane Element
Model 145, 1 Short Membrane p/n 33-3000
Model 200, 2 Short Membranes p/n 33-3001
Model 200, 1 Long Membrane p/n 33-3002
Membrane O-Ring Kit p/n 90-2512

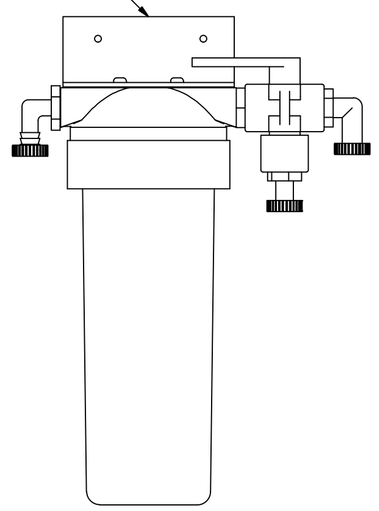
LTM System Manifold Assembly p/n V502060005
HP Gauge Replacement p/n 10181421CC
Flowmeter Replacement p/n 85012009
Manifold Rebuild Kit p/n V502060006

SYSTEM UPGRADE
AS OF 2/15/2019

LWM-145 TO LWM-180 PLUMBING DIAGRAM



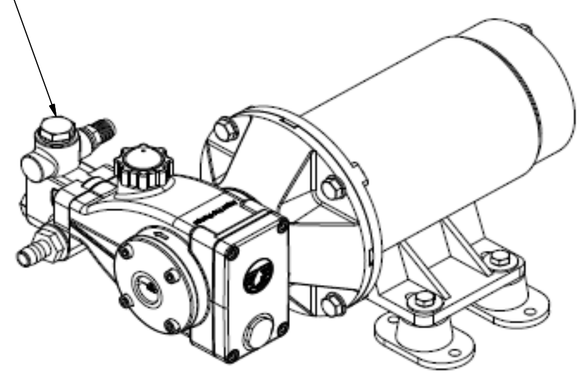
Fresh Water Flush Filter Assembly p/n 90-1288
Replacement Element p/n 33-0311
Replacement O-Ring p/n 85-0102
Flush valve p/n 60-0014



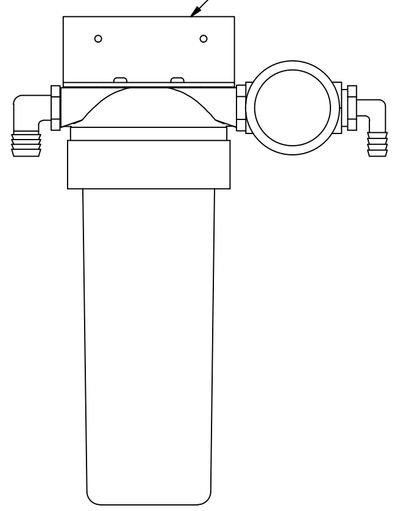
HP Pump
Model 145, 12V/24V p/n 80012061
Model 180, 12V p/n 80012060
Model 180, 24V p/n 80012069
Model 180, 110/230/1/60/50 p/n 80012070

Pumps p/n 70-6073C & 70-6074C
-Complete Service Kit p/n 61012051

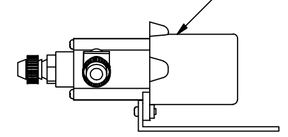
Pump Oil, p/n 85-0050



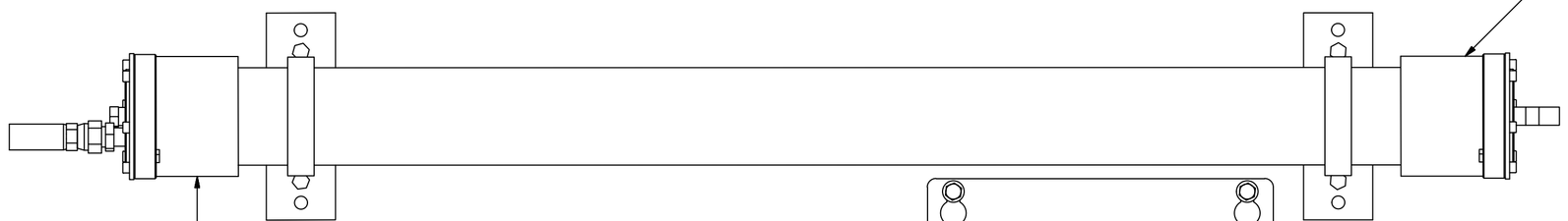
Pre-filter Assembly p/n 90-3272
Replacement Element p/n 33-0117
Replacement O-Ring p/n 85-0102
Filter Pressure Gauge, p/n 40-0300



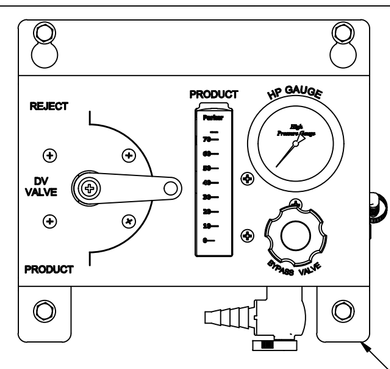
LP Pump
Low Pressure Mag Drive Pump 12V p/n V016020001
Low Pressure Mag Drive Pump 24V p/n V016020002
Low Pressure Mag Drive Pump 110/1/60 p/n 70-1500
Low Pressure Mag Drive Pump 230/1/50 p/n 70-1500
Kit, Rebuild, Pump Assy 110/1/60 & 230/1/50 p/n 70-1502-K01



See Bulletin for
Pressure Vessel
Parts, back of manual



Membrane Element
Model 145, 1 Short Membrane p/n 33-3000
Model 200, 2 Short Membranes p/n 33-3001
Model 200, 1 Long Membrane p/n 33-3002
Membrane O-Ring Kit p/n 90-2512



LTM System Manifold Assembly p/n V502060005
HP Gauge Replacement p/n 10181421CC
Flowmeter Replacement p/n 85012009
Manifold Rebuild Kit p/n V502060006

Village Marine 708-1 Pump

Village Marine 708-3 Pump

Village Marine 708-5 Pump

Part Number: 95-0014

708 Titan Series

High Pressure Titanium Positive Displayment Pumps

Installation, Operation & Maintenance

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

Parker

ENGINEERING YOUR SUCCESS.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Aqua Pro Pumps “708 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

	708-1 (15 GPH)	708-1 (22 GPH)	708-1 (29 GPH)	708-3 (2.3 GPM)	708-3 (3.5 GPM)	708-5 (8 GPM)
Number of Plungers:	1	1	1	3	3	5
Bore:	.707”	.707”	.707”	.707”	.707”	.707”
Stroke:	.2”	.3”	.4”	.276”	.512”	.625”
Oil Capacity:	6 oz	6 oz	6 oz	19.5 oz	19.5 oz	32 oz

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	Capacity	Inlet Port Size	Discharge Port Size	Dimensions L x W x H	Weight	Shaft
708-1	15 GPH	.50 NPT	.25 NPT	9.125”x 5.5” x 4”	11 lbs.	∅.625
708-1	22 GPH	.50 NPT	.25 NPT	9.125”x 5.5” x 4”	11 lbs.	∅.625
708-1	29 GPH	.50 NPT	.25 NPT	9.125”x 5.5” x 4”	11 lbs.	∅.625
708-3	2.3 GPM	.75 NPT	.5” MS16142-8	7.5”x 6” x 4.5”	18.9 lbs.	∅.650
708-3	3.5 GPM	.75 NPT	.5” MS16142-8	7.5”x 6” x 4.5”	18.9 lbs.	∅.650
708-5	8 GPM	.75 NPT	.5” MS16142-8	11.5”x 9.5” x 5.5”	27.6 lbs.	∅.938

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. Then look into the sight glass in the side cover. Oil level should be level with the mark on the sight glass (Fig.1).

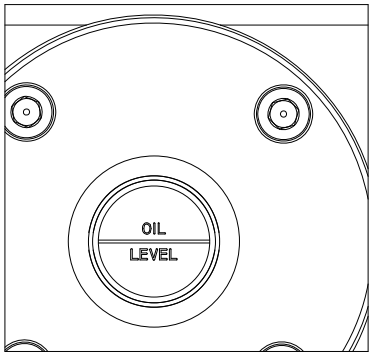


Fig. 1: Oil Level Sight Glass Detail.

NOTE

Change the original oil that came in the pump after running the pump for 100 hours. After the initial oil change, the oil should be changed at 500-hour service intervals.

PUMP FLOW DESIGN

To drive the pump to give the desired discharge volume for your specific application equation 2.1 is to be used.

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

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 should be sized to not exceed the maximum pump RPM rating.

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

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, which 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.

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

Table 1: Approximate Horsepower Required

HP Required (708-1 – 15 GPH)		Working Pressure [PSI]	
Flow [GPH]	Speed [RPM]	800	1000
15	734	.14	.17
14	686	.13	.16
13	637	.12	.15
12	588	.11	.14

HP Required (708-1 – 22 GPH)		Working Pressure [PSI]	
Flow [GPH]	Speed [RPM]	800	1000
22	718	.20	.25
21	686	.19	.24
20	653	.18	.23
19	620	.17	.22

HP Required (708-1 – 29 GPH)		Working Pressure [PSI]	
Flow [GPH]	Speed [RPM]	800	1000
29	710	.26	.33
28	686	.26	.32
27	661	.25	.31
16	637	.24	.30

HP Required (708-3 – 2.3 GPM)		Working Pressure [PSI]	
Flow [GPM]	Speed [RPM]	800	1000
2.5	1774	1.37	1.71
2.3	1632	1.26	1.58
2.0	1419	1.10	1.37
1.5	1064	.82	1.03

HP Required (708-3 – 3.5 GPM)		Working Pressure [PSI]	
Flow [GPM]	Speed [RPM]	800	1000
4	1530	2.19	2.74
3.5	1339	1.92	2.40
3	1148	1.64	2.05
2	765	1.10	1.37

HP Required (708-5 – 8 GPH)		Working Pressure [PSI]	
Flow [GPM]	Speed [RPM]	800	1000
8	1504	4.38	5.48
7	1316	3.84	4.79
6	1128	3.29	4.11
5	940	2.74	3.42

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.

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 in a humid environment, 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.

In installations utilizing a Pulsation Dampening device, the device should be mounted directly to the discharge line. Consult 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; this 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 that the discharge or down-stream plumbing becomes restricted or is turned 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 sufficient to allow free flow of influent fluid at the pumping flow rate. 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 not running, 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, 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 100 HRS.	EVERY 500 HRS.	EVERY 1500 HRS.	PLAN FOR EVERY 3000 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			
Routine Service Kit					X		
Crankcase Rebuild Kit						X	
Manifold Rebuild Kit						X	
Crankshaft Bearings							X

* If applicable for system

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
100	Oil				
500	Oil				
1000	Oil				
1500	Service Kit, Oil				
2000	Oil				
2500	Oil				
3000	Service Kit/Full Kit*, Oil				
3500	Oil				
4000	Oil				
4500	Service Kit, Oil				
5000	Oil				
5500	Oil				
6000	Service Kit/Full Kit*, Oil				
6500	Oil				
7000	Oil				
7500	Service Kit, 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 problem persists, 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 manifold rebuild kit(not service 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 with manifold rebuild kit(not service kit).
Slight water leakage from under the manifold	Possible condensation	No fix needed.
	Worn low pressure seals	Replace seals with Manifold Service Kit (not Rebuild Kit), check inlet pressure and inspect ceramic plunger for damage.
Excessive oil leak between crankcase and pumping section	Worn crankcase oil seals	Replace crankcase oil seals.

PROBLEM	PROBABLE CAUSE	SOLUTION
Oil leaking in the area of the crankshaft	Worn crankshaft oil seal	Replace damaged oil seals. (Purchase crankcase rebuild kit, not service kit)
	Bad bearing	Replace bearing.
	Cut or worn o-ring on bearing case	Replace o-ring on bearing case.
Water in crankcase	Humid air condensing into water inside the crankcase	Change oil every three months or 300 hours
	Worn or improperly installed crankcase oil seals	Replace seals; follow proper installation procedure.
	Excessive water leaking through low pressure seals	Replace seals with manifold rebuild kit(not service kit).
Excessive play in the end of the crankshaft	Worn bearing	Replace bearing.
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.
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.

SERVICE

An authorized technician should perform all service.

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 utmost cleanliness be maintained during the rebuild of your Aqua Pro Pump. The numbers following the parts are call out numbers. They correspond to the parts on the drawings.

READ THE INSTRUCTIONS COMPLETELY BEFORE ATTEMPTING TO PERFORM ANY SERVICE.

Before assembling any parts, 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	Phillips Head Screwdriver
1/4” Allen Wrench	Pick
7/16" Socket/ Socket Wrench or Combination Wrench	Snap Ring Pliers
9/16" Socket/ Socket Wrench or Combination Wrench	Torque Wrench (220 in.-lb.)
1/2” Socket/ Socket Wrench or Combination Wrench	Weep Ring Removal Tool (PN 91-3827)
3/4" Socket/ Socket Wrench or Combination Wrench	Dead Blow Hammer
7/8" Socket/ Socket Wrench or Combination Wrench	Flat Head Screwdriver
7/8" Combination Wrench	

DETACHING THE MANIFOLD FROM THE CRANKCASE

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

- 9/16” Socket/ Socket Wrench (for 708-5)
- 1/2” Socket/ Socket Wrench (for 708-3)
- 3/16” Allen Wrench (for 708-1)
- Dead Blow Hammer

Remove the two manifold bolts (58) with a 9/16” socket wrench for the 708-5, with a 1/2” socket wrench for the 708-3, or the 4 socket head bolts with the 3/16” Allen wrench for the 708-1. Loosen the manifold assembly by lightly tapping off the manifold using the dead blow hammer, as seen in Fig. 2. Tap the manifold from both sides to apply even force to the manifold. Failing to do so can result in damage to the Ceramic Plungers. Set the manifold assembly aside in a clean work area. If the manifold assembly locating dowel pins (53) fall out, reinsert them into the manifold alignment pin holes.

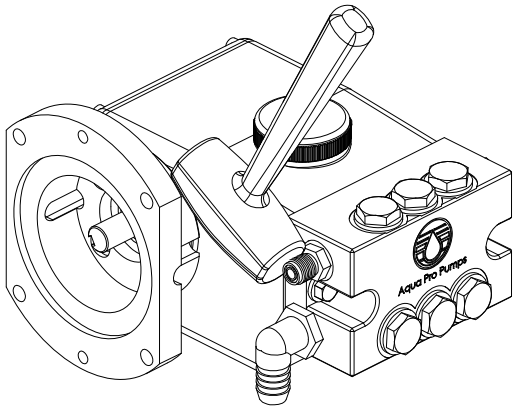


Fig. 2: Manifold Assembly Removal

ROUTINE SERVICE KIT

The following are the part numbers for the 708 Series Routine Service Kits.
708-1 Routine Service Kit (PN. 70-6181).
708-3, 2.3 Routine Service Kit (PN. 70-6182).
708-3, 3.5 Routine Service Kit (PN. 70-6183).
708-5 Routine Service Kit (PN. 70-6184).

The Manifold Assembly must be detached from the crankcase to do the following service.

VALVE ASSEMBLY ROUTINE SERVICE

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

- 7/8" Socket Wrench or Combination Wrench
- Pick
- Spring, Valve (45): PN. 70-6003
- Valve, Standard, 708 Series (44): PN. 70-6093 (For 708-1 & 708-3 2.3)
- Assembly, Valve, Heavy Duty, 708 Series (44): PN. 70-6104 (For 708-3 3.5 & 708-5)
- O-Ring, Valve Plug (46): PN. 70-6002
- Silicone Grease Lubricant: PN. 21-1122
- Anti-Seize Lubricant: PN. 85-0094
- Lint-Free Cloths

When the 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 7/8" socket wrench or combination wrench. Remove the valve (44) from the assembly, followed by the valve spring (45). With the aide of a pick remove the o-ring (46) from the valve plug.

NOTE

Valve plugs (47) 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 (47) prior to reassembling. If there is a problem, contact your dealer. Once all valve plugs (47) are clean and dry, install new valve plug o-ring (46) onto valve plug (47). Install the valve spring (45) onto the valve plug (47), it should now be attached to the plug. Press the valve (44) onto the valve spring (45). Complete valve assembly shown in Fig. 3.

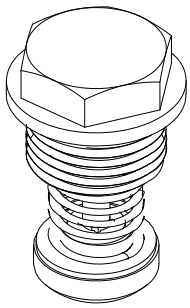


Fig. 3: Valve Assembly
(NOTE: There are two different valve plug designs)

NOTE

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

Inspect the manifold (38) 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 7/8" socket wrench or combination wrench and tighten.

MANIFOLD SEAL ROUTINE SERVICE

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:

- Flat screw driver
- Seal, LP (45): PN. 70-6009
- 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. 4.

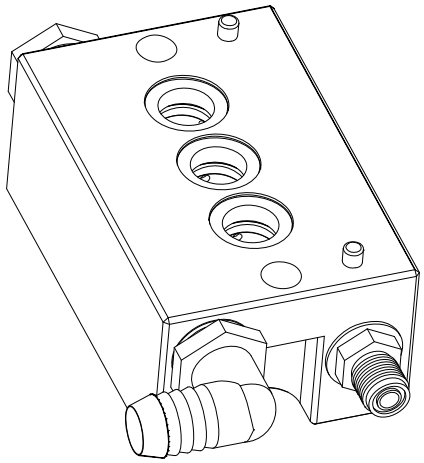


Fig. 4: Orientation for Manifold Seal Servicing

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.

With a flat screw driver remove the low-pressure seal (43). Ensure that the low-pressure seal spacer (39) was not accidentally removed when the low-pressure seal was removed and press in the new low-pressure seal (43).

CRANKCASE SEAL ROUTINE SERVICE

Remove the seal retainer (29) and set aside. Remove the plunger retainer bolt (28) with a 7/16" wrench, set aside. There is no need to remove the plunger retainer washer (28) or plunger retainer o-rings (27) from the plunger retainer bolt (28). Remove the ceramic plunger (26). Remove the slinger (25) and the outer washer (6). With the aid of the pick remove the plunger rod oil seal (7) from the crankcase. Inspect the seal retainer washers (8) for damage, if none evident then reuse, if damage is evident consult the factory.

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 (7) into crankcase making sure that the seal is fully seated, place outer washer (6) on seal. Place slinger (25) onto the plunger rod (9).

NOTE

Examine the ceramic plungers (26) for cracks, heavy scoring, or unusual wear. If there is a problem, contact your dealer.

Slide ceramic plungers (26) onto plunger rod and insert the plunger retainer washer (28) into the plunger. Clean the plunger retaining bolt's (29) threaded area. If they were removed replace the o-rings (27) onto the plunger retainer (29). Slide the plunger retaining washer (28) onto the plunger retainer (29).

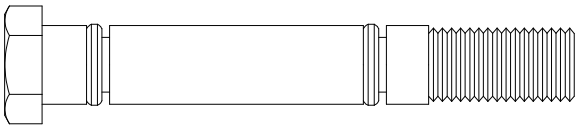


Fig. 5: Plunger Retaining Bolt Assembly

Apply Red Loctite # 262 to retainer bolt (29) threads. Reinstall the plunger retainer bolt (29) and torque to 100 in. lb. using a 7/16" socket.

NOTE

Be CAREFUL not to get the red loctite on any other components.

Apply Aqua Pro's special Ceramic Lubricant (PN. 85-0087) to the ceramic plungers (26). Slide the seal retainer over the ceramic plungers (26). Make sure that the flanged side is close proximity to the manifold assembly, and that hole is oriented downward ensuring that the seal retainer has adequate water drainage.

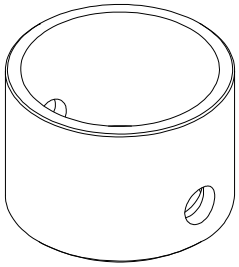


Fig. 6: Seal Retainer

Routine service is now complete.

SERVICING THE CRANKCASE

The following are the procedures for servicing the crankcase assembly using the
708-1 Crankcase Rebuild Kit (PN. 70-6113).
708-3 Crankcase Rebuild Kit (PN. 70-6112).
708-5 Crankcase Rebuild Kit (PN. 70-6107).

The manifold assembly must be detached from the crankcase to do the following service.

OIL DRAIN PLUG O-RING REPLACEMENT

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

- 7/8" 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 7/8" wrench and drain the crankcase oil. Clean the drain plug (5), remove the o-ring (4) with the aide of the pick if necessary. Replace with the new one supplied in the kit. Apply anti-seize lube to the threads of the drain plug (5) and reinstall.

PLUNGER ROD SEAL REPLACEMENT

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

- 7/16" Socket/ Socket Wrench
- Torque Wrench
- Seal, Oil, Plunger Rod (7): PN. 70-6018
- Washer, Plunger Retainer (27): PN. 70-6035
- O-Ring, Plunger Retainer (26): PN. 70-6012
- Slinger Barrier (24): PN. 70-6015
- Ceramic Lubricant: PN. 85-0087
- Silicone Grease Lubricant: PN. 21-1122
- Red Loctite # 262
- Lint-free Cloths

Remove the seal retainer (29) and set aside. Remove the plunger retainer bolt (28) with a 7/16" wrench, set aside. Remove the plunger retainer washer (28) and remove the ceramic plunger (26). Remove the slinger (25) and the outer washer (6). With the aide of the pick remove the plunger rod oil seal (7) from the crankcase. Inspect the seal retainer washers (8) for damage, if none evident then reuse, if damage is evident consult the factory.

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 (7) into crankcase making sure that the seal is fully seated, place outer washer (6) on seal. Place slinger (25) onto the plunger rod (9).

NOTE

Examine the ceramic plungers (26) for cracks, heavy scoring, or unusual wear. If there is a problem, contact your dealer.

Slide ceramic plungers (26) onto plunger rod and insert the plunger retainer washer (28) into the plunger. Clean the plunger retaining bolts (29). With the aide of a pick, remove the plunger retainer o-ring (27). Replace the o-ring (27) with the new one supplied in the kit as shown in Fig. 6. Slide the plunger retaining washer (28) onto the plunger retainer (29).

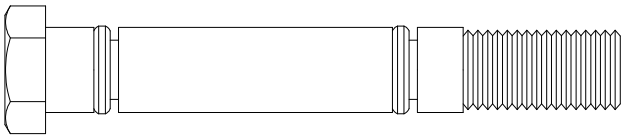


Fig. 5: Plunger Retaining Bolt Assembly

Apply Red Loctite # 262 to retainer bolt (29) threads. Reinstall the plunger retainer bolt (29) and torque to 100 in. lb. using a 7/16" socket.

NOTE

Be CAREFUL not to get the red loctite on any other components.

Apply Aqua Pro's special Ceramic Lubricant (PN. 85-0087) to the ceramic plungers (26). Slide the seal retainer over the ceramic plungers (26). Make sure that the flanged side is close proximity to the manifold assembly, and that hole is oriented downward ensuring that the seal retainer has adequate water drainage.

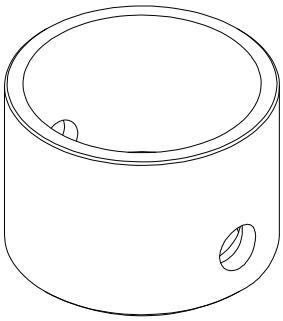


Fig. 6: Seal Retainer

BEARING SIDE PLATE O-RING/SEAL REPLACEMENT

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

- 3/16" Allen Wrench
- Philips Head Screw Driver

- Pick
- Seal, Oil, Crankshaft (18): PN. 70-6038 (708-1, 708-3) 70-6061 (708-5)
- O-Ring, Bearing Side Plate (15): PN. 70-6039
- O-Ring, Sight Glass (22): 70-6082
- Silicon Grease Lubricant: PN. 21-1122
- Anti-Seize Lubricant: PN. 85-0094

Remove the 4 socket head cap screws (19) with a 3/16" Allen Wrench from each of bearing side plate (16), (17), this applies to the 708-1, 708-3 3.5 GPM, and the 708-5 pumps. With the aide of a pick remove the o-rings from the grooves, remove the crankshaft oil seal (18) from the pulley side bearing cap (17).

For 708-3 2.3 GPM pumps with direct drive, uncouple the pump from the motor. Remove the 4 Philips head screws (36) holding the bell housing (34) to the pump. Now remove the bearing side plate (17), o-rings and seal can now be replaced.

Remove the sight glass retainer (24) from the bearing side plate (16). With the aide of a pick remove the sight glass o-ring (22). Replace o-ring with the one provided in the kit.

CAUTION

Crankshaft oil seal is press fit at the factory, care is to be exercised during removal so damage does not occur 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 (18) into pulley side bearing cap (17), Install o-ring (15) in o-ring groove on the crankshaft bearing caps (16), (17) 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 (19) onto each of the bearing side plates and tighten with a 1/4" Allen Wrench. This applies to the 708-1, 708-3 3.5 GPM, and the 708-5 pumps. For the 708-3 2.3 GPM pump, reinstall the bell housing (34) by installing the 4 Philips head screws (36).

CRANKCASE COVER 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 crankcase cover screws (19) with the 3/16” Allen wrench. With the aide of the pick remove the crankcase cover o-ring (20).

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 crankcase cover o-ring (20) 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.

Reinstall the crankcase cover and tighten the crankcase cover screws (19) with the 3/16” Allen wrench.

CRANKSHAFT BEARING, CONNECTING ROD-PISTON ASSEMBLY SERVICE

It is recommended that any service to the crankshaft bearings (16) 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. Performing any maintenance other than rebuild and service kits voids the warranty if not performed by factory trained personnel.

SERVICING THE MANIFOLD

The following are the procedures for servicing the crankcase assembly using the
708-1 Manifold Rebuild Kit (PN. 70-6079).
708-3 2.3 GPM Manifold Rebuild Kit (PN. 70-6110).
708-3 3.5 GPM Manifold Rebuild Kit (PN. 70-6111).
708-5 Manifold Rebuild Kit (PN. 70-6105). 8 GPM Pump Manufactured After Feb 2002
708-5 Manifold Rebuild Kit (PN. 70-6108). 7 GPM Pump Manufactured Before Aug 2002

The manifold assembly must be detached from the crankcase to do the following service.

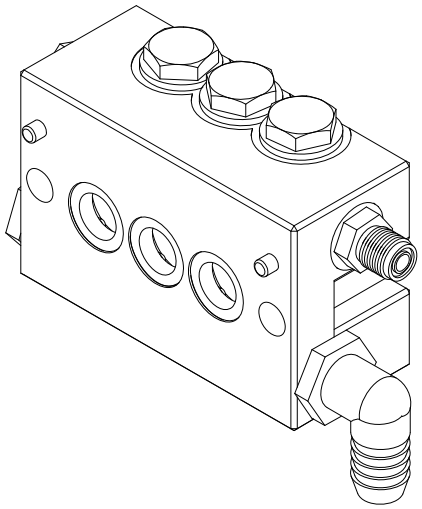


Fig. 7: Manifold Assembly

INLET/DISCHARGE ADAPTER O-RING REPLACEMENT 708-3 & 708-5

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

- 3/4” Socket/ Socket Wrench
- Pick
- O-Ring, Discharge Plug Adapter (48): PN. 30-1286
- Silicone Grease Lubricant: PN. 21-1122
- Anti-Seize Lubricant: PN. 85-0094

Remove the Discharge/Plug (50) and (49) adapters from the manifold assembly with the 3/4” Socket/ Socket Wrench. With the aide of a pick remove the o-rings (48) 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 (48) 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, tighten adapter with 3/4” Socket/ Socket Wrench.

VALVE ASSEMBLY SERVICING

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

- 7/8" Socket Wrench or Combination Wrench
- Pick

- Spring, Valve (45): PN. 70-6003
- Valve (44): PN. 70-6093
- O-Ring, Valve Plug (46): PN. 70-6002
- 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 7/8” socket wrench or combination wrench. Remove the valve (44) from the assembly, followed by the valve spring (45). With the aide of a pick remove the o-ring (46) from the valve plug.

NOTE

Valve plugs (47) 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 (47) prior to reassembly. If there is a problem, contact your dealer. Once all valve plugs (47) are clean and dry, install new valve plug o-ring (46) onto valve plug (47). Install the valve spring (45) onto the valve plug (47), it should now be attached to the plug. Press the valve (44) onto the valve spring (45). Complete valve assembly shown in Fig. 9.

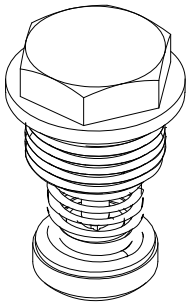


Fig. 8: Valve Assembly
(NOTE: There are two different valve plug designs)

NOTE

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

Inspect the manifold (38) 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 7/8" 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 Puller, 708 Series: PN. 91-3827
- Flat screw driver
- Seal, HP (40): PN. 70-0071
- Ring, Snap (42): PN. 70-6010
- Assembly, Weep Ring (41): PN. 70-3018
- Seal, LP (43): PN. 70-6009
- 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.

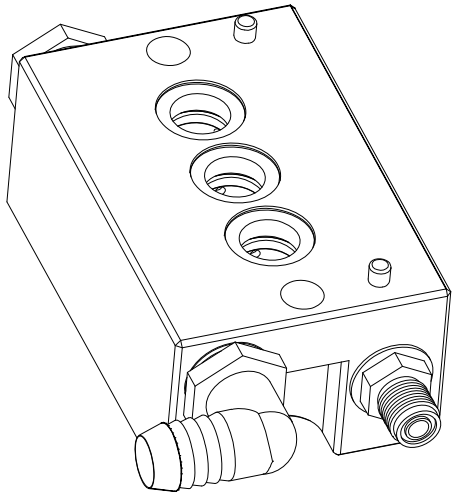


Fig. 9: Orientation for Manifold Seal Servicing

With a flat screw driver remove the low-pressure seal (43). Manually remove the low-pressure seal spacer (39). With the snap ring pliers remove the snap ring (42). Using the weep ring extracting tool remove the weep ring assembly (41) 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 tighten the expansion bolt to grip the ring. Install the extraction stand and nut, tightening nut will extract to weep ring and isolating ring from manifold.

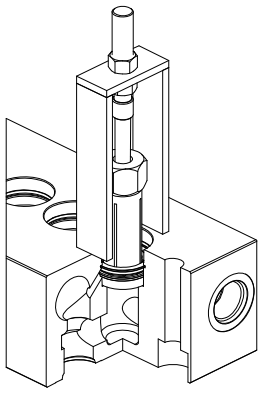


Fig. 10: Weep Ring Extraction

With a flat screwdriver remove the high-pressure seals (40). Manually remove the high-pressure seal spacer (40).

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

- Spacer, High-Pressure Seal (39): PN. 70-6016
- Spacer, Low-Pressure Seal (39): PN. 70-6016

Insert the high-pressure seal spacer (39) 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 (40) into the bore until the seal is fully seated on the high-pressure seal spacer (39).

Insert the weep ring (41) into the bore after the installation of the high-pressure seals (39). Install the snap ring (42) using the snap ring pliers.

NOTE

Ensure that the snap ring (42) is fully seated in the snap ring groove before continuing.

Insert the low-pressure seal spacer (39) and press in the new low-pressure seal (43). The manifold seal servicing is complete.

ATTACHING THE MANIFOLD TO THE CRANKCASE

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

- 9/16” Socket/ Socket Wrench (for 708-5)
- 1/2” Socket/ Socket Wrench (for 708-3)
- 3/16” Allen Wrench (for 708-1)
- Dead Blow Hammer
- Dead Blow Hammer
- Manifold Bolt (58): PN. 70-6055 (for 708-5)
- Manifold Bolt (58): PN. 70-6008 (for 708-3)
- Manifold Screw (58): PN. 70-6046 (for 708-1)
- 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 (53) 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

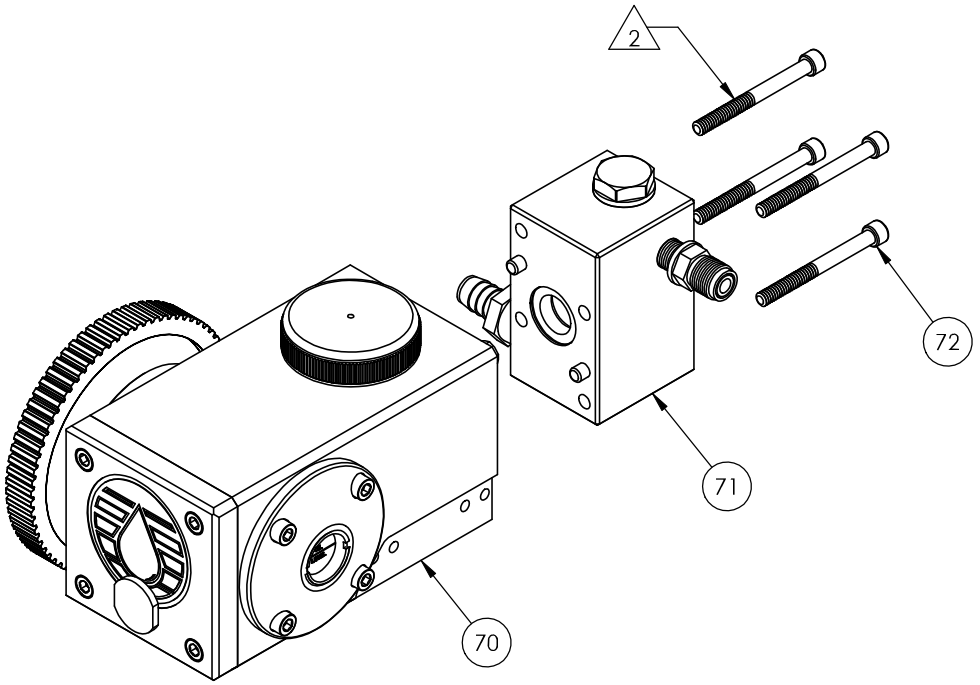
A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

Align manifold assembly to crankcase assembly and tighten the two manifold bolts (58) with a 9/16" socket wrench for the 708-5, with a 1/2" socket wrench for the 708-3, or the 4 socket head bolts with the 3/16" Allen wrench for the 708-1.

708-1 DRAWINGS

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	5/27/05	BC
A	SHEETS 2 AND 3 HAVE BEEN REVISED	4/21/10	
B	ADD PULLEY, SEE SHT 2	11/15/12	TH TQD
C	PER ECO-0031589: ADD NOTE 2; RENUMBER PARTS LIST; REVISE P2, P3 - AS NOTED ON SHEETS	1/10/2013	TH TQD GA

NOTES:
1: ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6073 PUMP, 708-1, .200 CRANKSHAFT
70-6074 PUMP, 708-1, .300 CRANKSHAFT
70-6075 PUMP, 708-1, .400 CRANKSHAFT
2. APPLY A LAYER OF GRAPHITE ANTISEIZE 85-0094 ON THREADS OF ITEM # 72 BEFORE MOUNTING.



ITEM	PART NUMBER	DESCRIPTION	QTY 708-1 200 GPD	QTY 708-1 300 GPD	QTY 708-1 400 GPD
72	70-6046	SCREW, .25-20UNC-2A SHC X 2.50	4	4	4
71	70-6121	ASSEMBLY, 708-1 MANIFOLD	1	1	1
70	70-6131	ASSEMBLY, 708-1 CRANKCASE	-		1
70	70-6130	ASSEMBLY, 708-1 CRANKCASE	-	1	-
70	70-6129	ASSEMBLY, 708-1 CRANKCASE	1	-	-

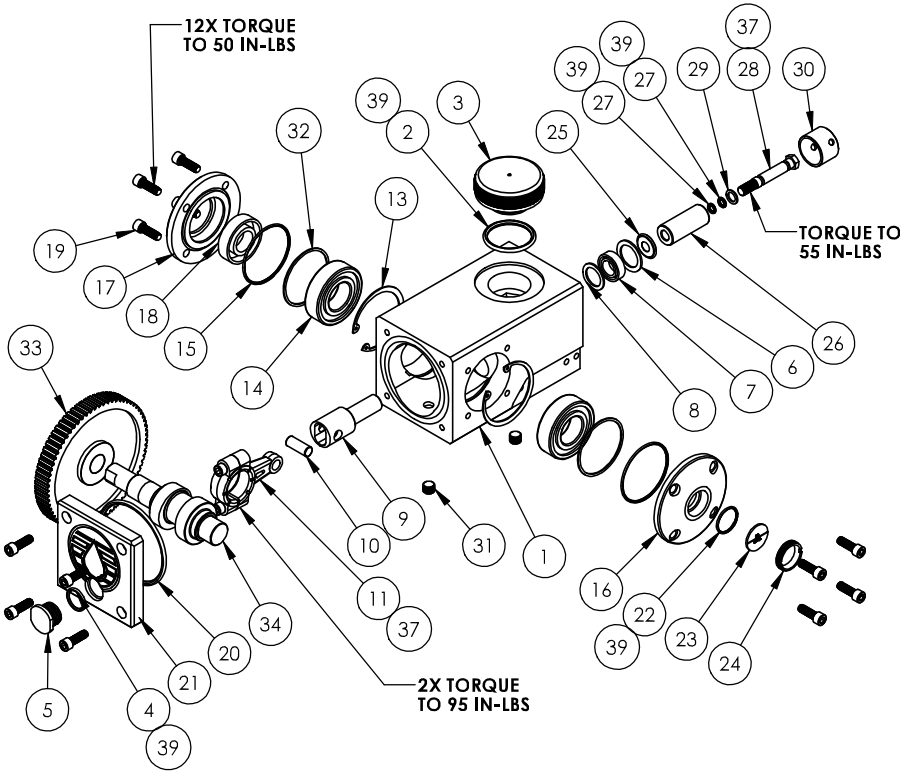
3	2	1	SHT	REVISION STATUS OF SHEETS
B	C	C	REV	

SIZE	TITLE	REV
B	ASSEMBLY, 708-1 MAIN	C
DATE: 05-27-05	B CHAIDEZ	SHEET 1 OF 3

NOTES:
1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
   70-6129 ASSY, CRANKCASE, 708-1, .200 CRANKSHAFT
   70-6130 ASSY, CRANKCASE, 708-1, .300 CRANKSHAFT
   70-6131 ASSY, CRANKCASE, 708-1, .400 CRANKSHAFT
   70-6113 KIT, REBUILD, CRANKCASE, 708-1
   70-6181 KIT, ROUTINE SERVICE, 708-1
2) PART NUMBER 85-0087 AND 21-1122 ARE NOT SHOWN IN DRAWING
3) ITEMS 9,10 AND 11 MAY BE PURCHASE UNDER THE FOLLOWING PART NUMBER:
   70-6128 ASSY, DRIVE , 708 SERIES PUMPS
4) PUMP CRANKSHAFTS ARE STAMPED WITH A NUMBER 2, 3, OR 4 ON THE END THIS DENOTES THE OFFSET OF THE CRANKSHAFT STROKE. SEE DESCRIPTION FOR ITEM (12).

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	5/26/05	BC
A	MODIFIED BOM QTY TITLE, NOTE INCLUDES ITEMS NOT IN BOM TABLE	3/26/10	CC
B	ADD ITEM 32 & 33, PART 34 WAS PART 37 ADD PART 33 TO SHEET 2	11/15/12	TH TQD
C	PER ECO-0031589: ADD ITEM 37 - THREAD LOCKER: ADD ITEMS 37 & 39 BALLOONS; ADD: TORQUES	1/10/13	TH TQD GA



ITEM	PART NUMBER	DESCRIPTION	QTY .200 STROKE (70-6129)	QTY .300 STROKE (70-6130)	QTY .400 STROKE (70-6131)	QTY REBUILD KIT (70-6113)	QTY SERVICE KIT (70-6181)
39	21-1122	SILICONE GREASE	-	-	-	-	1
38	85-0087	ANTISIEZE, NM.91	-	-	-	1	1
37	90-0225	LOCKTITE 262, THREAD LOCKER	AR	AR	AR	-	-
36	-	NOT USED	-	-	-	-	-
35	-	NOT USED	-	-	-	-	-
34	70-6050	CRANKSHAFT,708-1,.200	1	-	-	-	-
33	70-0597	PULLEY	1	1	1	-	-
32	70-0031	SPACER,CRANKSHAFT,708-1	2	2	2	-	-
31	30-1106	PLUG, CRANKCASE	2	2	2	-	-
30	70-6014	RETAINER,SEAL,708-1/3 SERIES	1	1	1	1	-
29	70-6035	WASHER, PLUNGER RETAINER, 708 SERIES	1				-
28	70-6011	BOLT, PLUNGER RETAINER, 708 SERIES	1	1	1	-	-
27	70-6012	O-RING, PLUNGER RETAINER	2	2	2	2	-
26	70-6013	PLUNGER, 708 SERIES	1	1	1	-	-
25	70-6015	SLINGER, PLUNGER, 708 SERIES	1	1	1	-	-
24	70-6043	RETAINER, SIGHTGLASS	1	1	1	-	-
23	70-6044	SIGHTGLASS, OIL	1	1	1	-	-
22	70-6082	O-RING, OIL SIGHTGLASS	1	1	1	1	-
21	70-6049	COVER, CRANKCASE, 708-1	1	1	1	-	-
20	70-6048	O-RING, REAR COVER, 708-1	1	1	1	1	-
19	86-0151	CAPSCREW, SKT HD, .25-20UNC-2A, .75, 316 CRES	12	12	12	-	-
18	70-6038	SEAL, OIL, CRANKSHAFT, 708-1/3	1	1	1	1	-
17	70-6041	CAP, PULLEY BEARING, 708 SERIES	1	1	1	-	-
16	70-6042	CAP, GUIDE BEARING, 708 SERIES	1	1	1	-	-
15	70-6039	O-RING, BEARING CAP	2	2	2	2	-
14	70-6037	BEARING, CRANKSHAFT, 708-1/3	2	2	2	-	-
13	70-1281	RING, SNAP, 708 SERIES	2	2	2	-	-
12	70-6052	CRANKSHAFT, 708-1, 29 GPH (.4" STROKE)	-	-	1	-	-
12	70-6051	CRANKSHAFT, 708-1, 22 GPH (.3" STROKE)	-	1	-	-	-
11	70-6033	ASSY, CONNECTING ROD, 708 SERIES	1	1	1	-	-
10	70-0382	PIN, DOWEL, M9, 22, STL	1				
9	70-6067	PLUNGER, 708 SERIES	1	1	1	-	-
8	70-6019	WASHER, OIL SEAL, INNER, 708 SERIES	1	1	1	-	-
7	70-6018	SEAL, OIL, 708 SERIES	1	1	1	1	1
6	70-6017	WASHER, OIL SEAL, OUTER, 708 SERIES	1	1	1	-	-
5	70-0696	PLUG, MS18829-08	1	1	1	-	-
4	30-1286	O-RING, PLUG, OIL DRAIN	1	1	1	1	-
3	70-6030	CAP, OIL FILLER, PUMP, 708 SERIES	1	1	1	-	-
2	70-6029	O-RING, OIL FILLER CAP	1	1	1	1	-
1	70-6045	CRANKCASE,708-1,AL	1	1	1	-	-

SIZE	TITLE	REV
B	ASSEMBLY, 708-1 CRANKCASE	C
DATE: 05-26-05	B CHAIDEZ	SHEET 2 OF 3

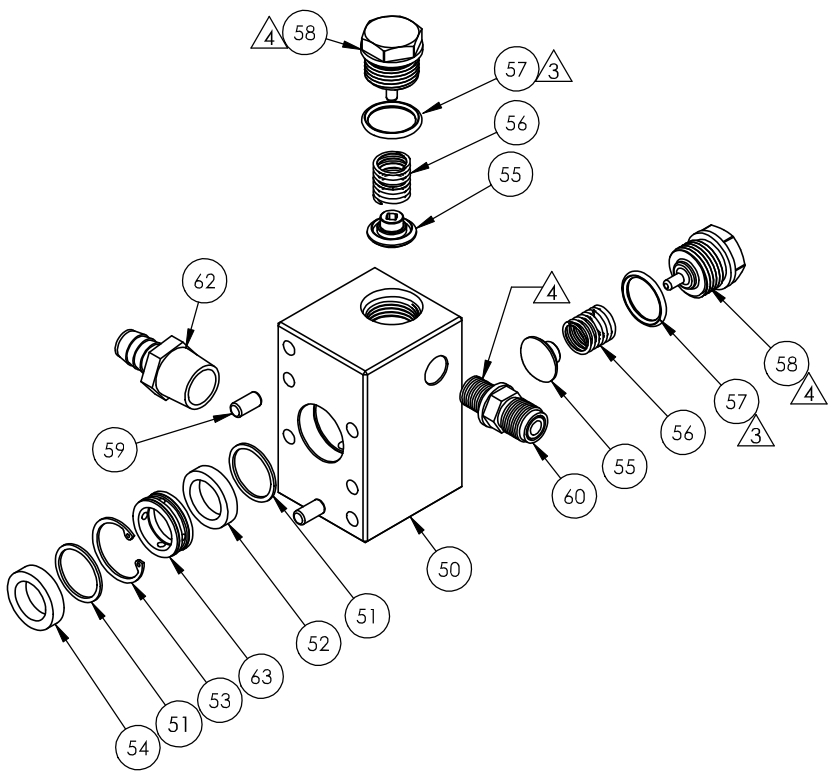
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	5/27/05	BC
A	MODIFIED BOM QTY TITLE, NOTE INCLUDES ITEMS NOT IN BOM TABLE	3/26/10	CC
B	PER ECO-0031589: DEL NOTE 2; ADD: NOTES 3,4; RENUMBER P/LIST	1/10/13	GHTQD GA

NOTES:

1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
   70-6121 ASSY, MANIFOLD, 708-1
   70-6079 KIT, REBUILD, MANIFOLD, 708-1
   70-6181 KIT, SERVICE KIT, 708-1
2) ~~PART NO. 8500087 AND 21-0022 ARE NOT SHOWN IN DRAWING.~~

△3 APPLY A THIN LAYER OF SILICONE GREASE ITEM 65 (21-0022) TO ALL O-RINGS.

△4 APPLY A LAYER OF GRAPHITE ANTISEIZE ITEM 64 (OR P/N 90-0928) TO ALL CONTACT THREADS OF ITEMS 58 & 60 BEFORE MOUNTING.



ITEM	PART NUMBER	DESCRIPTION	QTY (70-6121)	QTY REBUILD KIT (70-6079)	QTY SERVICE KIT (70-6181)
65	21-1122	SILICONE GREASE	-	1	1
64	85-0094	ANTISIEZE, GRAPHITE, FOOD GRADE	-	-	1
63	70-3018	ASSY, WEEP RING, 708 SERIES	1	1	-
62	30-0453	ADAPTER, LP INLET, 708-1	1	-	-
60	30-0946	ADAPTER, HP DISCHARGE, 708-1	1	-	-
59	70-6087	PIN, MANIFOLD, 708 SERIES	2	-	-
58	70-6001	PLUG,VALVE,STANDARD,708 SERIES	2	-	-
57	70-6002	O-RING, OIL DRAIN/VALVE PLUG	2	2	2
56	70-6003	SPRING, VALVE, 708 SERIES	2	2	2
55	70-6093	VALVE, 708 SERIES	2	2	2
54	70-6009	SEAL, LP, 708 SERIES	1	1	1
53	70-6010	RING, SNAP, 708 SERIES	1	1	-
52	70-0071	SEAL, HP, 708 SERIES	1	1	-
51	70-6016	RING, SPACER, SEAL, 708 SERIES	2	2	-
50	70-6047	MANIFOLD, 708-1	1	-	-

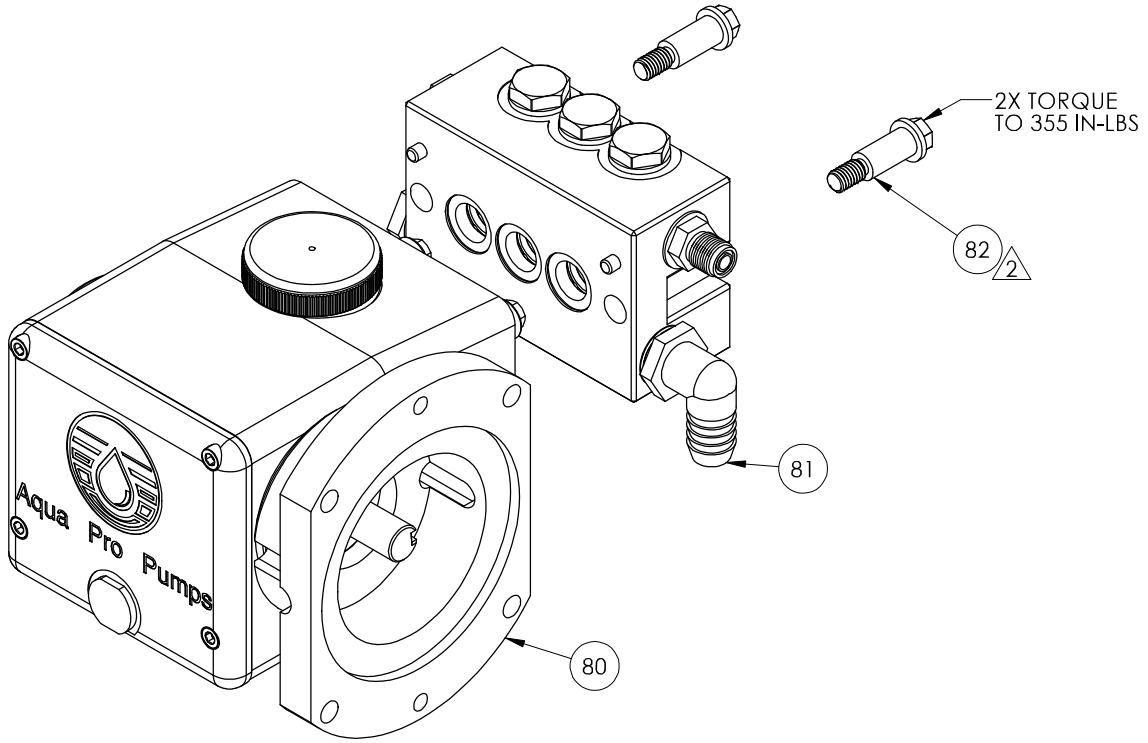
SIZE	TITLE	REV
B	ASSEMBLY, 708-1 MANIFOLD	B
DATE: 05-27-05	B CHAIDEZ	SHEET 3 OF 3

708-3 DRAWINGS

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	3/14/05	BC
A	SHEETS 2 AND 3 HAVE BEEN REVISED	4/21/10	
B	ECO-0031541 - RENUMBER P/L; ADD: NOTE 2 & TORQUE INFO	1/31/13	TH TD DM

NOTES:
1: ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6076 PUMP, 708-3, 2.3 GPM, LEFT CRANKSHAFT
70-6126 PUMP, 708-3, 2.3 GPM, RIGHT CRANKSHAFT
70-6072 PUMP, 708-3, 3.5 GPM

△2 APPLY A LAYER OF GRAPHITE ANTISEIZE 85-0094



ITEM	PART NUMBER	DESCRIPTION	QTY 708-3 2.3 GPM	QTY 708-3 3.5 GPM
82	70-6008	BOLT, SHOULDER, MANIFOLD	2	2
81	70-6119	ASSEMBLY, 708-3 MANIFOLD	-	1
81	70-6118	ASSEMBLY, 708-3 MANIFOLD	1	-
80	70-6125	ASSEMBLY, 708-3 CRANKCASE	-	1
80	70-6124	ASSEMBLY, 708-3 CRANKCASE	1	-

3	2	1	SHT	REVISION STATUS OF SHEETS
B	B	B	REV	

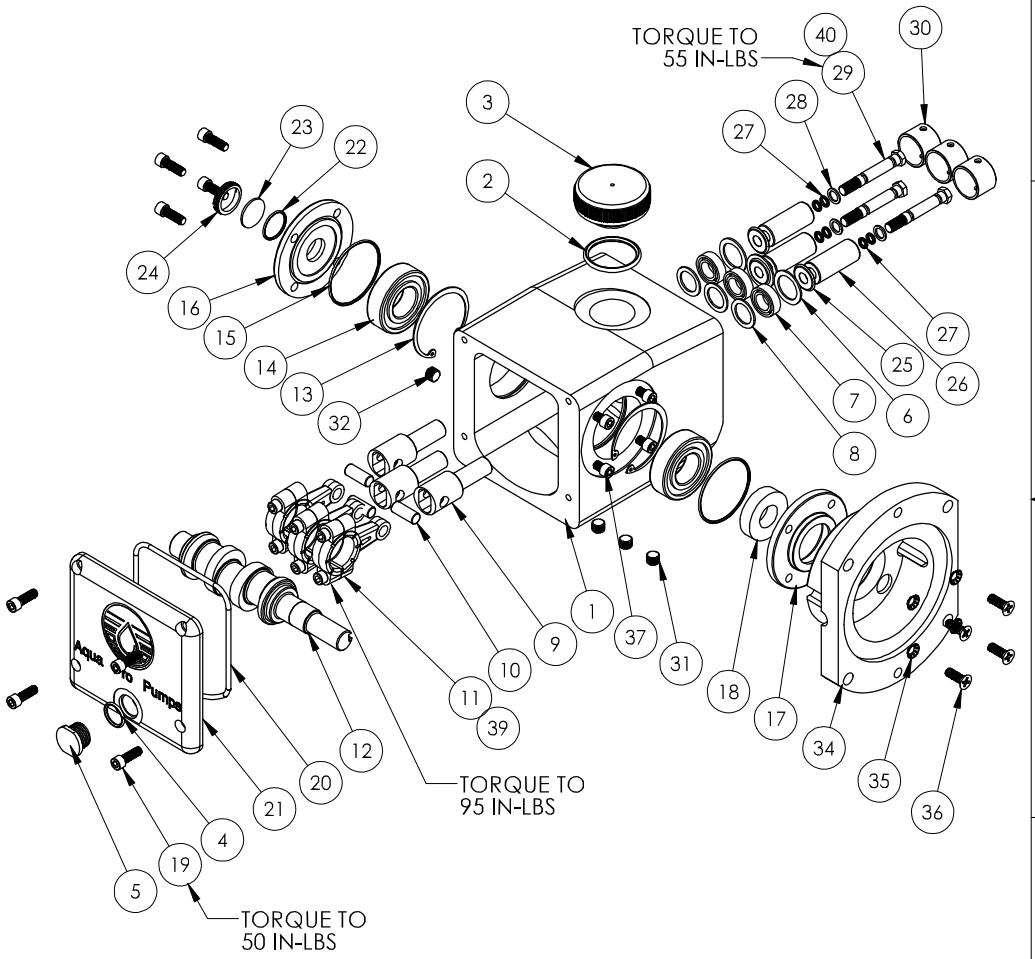
SIZE	TITLE	REV
B	ASSEMBLY, 708-3 MAIN	B
DATE: 03-14-05	J RODRIGUEZ	SHEET 1 OF 3

NOTES:
1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6124 ASSY,CRANKCASE,708-3,2.3 GPM
70-6125 ASSY,CRANKCASE,708-3,3.5 GPM
70-6112 KIT,REBUILD,CRANKCASE,2.3/3.5 GPM
70-6182 KIT,ROUTINE SERVICE,708-3,2.3
70-6183 KIT,ROUTINE SERVICE,708-3,3.5
2) PART NUMBER 85-0087 AND 21-1122 ARE NOT SHOWN IN DRAWING
3) ITEMS 9, 10 AND 11 MAY BE PURCHASED UNDER THE FOLLOWING PART NUMBER.
70-6128 ASSY,DRIVE,708 SERIES PUMPS

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	3/14/05	BC
A	MODIFIED BOM QTY TITLE, NOTE INCLUDES ITEMS NOT IN BOM TABLE	3/26/10	CC
B	ECO-0031541 - RENUMBER PARTS 37, 38, 39; ADD: #40, BALLOONS & TORQUES	1/31/13	TH TD DM

ITEM	PART NUMBER	DESCRIPTION	QTY 2.3 GPM (70-6124)	QTY 3.5 GPM (70-6125)	QTY REBUILD KIT (70-6112)	QTY 2.3 SERVICE KIT (70-6182)	QTY 3.5 SERVICE KIT (70-6183)
40	90-0223	LOCKTITE 252, THREAD LOCKER	A/R	A/R	1	1	1
39	21-1122	SILICONE GREASE	-	-	-	1	1
38	85-0087	ANTISIEZE NM-91	A/R	A/R	1	1	1
37	86-0151	CAPSCREW, SKT HD, .25-20UNC-2A, .75, 316 CRES	4	-	-	-	-
36	70-0159	SCREW, BELL HOUSING	4	-	-	-	-
35	70-0192	WASHER, EXTERNAL TOOTH, BELL HOUSING	4	-	-	-	-
34	70-6040	HOUSING, BELL, 708-3	1	-	-	-	-
33	-	NOT USED	-	-	-	-	-
32	30-0157	PLUG, CRANKCASE, SIDE	1	1	-	-	-
31	30-1106	PLUG, CRANKCASE	3	3	-	-	-
30	70-6014	RETAINER,SEAL,708-1/3 SERIES	3	3	3	-	-
29	70-6011	BOLT, PLUNGER RETAINER, 708 SERIES	3	3	-	-	-
28	70-6035	WASHER, PLUNGER RETAINER, 708 SERIES	3	-	-	-	-
27	70-6012	O-RING, PLUNGER RETAINER	6	6	6	-	-
26	70-6013	PLUNGER, 708 SERIES	3	3	-	-	-
25	70-6015	SLINGER, PLUNGER, 708 SERIES	3	3	-	-	-
24	70-6043	RETAINER, SIGHTGLASS	1	1	-	-	-
23	70-6044	SIGHTGLASS, OIL	1	1	-	-	-
22	70-6082	O-RING, OIL SIGHTGLASS	1	1	1	-	-
21	70-6023	COVER, CRANKCASE, 708-3	1	1	-	-	-
20	70-6022	O-RING, REAR COVER, 708-3	1	1	1	-	-
19	86-0151	CAPSCREW, SKT HD, .25-20UNC-2A, .75, 316 CRES	8	12	-	-	-
18	70-6038	SEAL, OIL, CRANKSHAFT, 708-1/3	1	1	1	-	-
17	70-6041	CAP, PULLEY BEARING, 708 SERIES	1	1	-	-	-
16	70-6042	CAP, GUIDE BEARING, 708 SERIES	1	1	-	-	-
15	70-6039	O-RING, BEARING CAP	2	2	2	-	-
14	70-6037	BEARING, CRANKSHAFT, 708-1/3	2	2	-	-	-
13	70-1281	RING, SNAP, 708 SERIES	2	2	-	-	-
12	70-6031	CRANKSHAFT, 708-3, 3.5 GPM	-	1	-	-	-
12	70-6032	CRANKSHAFT, 3 PLGR, 2.3 GP	1	-	-	-	-
11	70-6033	ASSY, CONNECTING ROD, 708 SERIES	3	3	-	-	-
10	70-0382	PIN, DOWEL, DRIVE ASSY	3	3	-	-	-
9	70-6067	PLUNGER, 708 SERIES	3	3	-	-	-
8	70-6019	WASHER, OIL SEAL, INNER, 708 SERIES	3	3	-	-	-
7	70-6018	SEAL, OIL, 708 SERIES	3	3	3	3	3
6	70-6017	WASHER, OIL SEAL, OUTER, 708 SERIES	3	3	-	-	-
5	70-0696	PLUG, MS18829-08	1	1	-	-	-
4	30-1286	O-RING, PLUG, OIL DRAIN	1	1	1	-	-
3	70-6030	CAP, OIL FILLER, PUMP, 708 SERIES	1	1	-	-	-
2	70-6029	O-RING, OIL FILLER CAP	1	1	1	-	-
1	70-6020	CRANKCASE, 708-3	1	1	-	-	-



SIZE	TITLE	REV
B	ASSEMBLY, 708-3 CRANKCASE	B
DATE: 03-14-05	J RODRIGUEZ	SHEET 2 OF 3

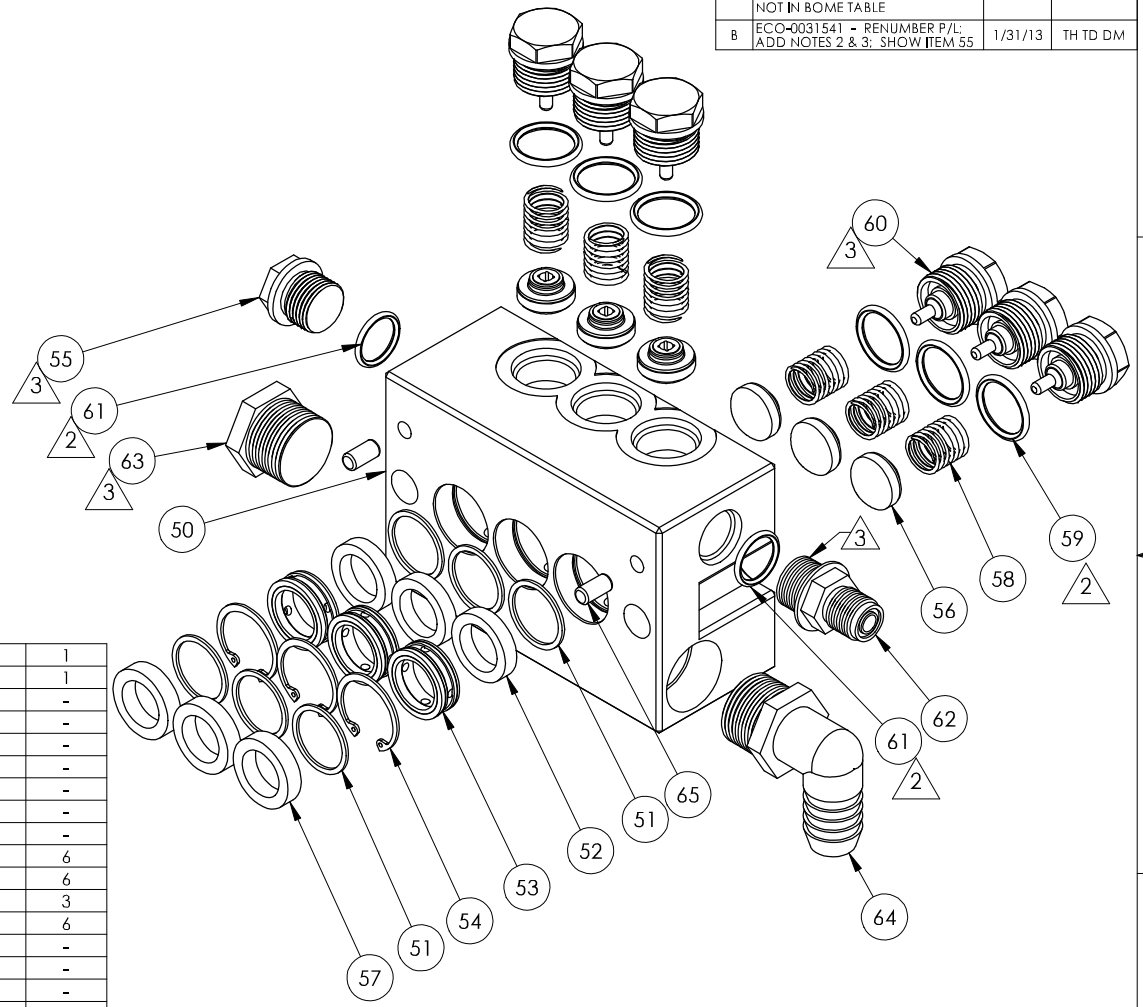
NOTES:

1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
   - 70-6118 ASSY, MANIFOLD, 708-3, 2.3 GPM
   - 70-6119 ASSY, MANIFOLD, 708-3, 3.5 GPM
   - 70-6110 KIT, REBUILD, MANIFOLD, 708-3, 2.3 GPM
   - 70-6111 KIT, REBUILD, MANIFOLD, 708-3, 3.5 GPM
   - 70-6182 KIT, ROUTINE SERVICE, 708-3,2.3
   - 70-6183 KIT, ROUTINE SERVICE, 708-3,3.5

△2 APPLY A THIN LAYER OF SILICONE GREASE, P/N 21-1122, TO ALL O-RINGS.

△3 APPLY A LAYER OF GRAPHITE ANTI SEIZE, P/N 85-0094 TO ALL THREADS.

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	3/14/05	BC
A	UPDATED BOM TABLE. 70-6104 IS NOW 70-6096. 70-3018 IS NOW 70-6006. NOTE INCLUDES ITEMS NOT IN BOME TABLE	3/29/10	CC
B	ECO-0031541 - RENUMBER P/L; ADD NOTES 2 & 3; SHOW ITEM 55	1/31/13	TH TD DM



ITEM	PART NUMBER	DESCRIPTION	QTY 3.5 GPM (70-6119)	QTY 2.3 GPM (70-6118)	QTY 3.5 REBUILD KIT (70-6111)	QTY 2.3 REBUILD KIT (70-6110)	QTY 3.5 SERVICE KIT (70-6183)	QTY 2.3 SERVICE KIT (70-6182)
67	21-1122	SILICONE GREASE	-	-	1	1	1	1
66	85-0094	ANTISIEZE, GRAPHITE FOOD GRADE	-	-	-	-	1	1
65	70-6087	PIN, MANIFOLD, 708 SERIES	2	2	-	-	-	-
64	30-0441	ADAPTER, LP INLET, 708-3/5	1	1	-	-	-	-
63	30-0573	PLUG, LP INLET, 708-3/5	1	1	-	-	-	-
62	30-1082	ADAPTER, HP DISCHARGE, 708 SERIES	1	1	-	-	-	-
61	30-1286	O-RING, PLUG, OIL DRAIN	2	2	2	2	-	-
60	70-6001	PLUG, VALVE, 708 SERIES	-	6	-	-	-	-
60	70-0660	PLUG, VALVE, HD, 708 SERIES	6	-	-	-	-	-
59	70-6002	O-RING, OIL DRAIN/VALVE PLUG	6	6	6	6	6	6
58	70-6003	SPRING, VALVE, 708 SERIES	6	6	6	6	6	6
57	70-6009	SEAL, LP, 708 SERIES	3	3	3	3	3	3
56	70-6096	VALVE, STANDARD, 708 SERIES	-	6	-	6	-	6
56	70-6104	ASSY, VALVE, HVY DUTY, 708 SERIES	6	-	6	-	6	-
55	70-3052	PLUG, HP DISCHARGE, 708-3/5	1	1	-	-	-	-
54	70-6010	RING, SNAP, 708 SERIES	3	3	3	3	-	-
53	70-3018	ASSY, WEEP RING, 708 SERIES	3	3	3	3	-	-
52	70-0071	SEAL, HP, 708 SERIES	3	3	3	3	-	-
51	70-6016	RING, SPACER, SEAL, 708 SERIES	6	6	6	6	-	-
50	70-6000	MANIFOLD, 708 SERIES, 3 PLUNGER	1	1	-	-	-	-

SIZE	TITLE	REV
B	ASSEMBLY, 708-3 MANIFOLD	B
DATE: 03-14-05	J RODRIGUEZ	SHEET 3 OF 3

708-5 DRAWINGS

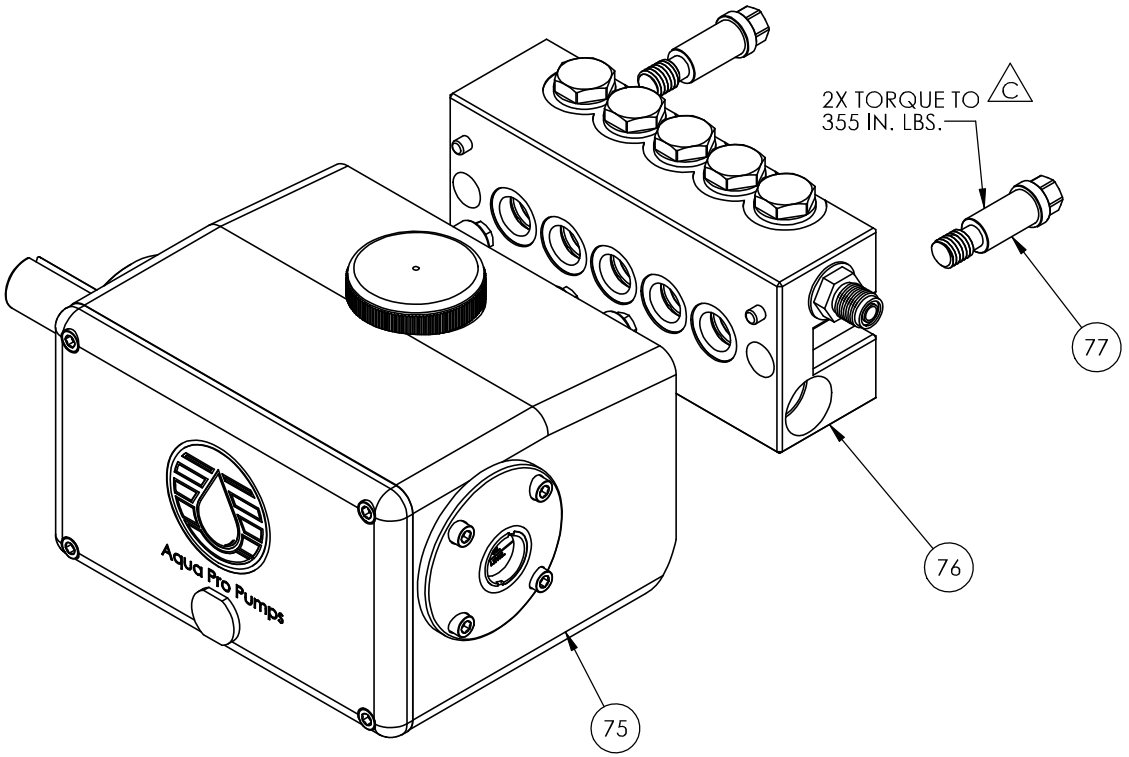
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	3/14/05	BC
A	SHEETS 2 AND 3 HAVE BEEN REVISED	4/21/10	CC
B	ADD: SPEC NOES	5/30/12	TH GA
C	ECO-0031312: ADD TORQUES - UPDATE EACH SHEET TO CURRENT STANDARDS - RENUMBER CONFLICTING PARTS LISTS	1/25/13	TH TQD GA

NOTES:
1: ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6178 PUMP, 708-5, 8.0 GPM
70-6097 PUMP, 708-5, 8.0 GPM, LEFT CRANKSHAFT

SPEC

CAPACITY: FLOW RATE - 8 GPM
MAX INLET PRESSURE - 60 PSI
MAX RPM - 1500

LUBRICATION: VMT PUMP OIL - 85-0050 (C)
ANTI-SIEZE - 85-0094
LOCTITE - RED



3	2	1	SHT	REVISION STATUS OF SHEETS
D	C	C	REV	

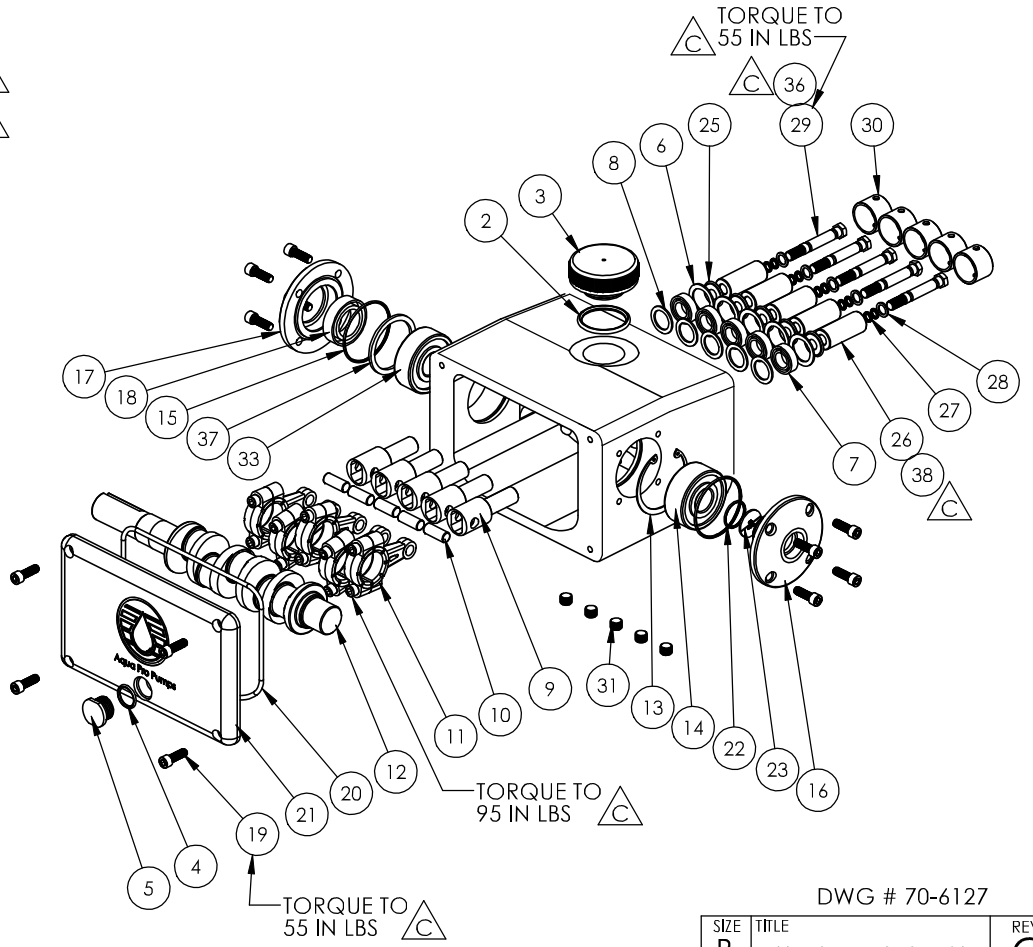
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
77	70-6055	BOLT, .50-13UNC-2A, SHOULDER	2
76	70-6123	ASSEMBLY, 708-5 MANIFOLD	1
75	70-6127	ASSY, CRANKCASE, 708-5	1

SIZE	TITLE	REV
B	ASSEMBLY, 708-5 MAIN	C
DATE: 03-14-05	J RODRIGUEZ	SHEET 1 OF 3

NOTES:
1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
   70-6127 ASSY, CRANKCASE, 708-5, 8.0 GPM
   70-6107 KIT, REBUILD, CRANKCASE, 708-5
   70-6184 KIT, ROUTINE SERVICE, 708-5
2) PART NUMBERS 85-0087 AND 21-1122 ARE NOT SHOWN IN DRAWING
3) ITEMS 9, 10 AND 11 MAY BE PURCHASED UNDER THE FOLLOWING PART NUMBER.
   70-6128 ASSY, DRIVE, 708 SERIES PUMPS

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	3/14/05	BC
A	MODIFIED BOM QTY TITLE; NOTE INCLUDES ITEM NOT IN BOM TABLE	3/30/10	CC
B	UPATED BOM	10/29/10	CC
C	ECO-0031312: ADD: ITEM 36; ADD: NM91 TO ITEM 38; ADD: TORQUES	1/25/13	TH TQD GA

ITEM	PART NUMBER	DESCRIPTION	QTY (70-6127)	QTY REBUILD KIT (70-6107)	QTY SERVICE KIT (70-6184)	QTY SERVICE KIT (70-6128)	
39	21-1122	SILICONE GREASE	-	1	1	-	C
38	85-0087	ANTISIEZE NM91	-	1	1	-	C
37	70-0412	SPACER, BEARING, PULLY SIDE, 708-5	1	-	-	-	
36	90-0225	LOCKTITE 262, THREAD LOCKER	A/R	-	-	-	
35	-	NOT USED	-	-	-	-	
34	-	NOT USED	-	-	-	-	
33	70-0311	BEARING, PULLEY, 708-5	1	-	-	-	
32	-	NOT USED	-	-	-	-	
31	30-1106	PLUG, CRANKCASE	5	-	-	-	
30	70-6114	RETAINER, SEAL, 708 SERIES	5	5	-	-	
29	70-6011	BOLT, PLUNGER RETAINER, 708 SERIES	5	-	-	-	
28	70-6035	WASHER, PLUNGER RETAINER, 708 SERIES	5	-	-	-	
27	70-6012	O-RING, PLUNGER RETAINER	10	10	-	-	
26	70-6013	PLUNGER, 708 SERIES	5	-	-	-	
25	70-6015	SLINGER, PLUNGER, 708 SERIES	5	-	-	-	
24	70-6043	RETAINER, SIGHTGLASS	1	-	-	-	
23	70-6044	SIGHTGLASS, OIL	1	-	-	-	
22	70-6082	O-RING, OIL SIGHTGLASS	1	1	-	-	
21	70-6057	COVER, CRANKCASE, 708-5	1		-	-	
20	70-6058	O-RING, REAR COVER, 708-5	1	1	-	-	
19	86-0151	CAPSCREW, SKT HD, .25-20UNC-2A, .75, 316 CRES	12	-	-	-	
18	70-6061	SEAL, OIL, CRANKSHAFT, 708-5	1	1	-	-	
17	70-6041	CAP, PULLEY BEARING, 708 SERIES	1	-	-	-	
16	70-6042	CAP, GUIDE BEARING, 708 SERIES	1	-	-	-	
15	70-6039	O-RING, BEARING CAP	2	2	-	-	
14	70-6060	BEARING, GUIDE, 708-5	1	-	-	-	
13	70-1281	RING, SNAP, 708 SERIES	1	-	-	-	
12	70-6059	CRANKSHAFT, 708-5, 8 GPM	1	-	-	-	
11	70-6033	ASSY, CONNECTING ROD, 708 SERIES	5	-	-	5	
10	70-0382	PIN, DOWEL, DRIVE ASSY	5	-	-	5	
9	70-6067	PLUNGER, 708 SERIES	5	-	-	5	
8	70-6019	WASHER, OIL SEAL, INNER, 708 SERIES	5	-	-	-	
7	70-6018	SEAL, OIL, 708 SERIES	5	5	5	-	
6	70-6017	WASHER, OIL SEAL, OUTER, 708 SERIES	5	-	-	-	
5	70-0696	PLUG, MS18829-08	1	-	-	-	
4	30-1286	O-RING, PLUG, OIL DRAIN	1	1	-	-	
3	70-6030	CAP, OIL FILLER, PUMP, 708 SERIES	1	-	-	-	
2	70-6029	O-RING, OIL FILLER CAP	1	1	-	-	
1	70-6056	MACHINE,70-6056	1	-	-	-	



DWG # 70-6127

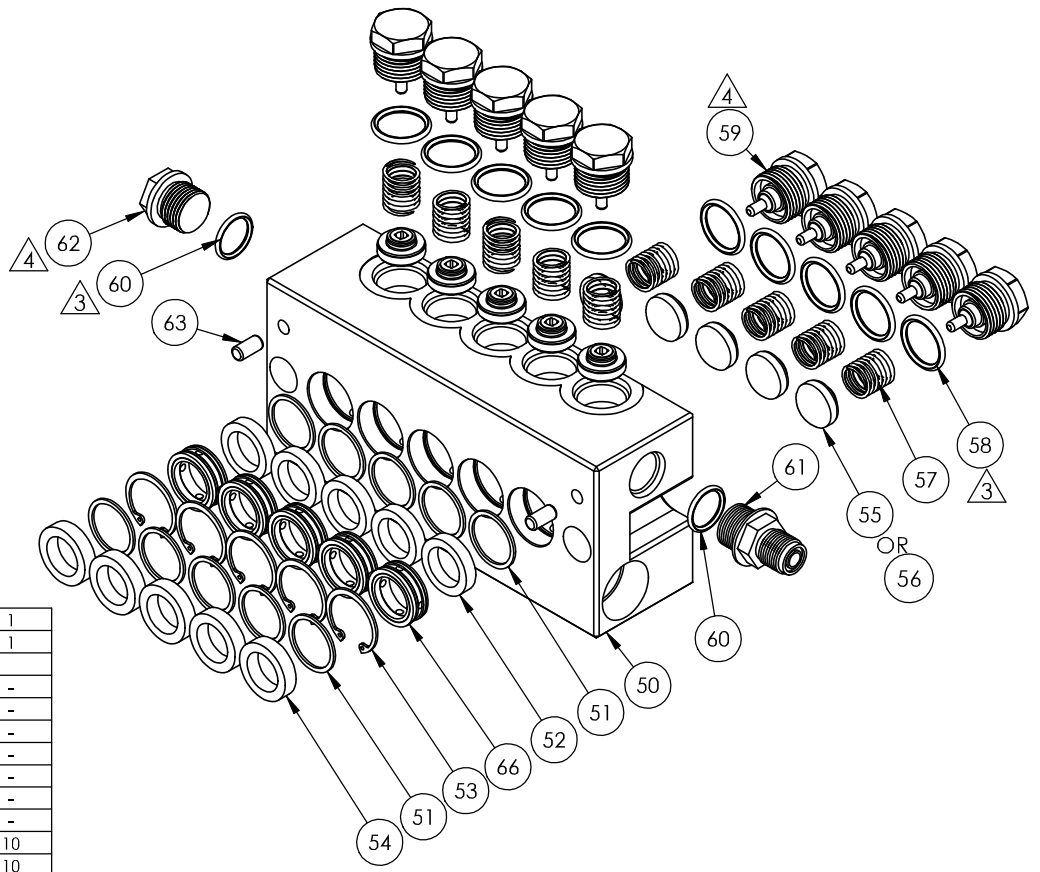
SIZE	TITLE	REV
B	ASSY, CRANKCASE, 708-5	C
DATE: 03-14-05	J RODRIGUEZ	SHEET 2 OF 3

NOTES:
1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6123 ASSY, MANIFOLD, 708-5, 8.0 GPM
70-6105 KIT, REBUILD, MANIFOLD, 708-5, 8.0 GPM MODEL
PRODUCTION CUT IN FEB-02
70-6108 KIT, REBUILD, MANIFOLD, 708-5, 7.0 GPM MODEL
PRODUCTION CUT OUT AUG-02
ITEM 44 IS 70-6093 INSTEAD OF 70-6104
70-6184 KIT, ROUTINE SERVICE, 708-5
2) ~~PART NUMBER 85-0087 AND 21-1122 ARE NOT SHOW IN DRAWING~~

△3 APPLY A THIN LAYER OF SILICONE GREASE (ITEM 68 P/N 21-1122) TO ALL O-RINGS.

△4 APPLY A LAYER OF GRAPHITE ANTISEIZE 85-0094 (ITEM 65) (OR P/N 90-0928) TO ALL THREADS OF ITEMS # 59, 61, 62.

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
-	INITIAL RELEASE	3/14/05	BC
A	MODIFIED BOM QTY TITLE, NOTE INCLUDES ITEMS NOT IN BOM TABLE	3/30/10	CC
B	UPDATED BOM	10/29/10	CC
C	UPDATED BOM CHANGED PC 54	11/23/10	GG
D	ECO-0031312: RENUMBER P/L;REVISE NOTES; CLARIFY ANTISEIZE AND SILICONE	1/28/13	TH TQD GA



ITEM	PART NUMBER	DESCRIPTION	QTY (70-6123)	QTY REBUILD KIT (70-6105)	QTY REBUILD KIT (70-6108)	QTY SERVICE KIT (70-6184)
68	21-1122	SILICONE GREASE	-	1	1	1
67	85-0094	ANTISIEZE, GRAPHITE, FOOD GRADE	-	-	-	1
66	70-3018	ASSY, WEEP RING, 708 SERIES	5	-	-	
65	85-0928	ANTISIEZE, GRAPHITE, FOOD GRADE	A/R	-	-	-
64	-	NOT USED	-	-	-	-
63	70-6087	PIN, MANIFOLD, 708 SERIES	2	-	-	-
62	70-3052	PLUG, HP DISCHARGE, 708-3/5	1	-	-	-
61	30-1082	ADAPTER, HP DISCHARGE, 708 SERIES	1	-	-	-
60	30-1286	O-RING, PLUG, OIL DRAIN	2	2	2	-
59	70-0660	PLUG, VALVE, HD, 708 SERIES	10	-	-	-
58	70-6002	O-RING, OIL DRAIN/VALVE PLUG	10	10	10	10
57	70-6003	SPRING, VALVE, 708 SERIES	10	10	10	10
56	70-6093	VALVE, PUMP, STD	-	-	10	-
55	70-6104	ASSY, VALVE, HVY DUTY, 708 SERIES	10	10	-	10
54	70-6009	SEAL, LP, 708 SERIES	5	5	5	5
53	70-6010	RING, SNAP, 708 SERIES	5	5	5	-
52	70-0071	SEAL, HP, 708 SERIES	5	5	5	-
51	70-6016	RING, SPACER, SEAL, 708 SERIES	10	10	10	-
50	70-6053	MANIFOLD, 708 SERIES, 5 PLUNGER	1	-	-	-

SIZE	TITLE	REV
B	ASSEMBLY, 708-5 MANIFOLD	D
DATE: 03-14-05	J RODRIGUEZ	SHEET 3 OF 3

AquaPro® Sea Water RO Membranes

Contact Information:

Parker Hannifin Corporation
Water Purification
2630 E. El Presidio Street
Carson, CA 90810

phone (310) 608-5600
fax (310) 608-5692
waterpurification@parker.com
www.parker.com/waterpurification

AquaPro® thin film composite reverse osmosis membranes deliver high salt rejection while maintaining high production rates to obtain the energy efficiency demanded by plant operators.

By selecting the highest grade of materials and thoroughly testing performance, Parker is able to offer the highest quality products.

Aqua Pro® membranes are designed for use in Parker pressure vessel housings as well as other brand housings.

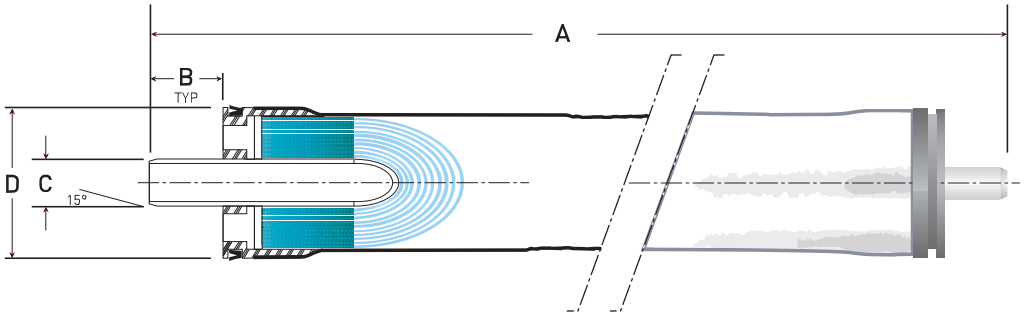
Parker

ENGINEERING YOUR SUCCESS.

AquaPro® Sea Water RO Membranes

Recommended Operating Limits:

- Maximum Operating Pressure: 1000 psi
- Maximum Operating Temperature: 113°F (45°C)
- Maximum Feed Turbidity: 1 NTU
- Free Chlorine Tolerance: 0 PPM
- Maximum Feed Silt Density Index: SDI 5
- pH Range: Continuous Operation: 4-11 Short-term for Cleaning: (30 minute duration) 2.5-11



VMT Part No.	Nominal Size	Product Flow GPD m³/day	Typical Salt Rejection %	Dimensions inches/cm			
				A*	B	C	D
33-2519	2519	220 - 0.83	99.4	19/48	1.1/2.8	0.75/1.9	2.4/6.1
33-3000 **	2519	150 - 0.57	99.0	19/48	1.1/2.8	0.75/1.9	2.4/6.1
33-3001**	2519	105 - 0.40	99.0	19/48	1.1/2.8	0.75/1.9	2.4/6.1
33-0238	2538	550 - 2.08	99.4	38/96.5	1.1/2.8	0.75/1.9	2.4/6.1
33-3002**	2538	210 - 0.80	99.0	38/96.5	1.1/2.8	0.75/1.9	2.4/6.1
33-0440	4040	1200 - 4.54	99.4	40/101.6	1.0/2.5	0.75/1.9	3.96/10.1
33-0036	6040	2500 - 9.47	99.4	40/101.6	1.27/3.2	1.5/3.8	5.98/15.2
33-0840	8040	7250-27.36	99.4	40/101.6	0	1.125/29	7.9/201

* All 19" and 38" elements come with a 2" removable extender so that the stocked size also fits 21" and 40" housings
** Elements are specially designed for low feed flow applications. Use only with certain Sea Quencher and Little Wonder watermakers.

Notes:

- Keep elements moist at all times
- Permeate obtained from first two hours of operation should be discarded
- To prevent biological growth during storage, shipping, or system shutdowns it is recommended that elements be immersed in a protective solution. The standard solution for long or short term storage should contain 1.0 percent (by weight) sodium metabisulfite (available as VMT p/n 85-0103, 85-0038, 85-0044 or 85-0049)
- Standardized test conditions are 32,000 ppm NaCl at 77° F (25° C), with 800 psi feed. Production rates for individual elements may vary +/- 20% and rejection may vary +/- 0.4%

To maintain peak performance always use genuine Parker Water Purification parts.
We reserve the right to change our specifications or standards without notice.

© 2017 Parker Hannifin Corporation

Print Reorder Number 7897 Rev-Q 05-30-2017

WARNING: This product can expose you to chemicals including Di(2-ethylhexyl)phthalate (DEHP), which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

ENGINEERING YOUR SUCCESS.

Pressure Vessel Assemblies

For Seawater Elements

Contact Information:

Parker Hannifin Corporation
Racor Division/Village Marine Tec.
2630 E. El Presidio Street
Carson, CA 90810

phone 310 516 9911
fax 310 538 3048
racor@parker.com
www.villagemarine.com

www.parker.com/racor

Key Features:

Racor Village Marine RO membrane pressure vessels feature non-metallic wetted surfaces for excellent corrosion resistance.
Simple end plug design allows quick removal for element servicing.
If the size you require is not shown please contact us for custom builds.

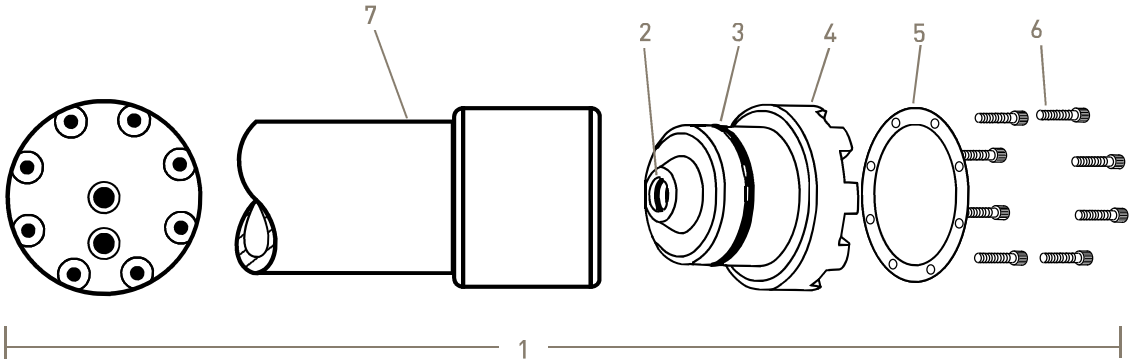
- Operating Pressure: 1000 psi/68 bar
- Shell: Filament Wound fiberglass
- Collars: 6061 T-6 Powdercoated aluminum
- End Plugs: Thermoplastic
- End Ring:
  6061 T-6 Anodized aluminum on 2.5" and 4" size
  SS316 on 6" size
- Fasteners: SS316

Parker | Racor

ENGINEERING YOUR SUCCESS.

Pressure Vessel Assemblies

For Seawater Elements



Part Numbers:

Item	Description		Quantity per Assembly	2.5" x 19"	2.5" x 38"	4" x 40"	6" x 40"
1	Vessel Assembly**			32-2519	32-2537*	32-0444	32-6040
2	Product O-ring		4	32-2116	32-2116	32-2116	32-2229
3	End Plug O-ring		2	32-2228	32-2228	32-4342	32-0640
4	End Plug		2	32-2513*	32-2513*	32-4012	32-6012
5	End Ring		2	32-4013	32-4013	32-4014	32-0096
6	Capscrews		***	86-0106	86-0106	86-0123	86-0136
7	Shell	White	1	32-0025	32-0026	Please Call	Please Call
		Gray	1	32-0098	32-0099	32-4001	32-0001
	Weight (lbs/kg)			5/2	7/3	22/10	45/20

Notes:

*End Plug 32-2517 is also available for 2.5" vessels, which offers straight, coarse thread feed/reject port used on some VMT PW watermakers. Use of coarse thread end plug changes the vessel assembly p/n to 32-2538

**Membrane not included. For applicable membrane elements see bulletin No. 7897 (Aqua Pro RO Membranes)

*** Capscrews:
Order 6 per end plug on 2.5" size
Order 8 per end plug on 4" size
Order 10 per en plug on 6" size

To maintain peak performance always use genuine Parker-Racor/Village Marine Tec. replacement parts.
We reserve the right to change our specifications or standards without notice.

© 2012 Parker Hannifin Corporation

Print Reorder Number **7898** Rev-A 12-10-2012

Parker Racor

ENGINEERING YOUR SUCCESS.

Pleated Filters and Filter Cartridge Kits

Contact Information:

Parker Hannifin Corporation
Water Purification
2630 E. El Presidio Street
Carson, CA 90810

phone (310) 608-5600
fax (310) 608-5692
waterpurification@parker.com
www.parker.com/waterpurification

The Parker line of pleated filters are designed specifically for the RO watermaker industry and are superior to wound or polyspun cartridges to gi longer filter life as well as increasing flow rates and keeping cartridge size down.

Available in a wide arrange of sizes and micron ranges to ensure that every ty lter need is taken care of. Stock sizes fit most standard filter housings, if the size you need is not shown please contact us with the dimensions required.

Single use Cleaning and Preservative Cartridge Kits are designed specifically for small RO Systems. The Cartridges allow for easy and effective membrane maintenance.

The Cleaning and Preservative Cartridge Kits eliminate the trouble and mess of measuring powdered chemicals and ensuring correct chemical concentrations. The Chemical cartridges fit directly into 2.5" x 10" or 4.5" x 10" housings and contain the correct amount of chemical for a single use.

Parker

ENGINEERING YOUR SUCCESS.

Pleated Filters and Filter Cartridge Kits

Features:

Pleated Filters

- Polypropylene pleated construction
- Longer service life over wound or polyspun cartridges
- Easily cleaned and reused
- Chemically compatible with a wide range of alkalies, most acids and saline solutions
- 0.5, 1, 5, and 20 micron nominal ratings available
- Pliable ends ensures filter seal to eliminate bypass
- High packing density reduces filter size while keeping flow rates up

Filter Cartridge Kits

- Cartridge with Blue stripe contains cleaner #1, a biological cleaner to remove algae, fungi and bacteria
- Cartridge with Red stripe contains cleaner #2, an acidic cleaner to remove scale from the membrane
- Cartridge with Green stripe contains the preservative. This chemical is used for pickling the membranes
- Cartridges are capable of being used in any housing that takes a standard 2.5" (64mm) x 10" (254mm) filter cartridges

Pleated Sediment Elements

Part Number	Microns	Filter Area ft^2/m^2	Diameter inch/cm	Length inch/cm
33-0118	20		2.75/7	9.75/25
33-0117	5		2.75/7	9.75/25
33-0053	20		4.5/11.4	9.75/25
33-0052	5		4.5/11.4	9.75/25
33-0020	20	30/2.79	8.63/22	7.75/20
33-0005	5	30/2.79	8.63/22	7.75/20
33-0058	20		4.5/11.4	20/51
33-0057	5		4.5/11.4	20/51
33-0172	100	100/9.29	8.63/22	24.3/62
33-2100	20	100/9.29	8.63/22	24.3/62
33-5100	5	100/9.29	8.63/22	24.3/62
33-1100	1	100/9.29	8.63/22	24.3/62
33-1105	0.5	100/9.29	8.63/22	24.3/62

Carbon Flushing Filters

Part Number	Diameter inch/cm	Length inch/cm
33-0311	2.75/7	9.75/25
33-0315	4.5/11.4	9.75/25
33-0083	4.5/11.4	20/50.8

Cartridge Filter Kits

Description	Part Number	Contents
Cleaning Kit	85-0102	One Blue stripe cleaner #1 plus One Red stripe cleaner #2
Preservation Kit	85-0103	Two Green stripe preservative

To maintain peak performance always use genuine Parker replacement parts.
We reserve the right to change our specifications or standards without notice.

© 2017 Parker Hannifin Corporation

Print Reorder Number 7905 Rev-Q 05-30-2017

WARNING: This product can expose you to chemicals including Di(2-ethylhexyl)phthalate (DEHP), which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

ENGINEERING YOUR SUCCESS.