Village Marine LWM 145-200

Part Number: 95-0024

The Little Wonder Modular

145-200

Installation, Operation & Maintenance

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

Parker

ENGINEERING YOUR SUCCESS.

Village Marine Tec.

Fresh Water from the Sea

SYSTEM START UP LOG

SYSTEM INFORMATION:

MODEL NUMBER: _____

SERIAL NUMBER: _____

DATE OF PURCHASE: _____

PURCHASED FROM: _____

_____

_____

_____

_____

INSTALLATION DATE: _____

START UP PERFORMANCE READINGS:

MEASURE AFTER 3 AND 24 HOURS OR PRESSURIZED TIME IN SIMILAR CONDITIONS

	3 Hours	24 Hours
FEED WATER TEMPERATURE:	_____	_____
FEED WATER SALINITY (IF KNOWN):	_____	_____
BATTERY VOLTAGE:	_____	_____
VOLTAGE AT UNIT:	_____	_____
AVERAGE AMP DRAW (IF KNOWN):	_____	_____
OPERATING PRESSURE:	_____	_____
PRODUCT WATER FLOW:	_____ **(GPH)**	_____ **(GPH)**
REJECT WATER FLOW (IF KNOWN):	_____ **(GPH)**	_____ **(GPH)**
PRODUCT WATER QUALITY (IF KNOWN):	_____ **(ppm)**	_____ **(ppm)**

1.0 INTRODUCTION

SYSTEM DESCRIPTION

Village Marine Tec's (VMT™) Little Wonder watermakers are well-engineered reverse osmosis (RO) systems, designed and built for simple operations and maintenance for the cruising sailor, or sport fisherman, or where space is at a premium. These modular 12 Volts DC desalination systems will produce seven to eight gallons per hour (GPH) of freshwater from the sea (gallon production will vary based upon water temperature, salinity, and model of the RO system).

The Little Wonder unit produces water, meeting or surpassing drinking water guidelines with seawater salt concentrations as high as 32,000 parts per million (ppm).

HOW TO USE YOUR MANUAL

This User Guide & Reference Manual contains important information about the safe operation and maintenance of your Little Wonder Vertical units.

We advise you to please read through the entire User Guide & Reference Manual carefully to ensure you familiarize yourself with the operation of your RO system and follow the recommendations within the manual, to help make your water producing experiences trouble-free and enjoyable.

SAFETY WARNINGS

Throughout this User Guide & Reference Manual you will see many important statements or labels indicated on the product with the following words:

⚠ WARNING **Indicates a strong possibility of severe personal injury or death if warning instructions are ignored.**

⚠ CAUTION **Indicates hazards or unsafe practices of product may cause minor personal injury or may cause property damage.**

NOTE: Text specifies useful information.

1.1 UNPACKING AND HANDLING

The Little Wonder reverse osmosis units are shipped pre-assembled, however, connection of the modules will be required. Inspect the RO unit to verify it was not damaged in transit. Also, please refer to the plumbing diagram to verify all components for the watermaker are shipped prior to installation.

⚠ CAUTION **DO NOT EXPOSE THE RO UNIT TO FREEZING TEMPERATURES WITHOUT PROPER STEPS TO TREAT THE RO UNIT FOR SUB-FREEZING TEMPERATURES.**

1.2 PERFORMANCE SPECIFICATIONS

Parameter	Specification
Raw water temperature (minimum)	33° F (1°C)
Raw water temperature (nominal)	77° F (25°C)
Raw water temperature (maximum)	113° F (45°C)
Min. raw water inlet pressure	Flooded suction pressure
Max. raw water inlet pressure*	30 psi
Flush water recommended max. pressure*	35 psi
Design RO element pressure	800 psi
Max. RO element pressure	1000 psi
Max. feedwater chlorine residual	< 0.1 ppm
Cleaning solution pH range	10-11 (chem. 1), 2-3 (chem. 2)
Membrane type	Thin film composite

Table 1.0 - Performance Characteristics

* For inlet pressure greater than recommended limits, install pressure regulator.

NOTE: **REGARDING WATER PRODUCTION:**
The RO series number (i.e. LWM 145, LWM 200) refers to gallons per day (GPD) production produced with new membranes at design optimum conditions.

To achieve optimum production:
(1) The feed flow must be unrestricted (positive water pressure at the inlet to high pressure pump).
(2) Seawater temperature at 77°F (25°C).
(3) Seawater salinity at 32,000 parts per million (ppm) total dissolved solids (TDS).
(4) Direct current (DC) units should be at charging voltage (13.8 volts for a 12 volt system) and wire size should be 6 gauge.

Variation of conditions (environmental, temperature, and frequency of use) and normal aging of membranes will decrease production. Normal membrane fouling will be partially recovered by chemical cleaning, but 100% recovery should not be expected. Production rates from membrane to membrane can vary ± 15%.

1.3 ENVIROMENTAL REQUIREMENTS

Parameter	Specifications
List (Permanent):	15°
Trim (Fore and Aft):	+ 30°
Pitch:	6108 (6 sec cycle)
Roll:	6308 (12 sec cycle)

Table 1.1 - Nominal Operating Conditions

1.4 CONSUMABLES

Table 1.2 lists the consumables required for the RO unit. Use **ONLY** Village Marine Tec. approved filters and chemicals.

LW 145/200		
Description	**QTY**	**VMT Part No.**
Chemical Cleaning Cartridge Kit #1, #2	$1^{ea}/_{box}$	85-0102
Preservative Cartridge Kit, Chemical #3	2/box	85-0103
Filter, 5 micron, 10 sq-ft.	1^{ea}	33-0117
Filter, Carbon, 10 sq-ft.	1^{ea}	33-0311
Aqua Pro High Pressure Pump Oil	1 qt	85-0050

Table 1.2 – VMT Approved Consumables

1.5 MAINTENANCE EQUIPMENT

Table 1.3 lists the test equipment required for performance verification and maintenance of the RO unit.

Description	VMT Part No.
Kit, Pump, Service	70-6181
Economy Mini Water Tester, TDS	99-1990

Table 1.3 – Maintenance Equipment List

2.0 INSTALLATION

Village Marine Tec. recommends installing the RO unit in a dry sheltered location at or aft of midship, with drainage underneath (to draw off standing water when performing routine maintenance or service). The portion of the watermaker up to and including the high pressure pump should be installed **BELOW** waterline (Refer to Figure 2.1). If the high pressure pump cannot be below waterline, then contact your VMT distributor for the high lift LP pump, p/n 70-0512. The pressure vessel tube and instruments can be ABOVE waterline. Give consideration to extra space around the RO unit, allowing access for the unit's maintenance (i.e. membrane replacement, oil change, prefilter replacement, or other service).

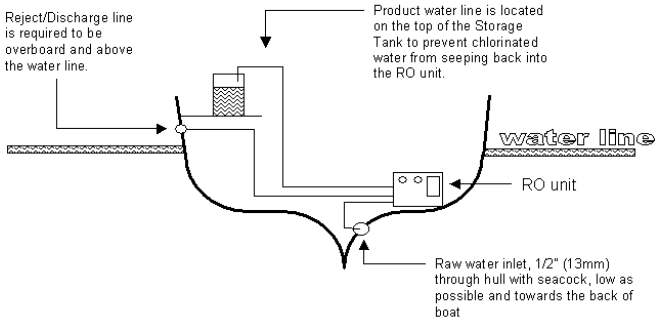


Figure 2.1: Recommended installation BELOW waterline.

Locate or create a ½" 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. Village Marine Tec. 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 VMT.

2.1a TO CONNECT PLUMBING

Step 1: Refer to **Section 9** for the **EXPANDED** detailed **Little Wonder MODULAR** plumbing diagram.

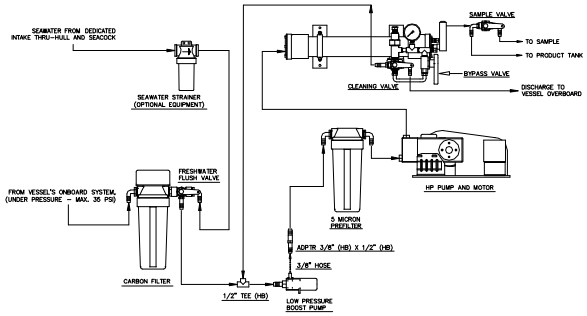


Figure 2.1: Little Wonder MODULAR Plumbing Diagram.

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 2.3 for a view of the carbon filter and freshwater flush valve.

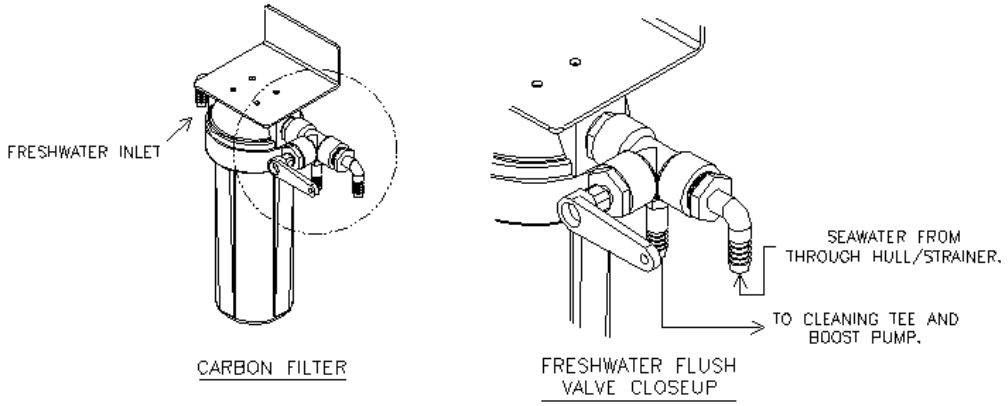


Figure 2.2: Carbon Filter with Freshwater Flush Valve – Isometric Views.

NOTE: Village Marine Tec. 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.

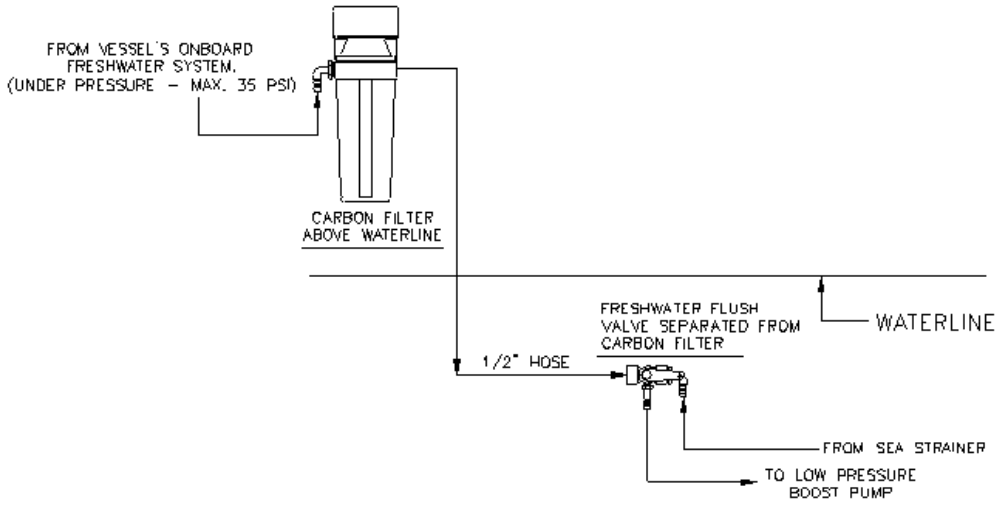


Figure 2.4: Connecting the Carbon Filter Outlet to the Separated Freshwater Flush Valve.

Step 3: Connect ½" 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 ½" diameter using the step size adaptor supplied.

BRINE DISCHARGE

Locate a convenient spot in the boat to install an overboard discharge through-hull with an ½" diameter. Discharge line is required to be **ABOVE** waterline. Refer to Figure 2.1. If connecting to a common drain, tee in from above so that backflow contamination to the watermaker from other drains is not possible.

PRODUCT WATER AND SAMPLE WATER

Connect a ¼" 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 2.5). On both outlets of the sample valve, connect a ¼" 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 2.1).

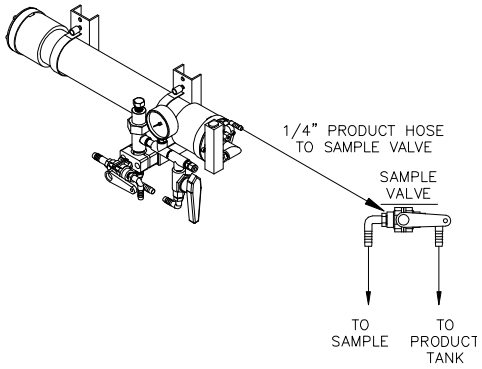


Figure 2.5: Little Wonder MODULAR Sample Valve Connection.

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.

NOTE: Village Marine Tec. 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.

FRESHWATER FLUSH

Tap into your boat's freshwater pressure system (Tee into the cold pressurized side) with a ½" diameter hose to the carbon flush filter. If the freshwater pressure on board is above 35 psi, install a pressure regulator.

2.1b **TO CONNECT THE ELECTRICAL**

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.

NOTE: **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. VMT 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 (Refer to Figure 2.6).

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 as shown in figure 2.6.

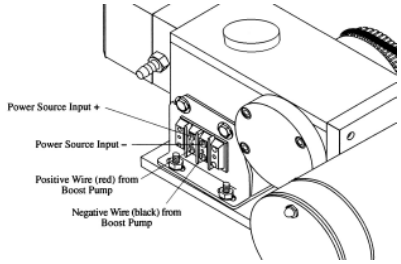


Figure 2.6: Little Wonder MODULAR (DC UNIT) Electrical Interface Views.

3.0 GENERAL THEORY OF OPERATION

3.1 REVERSE OSMOSIS THEORY

Reverse osmosis, like many other practical scientific methods, was developed from processes first observed in nature. Osmosis is a naturally occurring phenomenon in which a semi-permeable membrane separates a pure and a concentrated solution (a semi-permeable membrane is defined as one that preferentially passes a particular substance). Every fluid has an inherent potential that is directly related to the type and amount of solids in solution. This potential, referred to as osmotic pressure, increases in proportion to relative concentration of a solution. A concentrated solution, therefore, has an osmotic pressure that is higher than that of a pure solution.

In an osmotic system, the less concentrated solution will attempt to equalize the concentrations of both solutions by migrating across the semi-permeable membrane. When enough pure solution migrates across the membrane such that the inherent potential difference between the solutions in no longer higher than the osmotic pressure of the membrane, the purer solution will stop flowing. If the pressure on the concentrated solution is increased to above the osmotic pressure, fluid flow will be reversed. This condition, called Reverse Osmosis, can be established by artificially pressurizing the more concentrated solution using a high pressure pump. In this type of system, the concentrated solution (normally referred to as feedwater) will become more concentrated as pure water flows out of solution and across the membrane to the permeate side. Discounting the effects of feedwater temperature and salinity, the operating pressure normally required to produce significant amounts of pure water is at least twice the osmotic pressure of the membrane being used.

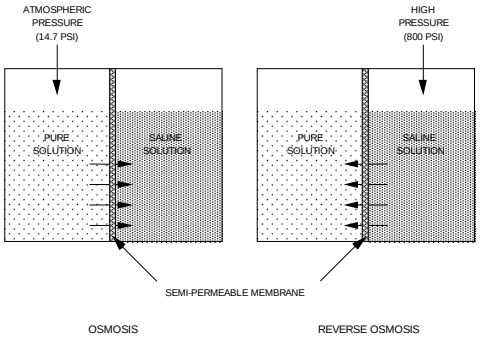


Figure 3.1 - Simple (Reverse) Osmosis Process.

3.2 APPLICATION OF REVERSE OSMOSIS

Seawater contains many kinds of solids dissolved in solution. The most prevalent is common table salt (sodium chloride). Other minerals that may be present in solution are substances that usually contain various compounds of calcium and sulfate. The sum of all of the solids dissolved in a particular sample of water is referred to as *Total Dissolved Solids* or TDS. Seawater normally averages 32,000 ppm (parts per million) TDS although variations of 5000 ppm are common in various parts of the world. The fundamental goal of any desalination process is a significant reduction in the amount of dissolved solids in water.

In a Reverse Osmosis desalination system, most of the dissolved solids do not pass through the membrane but are instead carried along the membrane surface. This rejected water, referred to as *brine*, becomes increasingly more concentrated as it flows across the surface of the membranes and is eventually piped to drain. The product water that flows through the membrane is referred to as *permeate*. The percentage of feedwater that enters the unit converted to permeate is called the

recovery rate. A higher than optimal recovery rate (which can be obtained by increasing the back pressure on the unit above the recommended range) results in greatly increased membrane fouling rates and a significant decrease in the operational life of the membranes.

It should be noted that no system is capable of removing all 100% of the dissolved solids from seawater. Designed to reject approximately 99% of the TDS, the system allows 1% of the 32,000 ppm TDS in the seawater to pass into the product water. This yields product water of less than 500 ppm, the recommended TDS for drinking water. A system such as this is said to have a *salt passage* of 1%.

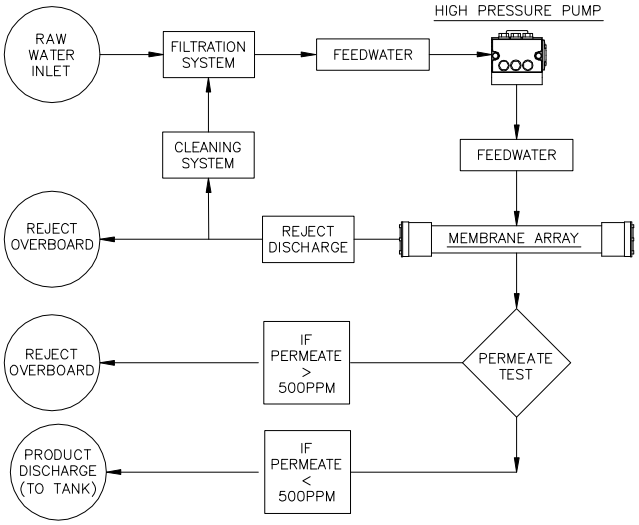


Figure 3.2: Simplified Schematic of an RO System.

3.3 PRODUCT WATER QUALITY STANDARDS

This RO unit will produce permeate (product water) with a quality of less than 500 ppm TDS and in accordance with World Health Organization (WHO) guidelines for drinking water. General WHO specifications for acceptable drinking water quality are as follows:

Constituent Ion / Molecule	Maximum Limits (ppm)
Nitrate	10
Fluorine	1
Sulfate	100
Magnesium	30
Calcium	75
Calcium Carbonate	100
Iron	0.1
Manganese	0.05
Total Dissolved Solids	500
Turbidity	5
Oil	0.1
Detergents (Anionic)	0.2
Phenols	0.001
Bacteria – E. Coli (per 100 ml)	0

Table 3.0 - WHO Drinking Water Guidelines.

3.4 FACTORS AFFECTING PERMEATE PRODUCTION

VARIATIONS IN TEMPERATURE, PRESSURE, AND SALINITY

The following table illustrates how the quality and quantity of permeate produced by a RO system is affected by changes in temperature, salinity and pressure:

With constant....	And increasing....	Permeate	
		TDS	Capacity
Salinity and Pressure	Temperature	Increases	Increases
Temperature and Pressure	Salinity	Increases	Decreases
Temperature and Salinity	Pressure	Decreases	Increases

Table 3.1 - Factors Affecting Permeate Quality

The RO system can be adjusted to maintain a constant permeate output when feedwater temperature and salinity is other than nominal. The operator can do this by controlling system pressure manually via the backpressure regulation valve located in the system brine piping. As permeate flow decreases, the operator can throttle the pressure regulation valve closed to increase system pressure. This, in turn, will increase the permeate output and mitigate the effect of a decrease in temperature or an increase in salinity. Conversely, the operator can open the pressure regulation valve to reduce pressure and permeate flow in areas of excessively high temperature or low salinity.

⚠ WARNING **IN FRESH OR BRACKISH FEEDWATER CONDITIONS, MAKE SURE TO REDUCE PRESSURE BY TURNING REGULATOR. SET PRESSURE SO PRODUCT FLOW IS NO MORE THAN 120% OF DESIGN FLOW TO AVOID MEMBRANE DAMAGE.**

3.4a TEMPERATURE CORRECTION FACTOR

As previously described, the output capacity of any RO unit is highly dependent on feedwater temperature. In order to quantify this relationship, operational data has been utilized to develop Temperature Correction Factors (TCF). The TCF (which is compensated to 25°C/77°F) is used to determine what part of any change in system output flow is due to variations in feedwater temperature alone. This, in turn, allows the operator to establish the baseline flow for a given temperature, allowing more accurate troubleshooting. The procedure for calculating the TCF and the temperature compensated flow is as follows:

1) Measure sea water temperature.
2) Determine the corresponding correction factor from Table 3.2 based on the measured temperature.
3) Note the product flow rate at the Product Flow meter.
4) Multiply the measure (uncorrected) product flow meter flow rate by the correction factor from Table 3.2 to give the calculated system output under standard conditions (25°C).

Example:

Raw water temp:	15°C
TCF:	1.47
Actual product flow:	5.67 (gph)
Calculation:	5.67 x 1.47 = 8.3349 (gph)
Calculated product flow:	8.3 (gph)
(Adjusted to 75° F)	(This is the normal flow for a LW 200)

°C	Factor	°C	Factor	°F	Factor	°F	Factor
1	3.64	26	0.97	34	3.47	84	0.88
2	3.23	26	0.94	36	3.18	86	0.82
3	3.03	28	0.91	38	3.18	88	0.79
4	2.78	29	0.88	40	2.68	90	0.79
5	2.58	30	0.85	42	2.47	92	0.77
6	2.38	31	0.83	44	2.29	94	0.75
7	2.22	32	0.80	46	2.14	96	0.73
8	2.11	33	0.77	48	2.01	98	0.70
9	2.00	34	0.75	50	1.88	100	0.68
10	1.89	35	0.73	52	1.77	102	0.65
11	1.78	36	0.71	54	1.68	104	0.63
12	1.68	37	0.69	56	1.59	106	0.61
13	1.61	38	0.67	58	1.51	108	0.59
14	1.54	39	0.65	60	1.44	110	0.57
15	1.47	40	0.63	62	1.36	112	0.55
16	1.39	41	0.61	64	1.30	114	0.53
17	1.34	42	0.60	66	1.24	116	0.51
18	1.29	43	0.58	68	1.17	118	0.49
19	1.24	44	0.56	70	1.12	120	0.47
20	1.19	45	0.54	72	1.08	122	0.45
21	1.15	46	0.53	74	1.05		
22	1.11	47	0.51	76	1.02		
23	1.08	48	0.49	78	1.00		
24	1.04	49	0.47	80	0.93		
25	1.00	50	0.46	82	0.90		

Table 3.2 - Temperature Correction Factors

4.0 OPERATION

4.1a TO START THE LITTLE WONDER MODULAR UNIT

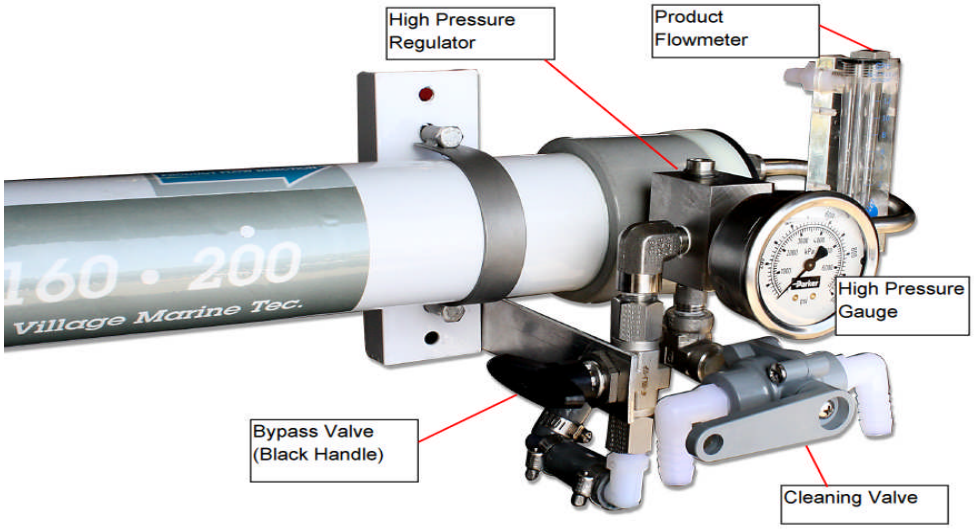


Figure 4.1: Little Wonder MODULAR Instrument Detail.

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 800psi. 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 800psi. 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 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 on page vii).

4.1b 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 Modular 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 in this "stand by" condition with the 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.

5.0 MAINTENANCE

The service life of most system equipment is related to the sea water inlet conditions and proper maintenance. Under normal conditions, a reverse osmosis membrane (which is the major consumable item) should have an effective service life somewhere between 3 and 6 years.

NOTE: The RO unit must be cleaned when product water output drops by 15%.

	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually	As Required	Labor Hours (approximate)
Check Belt Tension/Wear			•					0.5
Clean/inspect micron prefilter		•						0.5
Replace 5 micron filter							•	0.5
Replace carbon flush filter						•		0.5
Clean membranes							•	2.0
Replace Membranes							•	1.0
Check pump oil level			•					0.1
Change pump oil**							•	0.5

Table 5.0: Maintenance Task Chart.

* VMT prefilter 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.

FRESHWATER FLUSH / SHORT TERM STORAGE

Ideally, the Little Wonder 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. The flush pushes out older stagnant seawater (saltwater) out of the membranes and replacing it with freshwater, 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 one day. 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. THE FRESHWATER FLUSH SYSTEM USES A CARBON FILTER INLINE BEFORE SYSTEM TO REMOVE CHLORINE THAT MAY BE PRESENT IN DOCK WATER SUPPLIES.**

5.1 TO FLUSH THE LITTLE WONDER MODULAR UNIT

Step 1: Turn the High Pressure Bypass Valve to ***CLEANING*** (ensuring zero pressure in system). Verify the gray Cleaning Valve is positioned to ***NORMAL/REVERSE OSMOSIS*** position.

Step 2: Turn the gray Freshwater Flush Valve to ***FRESHWATER*** position. Freshwater should now start flowing through the watermaker from the "house" pump.

Step 3: **AC POWERED 110V/220V Little Wonder MODULAR Models:**
Turn the pump switches located on the control box panel to ***ON*** position to power up motor. Run unit for two minutes.

DC POWERED 12V Little Wonder MODULAR Models:
Turn ***ON*** the breaker at the main breaker panel and allow the unit to run for two minutes.

Step 4: Turn the gray Freshwater Flush Valve to ***SEAWATER*** position. Leave RO unit in standing condition, for up to three weeks. Then reflush or preserve.

5.2 MEMBRANE CLEANING AND PRESERVATION

This section is to guide the operator in the periodic care and cleaning of the RO membrane elements used in the LW unit. The basic procedure for all cleaning and preservative treatments is the same – 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 freshwater to optimize performance of cleaning process.

NOTE: Allow your unit's product water to run with product to SAMPLE for the first 10 minutes after cleaning or upon startup after preservation.

Description	Cartridge Form	Powder Form
Cleaning Chemical #1	1 Cartridge (Blue Stripe)	10 TBSP
Cleaning Chemical #2	1 Cartridge (Red Stripe)	10 TBSP
Preservative Chemical #3	1 Cartridge (Green Stripe)	3 TBSP

Table 5.1: Chemical Requirements

5.3 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.**

⚠ CAUTION **PRESERVATIVE CHEMICAL #3 IS A FOOD GRADE PRESERVATIVE. SEE WARNING LABEL ON SIDE OF PACKAGE AND ADHERE TO 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 VILLAGE MARINE TEC., WILL VOID THE RO UNIT WARRANTY.**

5.4 WHEN TO CLEAN

The RO unit must be chemically cleaned when product water output drops below 85% of original production. The frequency of this occurring will vary greatly upon feed water and usage pattern. Fouling from the membrane will naturally occur through regular RO use.

Prior to cleaning the membranes, verify that any reduction in product output is not the result of a corresponding variation in raw water inlet temperature or salinity. Refer to **Section 3.4: FACTORS AFFECTING PERMEATE PRODUCTION** for more information.

NOTE: Product water output of the system is dependent upon feedwater temperature, RO feed pressure and feedwater salinity. Reductions in product water output due to these factors are normal and may not indicate the need for membrane cleaning.

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

Single Use Cleaning Cartridges: Chemical #1 and Chemical #2		Single Use Preservative Cartridge: Chemical #3	
Step 1.	Prior to cleaning the RO, complete a freshwater flush to the system. **(REFER TO SECTION 5.1)**	Step 1.	Prior to preserving the RO, complete a freshwater flush to the system. **(REFER TO SECTION 5.1)**
Step 2.	Remove 5 micron prefilter from housing.	Step 2.	Remove 5 micron prefilter from housing.
Step 3.	Place cleaning filter Chemical # 1 (Blue Stripe) into prefilter housing and fill with water. Screw housing back into place.	Step 3.	Place preservation filter Chemical # 3 (Green Stripe) into prefilter housing and fill with water. Screw housing back into place.
Step 4.	**Make sure the** High Pressure Bypass Valve is in the Cleaning position.	Step 4.	**Make sure the** High Pressure Bypass Valve is in Cleaning position.
Step 5.	Turn cleaning valve to clean/recirculate position.	Step 5.	Turn cleaning valve to clean/recirculate position.
Step 6.	Start RO unit and let unit run for 30 minutes, in the recircluate mode.	Step 6.	Start RO unit and let unit run for 20 minutes, in the recircluate mode.
Step 7.	Turn Unit OFF after running for 30 minutes; Place cleaning valve to overboard position; Remove the cleaning chemical cartridge from the prefilter housing; Install a 5 micron prefilter cartridge in housing and resecure housing place.	Step 7.	Turn Unit OFF after running for 20 minutes.
Step 8.	Run the unit with seawater feed for 5 minutes to clear out cleaner #1.	Step 8.	Leave all valves in position they are now in.
Step 9.	To use Cleaning Chemical #2 (Red Stripe) return to Step 1 to follow steps 1 to 8 with the #2 cartridge.	Step 9.	Unit is now preserved and can be left as is for 6 months in temperate climates or 4 months in the tropics. After that, flush unit and represerve.
Step 10.	After 5 minutes running, close the bypass valve to bring the unit up to pressure. Record production flow rate before and after cleaning to determine effectiveness.		

NOTE: **For resuming normal RO operation (unpreserving or "unpickling"), install a FIVE MICRON filter into the prefilter housing. Begin system Start Up Procedures by referring to Section 4.0.**

NOTE: **When single use chemical cartridges are not available, the LW watermaker can be treated with powdered VMT cleaners. In step 3 above, substitute 10 tablespoons of cleaner #1 or 10 tablespoons of cleaner #2 or 3 tablespoons of preservative #3. Leave the 5 micron filter in place, and dissolve the powder in enough water to fill the filter housing.**

5.5 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 **Section 11.0: MANUFACTURER'S LITERATURE** in back of this manual.

⚠ CAUTION **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.

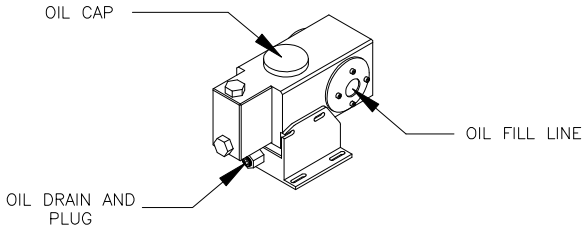


Figure 5.1: High Pressure Pump and Drain Plug – Isometric Views.

Date	Total Hours	HP Pump Inlet Pressure (AC UNITS)	RO Array Pressure	Product Flow GPH	Brine Flow GPH (IF KNOWN)	Prod water TDS, ppm	Water Temp, °C

Table 5.4: Sample Operational Log

6.0 MEMBRANE REPLACEMENT

6.1 PRESSURE VESSEL DISASSEMBLY

Step 1: Disconnect plumbing from pressure vessel for disassembly. Remove the pressure vessel from the LW vertical frame and continue on a workbench.

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. Refer to Figure 6.2.

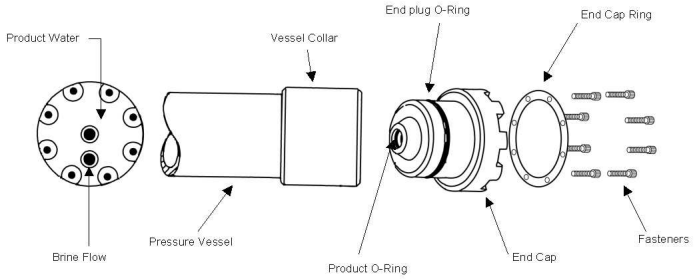


Figure 6.1 - Pressure Vessel End Plug Assembly Callout.

Step 3: Locate the screwdriver slots located on opposite ends of the pressure vessel end collar. Place an appropriate sized slot screwdriver in each slot. Twist both screwdrivers until the end plug breaks loose from the pressure vessel. The screwdrivers can now be placed between the end plug and collar. A prying motion on both sides of the end plug with the screwdrivers will quickly remove it. Use this procedure for both end caps.

Step 4: Push or pull the membrane element out of the pressure vessel tube.

Step 5: 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 (Refer to Figure 6.3). 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.**

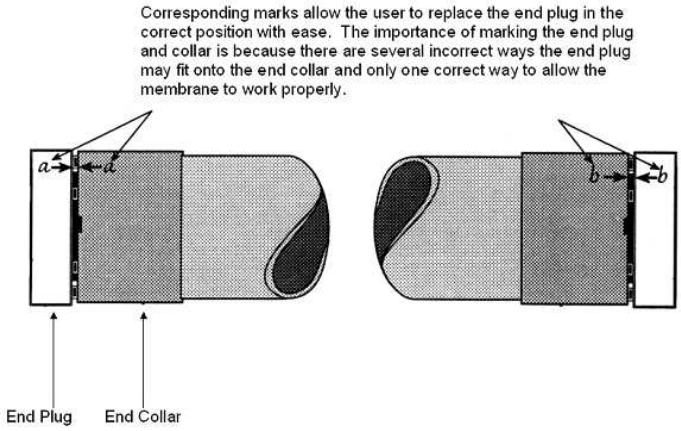


Figure 6.2 – Membrane Corresponding Mark Placement.

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.**

6.2 PRESSURE VESSEL ASSEMBLY

Step 1: Inspect all O-Rings; product O-Rings, end plug O-Rings, and Brine seal. Replace O-Rings if there is visible damage. The product water O-Rings are internal O-Rings, inside the center hole in the end cap. Refer to Figure 6.1.

Step 2: Clean all parts thoroughly.

Step 3: 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 4: 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.

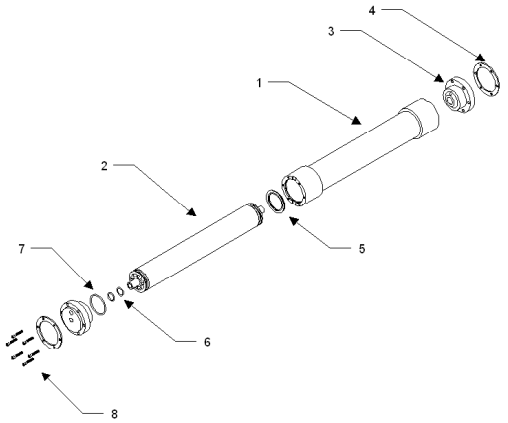
Step 5: Install the remaining end plug (align end plug holes with mounting holes properly), use the reference mark made in step 3 for correct assembly.

Step 6: Tighten the six fasteners for each end cap.

Step 7: Install the vessels and reconnect plumbing.

NOTE: Do not apply Teflon tape or sealant to SAE fittings such as those used on High Pressure assemblies and their adapters.

NOTE: For replacement parts call numbers, refer to Parts Reference section at the end of the manual and for additional information about the membranes and the pressure vessel, refer to the Manufacturer's Literature section at the back of this manual.



Item	Description
1	Vessel - 2538
1	Vessel - 2519
2	Membrane - SW 2538
2	Membrane - SW 2519
3	End cap
4	End cap ring
5	Brine Seal
6	Product O-rings
7	End Plug O-ring
8	Fasteners

Figure 6.3 - Exploded View of Pressure Vessel with Membrane.

7.0 FREEZE PROTECTION

There is a high probability of damaging your RO by exposing it to severe cold or icy conditions. Therefore protecting your RO against freeze damage is recommended. The following information provides steps towards safeguarding your RO and extending its plumbing life against freezing temperatures.

⚠ WARNING **DO NOT USE ETHYLENE GLYCOL (FOUND IN AUTOMOTIVE ANTIFREEZE PRODUCTS) TOWARDS FREEZE PROTECTING YOUR RO. ETHYLENE GLYCOL IS A TOXIC SUBSTANCE AND MUST NOT BE INGESTED NOR COME INTO CONTACT WITH YOUR RO SYSTEM.**

⚠ WARNING **USE ONLY FOOD GRADE NON-TOXIC PROPYLENE GLYCOL. DO NOT USE PROPYLENE GLYCOL BLENDED WITH SUPPLEMENTARY ADDITIVES.**

FREEZE PROTECT YOUR RO UNIT

Adhere to the packaging label directions of the food grade propylene glycol, for the amount of propylene glycol to be mixed based on the level of temperature protection required. Use non-chlorinated freshwater and make up sufficient solution to fill your prefilter housing.

Step 1: Close inlet seacock and flush unit with fresh water. Refer to **Section 5.1: TO FLUSH LITTLE WONDER UNITS**

Step 2: Remove the 5 micron filter from the prefilter housing and empty the prefilter housing.

Step 3: Pour the winterizing solution into filter housing and reattach the prefilter canister.

Step 4: Make sure the black High Pressure Bypass Valve is in ***CLEANING POSITION***. Turn the gray Cleaning Valve to ***CLEANING*** position.

Step 5: Turn on the RO pumps and run for at least 15 minutes to circulate the winterizing solution into the membranes, hoses, fittings, and pumps.

Step 6: Shut off the unit. Unit can be left in standby mode for up to 6 months.

The freeze protection solution is now circulated throughout the feed and reject sides, including the membrane and the pumps. To protect the product side, open the blue hoses and drain out the water from the membrane outlets, the product solenoid valve, the product manifold, the product flowmeter, and product relief valve, if equipped.

Step 7: Then switch ***OFF*** at your breaker at the main breaker panel.

TO FLUSH WINTERIZATION SOLUTION FROM THE RO UNIT

To return your machine to operating condition after freeze protecting it, adhere to the following steps.

Step 1: Verify the High Pressure Bypass Valve is in ***CLEANING*** (ensuring zero pressure in system). Turn the gray Cleaning Valve is positioned to ***NORMAL/REVERSE OSMOSIS*** position.

Step 2: Open the micron filter housing and put a new 5 micron filter inside. Fill the prefilter housing with freshwater by turning the flush valve temporarily to freshwater position.

Step 3: Verify the seacock intake to the RO is open.

Step 4: Run the unit to seawater for 10 minutes, and then close the HP bypass valve slowly and check fresh water generation. Record into your log sheet.

ALTERNATIVE FREEZE PROTECTION METHOD

Instead of applying propylene glycol to the RO system, an alternative method to freeze protect the RO is available.

Step 1: Perform a Chemical #3 preservation to the unit. To preserve the **LITTLE WONDER**, refer to instructions in **SECTION 5.2: STEPS FOR PRESERVATION CHEMICAL #3**

Step 2: Remove membrane vessels from the boat, placing caps over the fittings. This is a more practical alternative for **Little Wonder MODULAR** systems.

REMINDER: **Membranes must be kept wet with preservative solution, so the fittings must be capped.**

Step 3: Store the membranes in an environment protected from freezing.

Step 4: Refresh the preservative every 6 months as recommended.

Step 5: Drain all the remaining parts of the RO of all water.

8.0 TROUBLESHOOTING

Below is a list of frequently encountered operational problems and some guidelines and trouble shooting 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 the Village Marine Tec™ Service Department via phone calls and e-mail.

1. Check for proper valve configuration. Especially 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 a quart a 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.

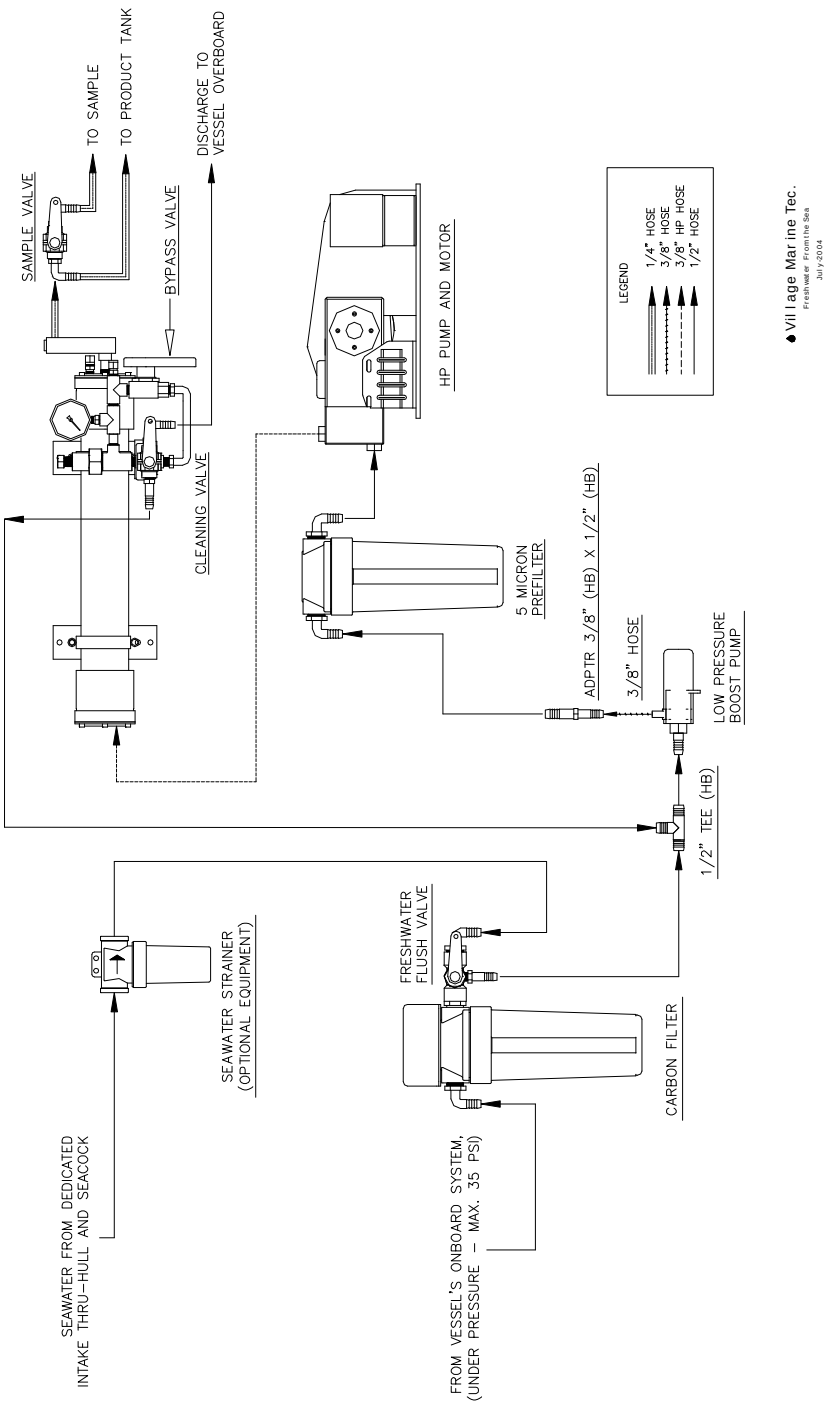
3. Confirm that a free sea water feed is supplied. A) The through-hull is clear of trash or kelp. B) Seacock is open. C) Sea strainer is clear. D) Boost pump is running. E) 5 micron filter is clean.

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.

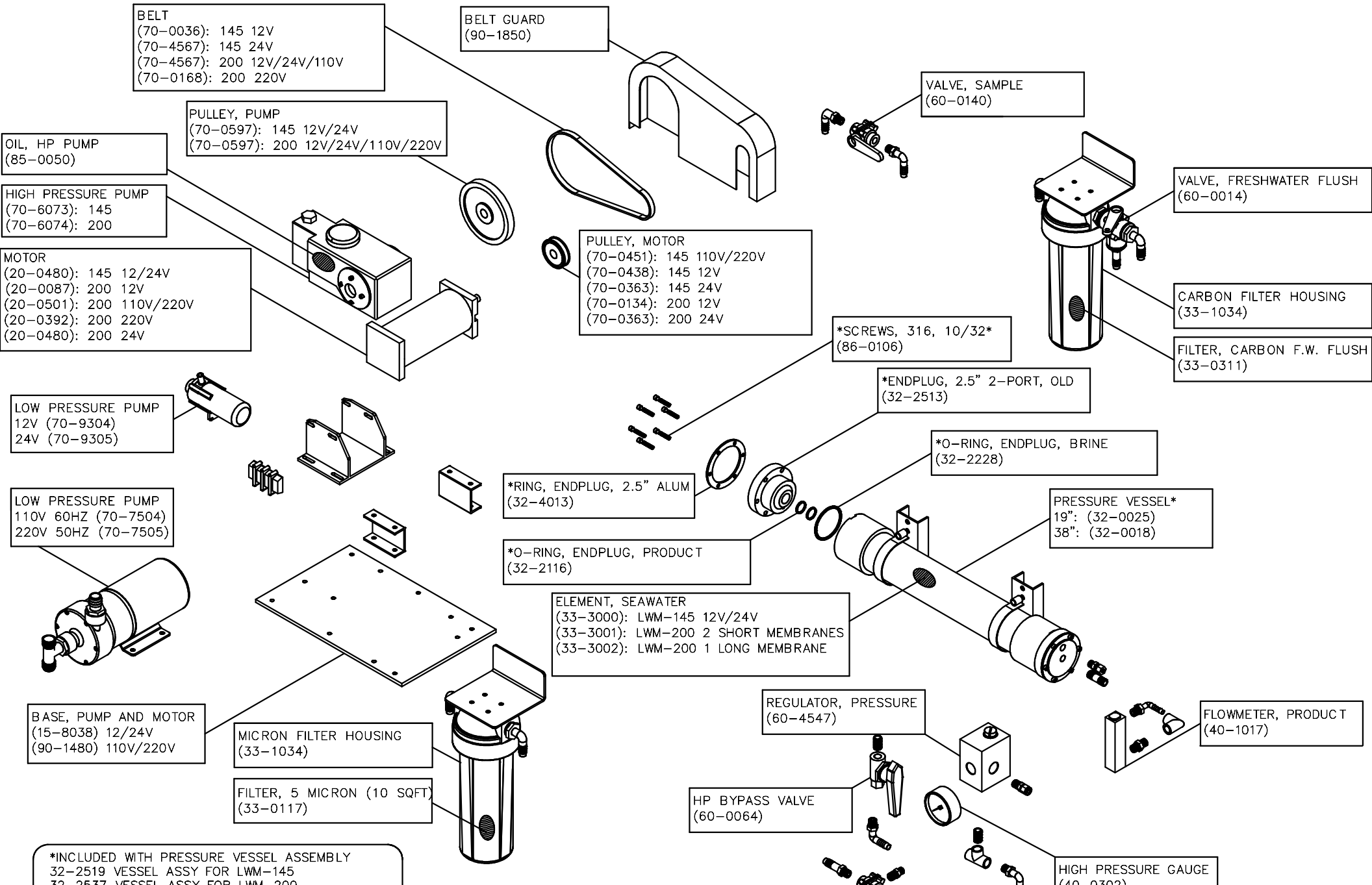
5. Low production GPH may be caused by cool seawater. Poor salt rejection may be caused by warm and/or salty seas. Do not interpret environmental factors as equipment problems.

9.0 PLUMBING DIAGRAMS

Little Wonder Modular Plumbing Diagram



Little Wonder Modular 145-200 - Main Parts Reference



*INCLUDED WITH PRESSURE VESSEL ASSEMBLY
32-2519 VESSEL ASSY FOR LWM-145
32-2537 VESSEL ASSY FOR LWM-200

Village Marine Tec.

Freshwater From the Sea

March 2013

708 TITAN SERIES

High Pressure Titanium
Positive Displacement Pump

OWNER'S MANUAL

Aqua Pro Pumps
The Professional's Choice

Aqua Pro Pumps
2000 W. 135th Street • Gardena, CA 90249
(310) 516-9911 • 800-421-4503

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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).

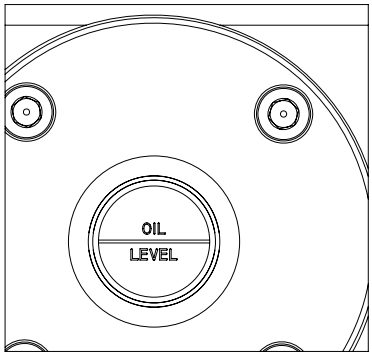


Fig. 1: Oil Level Sight Glass Detail.

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.

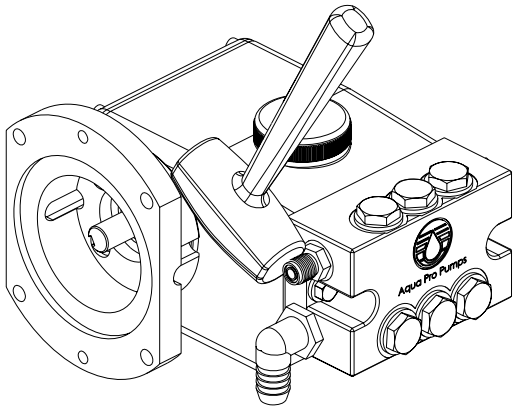


Fig. 2: Manifold Assembly Removal

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.

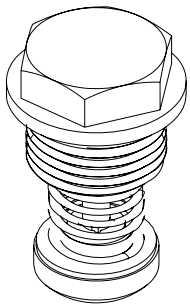


Fig. 3: Valve Assembly
(NOTE: There are two different valve plug designs)

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.

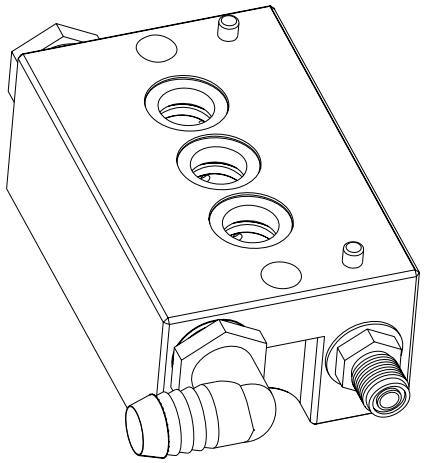


Fig. 4: Orientation for Manifold Seal Servicing

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).

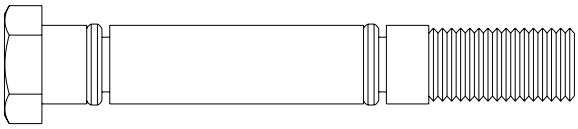


Fig. 5: Plunger Retaining Bolt Assembly

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. 90-1604) 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.

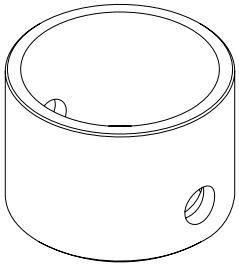


Fig. 6: Seal Retainer

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).

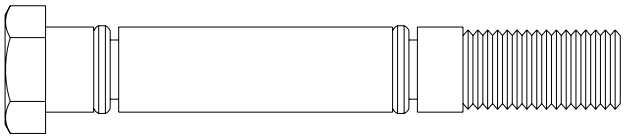


Fig. 5: Plunger Retaining Bolt Assembly

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. 90-1604) 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.

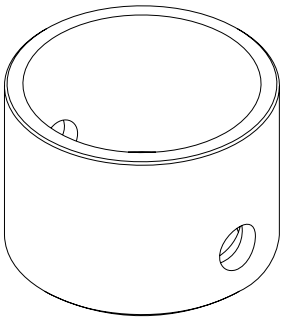


Fig. 6: Seal Retainer

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.

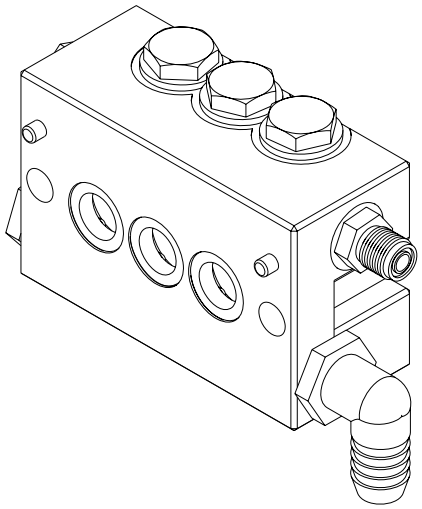


Fig. 7: Manifold Assembly

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.

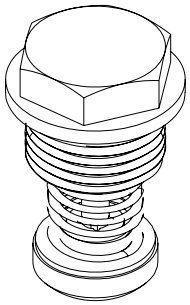


Fig. 8: Valve Assembly
(NOTE: There are two different valve plug designs)

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.

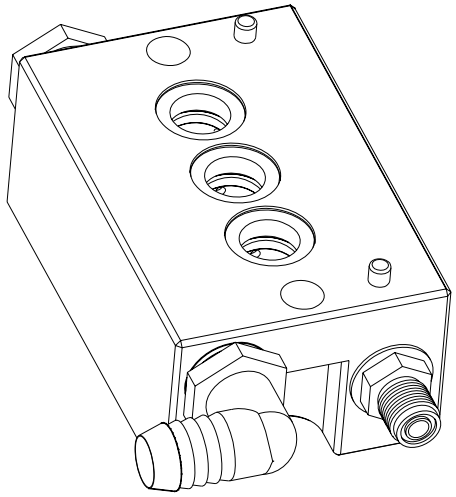


Fig. 9: Orientation for Manifold Seal Servicing

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.

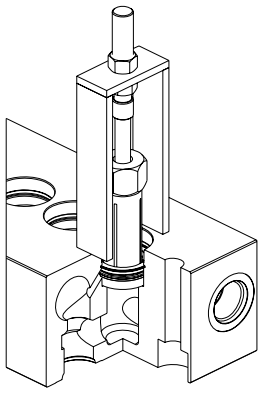


Fig. 10: Weep Ring Extraction

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

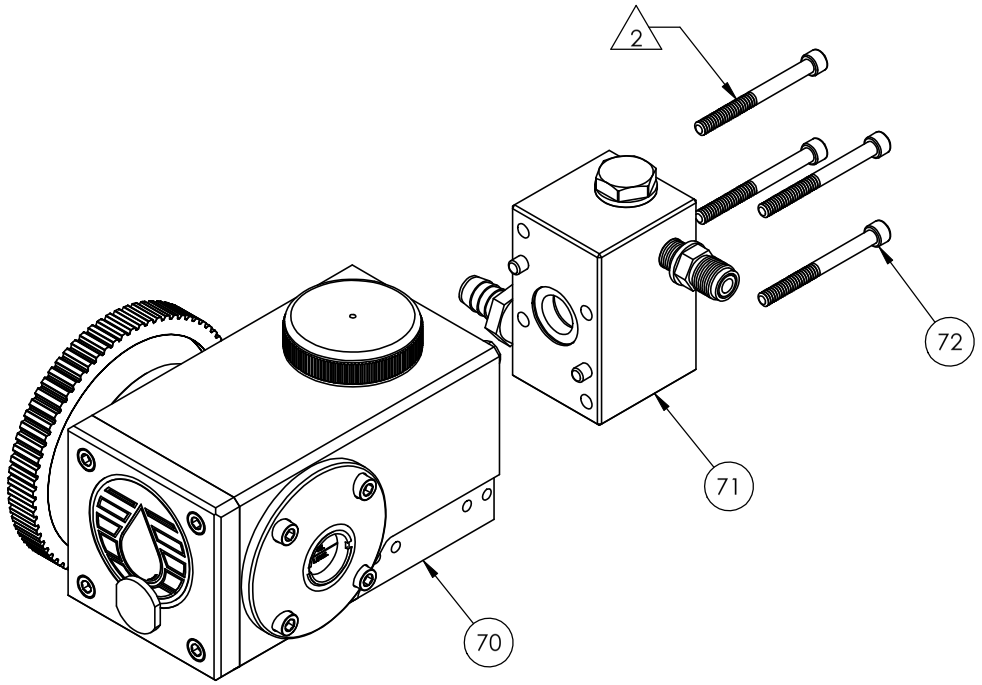
A light coating of Anti-Seize Lubricant (PN. 85-0094) should be applied on all threaded parts, unless otherwise stated.

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	-	-

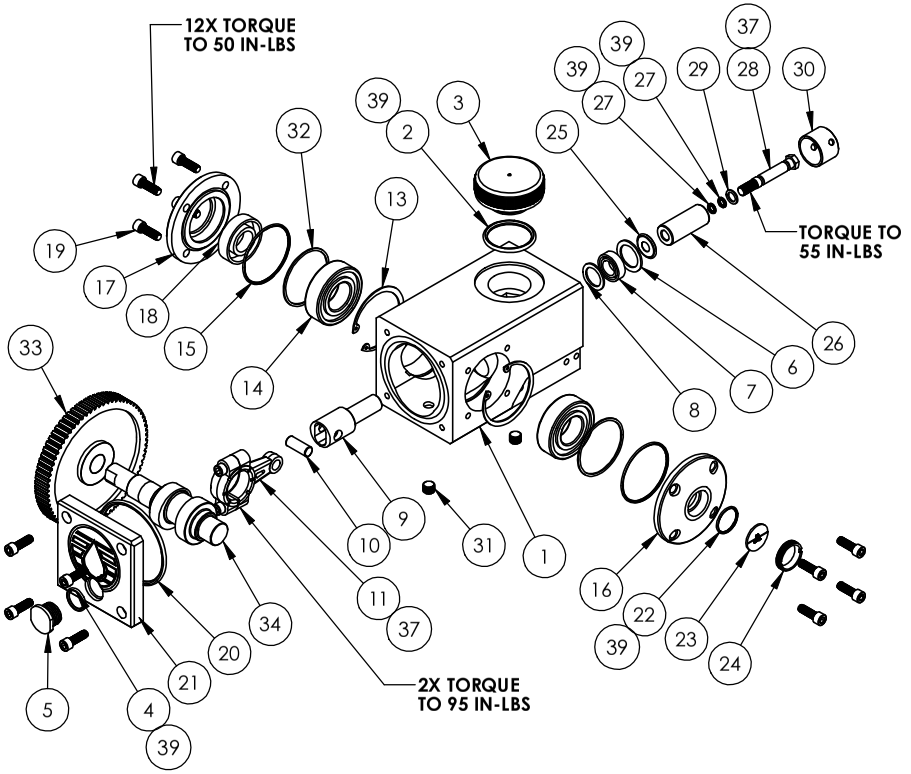
3	2	1	SHT	REVISION STATUS OF SHEETS
B	C	C	REV	

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	-	-

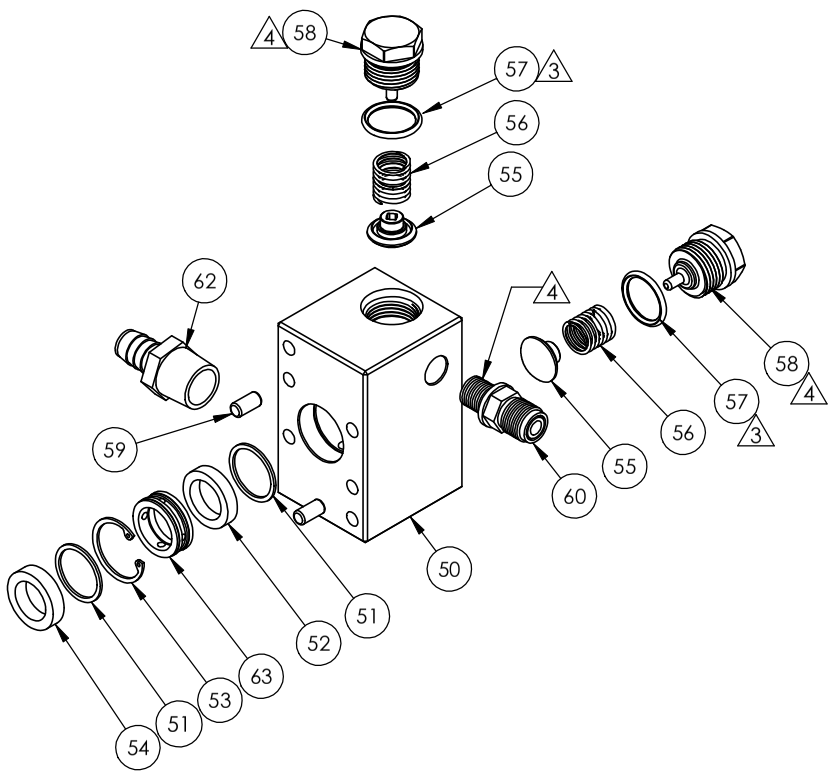
SIZE	TITLE	REV
B	ASSEMBLY, 708-1 CRANKCASE	C
DATE: 05-26-05	B CHAIDEZ	SHEET 2 OF 3

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	GH TQD 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

AquaPro® Sea Water RO Membranes

Contact Information:

Parker Hannifin Corporation
Filtration Group-Parker Village Marine
2630 E. El Presidio Street
Carson, CA 90810

Toll free: 1800 C-Parker
Phone: 310 608 5600
Fax: 310 608 5692
Email sales:
waterpurification@parker.com
Tech support:
watertech@parker.com
www.villagemarine.com
www.parker.com/watermakers

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, Racor Village Marine is able to offer the highest quality products.

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

Parker Village Marine

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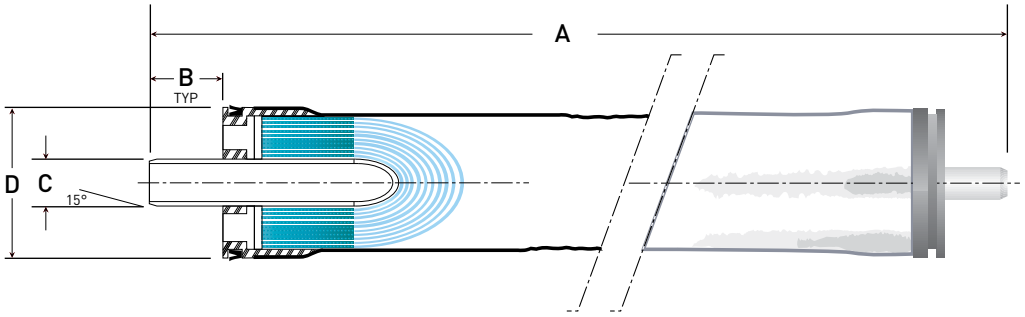
AquaPro® Sea Water RO Membranes

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-Racor/Village Marine Tec. replacement parts.
We reserve the right to change our specifications or standards without notice.

Print Reorder Number 7897 Rev-C 02-17-2016

Parker Village Marine

ENGINEERING YOUR SUCCESS.

Pressure Vessel Assemblies

For Seawater Elements

Contact Information:

Parker Hannifin Corporation
Filtration Group-Parker Village Marine
2630 E. El Presidio Street
Carson, CA 90810

Toll free: 1800 C-Parker
Phone: 310 608 5600
Fax: 310 608 5692
Email sales:
waterpurification@parker.com
Tech support:
watertech@parker.com
www.villagemarine.com
www.parker.com/watermakers

Key Features:

Parker 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

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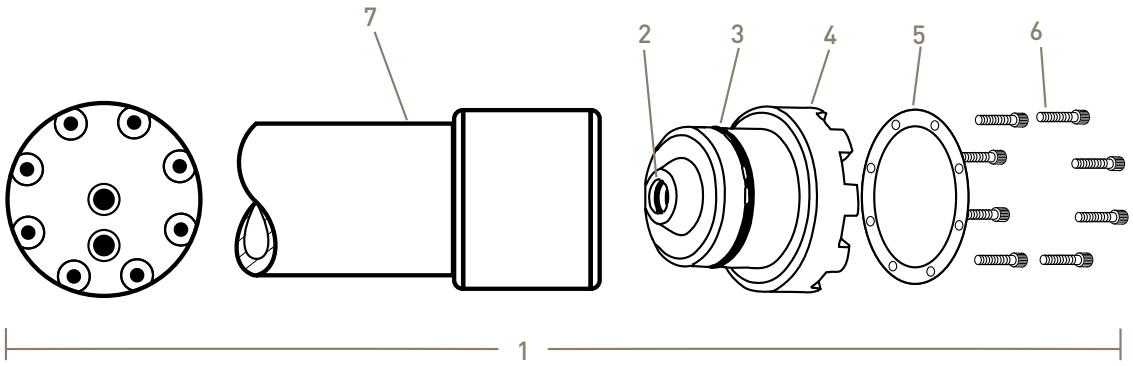
Pressure Vessel Assemblies

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.

Print Reorder Number **7898** Rev-B 02-17-2016

Parker Village Marine

ENGINEERING YOUR SUCCESS.

Pleated Filters and Filter Cartridge Kits

Contact Information:

Parker Hannifin Corporation
Filtration Group-Parker Village Marine
2630 E. El Presidio Street
Carson, CA 90810

Toll free: 1800 C-Parker
Phone: 310 608 5600
Fax: 310 608 5692
Email sales:
waterpurification@parker.com
Tech support:
watertech@parker.com
www.villagemarine.com
www.parker.com/watermakers

The Village Marine Tec. line of pleated filters are designed specifically for the RO watermaker industry and are superior to wound or polyspun cartridges to give you a 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 type of watermaker filter 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 Village Marine

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-Racor/Village Marine Tec. replacement parts.
We reserve the right to change our specifications or standards without notice.

Print Reorder Number 7905 Rev-C 02-17-2016

Parker Village Marine

ENGINEERING YOUR SUCCESS.