



Village Marine-PW 400-2000

Part Number: 95-0025

Pure Water Series

PW 400-2000 GPD

Installation, Operation & Maintenance

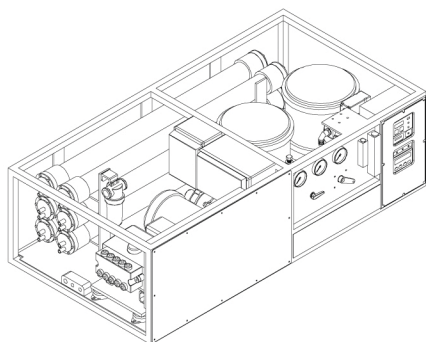
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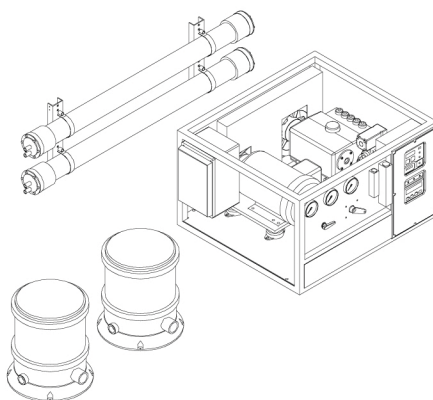
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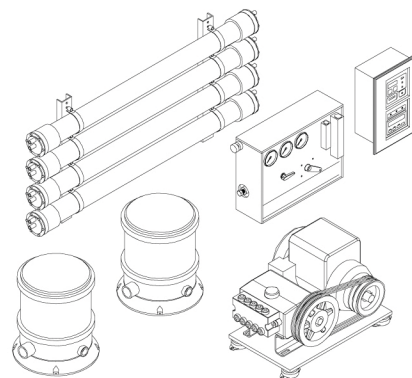
400-2000 GPD



PWF 2000



PWSM 800



PWM 1600

USER GUIDE & REFERENCE MANUAL



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**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):	_____	_____
MAINS VOLTAGE:	_____	_____
FILTER PRESSURE:	_____	_____
AVERAGE AMP DRAW (IF KNOWN):	_____	_____
OPERATING PRESSURE:	_____	_____
PRODUCT WATER FLOW:	_____ (GPH)	_____ (GPH)
REJECT WATER FLOW:	_____ (GPH)	_____ (GPH)
PRODUCT WATER QUALITY:	_____ (ppm)	_____ (ppm)

1.0 INTRODUCTION

SYSTEM DESCRIPTION

Parker Racor - Village Marine Tec's (VMT™) Pure Water watermakers are well-engineered reverse osmosis (RO) systems, designed and built for simple operations and maintenance for the cruising sailor, sport fisherman, or working vessels where space is at a premium. These self-contained AC desalination systems will produce sixteen to eighty-three 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 Pure Water units produce 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 Pure Water 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:



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



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

NOTE: Text specifies useful information.

INTRODUCTION

1.1 UNPACKING AND HANDLING

The Pure Water reverse osmosis units are shipped pre-assembled. There are no special instructions towards unpacking and handling of the watermaker system. Inspect the RO unit to verify it was not damaged in transit. Also, please refer to the plumbing diagram in **Section 9.0: DRAWINGS AND DIAGRAMS** to verify all components for the watermaker are shipped prior to installation. Note some units will be customized with bulkhead mount "Big White" filters. Also when inspecting delivery, check for either manual or automatic flush systems as shown on your order. See figures 2.8 and 2.9. Be sure to mark and record all hose locations for reference, if disconnection of hoses become necessary.



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)
Minimum raw water inlet pressure	Flooded suction pressure
Maximum raw water inlet pressure*	30 psi
Flush water recommended maximum pressure	35 psi
Design RO element pressure	800 psi
Maximum RO element pressure	1000 psi
Maximum feedwater chlorine residual	< 0.1 ppm
Cleaning solution pH range	10-11 (Chemical #1), 2-3 (Chemical #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. PWSM800, or PWM2000) 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 be at 77°F (25°C).
- (3) Seawater salinity at 32,000 parts per million (ppm) total dissolved solids (TDS).

Variation of conditions (environmental, temperature, and frequency of use) and normal aging of the membranes will decrease RO 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 $\pm 15\%$.

1.3 ENVIROMENTAL REQUIREMENTS

Parameter	Specifications
List (Permanent):	15°
Trim (Fore and Aft):	+ 30°
Pitch:	$\pm 10^\circ$ (6 sec cycle)
Roll:	$\pm 30^\circ$ (12 sec cycle)

Table 1.1 - Nominal Operating Conditions

1.4 CONSUMABLES

Table 1.2 lists the consumables required for operation of the RO unit. Use **ONLY** Parker Racor - Village Marine Tec. approved filters and chemicals. Further parts information can be found in section 10.

Description	PW 200-600 VMT P/N.	PW 800-2000 VMT P/N
Chemical Cleaning Kit #1, #2, & #3	90-0562	90-0562
Filter, 5 Micron, 30 sq-ft.*	33-0005	33-0005
Filter, 20 micron, 30 sq-ft.*	NOT APPLICABLE	33-0020
Filter, Carbon, 10 sq-ft.	33-0311	33-0315
Aqua Pro High Pressure Pump Oil	85-0050	85-0050
Kit, Pump Service	70-6184	70-6184

* Optional "Big White" filter housings use smaller filter elements 33-0052 and 33-0053 for 5 and 20 micron, respectively.

Table 1.2 – Parker Racor - VMT Approved Consumables

1.5 MAINTENANCE EQUIPMENT

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

Description	VMT Part No.
Meter, Hand Held, 0-5000 ppm	40-5000
10X Range Extender for Meter	40-5001
Kit, pH Test, 0-14, 10 Strips Kit	90-0135
Solution, Calibration, 300 ppm	90-1300
Solution, Calibration, 30,000 ppm	90-1301
Economy Mini Water Tester, TDS	99-1990

Table 1.3 – Maintenance Equipment Table

INSTALLATION

2.0 INSTALLATION

Parker Racor - Village Marine Tec. recommends **ALL** Pure Water models (as with all other Parker Racor - VMT model RO units) be **INSTALLED BELOW** the vessel's waterline, to ensure a flooded suction intake to the unit.

2.1a TO INSTALL THE PURE WATER UNIT

Parker Racor - 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). Also, the RO unit should be installed **BELOW** waterline (Refer to Figure 2.1). 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 services).

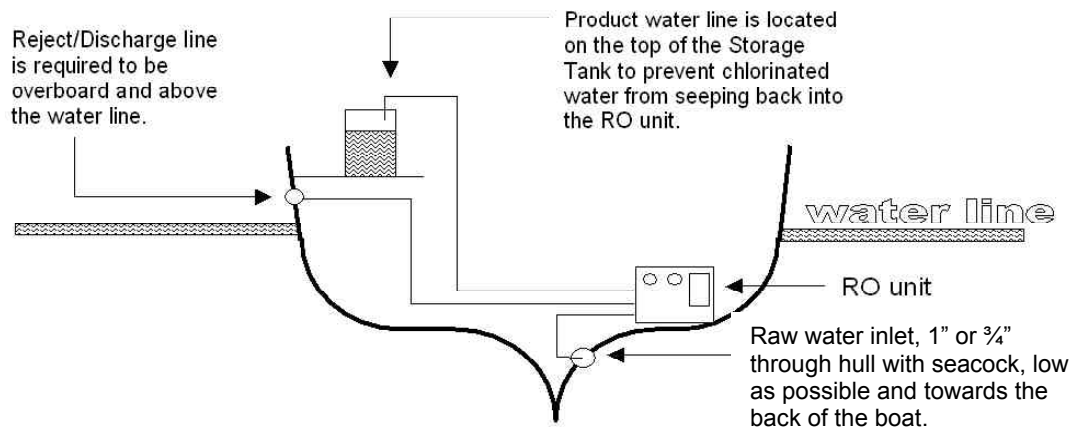


Figure 2.1: Recommended Installation Location - **BELOW** waterline.

If the Pure Water **FRAME** cannot mount below the water line then the boost pump must be mounted separately below water line. This can be very convenient with modular or semi-modular formats where the boost pump is already separate (see Figure 2.2).

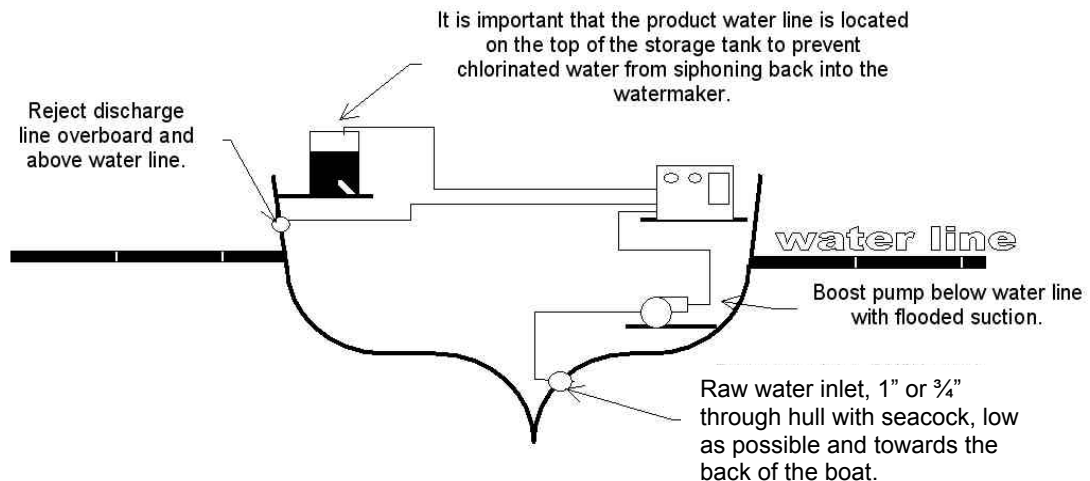


Figure 2.2: Recommended Installation Location - **ABOVE** waterline.

The through-hull should be 3/4" for units up to PW1200 and 1" for PW 1600 and PW 2000. The through-hull must be attached with a ball valve (seacock).

CAUTION

The Pure Water FRAME **SHOULD NOT SHARE** a through-hull feedwater intake. Avoid connecting the inlet piping to any water line which services an engine or other equipment. Air could be drawn through the unit causing damage to the RO unit's pumps, as well as **VOIDING** the RO unit's warranty with Parker Racor - VMT.

Drill a minimum of four mounting holes through the frame and/or mounting base. When drilling, **ALWAYS CHECK** for the drill bit from puncturing/damaging any component of the watermaker and the surrounding mounting area.

2.1b TO CONNECT PLUMBING

Refer to **SECTION 9** for the **EXPANDED** detailed **Pure Water** plumbing diagram for your model. Follow the diagram to mount and connect all components.

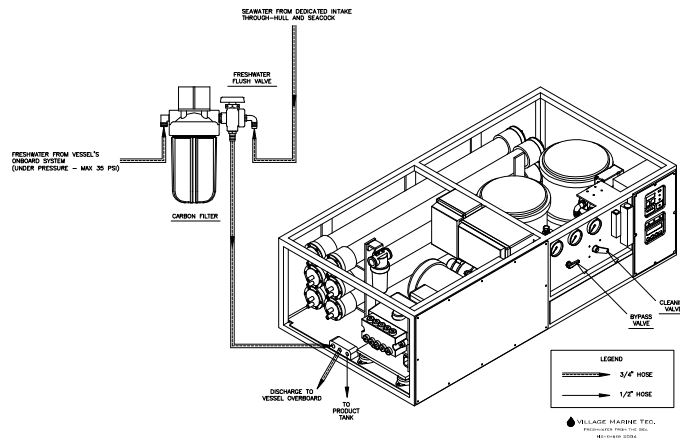


Figure 2.3: Pure Water FRAME Plumbing Diagram.

Refer to Figures 2.4 and 2.5 for the manifold identification.

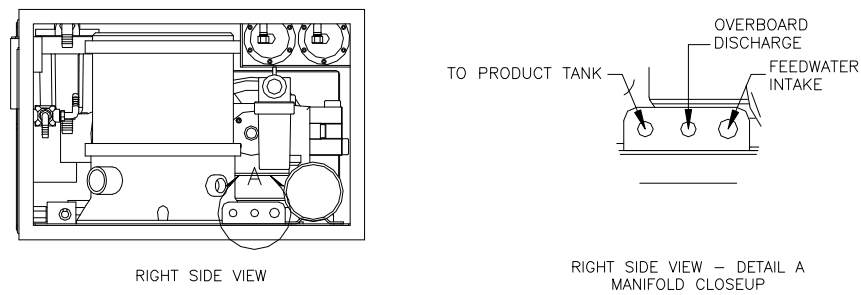


Figure 2.4: Pure Water FRAME (200-400) Manifold – Right View.

INSTALLATION

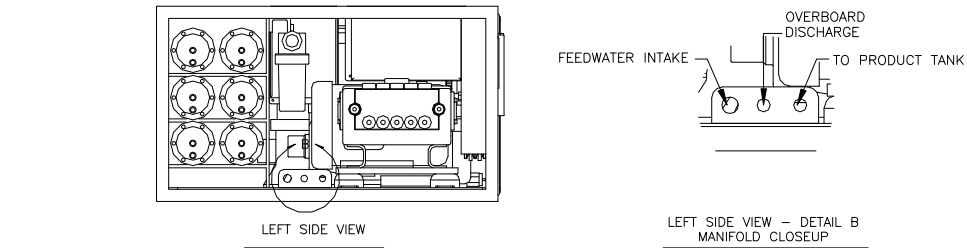


Figure 2.5: Pure Water FRAME (PWF600-PWF2000) Manifold – Left View.

FEEDWATER INTAKE AND FRESH WATER FLUSH

Units with **MANUAL** Freshwater Flush Assembly:

Mount the three-way manual Freshwater Flush Valve Assembly (attached to the Carbon Filter Housing) **BELOW** waterline. Refer to Figure 2.6 for views of the Carbon Filter and Freshwater Flush Valve.

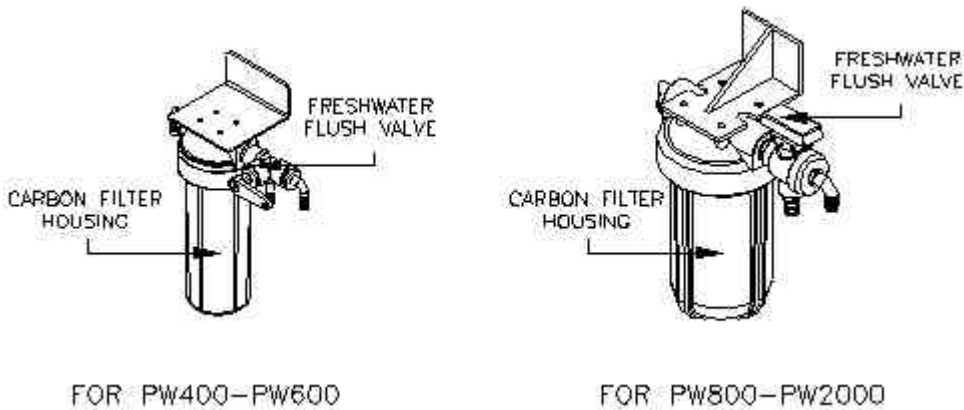


Figure 2.6: Carbon Filters with Freshwater Flush Valves – Isometric Views.

NOTE:

Parker Racor - 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 if it is difficult to get the filter housing that low. A hose can be plumbed to the filter housing from the valve, so the feedwater path does not go above waterline to avoid trapping air and creating a priming problem. See Figure 2.7.

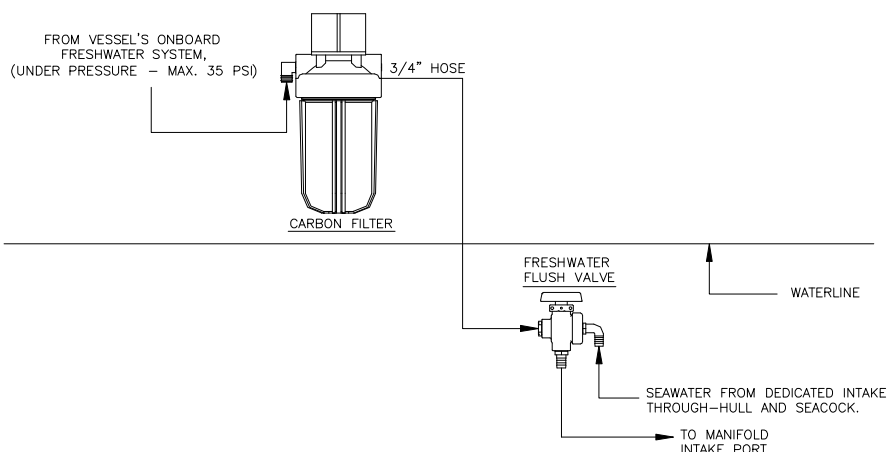


Figure 2.7: Separated Freshwater Flush Valve for ABOVE Waterline Connection.

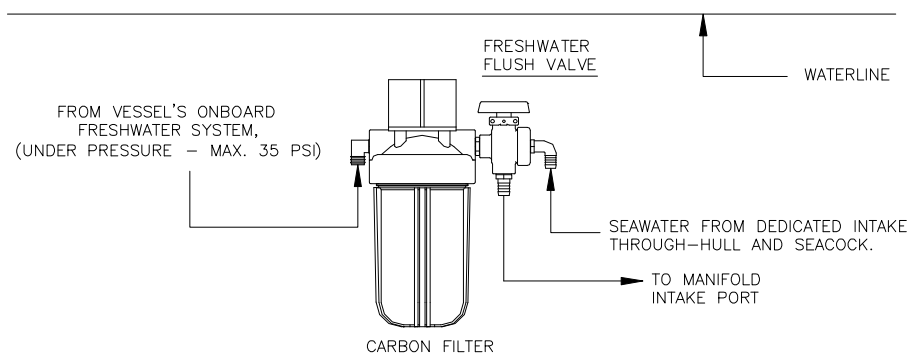


Figure 2.8: Manual Freshwater Flush Standard Configuration With Valve Connected.

Units with **AUTOMATIC** Freshwater Flush Assembly:

Mount the check valve component of the Automatic Freshwater Flush Valve Assembly **BELOW** waterline. Refer to Figures 2.9, 2.10 and 2.11 for views of the Carbon Filter and the Freshwater Flush Solenoid Valve.

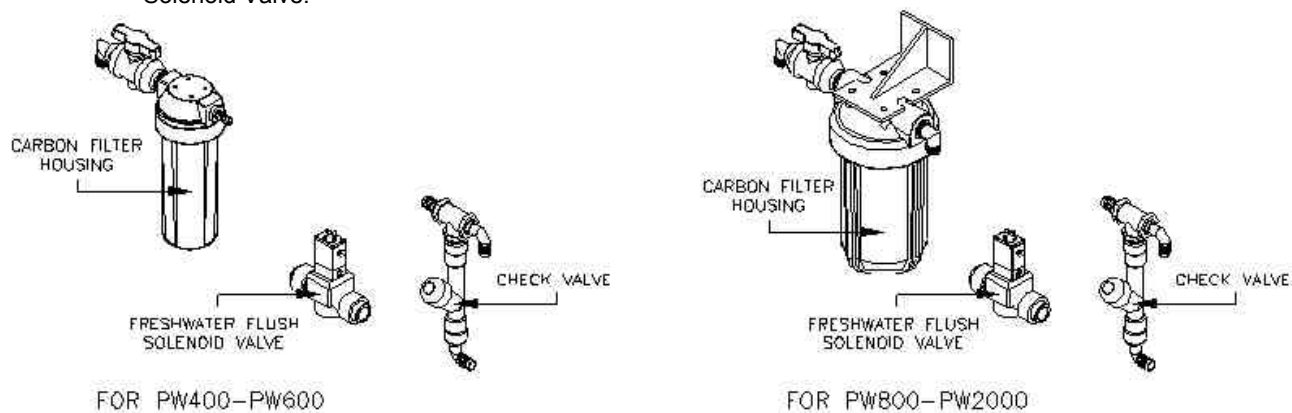


Figure 2.9: Carbon Filters with Freshwater Flush Solenoid Valves – Isometric Views.

INSTALLATION

Refer to Figures 2.10 or 2.11 for a diagram of the Automatic Freshwater Flush Assembly.

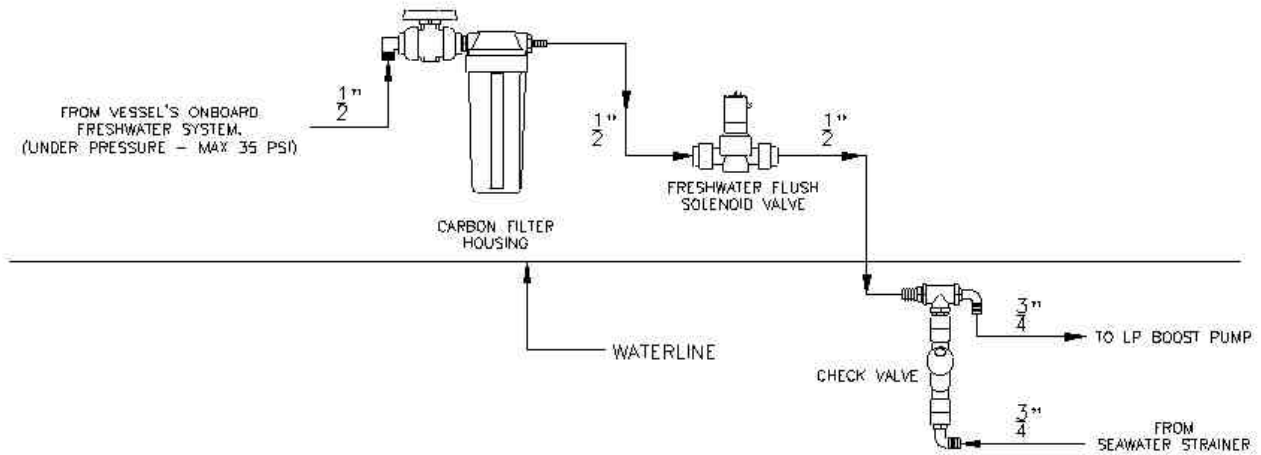


Figure 2.10: Typical Automatic Freshwater Flush Valve Assembly (PW400-PW600) Diagram.

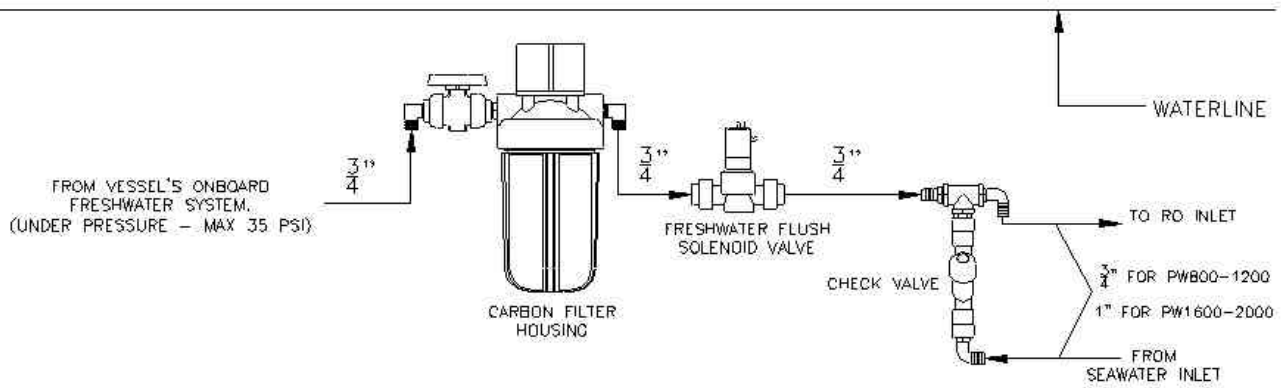


Figure 2.11 Automatic Freshwater Flush Valve Assembly Diagram for PW800-PW2000.

BRINE DISCHARGE

Locate a convenient spot in the boat to install an overboard through-hull. Discharge line is required to be **ABOVE** waterline (Refer to Figures 2.1, 2.12, 2.13 and 2.14).

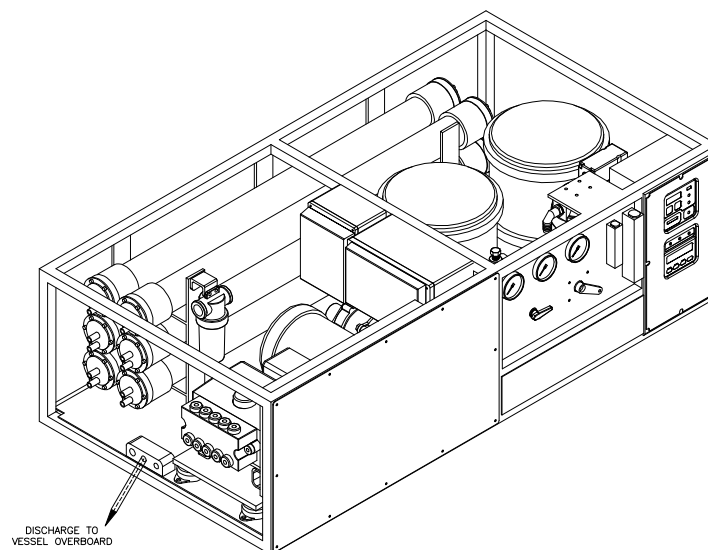


Figure 2.12: PURE WATER Brine Connection Overboard.

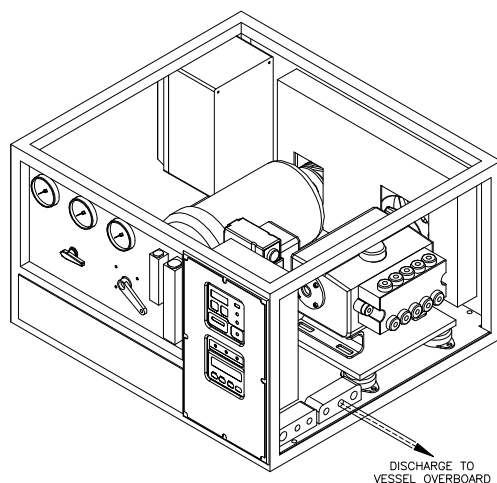


Figure 2.13: Pure Water SEMI-MODULAR Brine Connection Overboard.

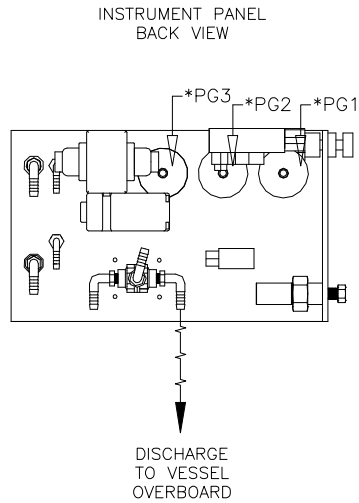


Figure 2.14: Pure Water MODULAR Brine Connection Overboard.

PRODUCT WATER

The product water hose line must go into the top of the product tank to prevent any possible back flow. Parker Racor - Village Marine Tec. recommends teeing into the tank fill line. Teeing into the tank vent line is possible if the vent is sufficient diameter to let air out of the tank while filling. See Figures 2.15, 2.16 and 2.17.

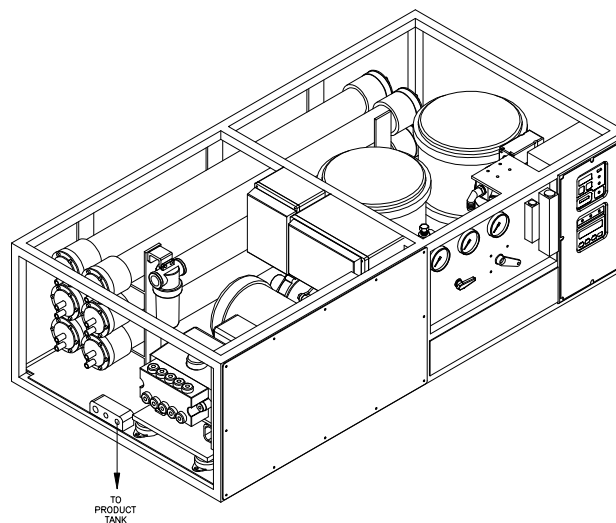


Figure 2.15: PURE WATER Product Water Hose Connection.

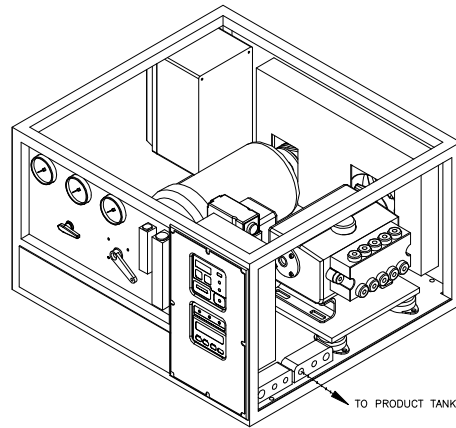


Figure 2.16: Pure Water SEMI-MODULAR Product Water Hose Connection.

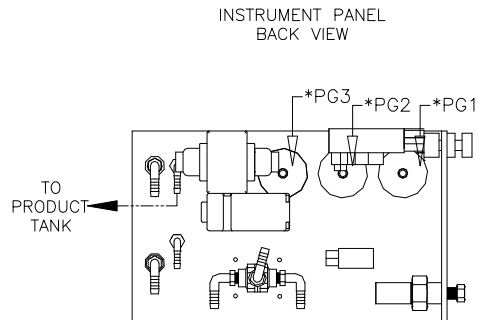


Figure 2.17: Pure Water MODULAR Product Water Hose Connection.

2.1c 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 CIRCUIT BREAKER.**

Verify all power switches and power sources are in the **OFF** position before any connection. Carefully check the power supply volts, phase and hertz on the PW serial number tag to be sure of the requirement. The PW unit comes with temporary power supply wires that we have used for testing. Connect the permanent power supply in the same way in appropriate cable or conduit.

NOTE: To protect the equipment, Parker Racor - VMT recommends use of a fuse or circuit breaker selected with a rating at least 150% of the normal operating current amp draw as listed on the RO's serial number tag.

Refer to **Section 9.0: DRAWINGS AND DIAGRAMS** for electrical schematics and wiring diagrams of the **PURE WATER**.

GENERAL THEORY

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 is 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.

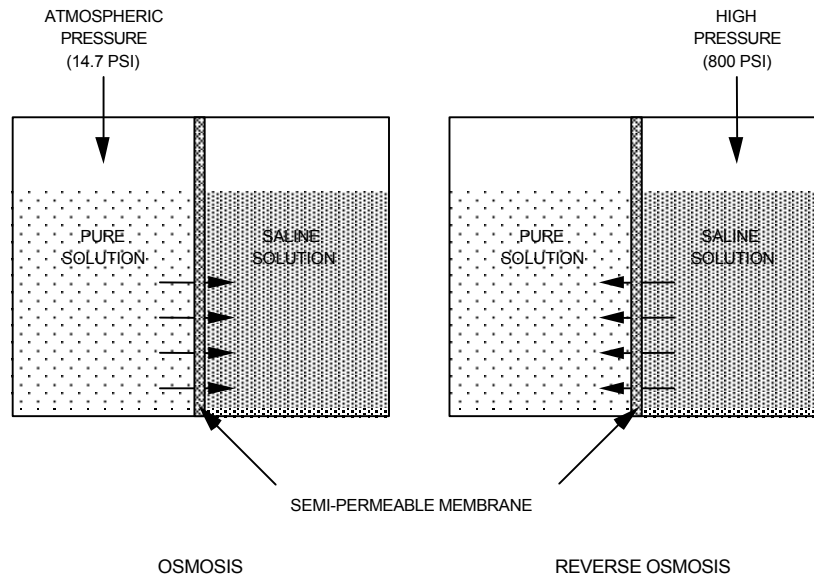


Figure 3.0 - Simple (Reverse) Osmosis Process.

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%.

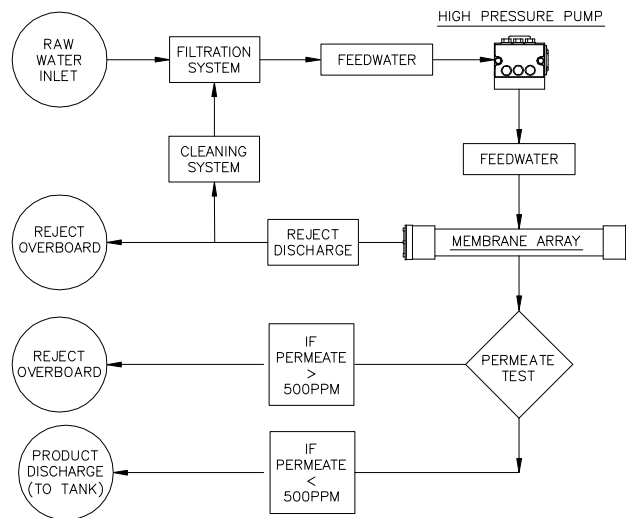


Figure 3.1: Simplified Schematic of an RO System.

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
Chlorine	250 (per USPHS 1962)
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.

GENERAL THEORY

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

* If the feedwater salt concentration decreases, the product water flow rate should not be allowed to increase more than 20% above rated flow. Feed pressure may need to be lowered to maintain rated flow in brackish water or tap water applications.

** Feed pressure shall not be increased above 950 psi.

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 raw 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 true system output under standard conditions (25°C).

Example:

Raw water temp: 15°C
 TCF: 1.47
 Actual product flow: 22.7 (gph)
 Calculation: $22.7 \times 1.47 = 33.369$ (gph)
 Corrected product flow: 33 (gph)
 Adjusted to 75° (This is the normal flow for a PW 800)

°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

GENERAL THEORY

3.5 OPERATIONAL DESCRIPTION

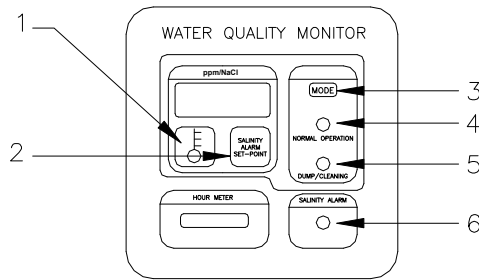


Figure 3.2: Water Quality Monitor - Panel View.

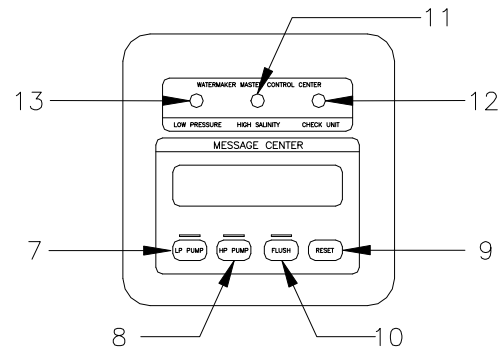


Figure 3.3: Master Control Center - Panel View.

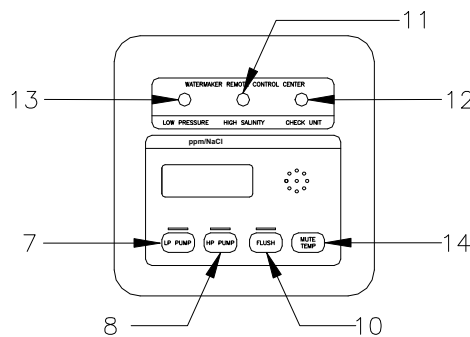


Figure 3.4: Optional Remote Control Center - Panel View.

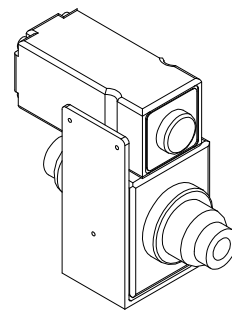


Figure 3.5: Product Solenoid Valve.

PRODUCT WATER MONITORING SYSTEM

The product water (or permeate) flows past a conductivity sensor which provides a signal to the water quality monitor. Depending on the concentration of total of dissolved solids (TDS) in the permeate, the following occurs:

If the permeate TDS is detected **AT GREATER** than 500 parts per million (ppm), indicating **POOR** quality water), a signal is sent from the water quality monitor (Figure 3.2), to the product diversion valve (Figure 3.5) to reroute the (high salinity) water away from your water storage tank(s) and into the reject stream.

If the permeate TDS has **LESS** than 500 ppm, indicating **GOOD** (drinking) water, a signal is sent to the product diversion valve to redirect the good permeate through the product flowmeter and finally into your water storage tank(s).

MASTER CONTROL CENTER

The Master Control Center (MCC) provides centralized control and monitoring of all important unit functions and operating parameters (Figure 3.3). This is achieved through the use of a fully integrated package of control pushbuttons and alarm/status lights, as well as an easy to read Message Display console.

REMOTE CONTROL CENTER (OPTIONAL)

Installed as an option, the Remote Control Center (RCC) provides remote control and monitoring of all important unit functions and operating parameters (Figure 3.4) from a remote location. The RCC has a similar configuration as the MCC with the exception of the Message Center and Reset Pushbutton.

PUSHBUTTON AND DISPLAY DESCRIPTIONS

Refer to the numerical callouts of Figures 3.2-3.5 for reference of the following pushbutton and displays explanation of the Water Quality Monitor, Master Control Center, and Remote Control Center panels.

WATER QUALITY MONITOR (WQM)

- (1) **TEMPERATURE**
Allows the operator to display permeate temperature (as opposed to the normal permeate salinity display). By adjusting the jumper on the back of the monitor, the temperature can be displayed in Fahrenheit (°F) or Celsius (°C).
- (2) **SALINITY ALARM SET POINT**
Allows the operator to display and change (via a control knob located on the back panel of the monitor), the salinity alarm set point.
- (3) **MODE**
Allows the operator to bypass the normal automatic operation and manually de-energize (dump) the product valve for product directed overboard with the reject.
- (4) **NORMAL OPERATION**
An illuminated green light activates when the product valve is energized and product water is flowing through the product valve.
- (5) **DUMP/CLEANING**
An illuminated yellow light activates when the product valve is de-energized and the product valve is directing permeate to the reject line.
- (6) **SALINITY ALARM**
An illuminated red light indicates product water quality is above the WQM salinity set point.

MASTER CONTROL CENTER (MCC) AND REMOTE CONTROL CENTER (RCC)

- (7) **LP PUMP** (Low Pressure Pump)
Controls the operation (ON/OFF) of the low pressure boost pump and energizes a light indicating when the pump is operating. When only the LP boost pump is running, it signals the MCC to display the message “**LP PUMP ON**”.
- (8) **HP PUMP** (High Pressure Pump)
Controls the operation (ON/OFF) of the HP pump and energizes a light indicating when the pump is operating. When only the HP pump is running, it signals the MCC to display the message “**HP PUMP ON**”.
- (9) **FLUSH**
Opens the automatic flush valve, if equipped. Also, activates an internal timer that will automatically run the LP and HP pumps for two minutes. Completion of each successful flush cycle will be recorded on the flush counter. After fifty flushes, the flush filter will signal the MCC to display a “**CHANGE FLUSH FILTER**” message.
- (10) **RESET**
Pressing this pushbutton will either reset any counter displayed or stop all active system alarms and begin a system alarm self-test. This self-test verifies that all visual alarms (WQM and MCC) and audible alarms (for RO systems with the Remote Control Center) are fully operable.
- (11) **HIGH SALINITY**
When the water monitor detects high saltwater content, a signal is sent to the MCC and the message “**CHECK PRODUCT WATER**” is displayed. Additionally, the MCC illuminates the “**HIGH SALINITY**” light.

- NOTE:** The automatic display feature is intended to provide general guidance concerning membrane cleaning frequency only. Actual membrane cleaning frequency will vary in response to changes in the seawater conditions. Refer to Section 3.4 for specific information regarding how to determine actual cleaning frequencies.

MESSAGE CENTER DISPLAY	ACTION
STANDBY MODE	Unit is in preparation for use
LP PUMP ONLY	Low Pressure Boost Pump running (only)
HP PUMP ONLY	High Pressure pump running (only) NO LP PUMP running
RO MODE	BOTH low and high pressure pumps OPERATING .
FLUSH	Perform Freshwater Flush
0>>>>>>>>>>>> 2	Automatic timer countdown of Freshwater Flush
CHECK PRODUCT WATER	High salt content
CHANGE HP PUMP OIL	Replace oil after each 500 hours of use*
CLEAN MEMBRANES	Clean membranes every 2000 hours of use**
CHANGE FLUSH FILTER	Replace filter after every 50 Freshwater flushes***

- * **Oil Changes:**
The first oil change required is after the first 50 hours of use on the RO unit. The Master Control Center continuously monitors and records the total operated hours of the high pressure pump and will automatically indicate when the pump needs an oil change. Pressing the **RESET** pushbutton will reset this counter. When the counter reaches 500 hours, the MCC illuminates the “**CHECK UNIT**” light.
- ** **Membrane Cleaning:**
The MCC illuminates the “**CHECK UNIT**” light when the counter reaches 2000 hours. This feature is an indication only to clean membranes and should be verified by calculating the temperature-corrected product flow. For more information please refer to **Section 5.0: MAINTENANCE**. Pressing the **RESET** pushbutton will reset this counter.
- *** **Change Flush Filter:**
The MCC continuously monitors and records the number of freshwater flush cycles performed. After 50 flushes, the flush filter will signal the MCC displaying “**CHANGE FLUSH FILTER**” message. Pressing the **RESET** pushbutton will reset this counter. Also, the MCC illuminates the “**CHECK UNIT**” light.

3.6 CONTROLS AND INSTRUMENTATION

The following table provides a brief description of each individual component along with an explanation of its function. It is intended as a supplement to the more detailed information contained in **Section 9.0: DRAWINGS AND DIAGRAMS**, drawing #13710.

CALL OUT	DESCRIPTION	FUNCTION
F1 ⁽¹⁾	20 Micron Pre-filter	Filters all particles ≥ 20 microns in diameter.
F2 ⁽¹⁾	5 Micron Pre-filter	Filters all particles ≥ 5 microns in diameter.
CTS ⁽⁴⁾	Cyclone Turbidity Separator	Removes particles with a specific gravity of ≥ 2.7 and a diameter of ≥ 6 microns.
FLUSH ⁽²⁾	Fresh Water Flush Button	Controls HP Pump and Fresh Water Flush Valve operation during the 2 minute flush cycle.
FM1	Reject Water Flow Meter	Indicates the rate of reject water (i.e. feed water not converted into fresh) discharged from the RO unit.
FM2	Product Water Flow Meter	Indicates the rate of fresh water production by the RO unit.
HP PUMP	HP Pump Start/Stop Button	Provides operational control of the HP Pump.
LP PUMP	LP Boost Pump Start/Stop Button	Provides operational control of the Low Pressure (LP) Boost Pump.
MON	Water Quality Monitor	See Section 3.5 for detailed description.
MC2	HP Pump Magnetic Starter	Energizes HP pump.
P1	Low Pressure (LP) Boost Pump	Pressurizes raw water to provide adequate suction pressure to the High Pressure Pump.
P2	High Pressure (HP) Pump	Pressurizes feed water to supply the membrane array at high pressure.
PG1	Vacuum and Pressure Gauge	Indicates filter array discharge pressure.
PG2	High Pressure Gauge	Indicates membrane array (brine side) discharge pressure.
PG3 ⁽³⁾	Product Water Discharge Pressure	Indicates product water discharge pressure.
PG-CTS ⁽⁴⁾	Cyclone Separator Feed Pressure	Indicates Cyclone Separator supply pressure.

GENERAL THEORY

PS1	Low Pressure Switch	Will initiate warning message "Check Filtration" when HP Pump inlet pressure is less than 0 psi.
RESET	Alarm Reset	Resets system alarms.
SR1	Product Conductivity Sensor Probe	Provides conductivity signal to water monitor (MON).
ST	Raw Water Strainer	Removes large particulate matter from the raw water stream to prevent system fouling.
V1	HP Bypass Valve	Allows operator to bypass the HP Regulating Valve during start-up, shutdown and cleaning.
V2	Cleaning Valve	Used to re-circulate the brine during cleaning and preservation procedures.
V3	HP Regulating Valve	Maintains and controls system back pressure.
V4	Product Diversion Valve	Based on its salinity, directs permeate to either the potable water tank(s) or to drain.
V5	Filter Bleed Check Valve	Prevents reject flow from back flowing through the filter housings into the feed water stream.
V6 ⁽³⁾	Product Water Relief Valve	Relieves product water pressure when Product Diversion Valve is shut. Factory set at 35 to 40 psi.
V7 ⁽⁴⁾	Cyclone Valve	Controls the differential pressure across the cyclone separator (20 psi minimum)

(1) For Models PW400-600, F1 is a 5 Micron Pre-filter and F2 is not used.

(2) Operator initiated automatic fresh water flush is optional.

(3) For Models PW400-600, not included

(4) For units equipped with (optional) Cyclone Separator installation.

Table 3.4: Instrumentation and Controls

4.0 OPERATION

4.1 TO START THE PURE WATER UNITS

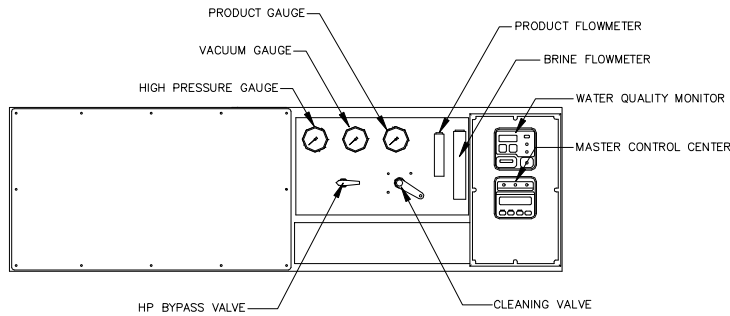


Figure 4.1: Pure Water FRAME - Instrument Detail.

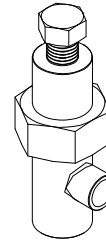


Figure 4.2: Pressure Regulator Valve

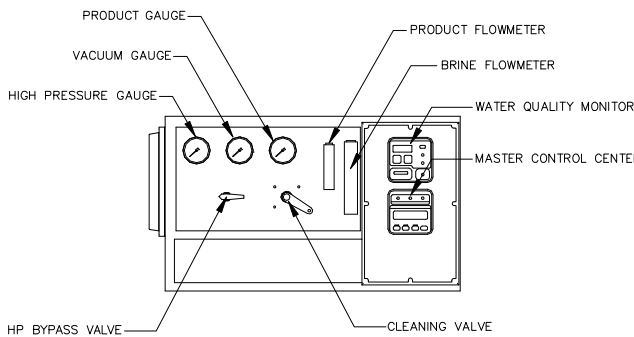


Figure 4.3: Pure Water SEMI-MODULAR - Instrument Detail.

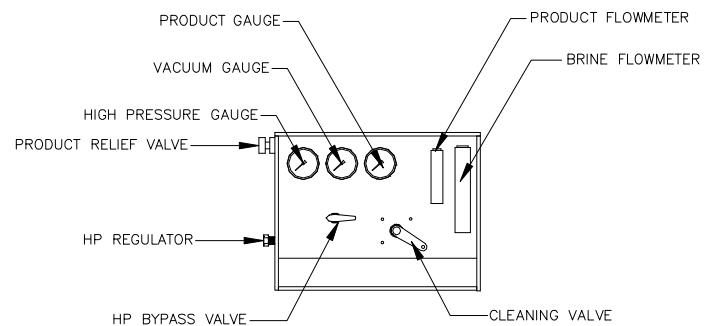


Figure 4.4: Pure Water MODULAR - Instrument Detail.

- Step 1:** Refer to instrument details in Figures 4.1-4.4. Turn High Pressure Bypass Valve (Black Valve) to **CLEANING POSITION**, counterclockwise. Verify the Cleaning Valve (Gray Valve) is positioned to **NORMAL** discharge. On manual flush units, check the gray Freshwater Flush Valve is positioned for seawater intake, **NOT** freshwater.
- Step 2:** Verify the seawater intake is open at the through-hull. This allows the feed seawater to flow into the unit.
- Step 3:** Switch **ON** the breaker at main breaker panel to power up unit. The master controller should now display **STANDBY**.
- Step 4:** Start the Low Pressure Boost Pump by pressing the **LP PUMP** pushbutton located on the Master Control Center (or on the Remote Control Center). Refer to Figures 3.2 and 3.4. Verify the Vacuum Gauge shows positive pressure, normally 10 to 15 psi.
- Step 5:** Start the High Pressure Pump by pressing the **HP PUMP** pushbutton located on the Master Control Center panel (or on the Remote Control Center). Refer to Figures 3.2 and 3.4. Verify the Vacuum Pressure Gauge reads more than zero (0 psi).
- Step 6:** Upon 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 7:** Observe the Brine Flowmeter, ensuring all air and bubbles have passed through the RO before proceeding to next step.
- Step 8:** Gradually turn the High Pressure Bypass Valve (Black Valve) to **NORMAL/RO** position. The pressure gauge should steadily rise to a reading of 800 psi.

OPERATION

NOTE: When the High Pressure Bypass valve is closed, the salinity of the initial permeate produced will be relatively high and will probably be enough to activate the salinity alarm. Salinity will reduce in 3-5 minutes.

Step 9: Observe the system pressure on the High Pressure Gauge. During RO production, the indicated pressure should be at 800 psi. If the pressure reading is not at 800 psi, adjust the nut on top of the pressure regulator valve (Refer to Figure 4.2) using a wrench until the reading reaches 800 psi.

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 pressure production should **NEVER EXCEED 950 psi**, doing so risks damage to RO unit which would **VOID** factory warranty.

NOTE: At initial start-up of RO unit, PRESS **DUMP** on the Water Quality Monitor to keep the product water diverted from the water storage tank. IF the unit is filled with preservative storage solution, water must be diverted **AT LEAST 10 MINUTES** to clear preservative solution from system.

Step 10: Check the RO unit for water leakage periodically at the initial start-up. Observe Product Flow meter. Record the operating data after 3 and 24 hours of operation (use the startup sheet provided on page V).

NOTE: **For Remote Control Operation:**
The initial start-up procedure must be followed **FIRST** prior to use of remote. Once initial start-up steps are performed, the necessary valve (HP Bypass Valve and Freshwater Flush Valve) positions would be set. Subsequent starts/stops can be controlled from the remote, if equipped, by leaving the black Bypass Valve closed all the time.

4.2 **TO SHUT DOWN UNIT**

Step 1: Turn the High Pressure Bypass Valve (Black Valve) to **CLEANING POSITION** while the RO unit is running. This will release the high pressure within the RO system.

Master Control Center (or via Remote Control Center)

Step 2: Press the **HP PUMP** pushbutton to stop the High Pressure Pump.

Master Control Center (or via Remote Control Center)

Step 3: Press the **LP PUMP** pushbutton to stop the Low Pressure Pump.

Step 4: Then turn switch **OFF** on your breaker at the main breaker panel.

The RO unit may be left in this "stand by" condition with the seawater for one or two days. If the RO unit will be out of service for extended time periods, please refer to the Maintenance section of this manual for flushing or preservation procedures.

5.0 MAINTENANCE

The service life of most system equipment is directly related to proper maintenance and to the raw water inlet conditions. Improper maintenance will reduce the life expectancy of the major unit components (such as the membranes, filters and pumps) as well as the reliability of the unit as a whole. Under normal conditions a reverse osmosis membrane (which is the major consumable item) should have an effective service life somewhere between 3 and 5 years.

	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually	As Required	Labor Hours (approximate)
Clean/inspect micron prefilter			•					0.5
Replace filter(s)* based on pressure drop							•	0.5
Replace carbon flush filter						•		0.5
Clean membranes							•	2.0
Replace Membranes							•	3.0
Check pump oil level			•					0.1
Change pump oil**						•		0.5

Table 5.1: Maintenance Task Chart.

* Parker Racor - 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

The watermaker performs optimally when 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 (non-saltwater), leaving less chance of fouling the membranes. The freshwater flush procedure should be used when the unit will be placed idle or in "stand by" condition for more than one or two days. 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 TO CONSUME THE CHLORINE THAT MAY BE PRESENT FROM THE DOCK WATER.

MAINTENANCE

5.1 TO FLUSH THE PURE WATER UNIT

Step 1:

For Units with Manual Freshwater Flush Valve Assembly:

Turn **ON** your water pressure and watermaker breakers on main electrical panel. 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. Turn the Flush valve to freshwater position to start flow through the unit.

For Units with Automatic Freshwater Flush Valve Assembly:

Verify the gray Cleaning Valve is positioned to **NORMAL/REVERSE OSMOSIS** position. Verify the isolation valve before the carbon filter is open.

Step 2:

Verify the freshwater supply pressure on the Vacuum/Pressure Gauge of micron filter assembly (Refer to Figures 4.1, 4.3, 4.4) does not exceed 35 psi. If it does, install a regulator in the fresh water supply branch.

Step 3:

Press the **FLUSH** pushbutton located on the Master Control Center on the electronic instrument panel (or the Remote Control Center, if equipped). This will automatically begin the freshwater flush cycle within the RO system. The electronic flush will automatically start the Low Pressure Boost Pump, then the High Pressure Pump, and begin the flushing process for a period of two minutes. Discharge overboard should be visible during flush.

After flushing the unit for two minutes, the High Pressure Pump and Low Pressure Pump will shutdown respectively. A confirmation of completion of the Freshwater Flush is displayed on the Master Control Center, reading STANDBY.

Step 4:

For Units with Manual Freshwater Flush Valve Assembly:

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

For Units with Automatic Freshwater Flush Valve Assembly:

Leave RO unit in standing condition, for up to three weeks. Then reflush or preserve.

5.2 MEMBRANE CLEANING

This section is to guide the operator in the periodic chemical cleaning of the RO membrane elements used in the PW400-PW2000 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 must be performed with freshwater to optimize performance of cleaning process.

NOTE: You should allow your unit's product water to run with product to DUMP for the first 10 minutes after cleaning or upon startup after preservation.

Description	PW400-600	PW800-2000
Cleaning Chemical #1	1 cup	2 cups
Cleaning Chemical #2	3/4 cup	1-1/2 cups
Preservative Chemical #3	1/6 cup	1/3 cup

Table 5.2: 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.

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

5.4 WHEN TO CLEAN

The RO unit must be chemically cleaned when the temperature corrected product water output drops below 80% of original production. The frequency of this occurring will vary greatly upon feed water. Fouling odor also may occur without proper cleaning of the membranes.

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.

MAINTENANCE

STEPS FOR CHEMICAL CLEANING #1: HIGH pH CLEANER

- Step 1: Freshwater Flush the watermaker so it is filled with fresh water, NOT seawater. To flush the **Pure Water**, refer to instructions in **Section 5.1: TO FLUSH THE PURE WATER UNIT**.
- Step 2: Dissolve the appropriate amount of Cleaning Chemical #1 (see Table 5.2) in one gallon of freshwater. Verify the chemical is completely dissolved (use warm water if necessary).
- Step 3: Verify that the (black) High Pressure Bypass Valve is in the **CLEANING** (open) position.
- Step 4: Place the (gray) cleaning valve in the **CLEANING** position.
- Step 5: Remove the prefilter elements from the prefilter tank(s) and replace one with a dedicated cleaning filter (5 micron). The operational filters can be returned to service when the cleaning is finished. Pour the chemical solution into the tanks, and reinstall the lids. Top up the filter housings with fresh water if necessary.

REMINDER: **One** prefilter housing for PW400-PW600 and **two** prefilter housings for PW800-PW2000.

- Step 6: Start the Low Pressure Boost Pump by pressing the **LP PUMP** pushbutton located on the Master Control Center (or on the Remote Control Center). Refer to Figures 3.2 and 3.4.
- Step 7: Start the High Pressure Pump by pressing the **HP PUMP** pushbutton located on the Master Control Center panel (or on the Remote Control Center). Refer to Figures 3.2 and 3.4. Verify the Vacuum Pressure Gauge reads more than zero (0 psi). Temporarily opening the flush valve can assist in building cleaning loop pressure.
- Step 8: After the chemical solution circulated through the RO for 3 minutes, shutdown the HP PUMP and LP PUMP, respectively.
- a) Remove the lid to the filter tank and manually sample the filter water. Measure the pH level of the sample using test kit #90-0135.
 - b) If the pH is LESS than 11, add Cleaning Chemical #1 to raise pH level. Repeat these steps until pH level is 11.
 - c) Once a pH level of 11 is achieved, re-secure the prefilter tank lid. Start the LP PUMP and HP PUMP respectively and allow the cleaning solution to circulate for an additional 30-40 minutes.
- Step 9: Shutdown the HP PUMP and LP PUMP, respectively.
- Step 10: Place the (gray) cleaning valve in **NORMAL** flow position.
- Step 11: Start the LP PUMP and HP PUMP respectively. Allow both pumps to run for 5 additional minutes to flush the chemical solution from the RO.

STEPS FOR CHEMICAL CLEANING #2: LOW pH CLEANER

- Step 12: Freshwater Flush the watermaker so it is filled with fresh water, NOT seawater. To flush the **Pure Water**, refer to instructions in **Section 5.1: TO FLUSH THE PURE WATER UNIT**.
- Step 13: Repeat steps 2 through 11 with chemical #2. In step 8, add chemical until a pH of 3 or less is achieved.
- Step 14: Remove and replace the prefilter(s) with the operational filters. Store the cleaning prefilter for future use. Start the watermaker as per section 4.1 and record operational data to determine effectiveness of cleaning cycle.

5.5 LONG TERM STORAGE / PRESERVATION PROCEDURE

During periods when the RO unit is to be shut down for an extended period of time, it is necessary to re-flush the unit every three weeks OR to circulate a preservative solution through the membrane to prevent the growth of biological organisms. Use the following procedure to preserve the RO elements:

NOTE: You should allow your unit's product water to run to drain for the first 10 minutes after cleaning or upon startup after preservation. Use the **MODE** button (see figures 3.2 and 3.4) to light the **DUMP** lamp and divert product to drain.

5.6 STEPS FOR PRESERVATION CHEMICAL #3

Step 1: Freshwater Flush the watermaker so it is filled **with fresh water**, **NOT** seawater. To flush the **Pure Water**, refer to instructions in **Section 5.1: TO FLUSH THE PURE WATER UNIT**.

Step 2: Dissolve the appropriate amount of Cleaning Chemical #3 (see Table 5.2) in one gallon of freshwater. Verify the chemical is completely dissolved (use warm water if necessary).



CAUTION

PRESERVATIVE CHEMICAL #3 IS A FOOD GRADE PRESERVATIVE. SEE WARNING LABEL ON SIDE OF PACKAGE AND ADHERE TO ALL SAFETY PRECAUTIONS ON LABEL.

Step 3: Verify that the (black) High Pressure Bypass Valve is in the **CLEANING** open position.

Step 4: Place the (gray) cleaning valve in the **CLEANING** position.

Step 5: Remove one of the prefilter housing lids and pour in the preservative solution prepared in Step #3.

Step 6: Start the Low Pressure Boost Pump by pressing the **LP PUMP** pushbutton located on the Master Control Center (or on the Remote Control Center). Refer to Figures 3.2 and 3.4.

Step 7: Start the High Pressure Pump by pressing the **HP PUMP** pushbutton located on the Master Control Center panel (or on the Remote Control Center). Refer to Figures 3.2 and 3.4. Verify the Vacuum Pressure Gauge reads more than zero (0 psi). Temporarily opening the flush valve will assist in building up pressure in the preserving loop.

Step 8: Allow the RO to run for than 10 minutes to allow the chemical solution to circulate through the RO.

Step 9: Shutdown the HP PUMP and LP PUMP, respectively.

Step 10: The system is properly conditioned and may be left idle for an extended period of time. This preservation procedure should be repeated at least every 3 months in tropical climates during the shutdown. In colder climates the interval between preservation cycles may be extended to 6 months. Be sure to flush out old preservative before adding new.

MAINTENANCE

5.7 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: MANUFACTURER'S LITERATURE** at the back of this manual.

 CAUTION

DO NOT RUN PUMP WITHOUT OIL IN THE CRANKCASE.

NOTE:

Prior to the oil change, it **MAY** facilitate the oil replacement process by running the RO unit to heat the oil. Heating the oil reduces the viscosity allowing it to be more fluid to travel through the drain tube.

THE PURE WATER UNIT OIL CHANGE PROCEDURE

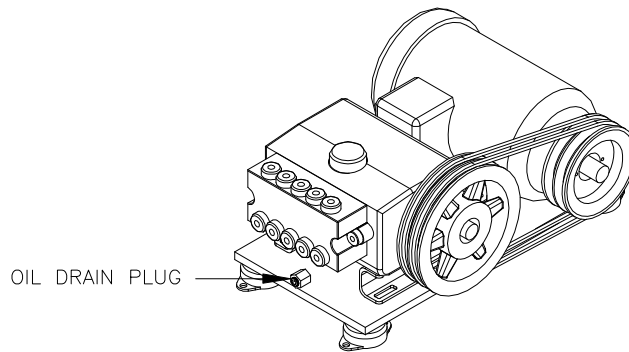


Figure 5.1: PURE WATER HP Pump and Motor.

- Step 1:** Before changing the oil, obtain a container (i.e. a small tray or catch basin) to collect the oil drainage.
- Step 2:** Remove the oil plug (Refer to Figure 5.1) and direct the oil to a catch basin or bottle. Allow the oil to drain empty.
- Step 3:** Reconnect the oil plug. Then unscrew the oil cap and refill oil (approximately one quart) to fill line (located on hp pump sight glass). Check for leaks and re-secure oil cap.

5.8 RO MOTOR LUBRICATION

NOTE: Motors should be re-lubricated at least once a year.

Step 1: Locate the grease fittings on the motor (Refer to Figure 5.2). Use a clean cloth to wipe fittings clean.

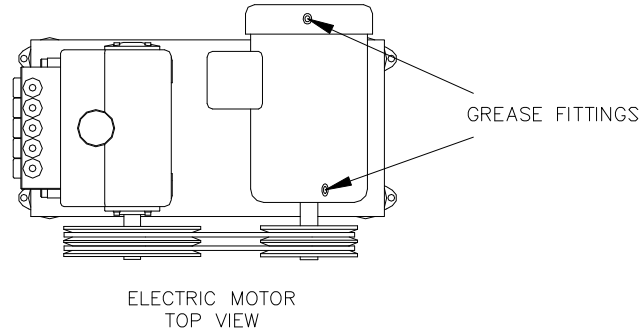


Figure 5.2: Electric Motor - Grease Fitting Locations.

Step 2: Add 2-3 strokes of grease using a low pressure grease gun (see Table 5.3 for grease type). Filling grease too quickly can cause untimely bearing malfunction. Introduce grease into motor slowly.

Location	Type
High Pressure Pump	Village Marine Tec. Pump Oil, P/N #85-0050
High Pressure Pump Motor	Chevron SRI Grease - NGLI 2 ExxonMobil PolyrexEM Grease Shell Oil Dolium R - NGLI 2 Texaco Premium RB
O-rings and Gaskets	Glycerin or Silicone Lubricant

Table 5.3: Motor and HP Pump Lubrication Requirements.

CAUTION

DO NOT mix grease types. Keep consistent the grade and type of grease used for motor. Also, keep the grease CLEAN.

Step 3: Secure the RO unit, wipe off any excess grease and replace any zerk caps. The motor is now ready to resume operation.

6.0 MEMBRANE REPLACEMENT

6.1 PRESSURE VESSEL DISASSEMBLY

Step 1: Disconnect plumbing from pressure vessel for disassembly. Remove the vessel from the PW unit and continue on a workbench.

Step 2: Remove the eight fasteners and cap ring holding each end plug with an allen wrench (refer to Figure 6.1). 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).

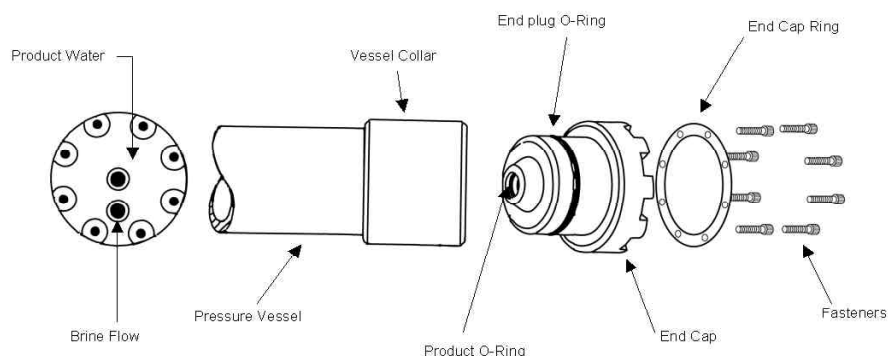


Figure 6.1 - Pressure Vessel End Plug Assembly Callout.

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 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**.

Corresponding marks allow the user to replace the end plug in the correct position with ease. The importance of marking the end plug and collar is because there are several incorrect ways the end plug may fit onto the end collar and only one correct way to allow the membrane to work properly.

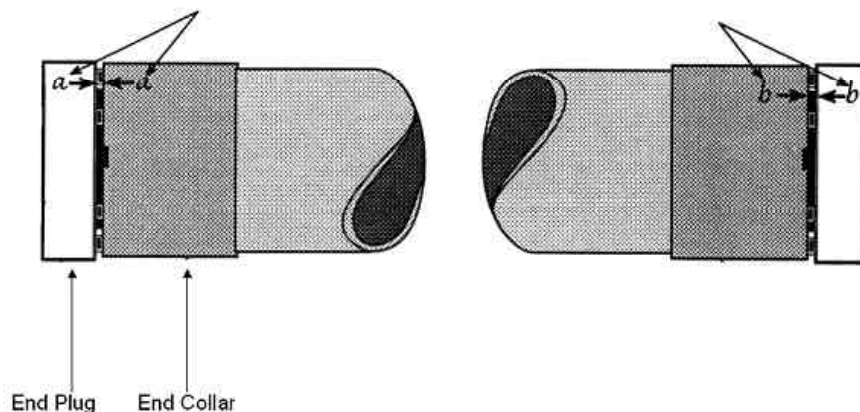


Figure 6.2 - Membrane Corresponding Mark Placement.

MEMBRANE REPLACEMENT

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: 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 handtight.

CAUTION

NEVER USE ANY TYPE OF LUBRICANT CONTAINING PETROLEUM OIL. OIL CAN DAMAGE YOUR UNIT AND REDUCE MEMBRANES PERFORMANCE.

Step 2: 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.

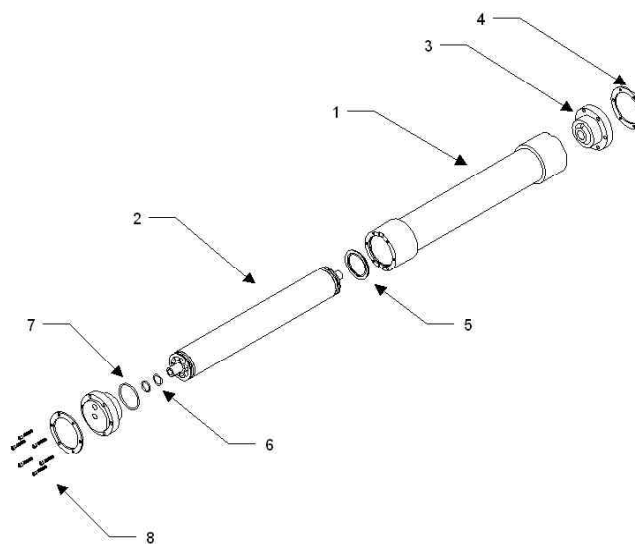
Step 3: Install the remaining end plug (align end plug holes with mounting studs properly), use the reference mark made in step 3 for correct assembly.

Step 4: Tighten the six fasteners for each end cap.

Step 5: Reconnect plumbing to pressure vessel(s).

NOTE: Do not apply Teflon tape or sealant to SAE (straight thread) fittings such as those used on High Pressure assemblies and their adapters. Use only on NPT taper thread fittings.

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. The following procedure will protect your RO against freeze damage.



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

Follow 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. Make a solution of fresh water and propylene glycol.

- Step 1: Flush with fresh water. See section 5.1.
- Step 2: Open the prefilter housings, pour the winterizing solution into filter housings and replace the housing covers. Use freshwater and make up sufficient solution to fill your prefilter housing(s).
- Step 3: Turn the High Pressure Bypass Valve (Black Valve) to **CLEANING POSITION**. Verify the Cleaning Valve (Gray Valve) is positioned to **CLEANING**. Also check the gray Freshwater Flush Valve is positioned for seawater intake **NOT** freshwater.
- Step 4: Start the Low Pressure Boost Pump by pressing the **LP PUMP** pushbutton located on the Master Control Center (or on the Remote Control Center). Refer to Figures 3.2 and 3.4.
- Step 5: Start the High Pressure Pump by pressing the **HP PUMP** pushbutton located on the Master Control Center panel (or on the Remote Control Center). Refer to Figures 3.2 and 3.4. Verify the Vacuum Pressure Gauge reads more than zero (0 psi). If the Vacuum Pressure Gauge reads less than 0 psi, open the flush valve for a brief moment to help pressurize the loop.
- Step 6: Allow the RO unit to run for at least 15 minutes to circulate the winterizing solution into the membranes, hoses, fittings, and pumps.
- Step 7: 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.

TO FLUSH WINTERIZATION SOLUTION FROM THE RO UNIT

To return your machine to operating condition after freeze protecting it, operate with the black bypass valve in cleaning position for 20 minutes. All other valves should follow section 4 instructions.

FREEZE PROTECTION

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 **PURE WATER**, refer to instructions in **SECTION 5.4: 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 **Pure Water MODULAR** systems. Membranes must be kept wet with preservative solution, so snug caps are required.
- Step 2: Store the membranes in an environment protected from freezing.
- Step 3: Drain the entire RO of all remaining water. Blow out all the hoses, and store dry through the winter.

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 Parker Racor - 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 3 to 5 GPM.
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) 20 and 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.

TROUBLESHOOTING

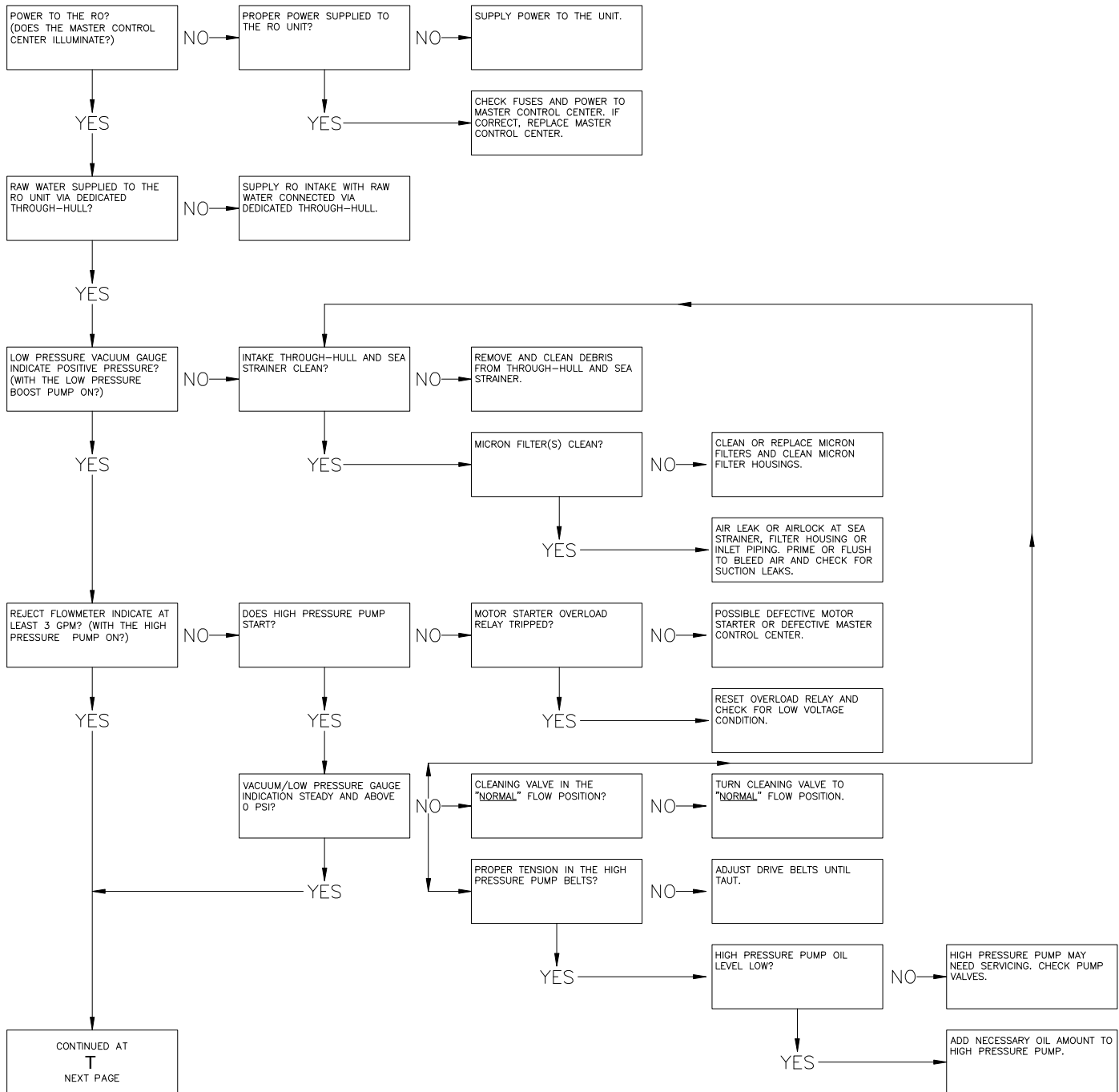


Figure 8.0: Troubleshooting Flow Diagram

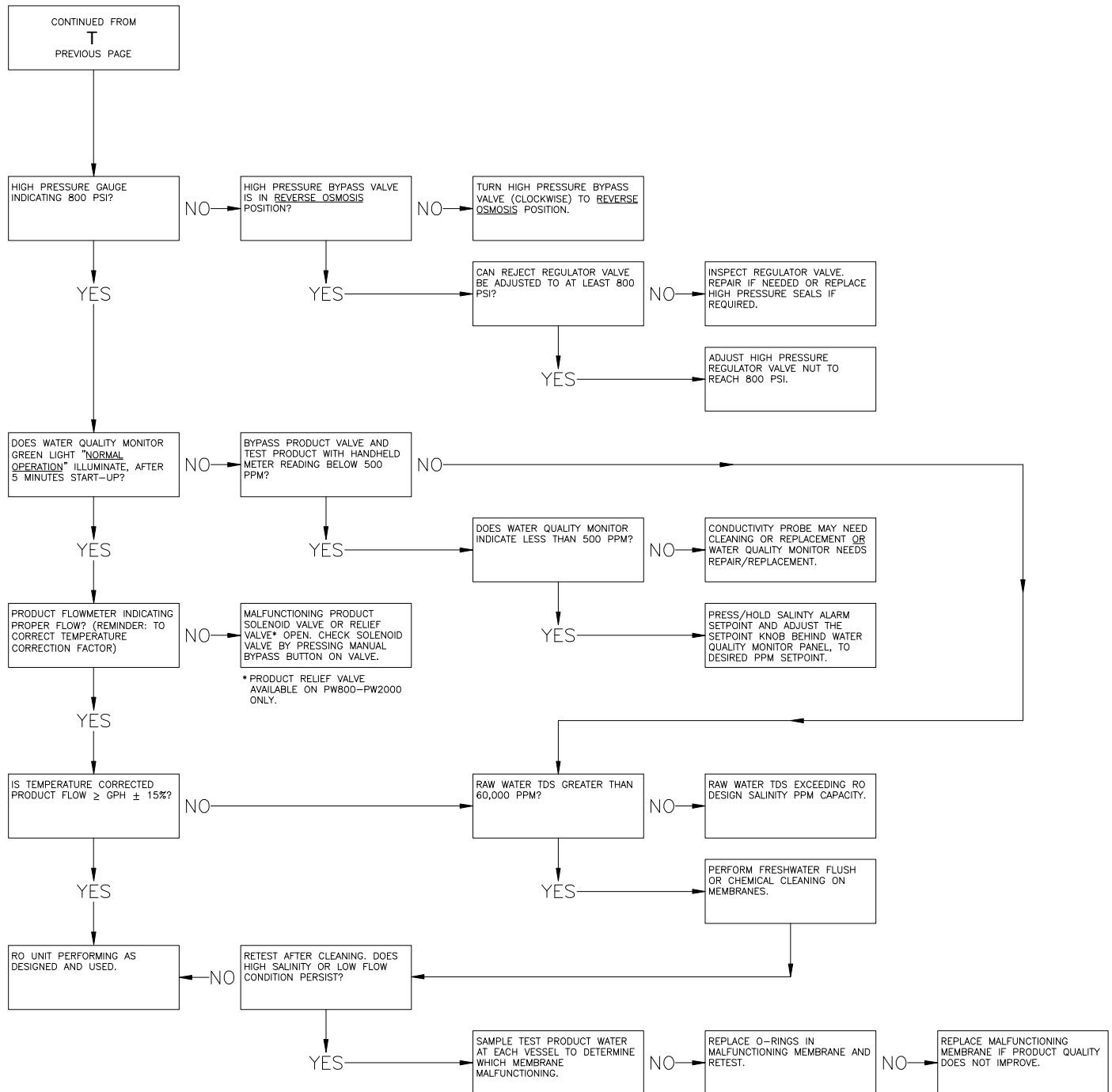
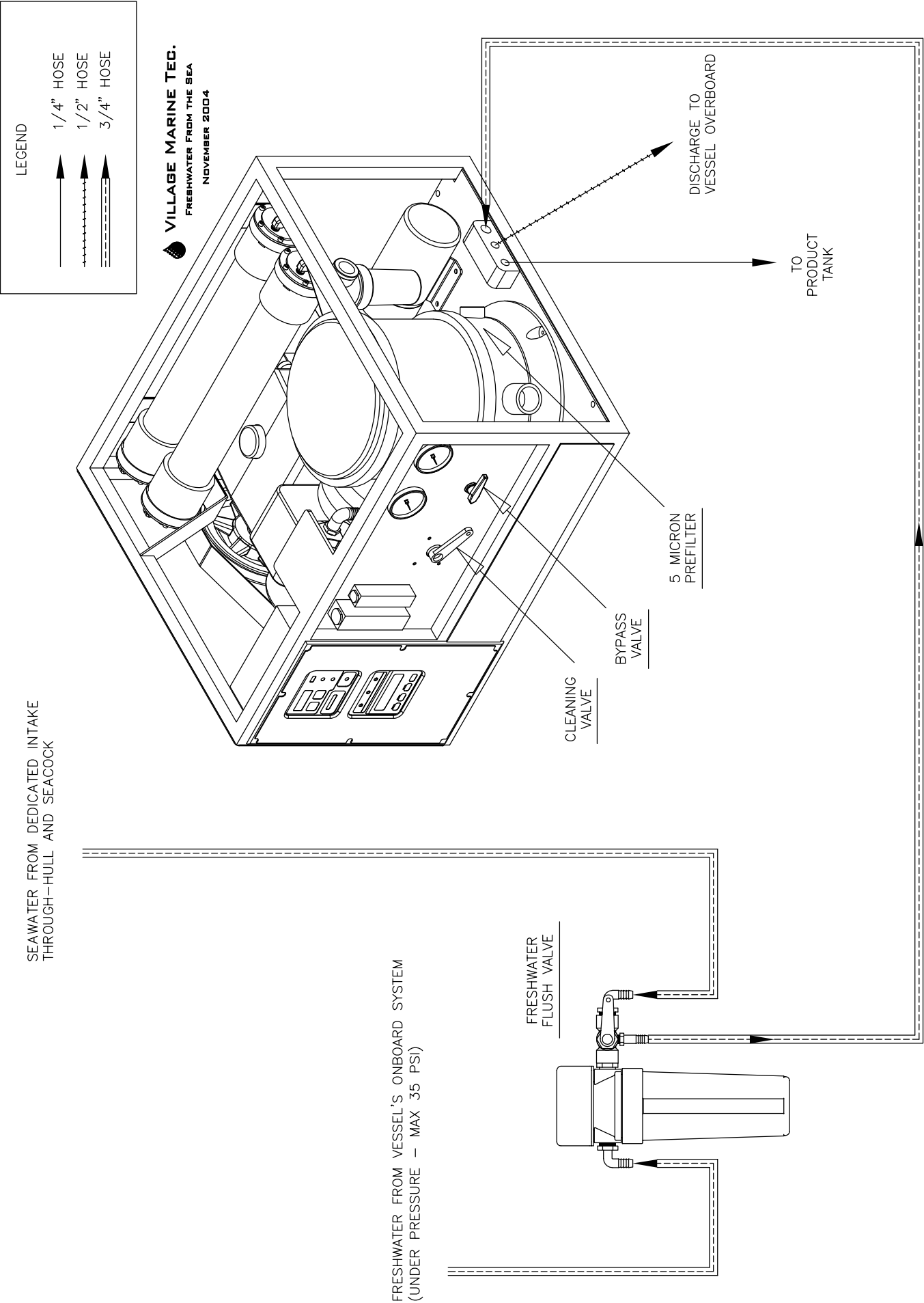


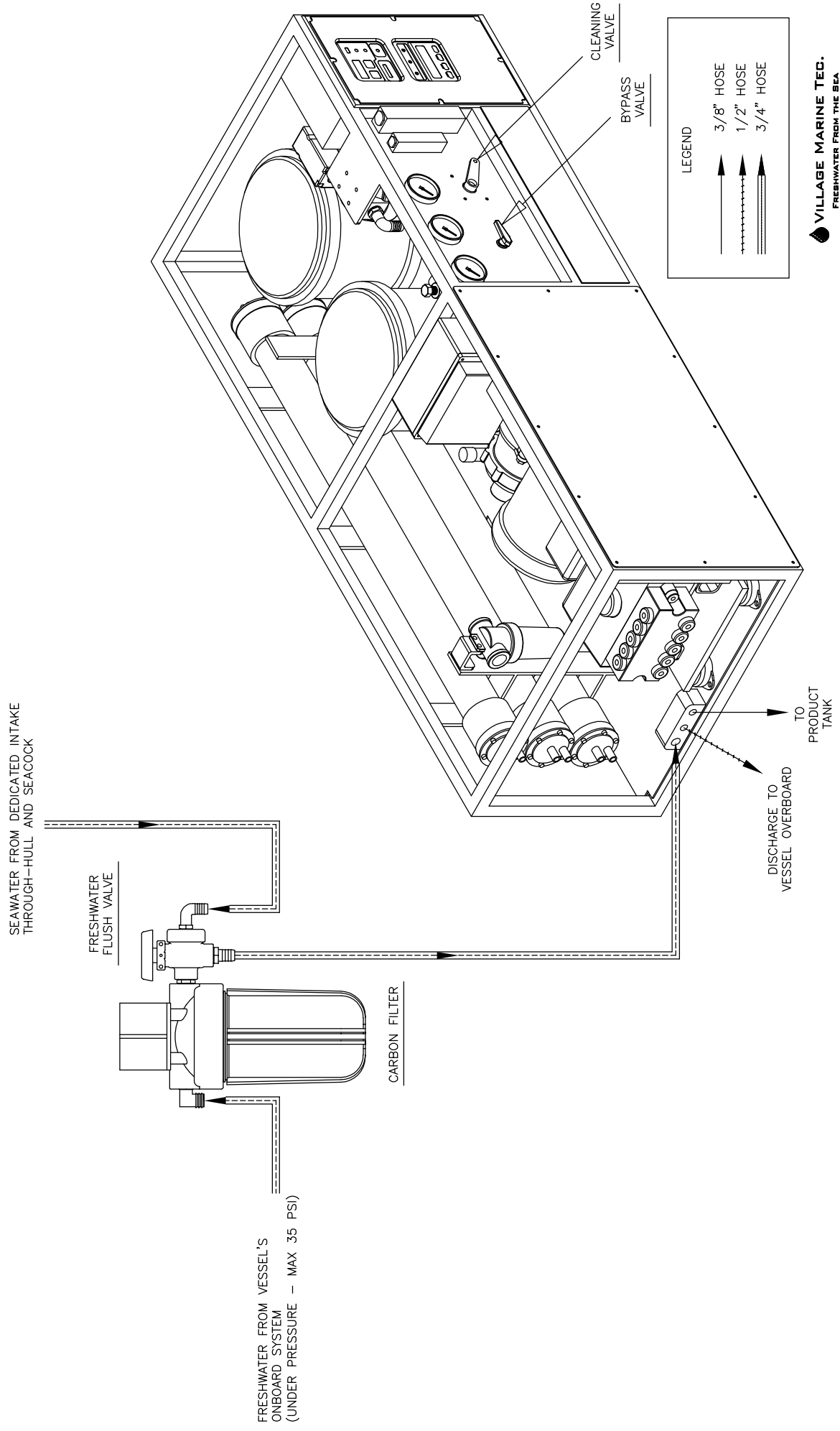
Figure 8.0: Troubleshooting Flow Diagram (CONTINUED)

9.0 DRAWINGS AND DIAGRAMS

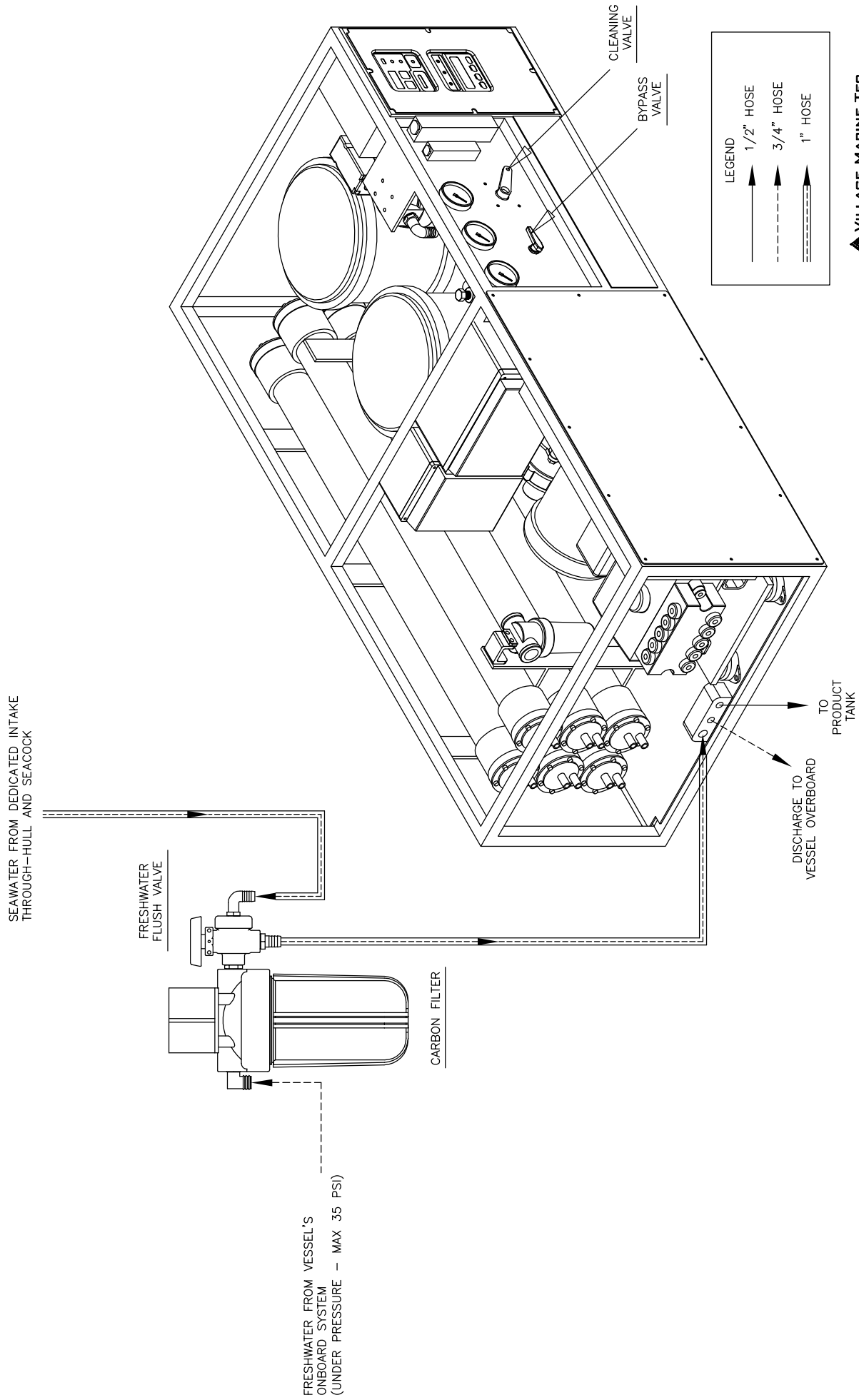
PURE WATER FRAME (PW 400) PLUMBING DIAGRAM



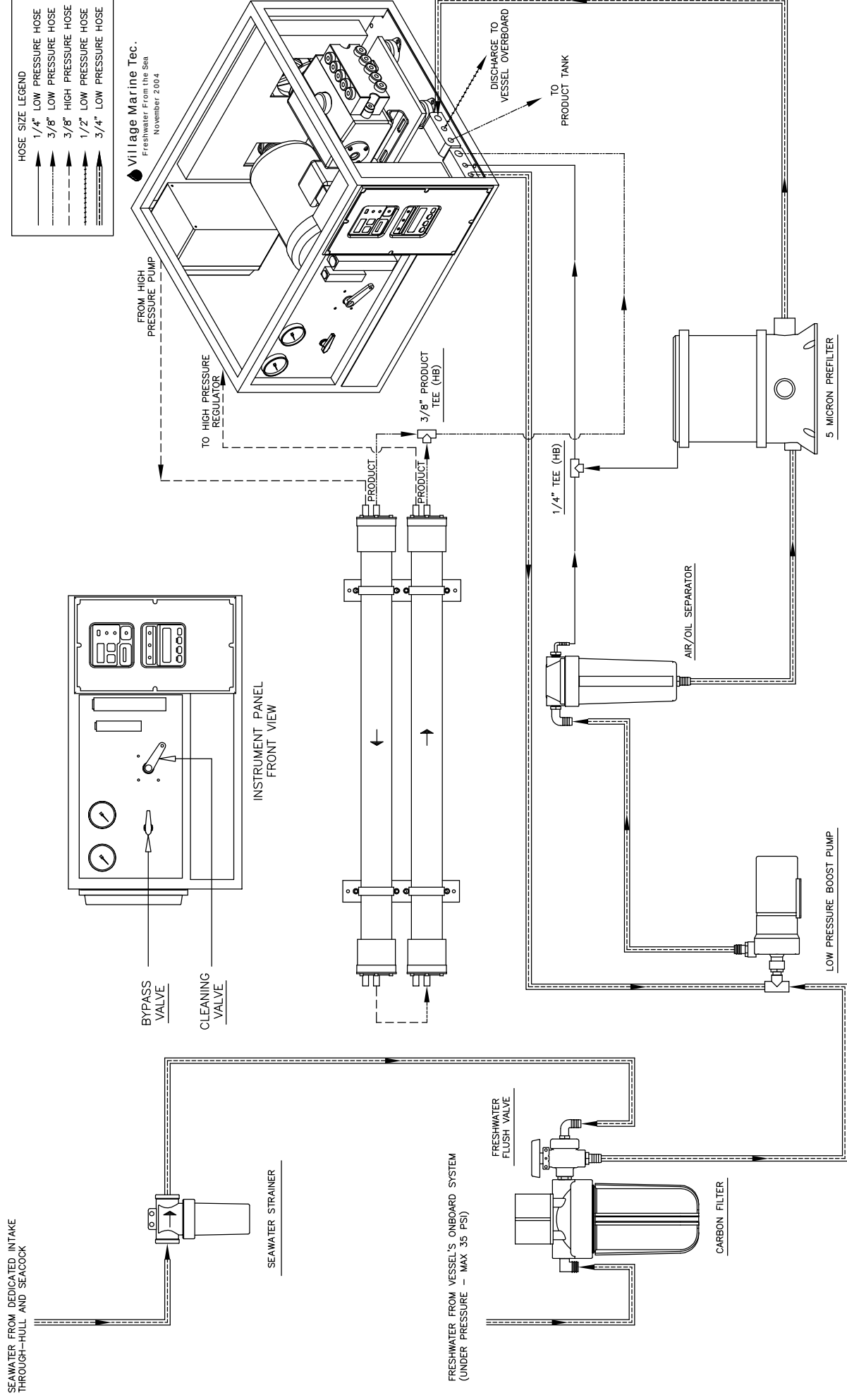
PURE WATER FRAME (PW 600-1200) PLUMBING DIAGRAM



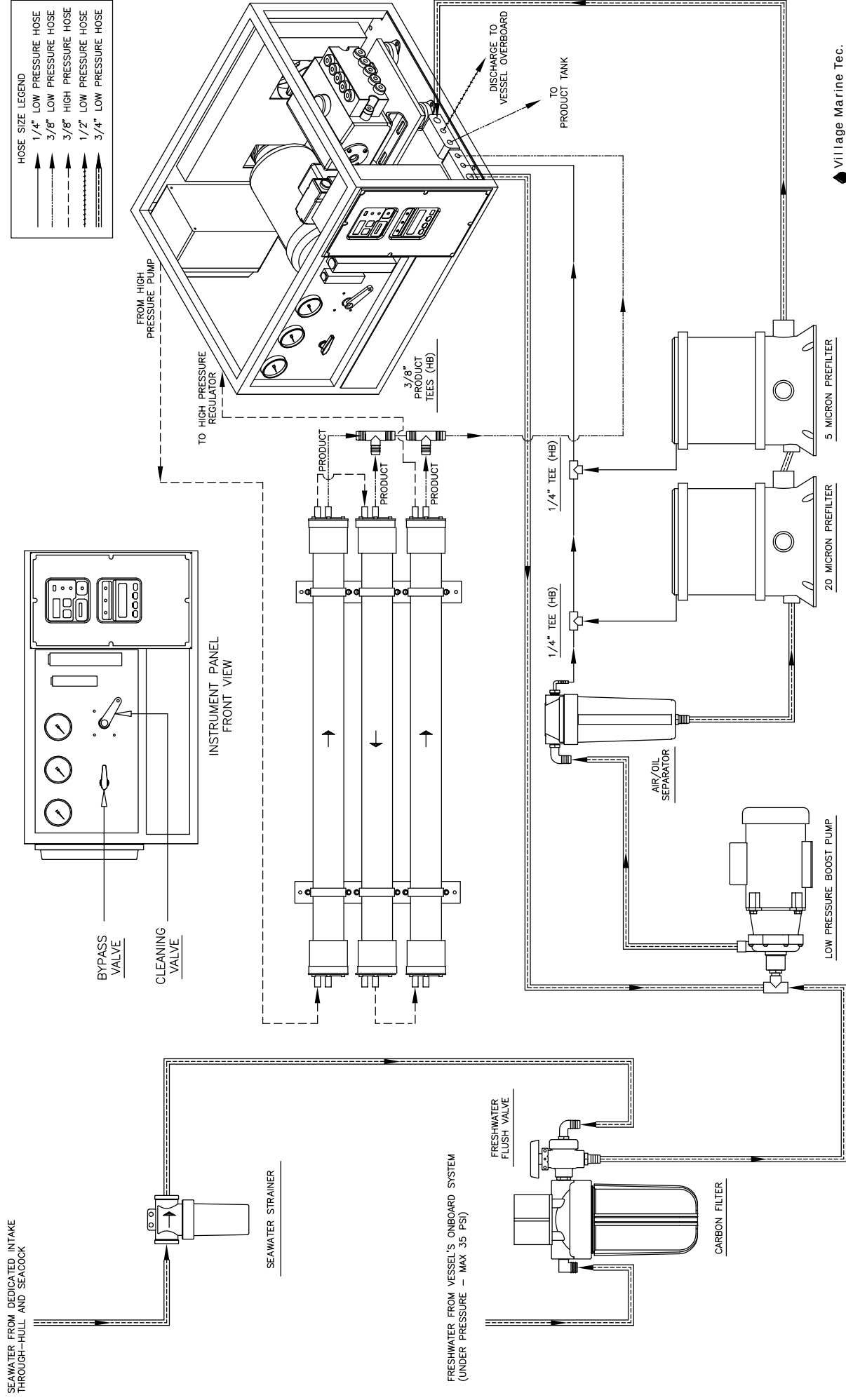
PURE WATER FRAME (PW 1600-2000) PLUMBING DIAGRAM



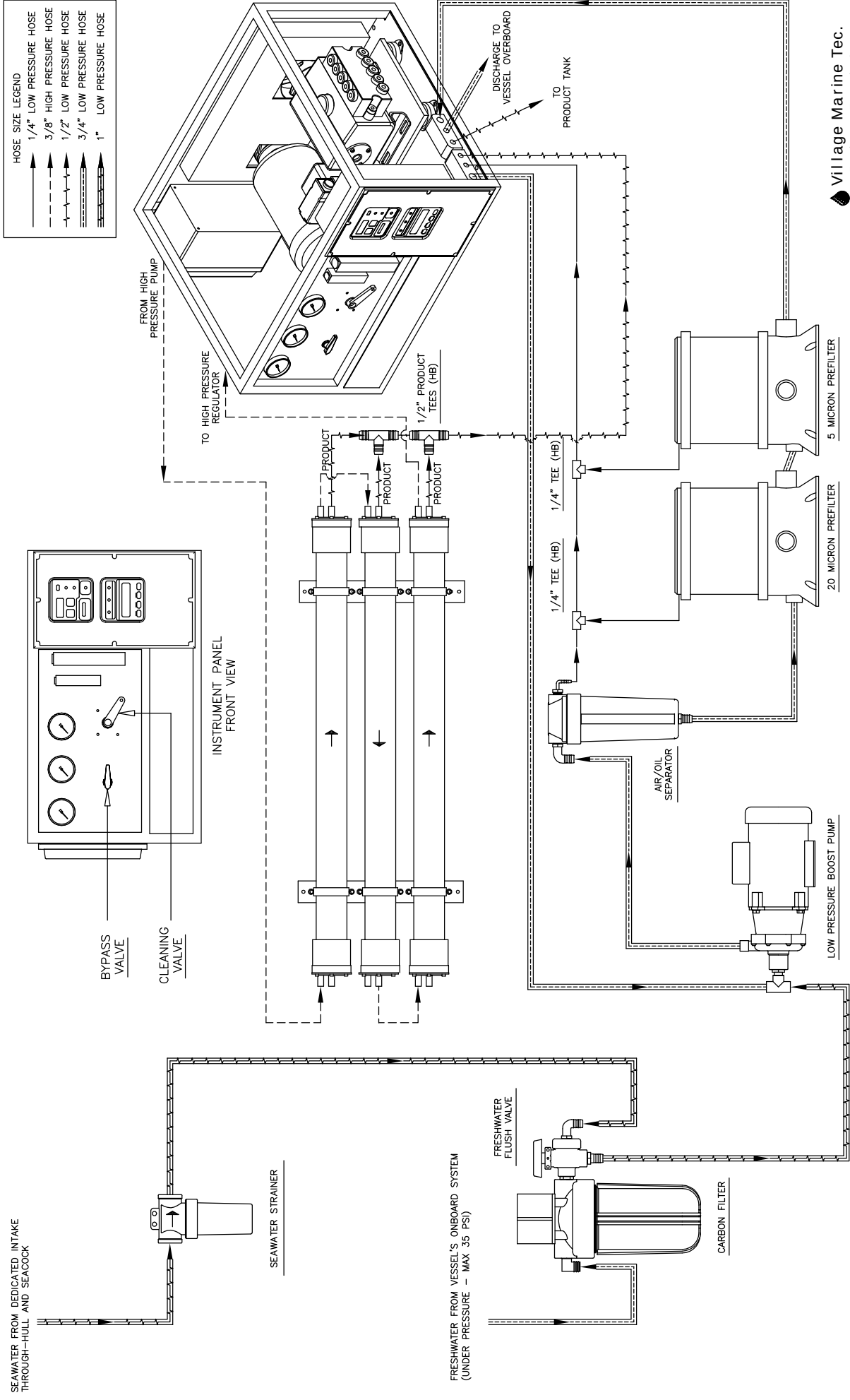
Pure Water Semi-Modular 600 (PWSM 600) Plumbing Diagram



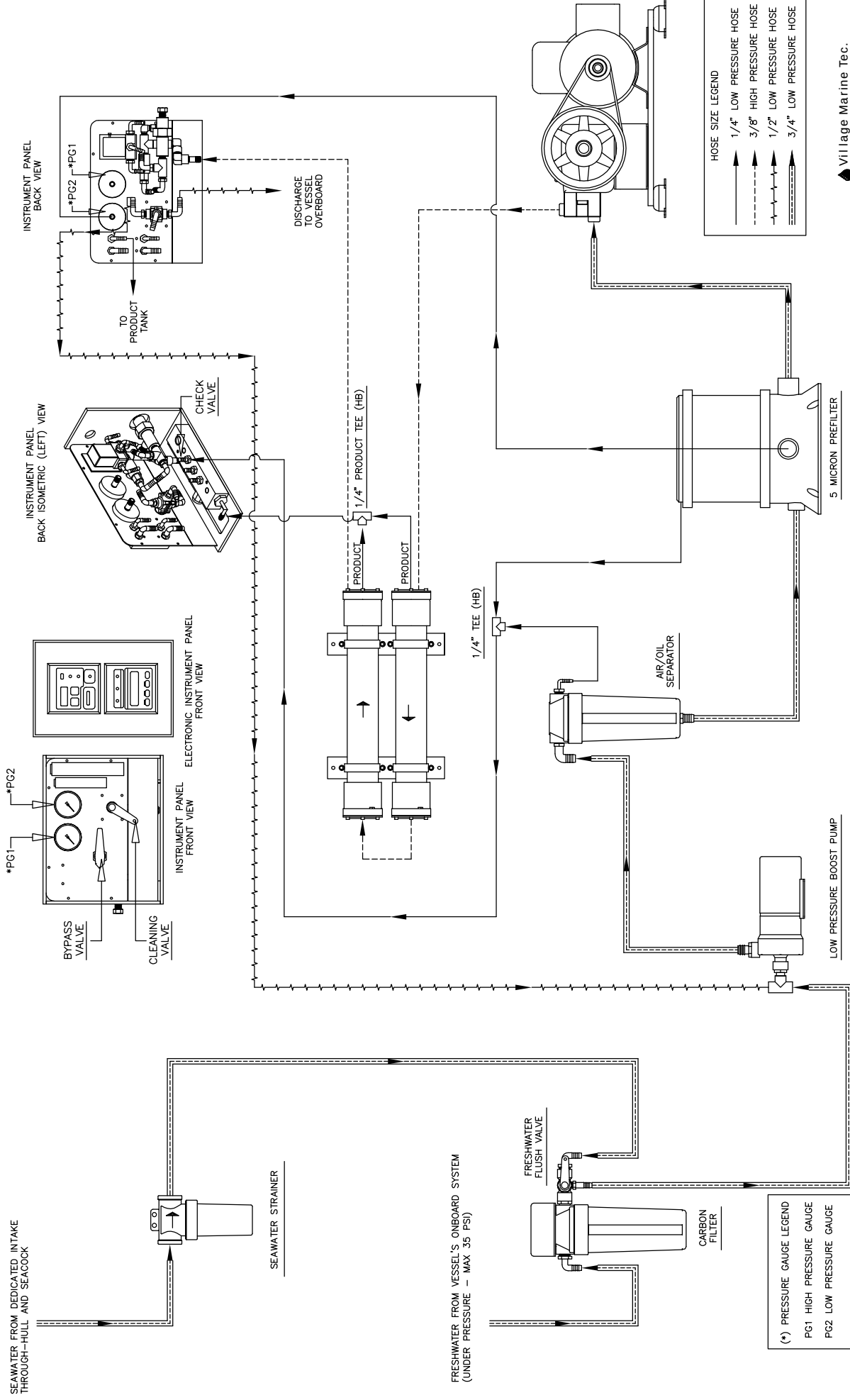
Pure Water Semi-Modular 800-1200 (PWSM 800-1200) Plumbing Diagram



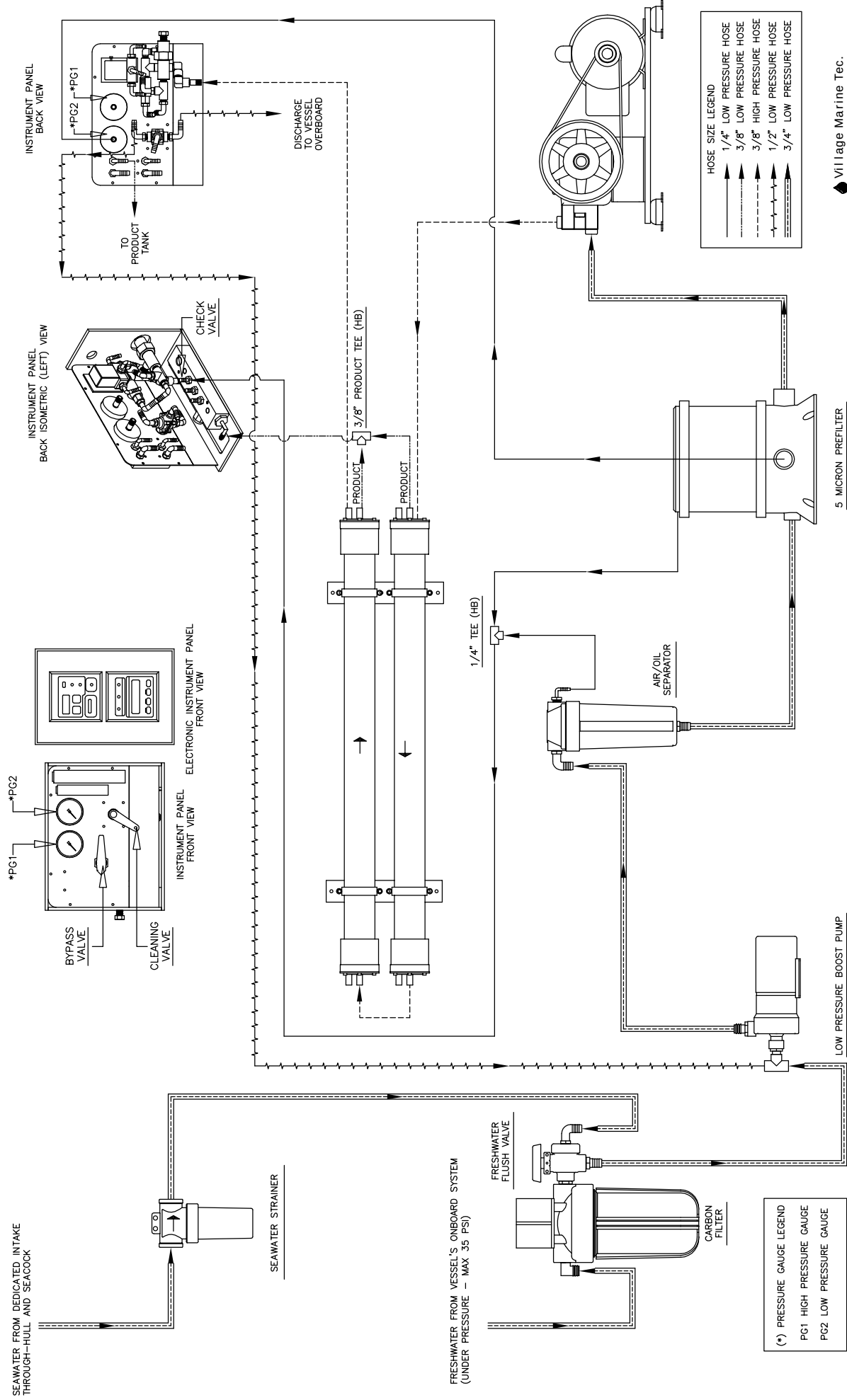
Pure Water Semi-Modular 1600-2000 (PWSM 1600-2000) Plumbing Diagram



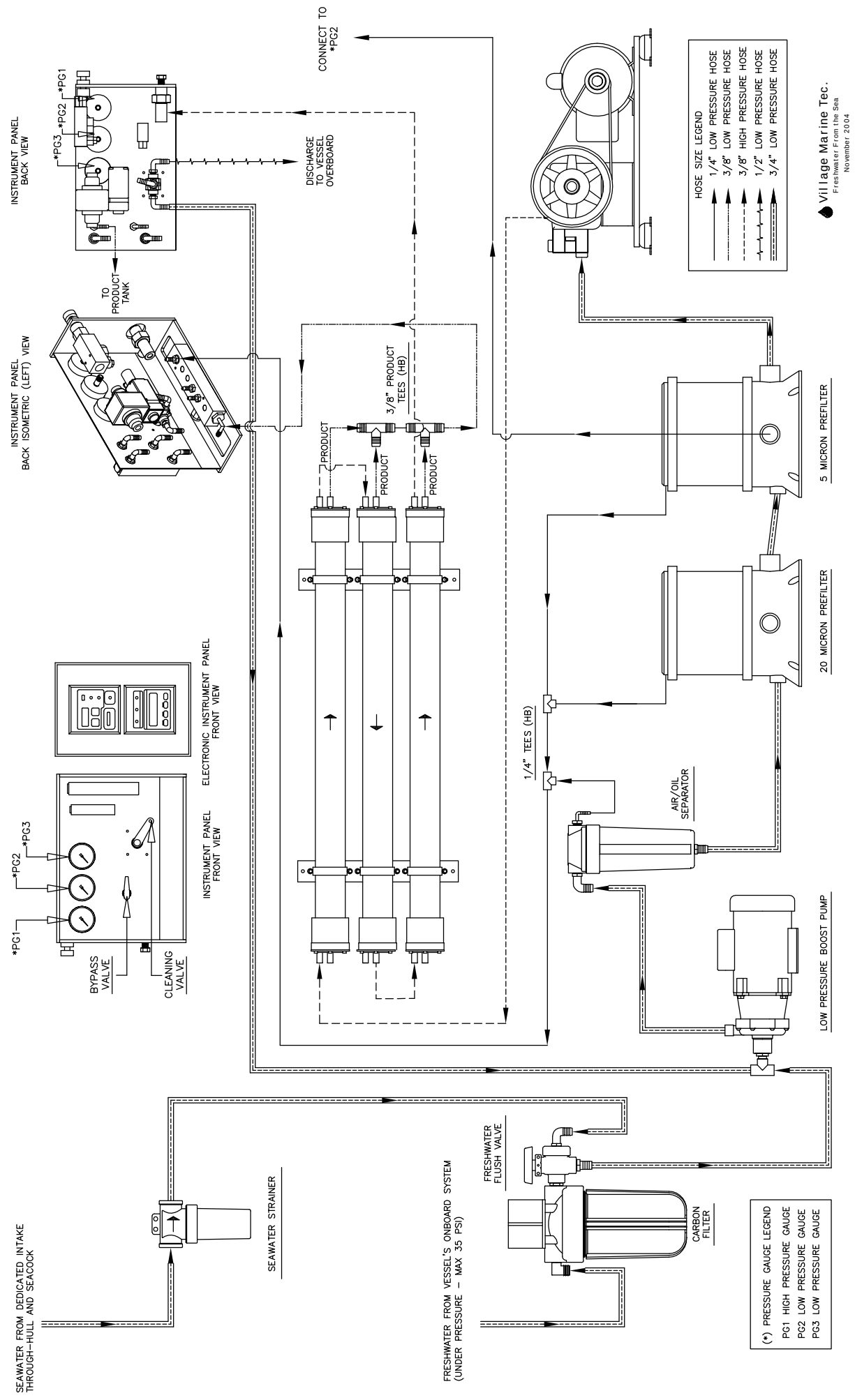
Pure Water Modular 400 (PWM 400) Plumbing Diagram



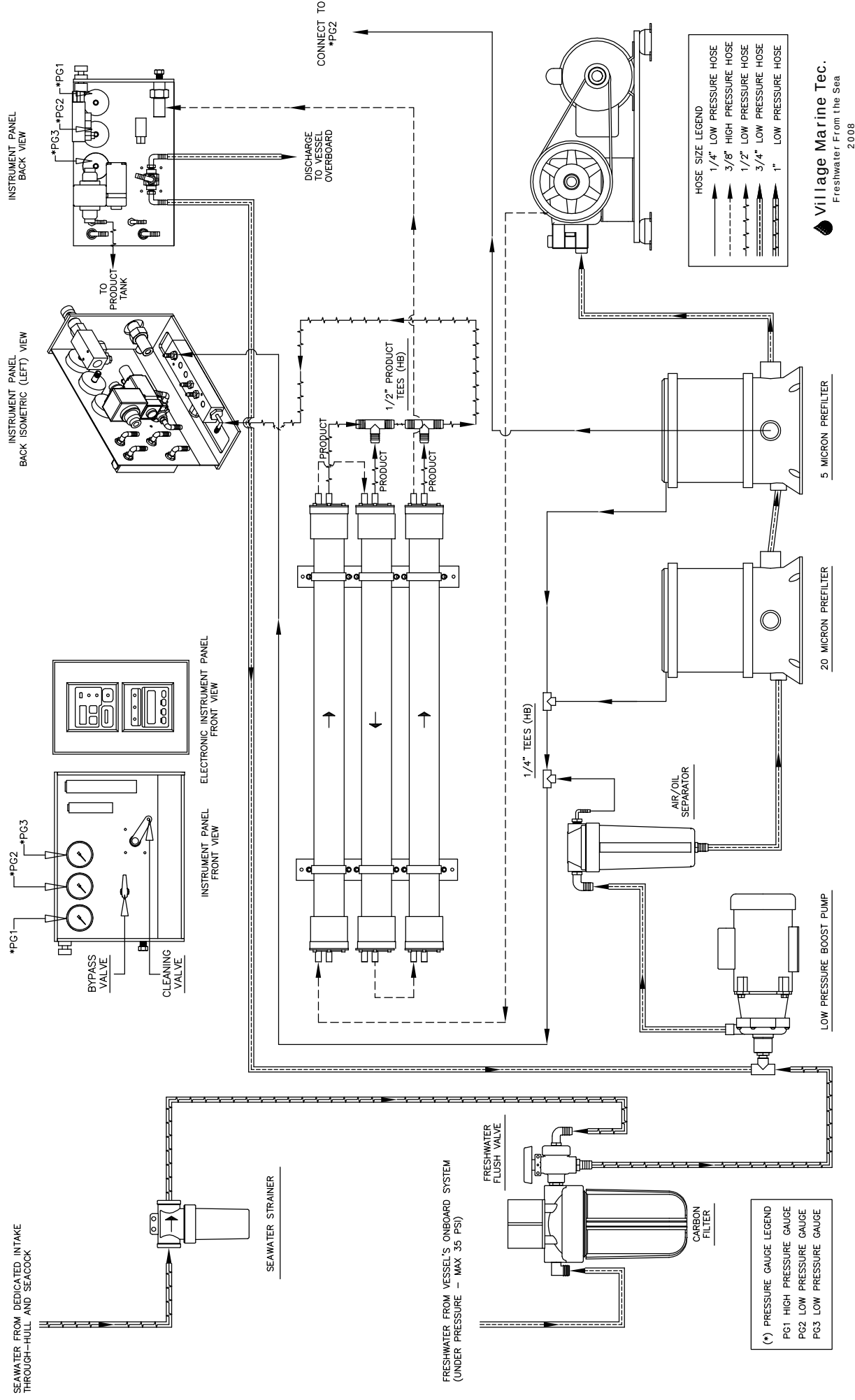
Pure Water Modular 600 (PWM 600) Plumbing Diagram

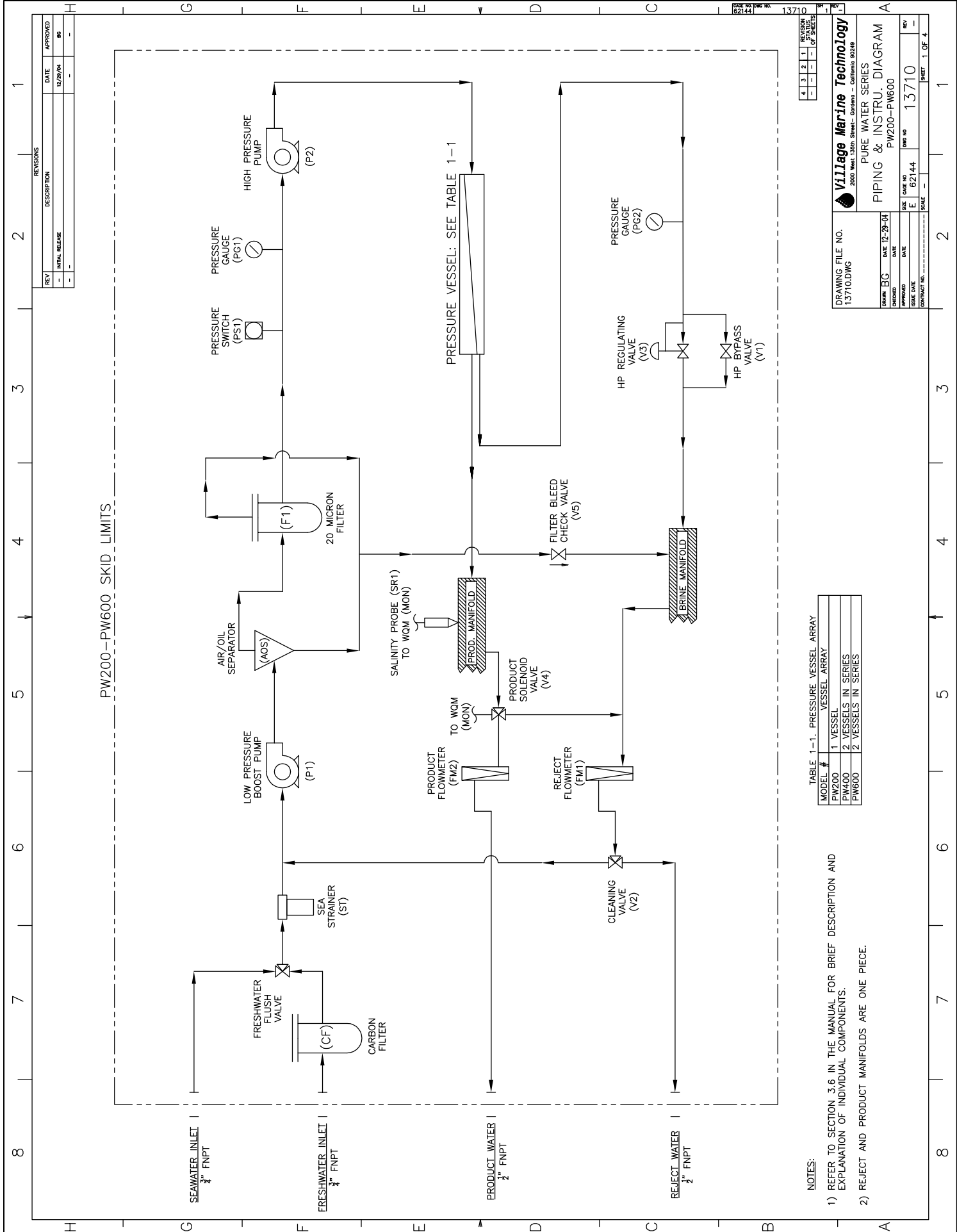


Pure Water Modular 800-1200 (PWM 800-1200) Plumbing Diagram



Pure Water Modular 1600-2000 (PWM 1600-2000) Plumbing Diagram





PW200-PW600 SKID LIMITS

NOTES:

- 1) REFER TO SECTION 3.6 IN THE MANUAL FOR BRIEF DESCRIPTION AND EXPLANATION OF INDIVIDUAL COMPONENTS.
- 2) REJECT AND PRODUCT MANIFOLDS ARE ONE PIECE.

TABLE 1-1. PRESSURE VESSEL ARRAY

MODEL #	VESSEL ARRAY
PW200	1 VESSEL
PW400	2 VESSELS IN SERIES
PW600	2 VESSELS IN SERIES

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13710.DWG

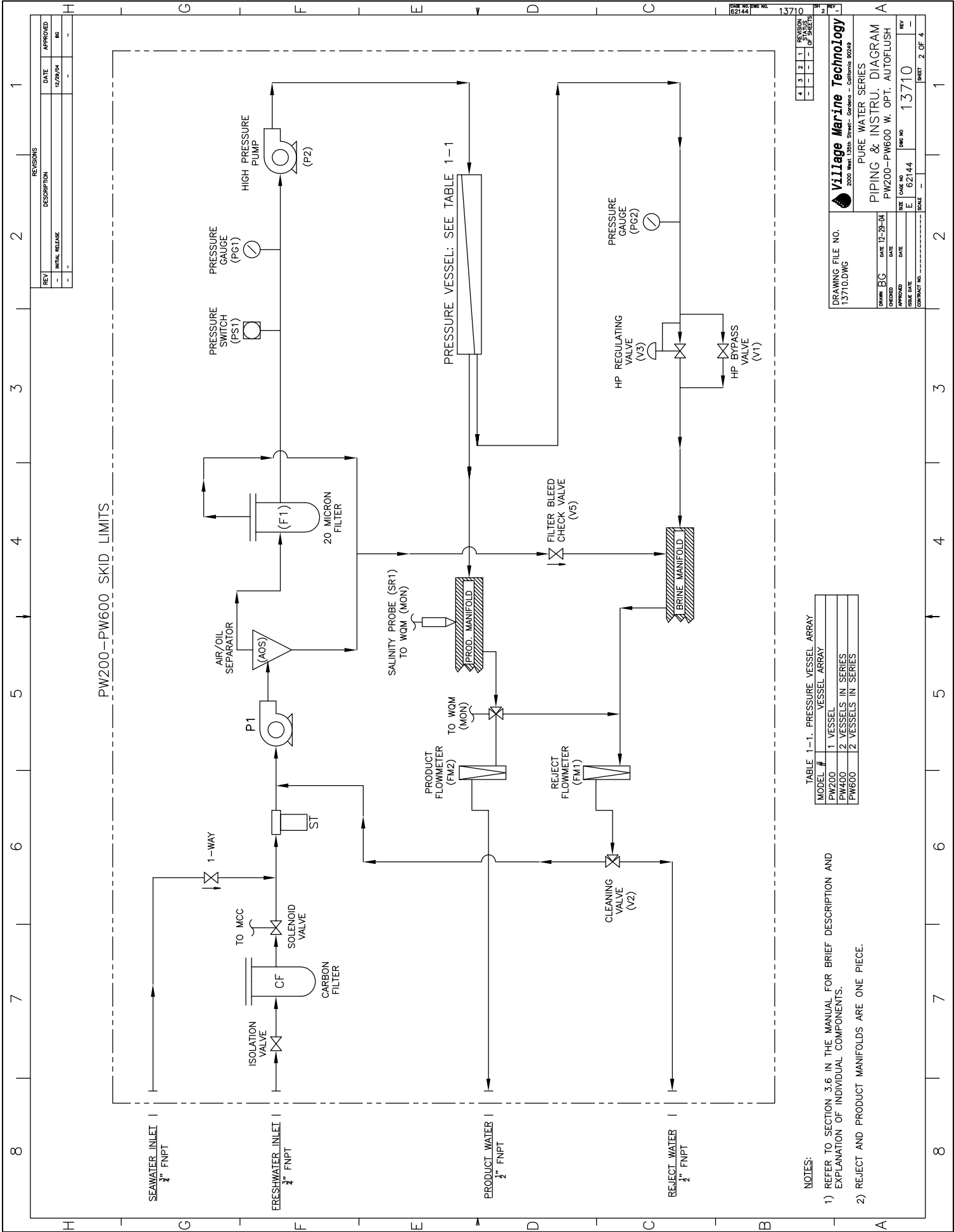
Village Marine Technology
2000 West 150th Street - Gardena - California 90249

PURE WATER SERIES
PW200-PW600

PIPING & INSTRU. DIAGRAM

DATE	DATE	DATE	DATE	DATE	DATE
12-29-04	12-29-04	12-29-04	12-29-04	12-29-04	12-29-04
REV	REV	REV	REV	REV	REV
1	2	3	4	5	6

SCALE 1 OF 4



4

3

2

1

REVISION
DATE
OF SHEET

13710

 Village Marine Technology

2000 West 135th Street - Gardena - California 90249

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13710.DWG

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DATE: 12-29-14

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APPROVED:

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CASE NO: 62144

DWG NO: 13710

REV: -

CONTRACT NO:

SHEET: 2 OF 4

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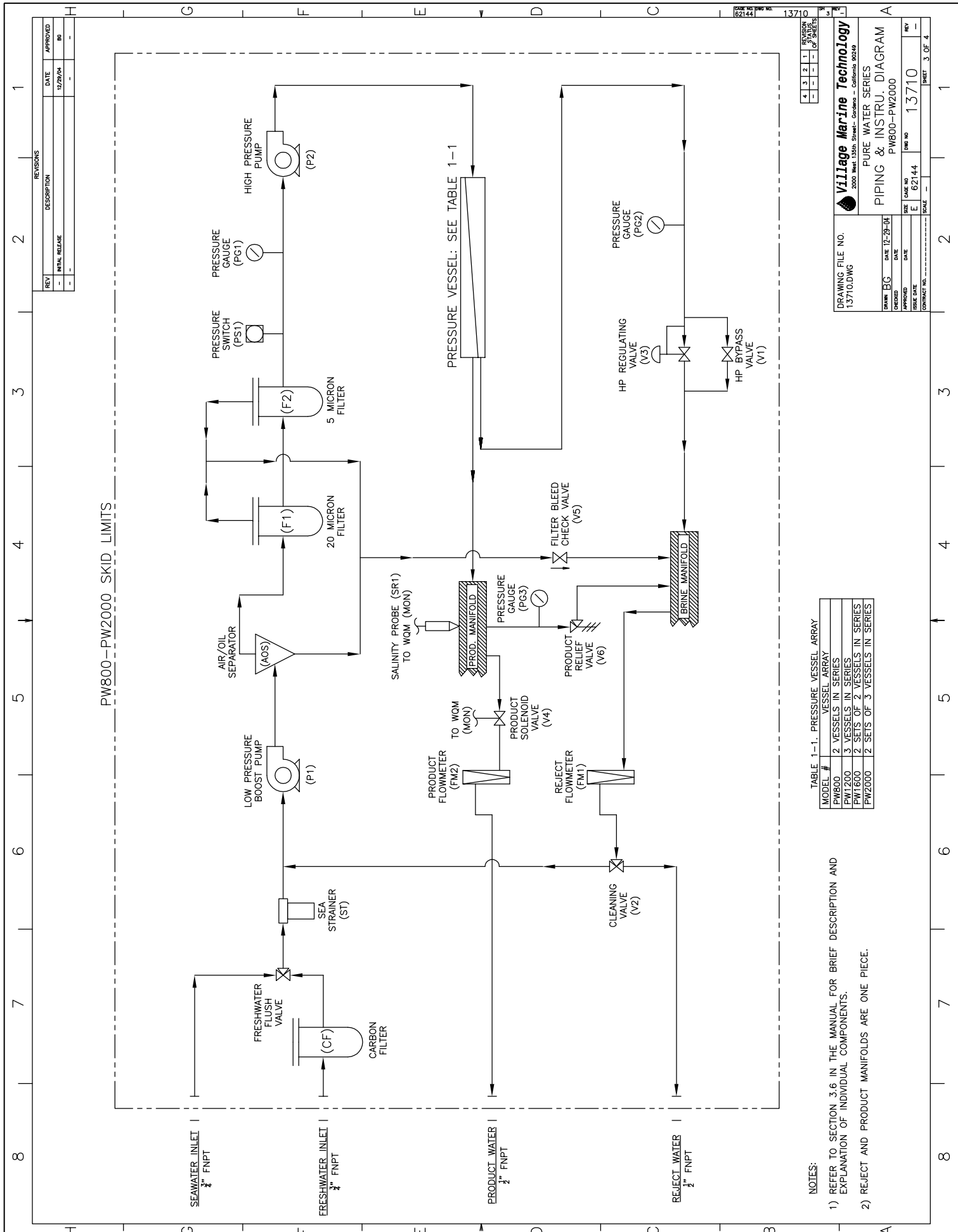
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CONTRACT NO:

SHEET: 2 OF 4



PW800-PW2000 SKID LIMITS

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4	3	2	1
-	-	-	-

Village Marine Technology
2000 West 125th Street - Gardena - California 90249

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CASE NO.
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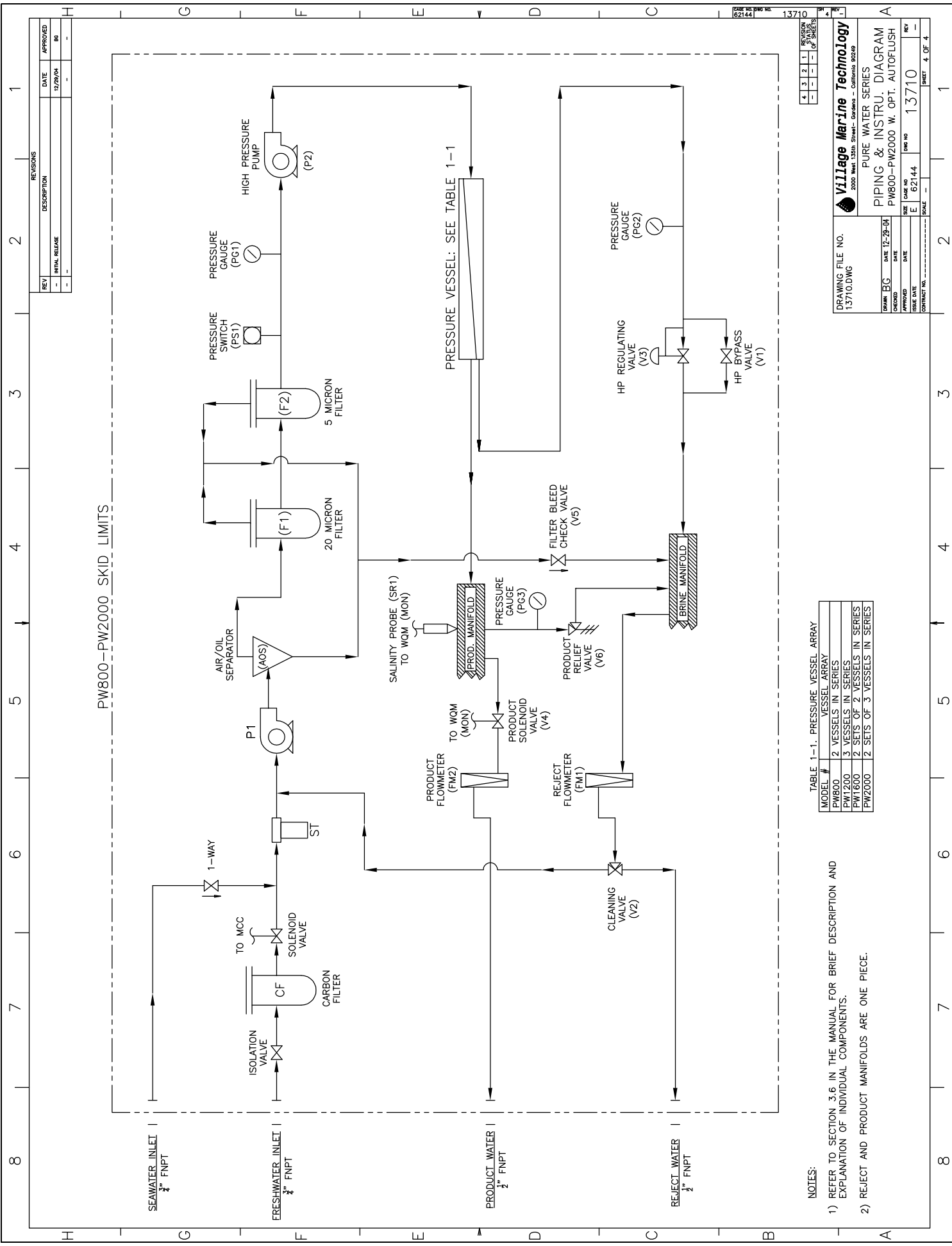
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OF
4

TABLE 1-1. PRESSURE VESSEL ARRAY

MODEL #	VESSEL ARRAY
PW800	2 VESSELS IN SERIES
PW1200	3 VESSELS IN SERIES
PW1600	2 SETS OF 2 VESSELS IN SERIES
PW2000	2 SETS OF 3 VESSELS IN SERIES

- NOTES:
- REFER TO SECTION 3.6 IN THE MANUAL FOR BRIEF DESCRIPTION AND EXPLANATION OF INDIVIDUAL COMPONENTS.
 - REJECT AND PRODUCT MANIFOLDS ARE ONE PIECE.



PW800-PW2000 SKID LIMITS

TABLE 1-1. PRESSURE VESSEL ARRAY

MODEL #	VESSEL ARRAY
PW800	2 VESSELS IN SERIES
PW1200	3 VESSELS IN SERIES
PW1600	2 SETS OF 2 VESSELS IN SERIES
PW2000	12 SETS OF 3 VESSELS IN SERIES

- NOTES:
- 1) REFER TO SECTION 3.6 IN THE MANUAL FOR BRIEF DESCRIPTION AND EXPLANATION OF INDIVIDUAL COMPONENTS.
 - 2) REJECT AND PRODUCT MANIFOLDS ARE ONE PIECE.

REV	DATE	DESCRIPTION	APPROVED
1	12/29/04	INITIAL RELEASE	BG

Village Marine Technology
2000 West 155th Street - Gardena - California 90249

DRAWING FILE NO.
13710.DWG

DATE 12-29-04

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REV	DATE	DESCRIPTION	APPROVED
1	12/29/04	INITIAL RELEASE	BG

Village Marine Technology
2000 West 155th Street - Gardena - California 90249

DRAWING FILE NO.
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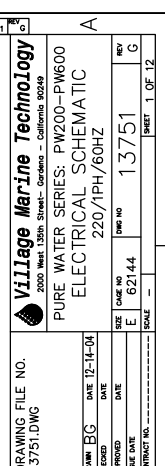
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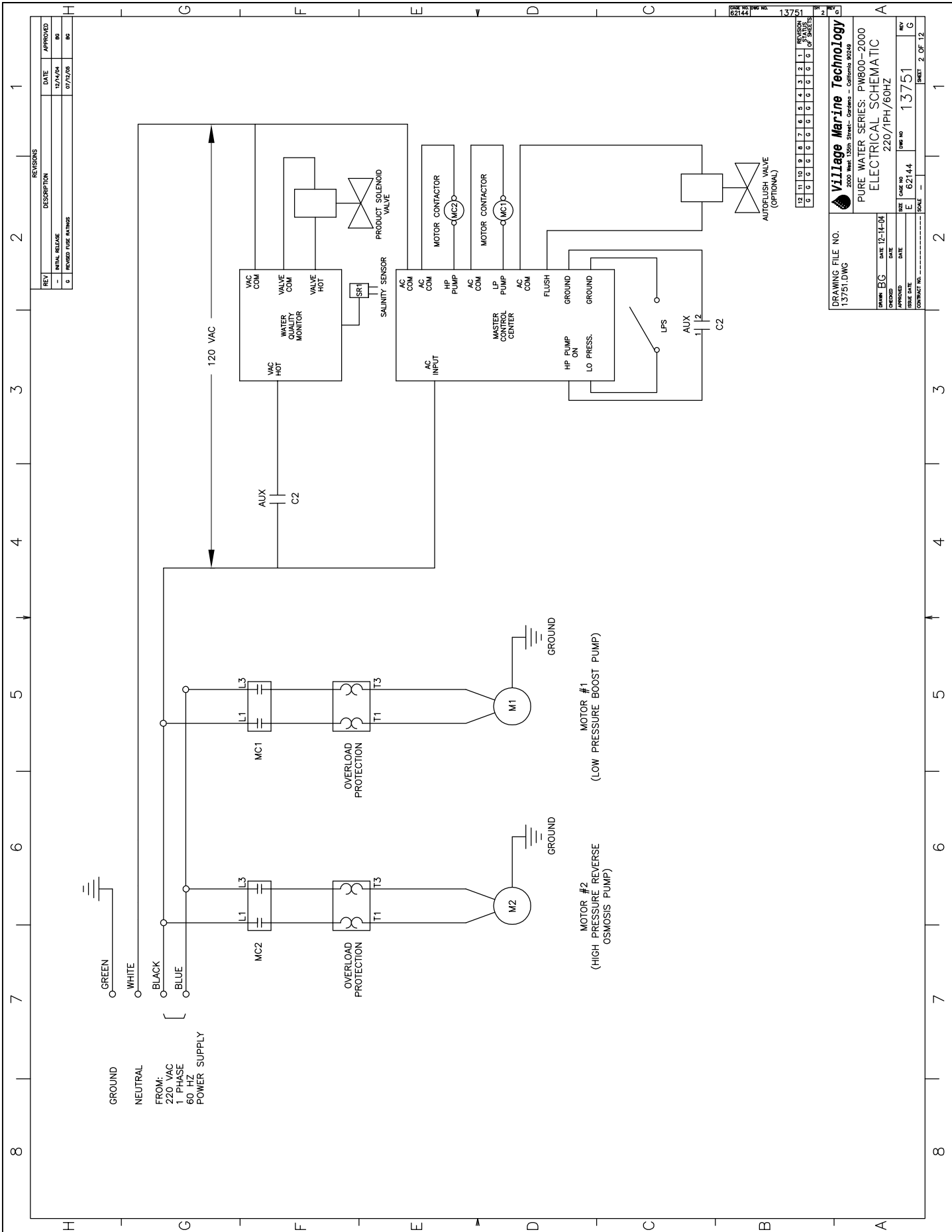
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NAME BG	DATE 12-14-04
CHECKED	DATE
APPROVED	DATE
DATE DATE	
CONTRACT NO.	



REVISIONS		DATE	APPROVED
REV	DESCRIPTION		
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2	REVISED FUSE RATINGS	07/25/05	BO

13751											
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13751											
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DATE 12-14-04
BY BO
CHECKED DATE
DESIGNED DATE
SCALE

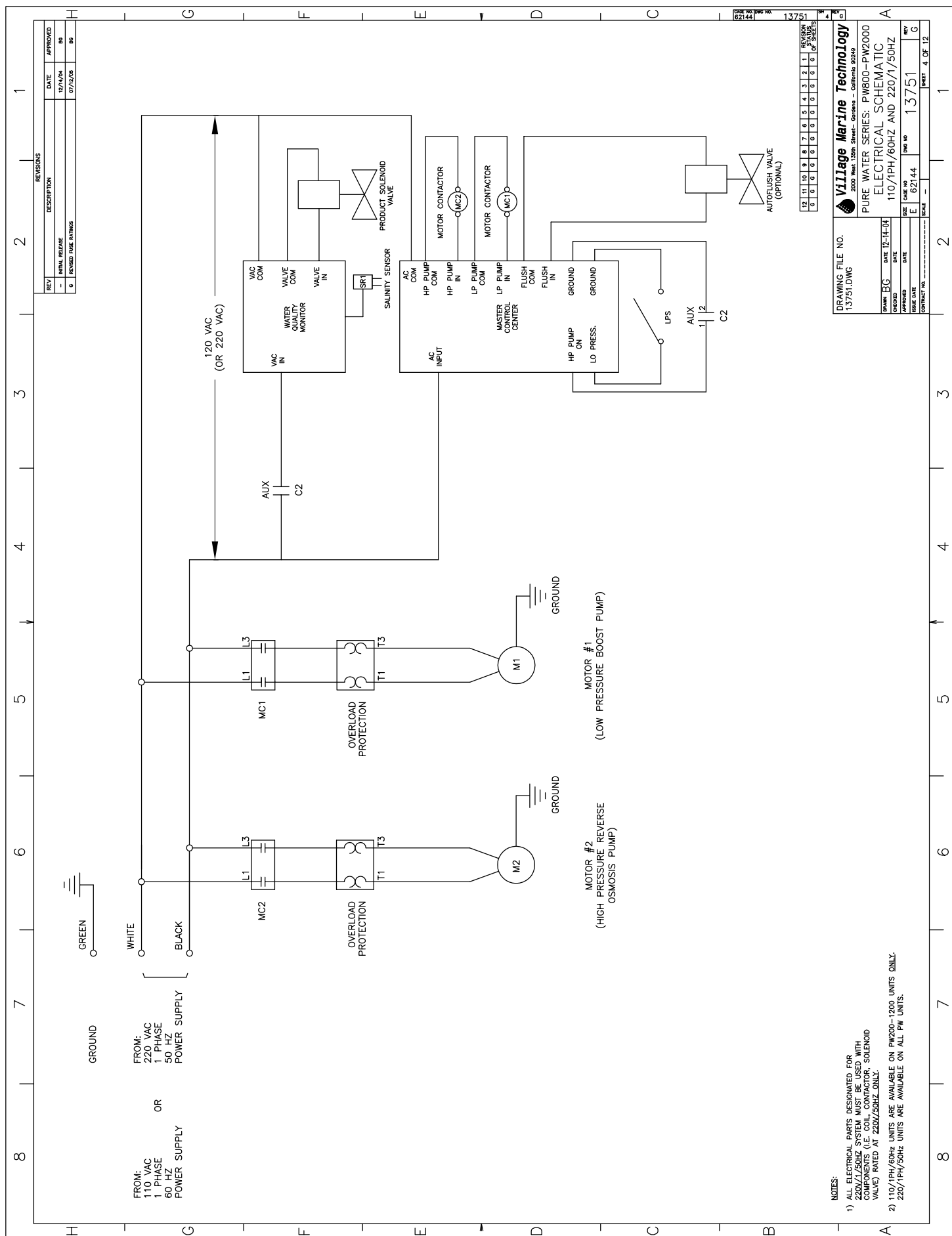
Village Marine Technology
2000 West 135th Street - Gardena - California 90248

PURE WATER SERIES: PW800-2000
ELECTRICAL SCHEMATIC
220/1PH/60HZ

DATE 12-14-04
BY BO
CHECKED DATE
DESIGNED DATE
SCALE

CONTRACT NO.
13751

SHEET 2 OF 12



NOTES:

- 1) ALL ELECTRICAL PARTS DESIGNATED FOR 220V/1/50HZ SYSTEM MUST BE USED WITH COMPONENTS (I.E. COIL, CONTACTOR, SOLENOID VALVE) RATED AT 220V/50HZ ONLY.
- 2) 110/1PH/60HZ UNITS ARE AVAILABLE ON PW200-1200 UNITS ONLY. 220/1PH/50HZ UNITS ARE AVAILABLE ON ALL PW UNITS.

DRAWING FILE NO.
13751.DWG

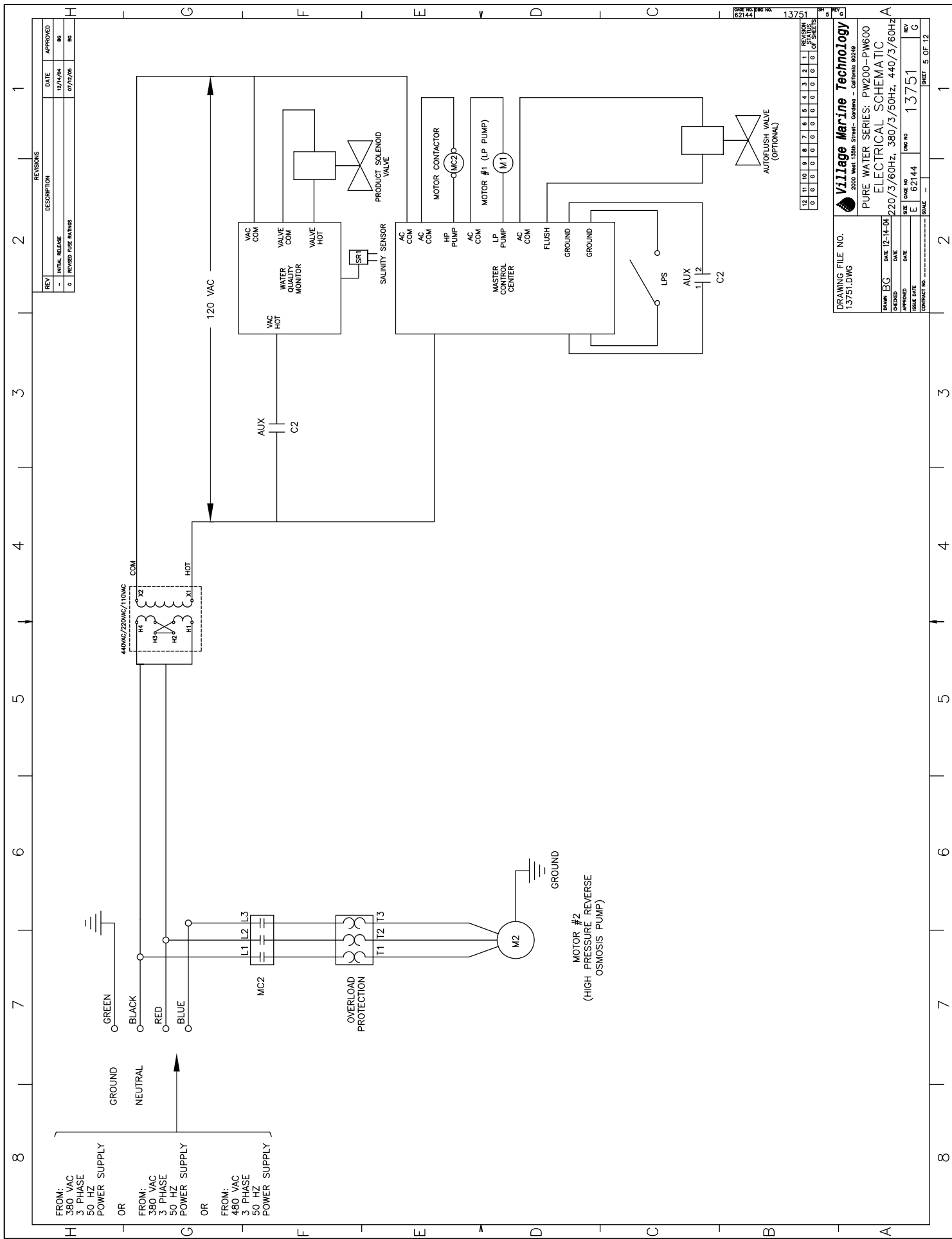
Village Marine Technology
2000 West 135th Street—Gardena—California 90248

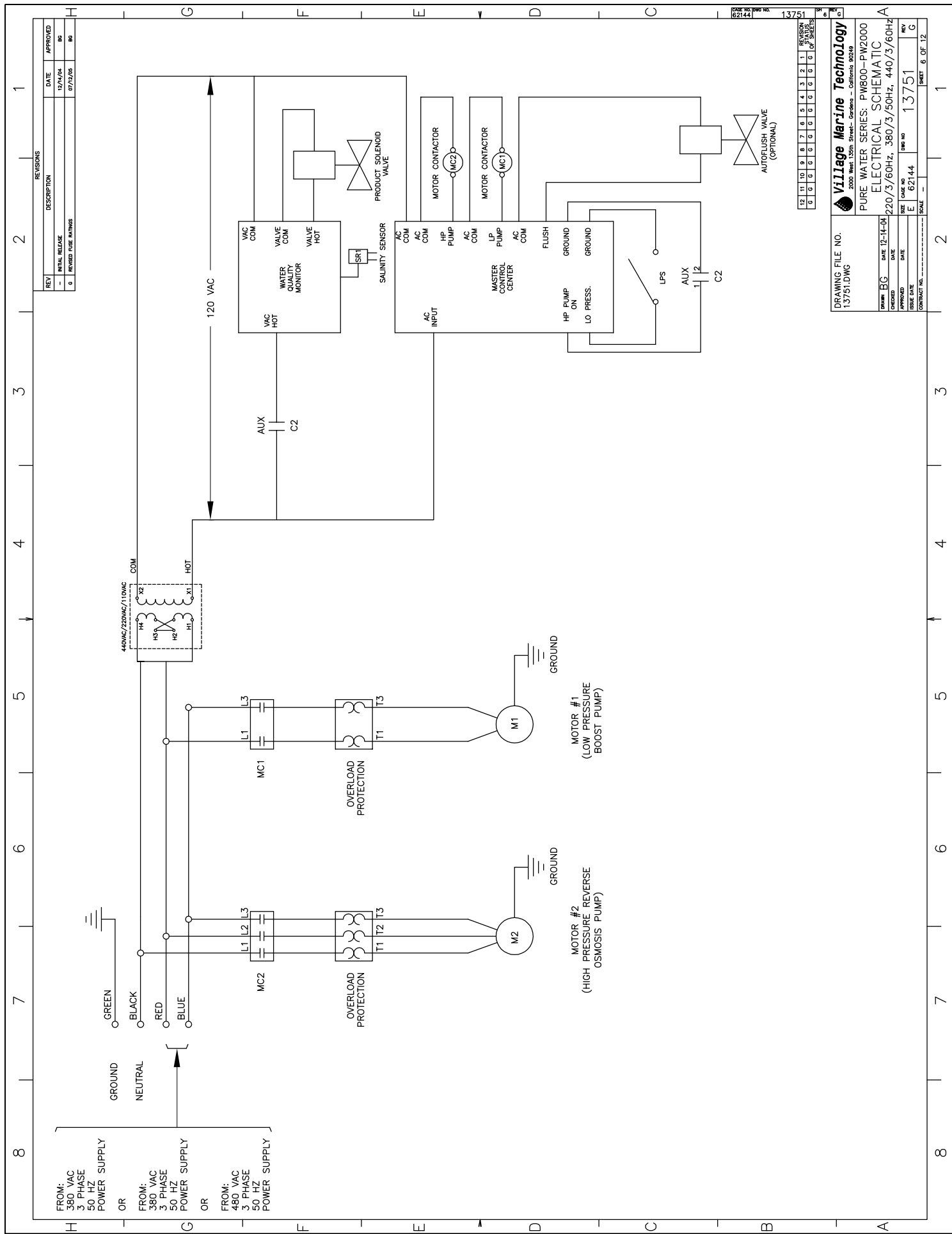
**PURE WATER SERIES: PW800-PW2000
ELECTRICAL SCHEMATIC**

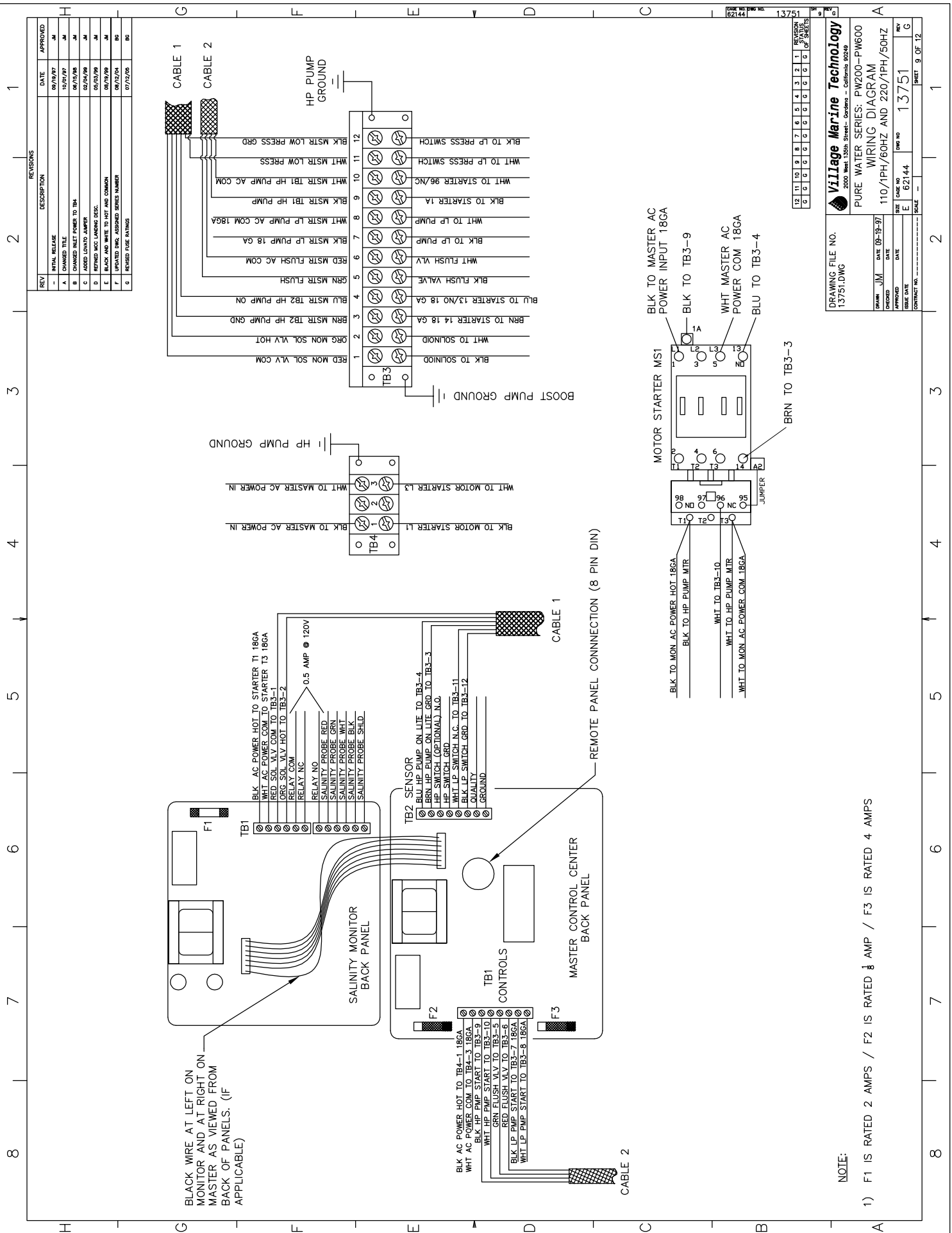
22) 110/1PH/60Hz UNITS ARE AVAILABLE ON PW200-1200 UNITS ONLY.
220/1PH/50Hz UNITS ARE AVAILABLE ON ALL PW UNITS

	REVISION	STATUS OF SHEETS
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11	2	G
10	3	G
9	4	G
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6	7	G
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1	12	G

DRAWING FILE NO. 13751.DWG		Village Marine Technology	2000 West 15th Street, Gardena - California 90249
SHEET 1	DATE 12-14-04	PURE WATER SERIES: PW800-PW2000 ELECTRICAL SCHEMATIC	NO. OF SHEETS 1
CHECKED DATE	ISSUED DATE	110/1PH/60HZ AND 220/1/50HZ	SCALE E 6/2144
DESIGNED BY BG	CONTRACT NO.	TOWN NO 13751	DATE 12-14-04







NOTE:

1) F1 IS RATED 2 AMPS / F2 IS RATED 1 AMP / F3 IS RATED 4 AMPS

DRAWING FILE NO.
13751.DWG

Village Marine Technology
2000 West 120th Street, Orem, UT 84058

PURE WATER SERIES: PW200-PW600
WIRING DIAGRAM
110/1PH/60HZ AND 220/1PH/50HZ

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DESIGNED: JM
CHECKED: JM
DATE: 09-19-97
SCALE: E 62144
SHEET: 9 OF 12

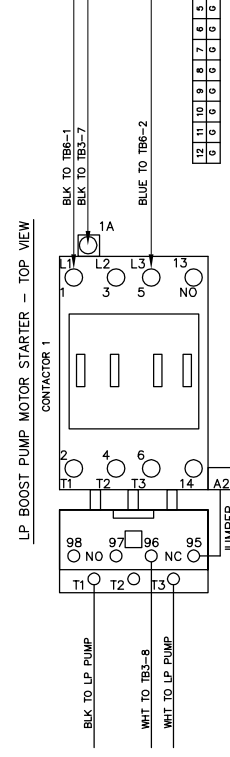
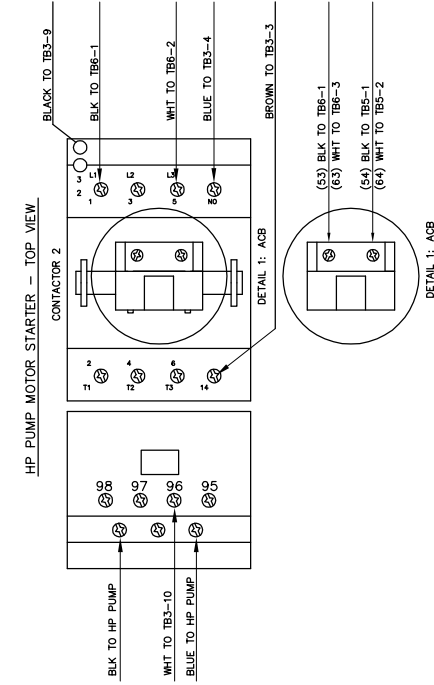
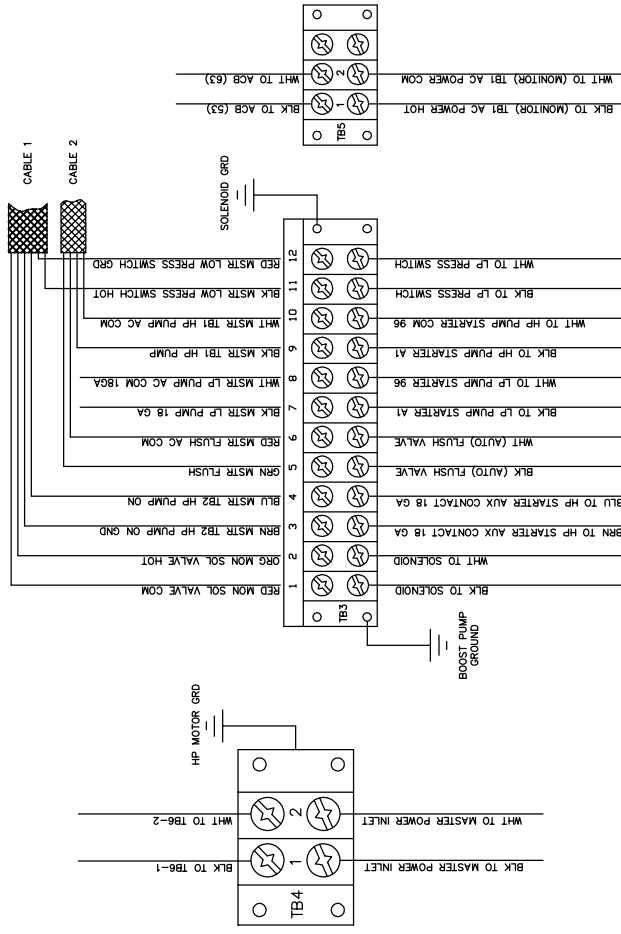
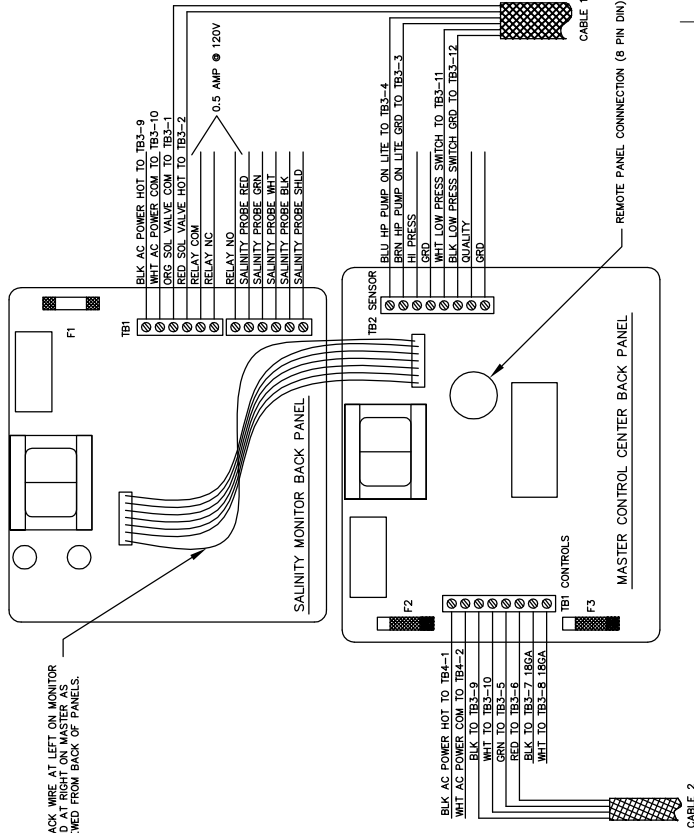
DATE: 09-19-97
DESIGNED: JM
CHECKED: JM
DATE: 09-19-97
SCALE: E 62144
SHEET: 9 OF 12

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	06/09/97	JM
B	CHANGED TITLE	10/07/97	JM
C	CHANGED LEFT POWER TO 254	06/25/98	JM
D	CHANGED UNITED JAWERS	02/04/99	JM
E	REFINED MCG LAMING DEC.	06/03/99	JM
F	BLACK AND WHITE TO HOT AND COMMON	06/09/99	JM
G	ADD AXES ON RULER BAR, UPDATED ENG. ASSIGNED SERIES NUMBER	12/17/04	BG
H	REVISED FILE NAMES	05/15/05	BG

NOTES:

- 1) F1 RATED: 2 AMPS / F2 RATED: $\frac{1}{8}$ AMP / F3 RATED: 4 AMPS
- 2) ACB = AUXILIARY CONTACT BLOCK; TMR = TRANSFORMER

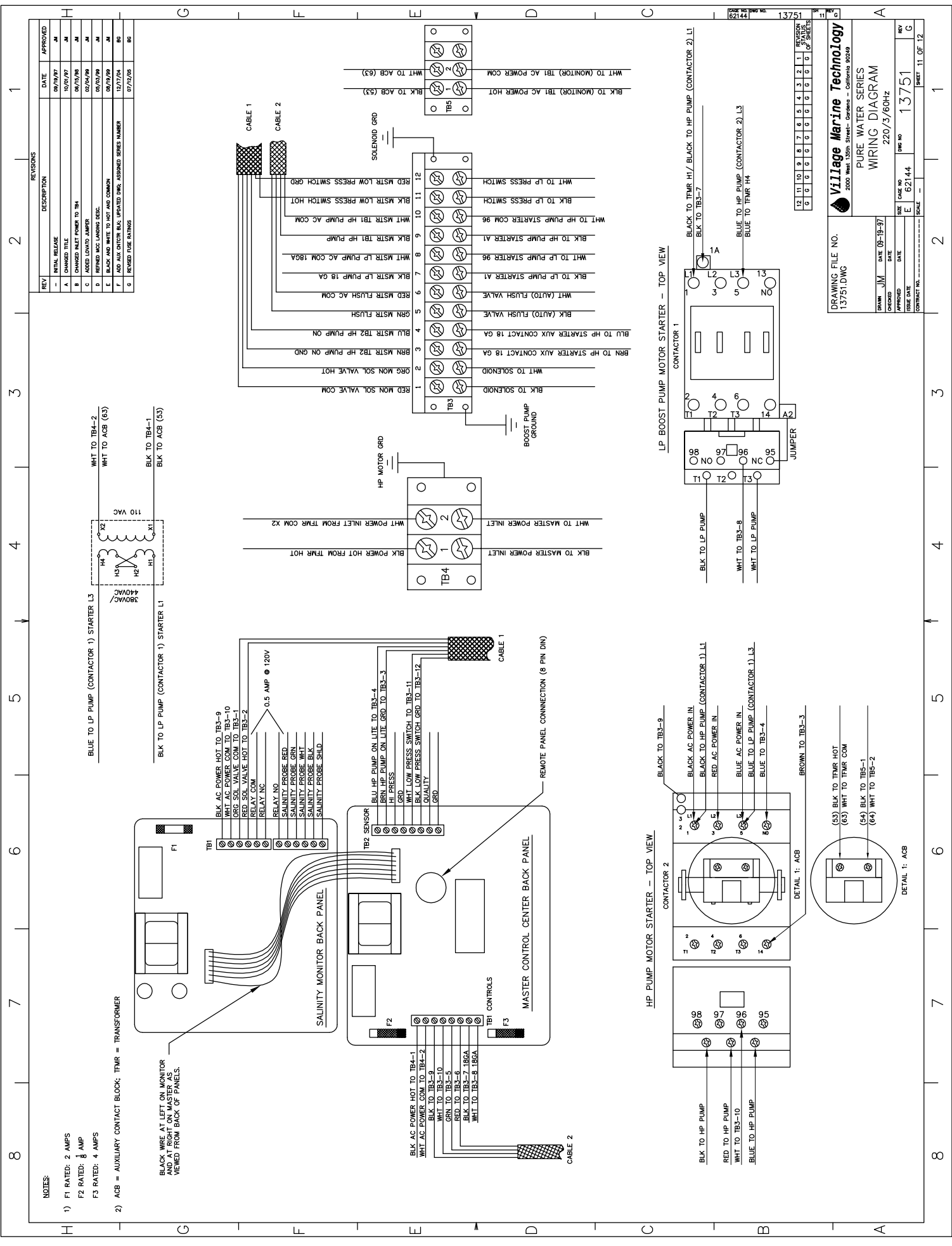
BLACK WIRE AT LEFT ON MONITOR
AND AT RIGHT ON MASTER AS
VIEWED FROM BACK OF PANELS.

[illegible]

Village Marine Technology
2000 West 135th Street—Gardens — California 90249

PURE WATER SERIES: PW800-PW2000
WIRING DIAGRAM
110 /1PH /50HZ AND 220 /1PH /50HZ

DRAWN	JM	DATE	09-19-97
CHECKED		DATE	
APPROVED		DATE	
ISSUE DATE			
CONTRACT NO.		SCALE	--
		SHEET	10 OF 12



NOTES:

- 1) F1 RATED: 2 AMPS
- F2 RATED: 8 AMP
- F3 RATED: 4 AMPS

2) ACB = AUXILIARY CONTACT BLOCK; THMR = TRANSFORMER

BLACK WIRE AT LEFT ON MONITOR AND AT RIGHT ON MASTER AS VIEWED FROM BACK OF PANELS.

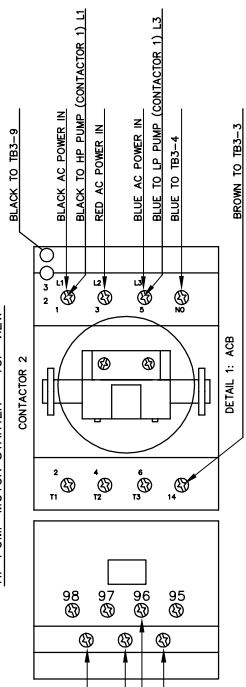
DRAWING FILE NO. 13751.DWG

Village Marine Technology
2000 West 15th Street, Orem, UT 84058

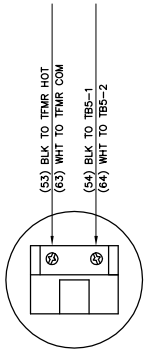
PURE WATER SERIES
WIRING DIAGRAM

DRAWN	JM	DATE	09-19-97
CHECKED		DATE	
APPROVED		DATE	
DATE DATE			
REV	E	DATE	02/14/04
REV	G	DATE	13751
REV	G	DATE	11 OF 12

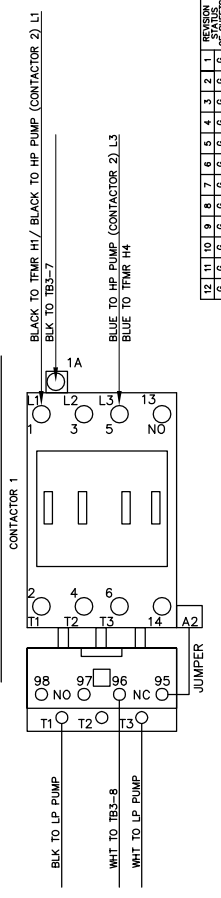
HP PUMP MOTOR STARTER - TOP VIEW



DETAIL 1: ACB

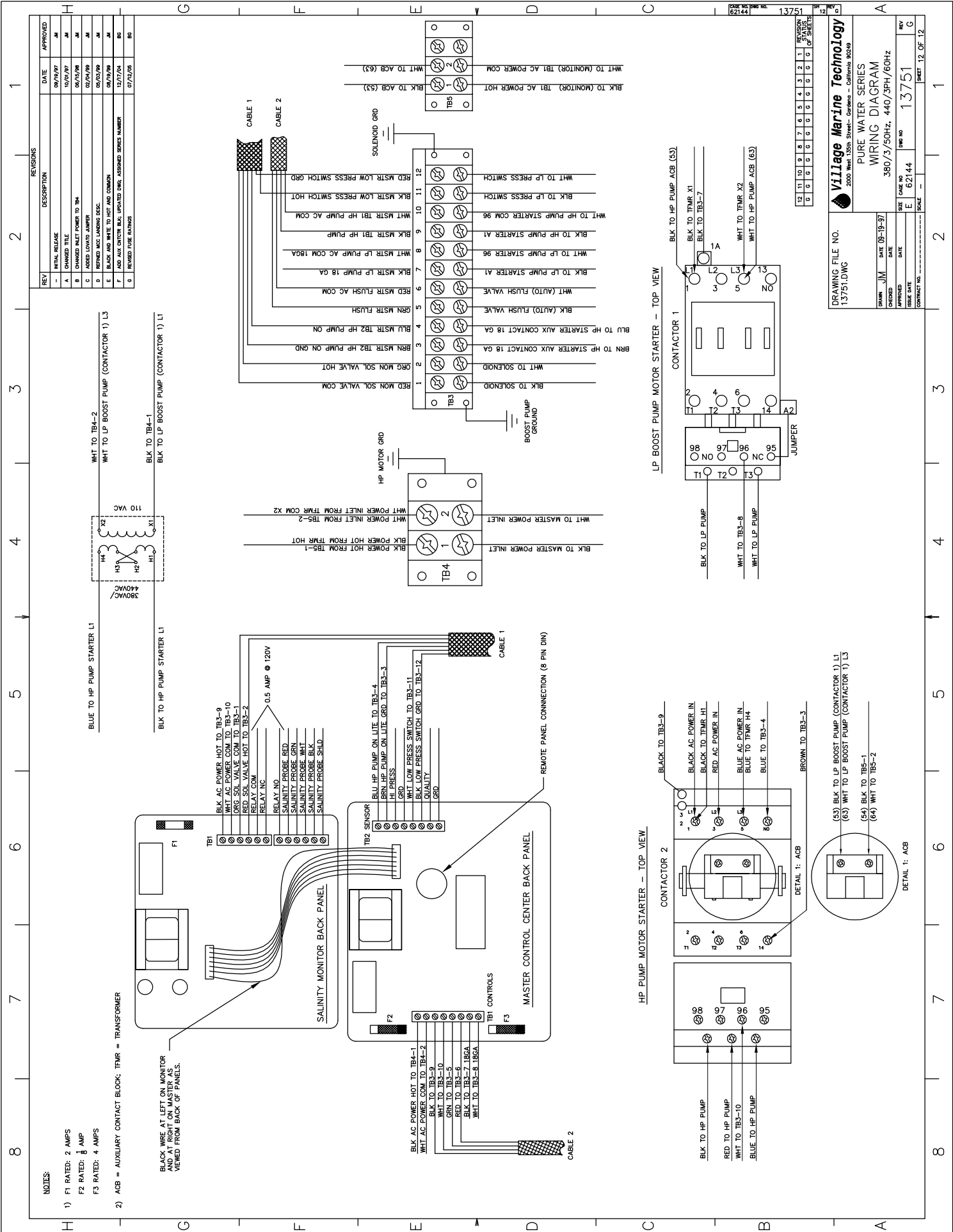


LP BOOST PUMP MOTOR STARTER - TOP VIEW



12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	0	0	0	0	0

REVISIONS
13751



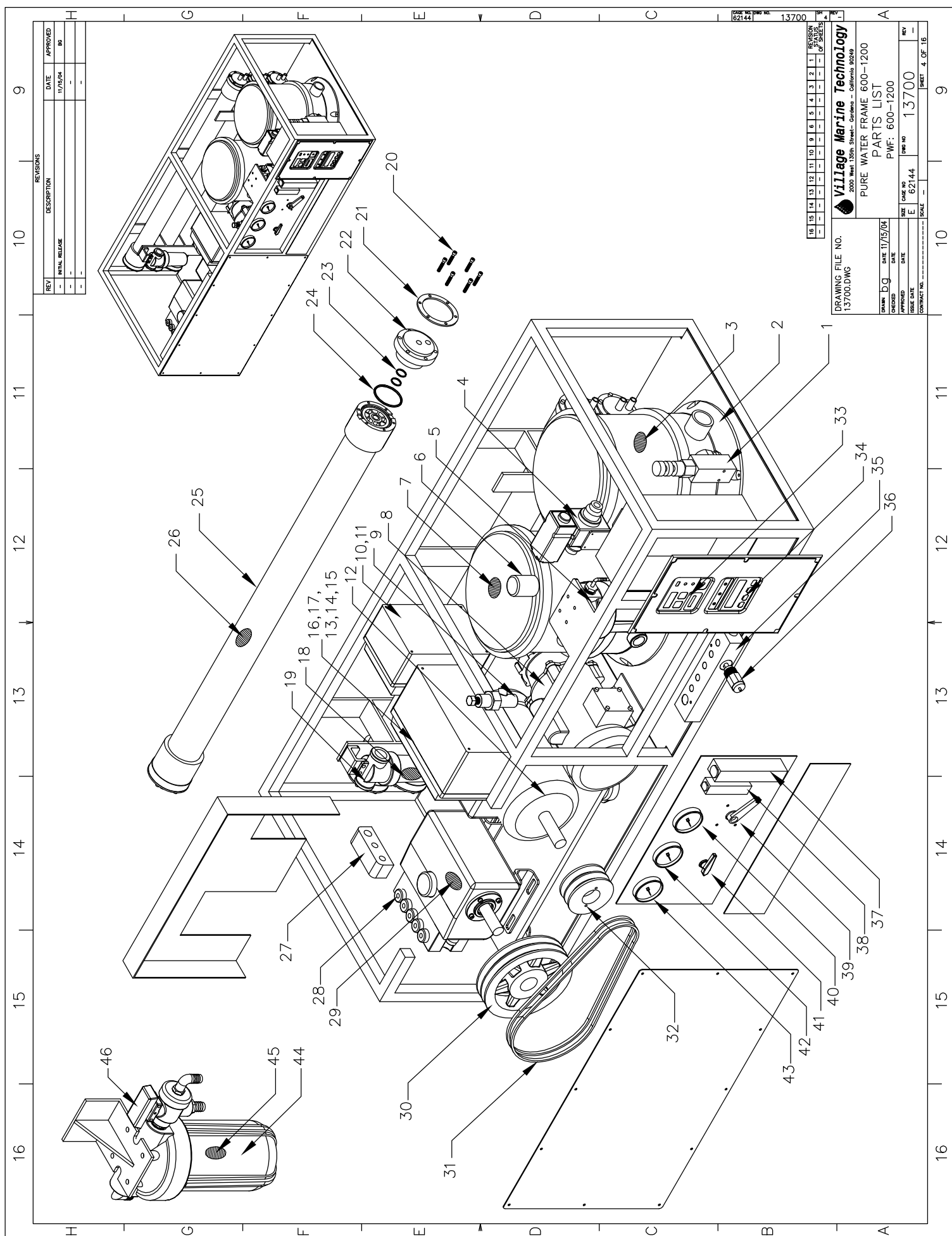
10.0 PARTS REFERENCE

- 1) INCLUDED PER PRESSURE VESSEL ASSEMBLY: 19" (32-2539).
PW200 USES TWO (1) PRESSURE VESSEL ASSEMBLY.
PW400 USES TWO (2) PRESSURE VESSEL ASSEMBLIES.
MEMBRANE 33-2519 WILL FIT INTO VESSELS 32-2521S AND 32-2519.
- 2) PW200 USES 12GPH FLOWMETER VMT P/N: 40-1017
PW400 USES 30GPH FLOWMETER VMT P/N: 40-1006

C		D		E		F		G		H		I		J		K		L		M		N		O		P		Q		R		S		T		U		V		W		X		Y		Z		AA		AB		AC		AD		AE		AF		AG		AH		AI		AJ		AK		AL		AM		AN		AO		AP		AQ		AR		AS		AT		AU		AV		AW		AX		AY		AZ		BA		BB		BC		BD		BE		BF		BG		BH		BI		BJ		BK		BL		BM		BN		BO		BP		BQ		BR		BS		BT		BU		BV		BW		BX		BY		BZ		CA		CB		CC		CD		CE		CF		CG		CH		CI		CJ		CK		CL		CM		CN		CO		CP		CQ		CR		CS		CT		CU		CV		CW		CX		CY		CZ		DA		DB		DC		DD		DE		DF		DG		DH		DI		DJ		DK		DL		DM		DN		DO		DP		DQ		DR		DS		DT		DU		DV		DW		DX		DY		DZ		EA		EB		EC		ED		EE		EF		EG		EH		EI		EJ		EK		EL		EM		EN		EO		EP		EQ		ER		ES		ET		EU		EV		EW		EX		EY		EZ		FA		FB		FC		FD		FE		FF		FG		FH		FI		FJ		FK		FL		FM		FN		FO		FP		FQ		FR		FS		FT		FU		FV		FW		FX		FY		FZ		GA		GB		GC		GD		GE		GF		GG		GH		GI		GJ		GK		GL		GM		GN		GO		GP		GQ		GR		GS		GT		GU		GV		GW		GX		GY		GZ		HA		HB		HC		HD		HE		HF		HG		HH		HI		HJ		HK		HL		HM		HN		HO		HP		HQ		HR		HS		HT		HU		HV		HW		HX		HY		HZ		IA		IB		IC		ID		IE		IF		IG		IH		II		IJ		IK		IL		IM		IN		IO		IP		IQ		IR		IS		IT		IU		IV		IW		IX		IY		IZ		JA		JB		JC		JD		JE		JF		JG		JH		JI		JJ		JK		JL		JM		JN		JO		JP		JQ		JR		JS		JT		JU		JV		JW		JX		JY		JZ		KA		KB		KC		KD		KE		KF		KG		KH		KI		KJ		KK		KL		KM		KN		KO		KP		KQ		KR		KS		KT		KU		KV		KW		KX		KY		KZ		LA		LB		LC		LD		LE		LF		LG		LH		LI		LJ		LK		LL		LM		LN		LO		LP		LQ		LR		LS		LT		LU		LV		LW		LX		LY		LZ		MA		MB		MC		MD		ME		MF		MG		MH		MI		MJ		MK		ML		MN		MO		MP		MQ		MR		MS		MT		MU		MV		MW		MX		MY		MZ		NA		NB		NC		ND		NE		NF		NG		NH		NI		NJ		NK		NL		NM		NO		NP		NQ		NR		NS		NT		NU		NV		NW		NX		NY		NZ		OA		OB		OC		OD		OE		OF		OG		OH		OI		OJ		OK		OL		OM		ON		OO		OP		OQ		OR		OS		OT		OU		OV		OW		OX		OY		OZ		PA		PB		PC		PD		PE		PF		PG		PH		PI		PJ		PK		PL		PM		PN		PO		PP		PQ		PR		PS		PT		PU		PV		PW		PX		PY		PZ		QA		QB		QC		QD		QE		QF		QG		QH		QI		QJ		QK	
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DRAWING FILE NO. 13700DWG		 Village Marine Technology 2000 West 13th Street - Corona - California 92619	
		PURE WATER FRAME 200-400 PARTS LIST PWF: 400	
DRAWN	bg	DATE	11/5/04
CHECKED		DATE	
APPROVED		DATE	
ISSUE DATE		ISSUE DATE	
CONTRACT NO.		CONTRACT NO.	
SIZE	A	SCALE	1 OF 15
QTY	1	QTY	1
REV	1	REV	1

1	32	RELAY, OVERLOAD, HP MOTOR	20-0215	20-0230	20-0215	20-0216	20-1025	20-1025
1	31	CONTACTOR, HIGH PRESSURE MOTOR	20-0264	20-0264	20-0264	20-0267	20-0267	20-0267
1	24	VALVE, SOL, 3-WAY, 1/4" 120V	19-1124	19-1124	19-2124	19-1124	19-1124	19-1124
1	22	PULLEY, MOTOR 1 Ø6 2.50"	70-0116	70-0116	70-0116	70-0116	70-0116	70-0116
1	21	BELT, DRIVE BX-31	70-0223	70-0223	70-0223	70-0223	70-0223	70-0223
1	20	PULLEY, HP PUMP 1 Ø6 7.75"	70-0601	70-0601	70-0601	70-0601	70-0601	70-0601
1	19	TRANSFORMER	N/A	N/A	N/A	20-1441	20-1440	20-1440
1	18	ENCLOSURE, ELECTRICAL, NEMA 4X, 8"X6"X5"	N/A	N/A	N/A	20-0865	20-0865	20-0865
1	16	MOTOR, HIGH PRESSURE PUMP	20-0192	20-0192	20-0033	20-0645	20-0192	20-0192
1	6	PUMP, LOW PRESSURE BOOST	70-0145	70-0145	70-0146	70-0145	70-0145	70-0145
QTY	IPC NO	DESCRIPTION	P/N 2221/1/60	P/N 1101/1/60	P/N 2210/1/50	P/N 220/3/60	P/N 380/3/50	P/N 440/3/60



NOTES:

- 1) INCLUDED PER PRESSURE VESSEL ASSEMBLY: 38" (32-2538). PWF-1600 USES FOUR (4) PRESSURE VESSEL ASSEMBLIES. PWF-2000 USES SIX (6) PRESSURE VESSEL ASSEMBLIES. MEMBRANE 33-0238 WILL FIT INTO VESSELS 32-2940 AND 32-2538.
- 2) ALL 50HZ UNITS, CONSULT EXISTING BELT FOR BELT P/N.

TABLE 1-5: PWF-2000 PARTS MATRIX

1	32			70-1034	70-0664	70-1034	70-0664	70-1034
2	31	BELT, DRIVE		70-0360	*SEE NOTE 2	70-0360	*SEE NOTE 2	70-0360
1	30	PULLEY, HP PUMP, 2 GRV, 7.75"		70-0775	70-0775	70-0775	70-0775	70-0775
1	17	RELAY, OVERLOAD, HP MOTOR		20-0950	20-0950	20-0582	20-0216	20-0216
1	16	CONTACTOR, HIGH PRESSURE MOTOR		20-0276	20-0275	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP		20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP		20-0264	20-0077	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL, 10"x6"x6"		20-1066	20-1066	20-1066	20-1066	20-1066
1	12	MOTOR, HIGH PRESURE PUMP, 5HP		20-0248	20-0500	20-0615	20-0357	20-0615
1	11	TRANSFORMER		N/A	N/A	20-1441	20-1118	20-1440
1	10	ENCLOSURE, ELECTRICAL, 8"x6"x5"		N/A	N/A	20-0865	20-0865	20-0865
1	4	VALVE, SOLENOID		20-1131	20-2133	20-1131	20-1132	20-1131
QTY	PC NO	DESCRIPTION		220V/1 / 60Hz	220V/1 / 50Hz	220V/1 / 60Hz	380V/3 / 50Hz	440V/3 / 60Hz

TABLE 1-4: PWF-1600 PARTS MATRIX

1	32	PULLEY, MOTOR 2 GRV	70-1034	70-0664	70-1034	70-0664	70-1034
2	31	BELT, DRIVE	70-0360	*SEE NOTE 2	70-0360	*SEE NOTE 2	70-0360
1	30	PULLEY, HP PUMP, 1 GRV, 7.75"	70-0775	70-0775	70-0775	70-0775	70-0775
1	17	PULLEY, OVERLOAD, HP MOTOR	20-0950	20-0950	20-0582	20-0216	20-0216
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0276	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP	20-0264	20-0077	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL, 10"x6"x6"	20-1066	20-1066	20-1066	20-1066	20-1066
1	12	MOTOR, HIGH PRESURE PUMP, 5HP	20-0248	20-0500	20-0615	20-0357	20-0615
1	11	TRANSFORMER	N/A	N/A	20-1441	20-1118	20-1440
1	4	ENCLOSURE, ELECTRICAL, 8"x6"x5"	N/A	N/A	20-0865	20-0865	20-0865
1	1	VALVE, SOLENOID	20-1131	20-2133	20-1131	20-1132	20-1131
QTY	PC NO	DESCRIPTION	220V/1/60Hz	220V/1/50Hz	220V/3/60Hz	380V/3/50Hz	440V/3/60Hz

1	46	VALVE, 3-WAY, 3/4" FNPT	PVC	—	60-0059	—
1	45	FILTER, CARBON, 4.5" X 10", FRESHWATER FLUSH	CARBON	—	33-0315	—
1	44	FILTER HOUSING, 5" X 10", BIG WHITE	PP	—	33-0011	—
1	43	GAUGE, PRESSURE 0-1000 PSI, BACK, CONN.	VARIOUS	—	40-0302	—
1	42	GAUGE, PRESSURE (-30-30) PSI, BACK, CONN.	VARIOUS	—	40-0300	—
1	41	VALVE, HIGH PRESSURE BYPASS	316SS	—	60-0064	—
QTY	PC	NO	DESCRIPTION	REMARKS	WMT	P/N LOC

[illegible][illegible]

FILE NO.	REV	5
 Village Marine Technology		

2000 West 135th Street- Gardena - California 90249

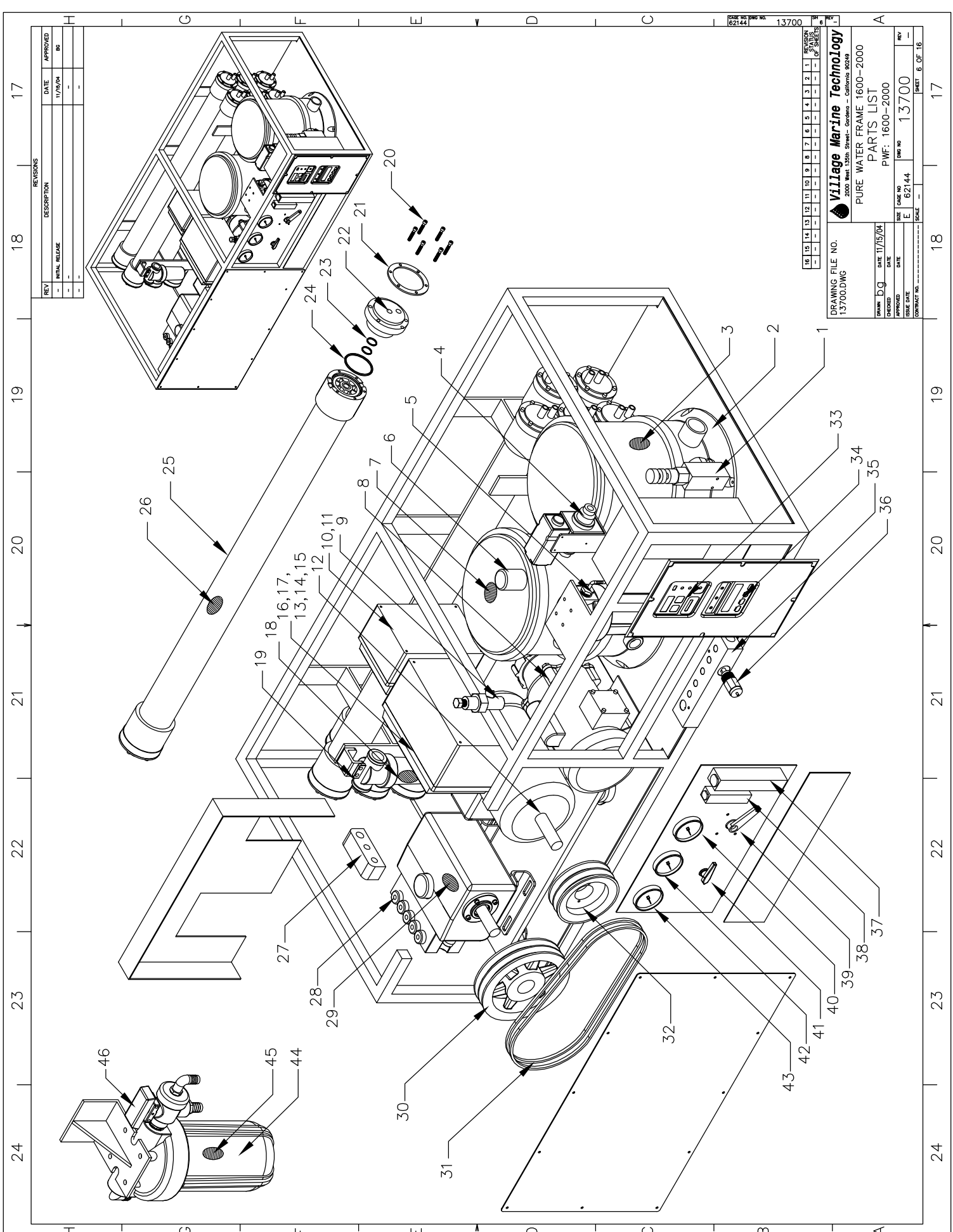
RUIDE WATER FRAME 1600-2000

DATE 11/15/04	PARTS LIST	FOUR WATER FRAME 1000-2000
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[illegible]

E	62144	13700	-
SCALE		-	SHEET 5 OF 16

18 — 17



REVISIONS		
REV	DESCRIPTION	DATE
1	INITIAL RELEASE	11/29/04
2		
3		

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

DRAWING FILE NO. 13700.DWG		DATE 11/15/04		CHECKED bg		DATE 11/15/04		DRAWN bg		DATE 11/15/04		APPROVED		DATE	
Village Marine Technology 2000 West 135th Street - Gardena - California 90248		PURE WATER FRAME 1600-2000		PARTS LIST		PWF: 1600-2000		CASE NO E 62144		REV NO 13700		REV —		SHEET 6 OF 16	

32	31	30	29	28	27	26	25
NOTES:							
1) RELIEF VALVE IS EXCLUDED FROM PWSM-600. AVAILABLE ON PWSM-800 AND ABOVE.							
2) PWSM-600 REQUIRES ONLY ONE (1) FILTER ASSEMBLY FOR 5 MICRON FILTER.							
PWSM-1200 REQUIRES TWO (2) FILTER ASSEMBLIES FOR 20 AND 5 MICRON FILTERS.							
3) PWSM-600 DOES NOT REQUIRE A 20 MICRON FILTER.							
4) INCLUDED PER PRESSURE VESSEL ASSEMBLY: 38" (32-2538).							
PWSM-600 AND PWSM-800 USES TWO (2) PRESSURE VESSEL ASSEMBLIES.							
PWSM-1200 USES THREE (3) PRESSURE VESSEL ASSEMBLIES.							
MEMBRANE 33-0238 WILL FIT INTO VESSELS 32-2540 AND 32-2538.							
NOTES:							
5) PWSM-600: ALL VOLTAGES REQUIRES ONLY ELECTRICAL ENCLOSURE (PC 13) P/N: 20-1066.							
PWSM-800-1200: 3 PHASE UNITS ONLY, REQUIRES LARGER ELECTRICAL ENCLOSURE P/N: 20-1287.							
6) PWSM-800 : 60Hz VMT BELT P/N: 70-0360.							
PWSM-1200: 60Hz VMT BELT P/N: 70-0380.							
ALL 50Hz UNITS, CONSULT EXISTING BELT FOR BELT P/N.							
7) PWSM-800 : 60Hz UNITS MOTOR PULLEY P/N: 70-0227.							
PWSM-1200: 60Hz UNITS MOTOR PULLEY P/N: 70-0662.							
PWSM-1200: 60Hz UNITS MOTOR PULLEY P/N: 70-1034.							
TABLE 1-3: PWSM-800-1200 PARTS MATRIX							
1	38	FLOWMETER, PRODUCT, 60 GPH	40-1018	40-1018	40-1018	40-1018	40-1018
1	32	PULLEY, MOTOR, 2 GRV	*SEE NOTE 6	*SEE NOTE 6	*SEE NOTE 6	*SEE NOTE 6	*SEE NOTE 6
2	31	BELT, DRIVE (*SEE NOTE 6 ABOUT SIZE)	*SEE NOTE 5	*SEE NOTE 5	*SEE NOTE 5	*SEE NOTE 5	*SEE NOTE 5
1	30	PULLEY, HP PUMP, 2 GRV, 7.75"	70-0775	70-0775	70-0775	70-0775	70-0775
1	17	RELAY, OVERLOAD, HP MOTOR	20-0230	20-0230	20-0216	20-0216	20-0216
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0276	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP	20-0264	20-0264	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL (*SEE NOTE 5)	20-1066	20-1066	20-1287	20-1287	20-1287
1	12	MOTOR, HIGH PRESSURE PUMP, 3HP	20-0213	20-0232	20-0301	20-0301	20-0232
1	11	TRANSFORMER	N/A	N/A	20-1441	20-1118	20-1440
1	8	PUMP, LOW PRESSURE BOOST	70-1550	70-1550	70-1550	70-1550	70-1550
1	4	VALVE, SOLENOID	20-1131	20-1131	20-1132	20-1131	20-1131
QTY	PC NO	DESCRIPTION	220V/1/60Hz	110V/1/60Hz	220V/1/50Hz	220V/3/50Hz	440V/3/60Hz
TABLE 1-2: PWSM-600 PARTS MATRIX							
1	38	FLOWMETER, PRODUCT, 30 GPH	40-1006	40-1006	40-1006	40-1006	40-1006
1	32	PULLEY, MOTOR 1 GRV	70-0117	70-0361	70-0117	70-0270	70-0117
1	31	BELT, DRIVE	70-0360	*SEE NOTE 6	70-0360	*SEE NOTE 6	70-0360
1	30	PULLEY, HP PUMP, 1 GRV, 7.75"	70-0601	70-0601	70-0601	70-0601	70-0601
1	17	RELAY, OVERLOAD, HP MOTOR	20-0215	20-0215	20-0216	20-1025	20-1025
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0275	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	N/A	N/A	N/A	N/A	N/A
1	14	CONTACTOR, LP PUMP	N/A	N/A	N/A	N/A	N/A
1	13	ENCLOSURE, ELECTRICAL (*SEE NOTE 5)	20-1066	20-1066	20-1066	20-1066	20-1066
1	12	MOTOR, HIGH PRESSURE PUMP, 2HP	20-3605	20-0292	20-3609	20-0356	20-3609
1	11	TRANSFORMER	N/A	N/A	20-1441	20-1118	20-1440
1	8	PUMP, LOW PRESSURE BOOST	70-0145	70-0146	70-0145	70-0145	70-0145
1	4	VALVE, SOLENOID	19-1124	19-1124	19-1124	19-1124	19-1124
QTY	PC NO	DESCRIPTION	220V/1/60Hz	110V/1/60Hz	220V/1/50Hz	220V/3/50Hz	440V/3/60Hz
1	46	VALVE, 3-WAY, 3/4" FNPT	PVC	-	-	60-0059	-
1	45	FILTER, CARBON, 4.5" X 10", FRESHWATER FLUSH	CARBON	-	-	33-0315	-
1	44	FILTER HOUSING, 5" X 10", BIG WHITE	PP	-	-	33-0011	-
1	43	GAUGE, PRESSURE 0-1000 PSI, BACK CONN.	VARIOUS	-	-	40-0302	-
1	42	GAUGE, PRESSURE (-30-30) PSI, BACK CONN.	VARIOUS	-	-	40-0300	-
1	41	VALVE, HIGH PRESSURE BYPASS	316SS	-	-	60-0064	-
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	WMT	P/N	LOC
TABLE 1-1: PWSM-800-1200 PARTS LIST							
1	40	GAUGE, PRESSURE 0-60 PSI, 2.5" BACK CONN.	VARIOUS	-	-	40-0303	-
1	39	VALVE, 3-WAY, 1/2" FNPT, CLEANING VALVE	PVC	-	-	60-0014	-
1	38	FLOWMETER, PRODUCT, 3 GPH	ACRYLIC	-	-	40-0093	-
1	36	PROBE, CONDUCTIVITY 5-WIRE	NYLON	-	-	20-4096	-
1	35	MANIFOLD, PRODUCT/BRINE	NYLON	-	-	30-0392	-
1	34	MASTER CONTROL CENTER	VARIOUS	-	-	20-0386	-
1	33	WATER QUALITY MONITOR	VARIOUS	-	-	40-4097	-
1	32	PULLEY, MOTOR	STEEL	-	-	VARIOUS	-
2*	31	BELT, DRIVE	VARIOUS	-	-	VARIOUS	-
1	30	PULLEY, HP PUMP	STEEL	-	-	VARIOUS	-
1	29	OIL, HIGH PRESSURE PUMP	OIL	-	-	85-0050	-
1	28	PUMP, HIGH PRESSURE, 5 FLUNGER	TITANIUM	-	-	70-6178	-
1	27	MANIFOLD, PROD/BRINE	NYLON	-	-	30-0391	-
1	26	ELEMENT, SEAWATER 2538	VARIOUS	-	-	33-0238	-
1	25	PRESSURE VESSEL 38", VESSEL ONLY	VARIOUS	-	-	32-2228	-
1	24	O-RING, ENDPUG, BRINE	BUNA-N	-	-	32-2228	-
1	23	O-RING, ENDPUG, PRODUCT	BUNA-N	-	-	32-2116	-
1	22	ENDPUG, 2.5" 2PORT	NYLON	-	-	32-2517	-
1	21	RING, ENDPUG, 2.5"	VARIOUS	-	-	32-4013	-
1	20	SCREWS, 316, 10/32" X 1-1/4"	VARIOUS	-	-	86-0106	-
1	19	STRAINER ASSY, T-TYPE 3/4" FNPT	NYLON	-	-	33-0340	-
1	18	STRAINER SCREEN, 40 MONEL MESH	MONEL	-	-	30-0040	-
1	17	RELAY, OVERLOAD, HP MOTOR	VARIOUS	-	-	VARIOUS	-
1	16	CONTACTOR, HIGH PRESSURE MOTOR	VARIOUS	-	-	VARIOUS	-
1	15	RELAY, OVERLOAD, LP PUMP	VARIOUS	-	-	VARIOUS	-
1	14	CONTACTOR, LP PUMP	ABS PLASTIC	-	-	VARIOUS	-
1	13	ENCLOSURE, ELECTRICAL	VARIOUS	-	-	VARIOUS	-
1	12	MOTOR, HIGH PRESURE PUMP	VARIOUS	-	-	VARIOUS	-
1	11	TRANSFORMER	VARIOUS	-	-	VARIOUS	-
-	10	NOT APPLICABLE	-	-	-	-	-
1	9	VALVE, REGULATOR, BRINE PRESSURE	316SS	-	-	60-0005	-
1	8	PUMP, LOW PRESSURE BOOST	VARIOUS	-	-	VARIOUS	-
1	7	FILTER, 5 MIC, 30 SQ FT	VARIOUS	-	-	33-0005	-
1	6	SWITCH, LOW PRESSURE, PUMP SUCTION	VARIOUS	-	-	20-0280	-
1	5	SEPARATOR, AIR/OIL, 2.5" X 10"	PP	-	-	33-0105	-
1	4	VALVE, SOLENOID	VARIOUS	-	-	VARIOUS	-
1*	3	FILTER, 20 MIC, 30 SQ FT (PMF-800-ABOVE)	VARIOUS	-	-	33-0020	-
2*	2	FILTER ASSY, 30 SQ FT	VARIOUS	-	-	30-0030	-
1	1	VALVE, RELIEF, 3/4" FNPT, NYL (PMF-800-ABOVE)	VARIOUS	-	-	60-7742	-
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	WMT	P/N	LOC
DRAWING FILE NO. 13700JWG							
Village Marine Technology 2000 West 135th Street, Gardena - California 90249							
PURE WATER SEMIMODULAR 600-1200							
PARTS LIST							
PWSM: 600-1200							
DRAWN	bg	DATE	11/15/04	DATE	11/15/04	DATE	11/15/04
CHECKED	bg	DATE		DATE		DATE	
APPROVED	E	DATE		DATE		DATE	
ISSUE DATE	E	DATE		DATE		DATE	
CONTRACT NO.		SCALE		SCALE		SCALE	
REV		REV		REV		REV	
1		1		1		1	
2		2		2		2	
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4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
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10		10		10		10	
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NOTES:

1) INCLUDED PER PRESSURE VESSEL ASSEMBLY: 38" (32-2538).
PWSM-1600 USES FOUR (4) PRESSURE VESSEL ASSEMBLIES.
PWSM-1600 USES TWO (2) PRESSURE VESSEL ASSEMBLIES.
MEMBRANE 33-0238 WILL FIT INTO VESSELS 32-2540 AND 32-2538.

2) ALL 50HZ UNITS, CONSULT EXISTING BELT FOR BELT P/N.

3) PWSM: 3 PHASE UNITS ONLY, REQUIRES LARGER ELECTRICAL ENCLOSURE P/N: 20-1287.

TABLE 1-5: PWSM-2000 PARTS MATRIX

1	32	PULLEY, MOTOR, 2 GRV	70-1034	70-0664	70-1034	70-0664	70-1034
2	31	BELT, DRIVE	70-0360	*SEE NOTE 2	70-0360	*SEE NOTE 2	70-0360
1	30	PULLEY, HP PUMP, 7.75"	70-0775	70-0775	70-0775	70-0775	70-0775
1	17	RELAY, OVERLOAD, HP MOTOR	20-0950	20-0950	20-0950	20-0950	20-0950
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0276	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP	20-0264	20-0077	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL (*SEE NOTE 3)	20-1066	20-1066	20-1287	20-1287	20-1287
1	12	MOTOR, HIGH PRESURE PUMP, SHP	20-0248	20-0500	20-0615	20-0357	20-0615
1	11	TRANSFORMER	N/A	N/A	20-1118	20-1118	20-1440
1	4	VALVE, SOLENOID	20-1131	20-2133	20-1131	20-1132	20-1131
QTY	PC NO	DESCRIPTION	220V/1/60Hz	220V/1/50Hz	220V/3/60Hz	380V/3/50Hz	440V/3/60Hz

TABLE 1-4: PWSM-1600 PARTS MATRIX

1	32	PULLEY, MOTOR 2 GRV	70-1034	70-0664	70-1034	70-0664	70-1034
2	31	BELT, DRIVE	70-0360	*SEE NOTE 2	70-0360	*SEE NOTE 2	70-0360
1	30	PULLEY, HP PUMP, 1 GRV, 7.75"	70-0775	70-0775	70-0775	70-0775	70-0775
1	17	RELAY, OVERLOAD, HP MOTOR	20-0950	20-0950	20-0582	20-0216	20-0216
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0275	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP	20-0264	20-0077	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL (*SEE NOTE 3)	20-1066	20-1066	20-1287	20-1287	20-0815
1	12	MOTOR, HIGH PRESSURE PUMP, SHP	20-0248	20-0500	20-0615	20-0357	20-0615
1	11	TRANSFORMER	N/A	N/A	20-1441	20-1118	20-1440
1	4	VALVE, SOLENOID	20-1131	20-2133	20-1131	20-1132	20-1131
QTY	PC NO	DESCRIPTION	220V/1/60Hz	220V/1/50Hz	220V/3/60Hz	380V/3/50Hz	440V/3/60Hz

TABLE 1-3: PWSM-1600 PARTS MATRIX

1	46	VALVE, 3-WAY, 3/4" FNPT	PVC	-	-	60-0059	-
1	45	FILTER, CARBON, 4.5" X 10", FRESHWATER FLUSH	CARBON	-	-	33-0315	-
1	44	FILTER HOUSING, 5" X 10", BIG WHITE	PP	-	-	33-0011	-
1	43	GAUGE, PRESSURE 0-1000 PSI, BACK CONN.	VARIOUS	-	-	40-0302	-
1	42	GAUGE, PRESSURE 0-1000 PSI, BACK CONN.	VARIOUS	-	-	40-0300	-
1	41	VALVE, HIGH PRESSURE BYPASS	316SS	-	-	60-0064	-
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	WMT P/N	LOC	

TABLE 1-2: PWSM-2000 PARTS MATRIX

1	40	GAUGE, PRESSURE 0-60 PSI, 2.5" BACK CONN.	VARIOUS	-	-	40-0303	-
1	39	VALVE, 3-WAY, 1/2" FNPT, CLEANING VALVE	PVC	-	-	60-0014	-
1	38	FLOWMETER, PRODUCT, 100 GPM	ACRYLIC	-	-	40-0240	-
1	37	FLOWMETER, BRINE 5 GPM	ACRYLIC	-	-	40-0025	-
1	36	PROBE, CONDUCTIVITY 5-WIRE	NYLON	-	-	20-4096	-
1	35	MANIFOLD, PRODUCT/BRINE	NYLON	-	-	30-0392	-
1	34	MASTER CONTROL CENTER	VARIOUS	-	-	20-0386	-
1	33	WATER QUALITY MONITOR	VARIOUS	-	-	40-4097	-
1	32	PULLEY, MOTOR	STEEL	*SEE TABLE 1-4, OR 1-5	VARIOUS	VARIOUS	-
2	31	BELT, DRIVE	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	VARIOUS	-
1	30	PULLEY, HP PUMP	STEEL	*SEE TABLE 1-4, OR 1-5	VARIOUS	VARIOUS	-
1	29	OIL, HIGH PRESSURE PUMP	OIL	-	85-0050	-	-
1	28	PUMP, HIGH PRESSURE, 5 PLUNGER	TITANIUM	-	70-6178	-	-
1	27	MANIFOLD, PROD/BRINE	NYLON	-	30-0391	-	-
1	26	ELEMENT, SEAWATER 2538	VARIOUS	*SEE NOTE 1	33-0238	-	-
1	25	PRESSURE VESSEL 38", VESSEL ONLY	VARIOUS	*SEE NOTE 1	32-2228	-	-
1	24	O-RING, ENDPUG, BRINE	BUNA-N	*SEE NOTE 1	32-2228	-	-
1	23	O-RING, ENDPUG, PRODUCT	BUNA-N	*SEE NOTE 1	32-2116	-	-
1	22	ENDPLUG, 2.5" 2PORT	NYLON	*SEE NOTE 1	32-2517	-	-
1	21	RING, ENDPUG, 2.5"	VARIOUS	*SEE NOTE 1	32-4013	-	-
1	20	SCREWS, 316, 10/32" X 1-1/4"	VARIOUS	*SEE NOTE 1	86-0108	-	-
1	19	STRAINER ASSY, T-TYPE 3/4" FNPT	NYLON	-	33-0340	-	-
1	18	STRAINER SCREEN, 40 MONEL MESH	MONEL	-	30-0040	-	-
1	17	RELAY, OVERLOAD, HP MOTOR	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	16	CONTACTOR, HIGH PRESSURE MOTOR	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	15	RELAY, OVERLOAD, LP PUMP	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	14	CONTACTOR, LP PUMP	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	13	ENCLOSURE, ELECTRICAL, NEMA 4X	ABS PLASTIC	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	12	MOTOR, HIGH PRESSURE PUMP	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	11	TRANSFORMER	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
-	10	NOT APPLICABLE	-	-	-	-	-
1	9	VALVE, REGULATOR, BRINE PRESSURE	316SS	-	60-0005	-	-
1	8	PUMP, LOW PRESSURE BOOST	VARIOUS	-	70-1550	-	-
1	7	FILTER, 5 MIC, 30 SQ FT	VARIOUS	-	33-0005	-	-
1	6	SWITCH, LOW PRESSURE, PUMP SUCTION	VARIOUS	-	20-0280	-	-
1	5	SEPARATOR, AIR/OIL, 2.5" X 10"	PP	-	33-0105	-	-
1	4	VALVE, SOLENOID	VARIOUS	*SEE TABLE 1-4, OR 1-5	VARIOUS	-	-
1	3	FILTER, 20 MIC, 30 SQ FT	VARIOUS	-	33-0020	-	-
2	2	FILTER ASSY, 30 SQ FT	VARIOUS	-	30-0030	-	-
1	1	VALVE, RELIEF, 3/4" FNPT, NYL	VARIOUS	-	60-7742	-	-
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	WMT P/N	LOC	

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2000 West 155th Street - Gardena - California 90249

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PURE WATER SEMIMODULAR 1600-2000

PARTS LIST

PWSM: 1600-2000

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2000 West 155th Street - Gardena - California 90249

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PURE WATER SEMIMODULAR 1600-2000

PARTS LIST

PWSM: 1600-2000

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Village Marine Technology

2000 West 155th Street - Gardena - California 90249

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PURE WATER SEMIMODULAR 1600-2000

PARTS LIST

PWSM: 1600-2000

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Village Marine Technology

2000 West 155th Street - Gardena - California 90249

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PURE WATER SEMIMODULAR 1600-2000

PARTS LIST

PWSM: 1600-2000

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DATE: 11/15/04

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SIZE: 11x17

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Village Marine Technology

2000 West 155th Street - Gardena - California 90249

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PURE WATER SEMIMODULAR 1600-2000

PARTS LIST

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Village Marine Technology

2000 West 155th Street - Gardena - California 90249

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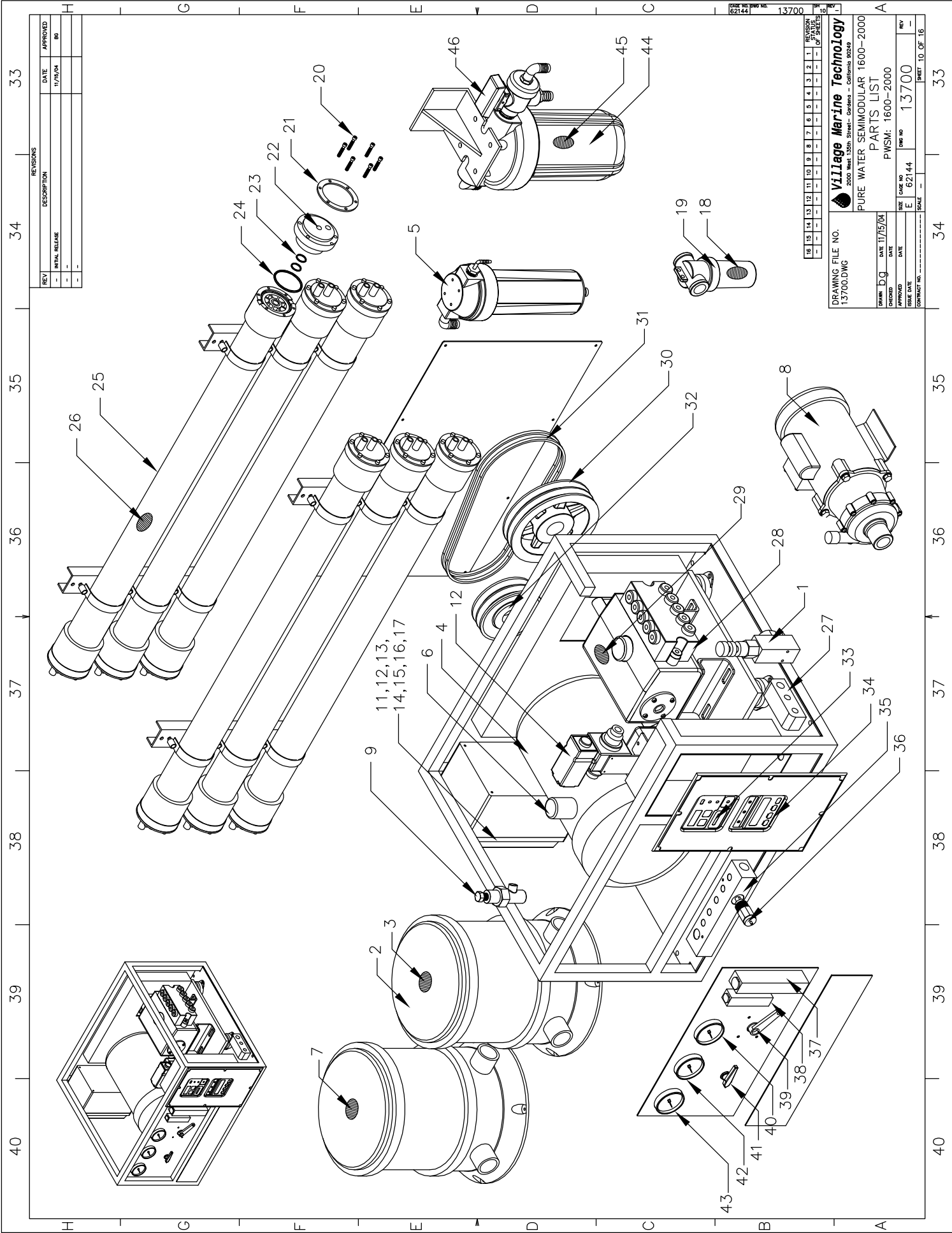
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Village Marine Technology
2000 West 125th Street - Gardena - California 90248

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PURE WATER SEMIMODULAR 1600-2000
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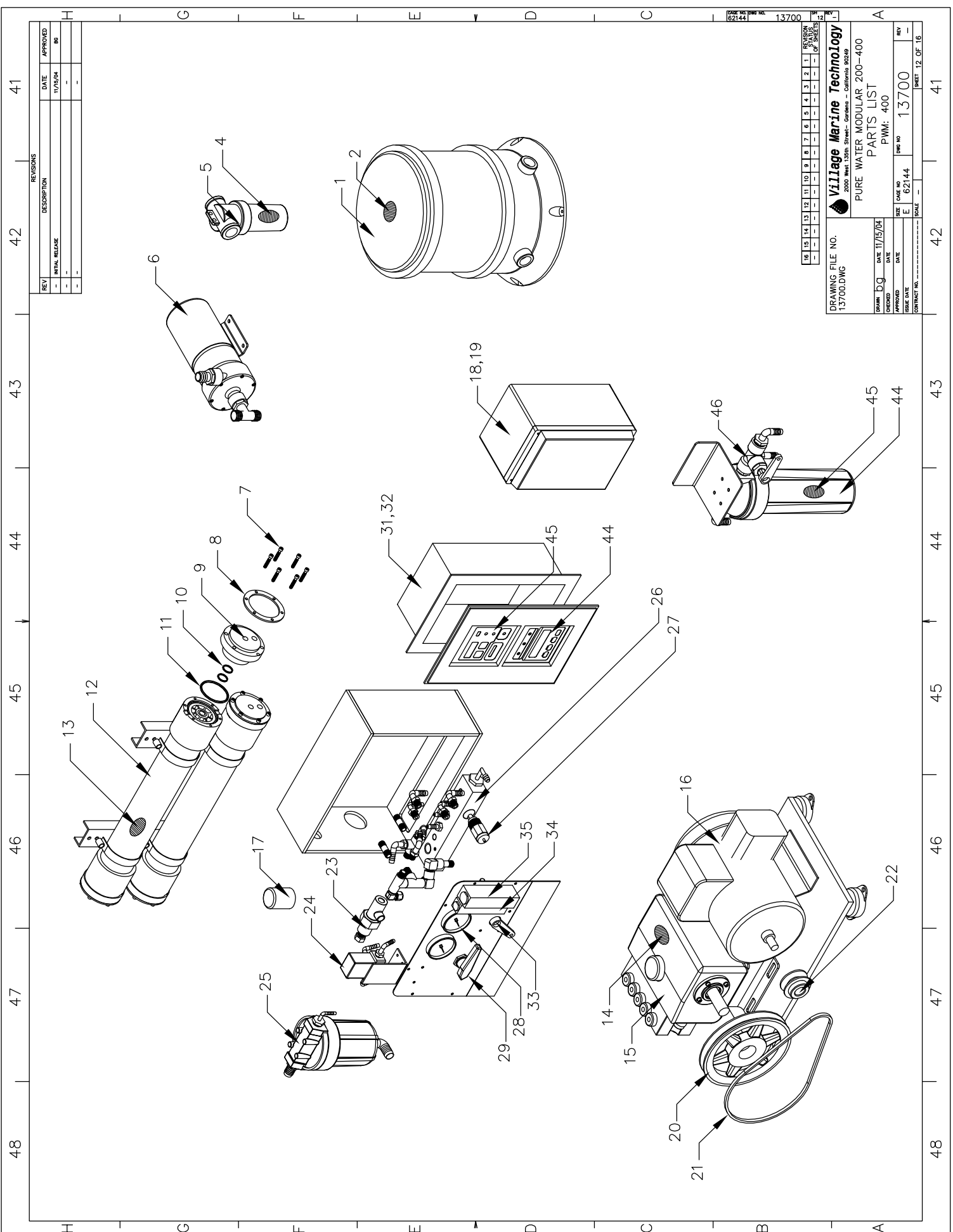
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ISSUE DATE:	DATE:	SIZE: E	DWG NO. 13700
CONTRACT NO.:	SCALE:	REV.:	SHEET 12 OF 16

NOTES:

- 1) INCLUDED PER PRESSURE VESSEL ASSEMBLY: 38" (32-2538),
PWW-1600 USES FOUR (4) PRESSURE VESSEL ASSEMBLIES.
PRESSURE VESSEL ASSEMBLY: PWW-1600 USES FOUR (4)
MEMBRANE 33-0238 WILL FIT INTO VESSELS 32-2540 AND 32-2538.
- 2) ALL 50HZ UNITS, CONSULT EXISTING LARGER FOR BELT P/N.
- 3) PWW: 3 PHASE UNITS ONLY, REQUIRES LARGER ELECTRICAL ENCLOSURE

TABLE 1-5: PWM-2000 PARTS MATRIX

1	32	PULLEY, MOTOR, 2 GRV	70-1034	70-0664	70-1034	70-0664	70-1034
2	31	BELT, DRIVE	70-0360	*SEE NOTE 2	70-0360	*SEE NOTE 2	70-0360
1	30	PULLEY, HP PUMP, 2 GRV, 7.75"	70-0775	70-0775	70-0775	70-0775	70-0775
1	17	RELAY, OVERLOAD, HP MOTOR	20-0950	20-0950	20-0582	20-0216	20-0216
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0275	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP	20-0264	20-0077	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL (*SEE NOTE 3)	20-1066	20-1066	20-1287	20-1287	20-1287
1	12	MOTOR, HIGH PRESURE PUMP, 5HP	20-0248	20-0500	20-0615	20-0357	20-0615
1	11	TRANSFORMER	N/A	N/A	20-1441	20-1118	20-1440
1	4	VALVE, SOLENOID	20-1131	20-2133	20-1131	20-1132	20-1131
QTY	PC NO	DESCRIPTION	220V/1/60Hz	220V/1/50Hz	220V/3/60Hz	380V/3/50Hz	440V/3/60Hz

TABLE 1-4: PWM-1600 PARTS MATRIX

1	32	PULLEY, MOTOR 2 GRV	70-1034	70-0664	70-1034	70-0664	70-1034
2	31	BELT, DRIVE	70-0360	*SEE NOTE 2	70-0360	*SEE NOTE 2	70-0360
1	30	PULLEY, HP PUMP, 1 GRV, 7.75"	70-0775	70-0775	70-0775	70-0775	70-0775
1	17	RELAY, OVERLOAD, HP MOTOR	20-0950	20-0950	20-0882	20-0216	20-0216
1	16	CONTACTOR, HIGH PRESSURE MOTOR	20-0276	20-0275	20-0276	20-0276	20-0276
1	15	RELAY, OVERLOAD, LP PUMP	20-1025	20-1025	20-1025	20-1025	20-1025
1	14	CONTACTOR, LP PUMP	20-0264	20-0077	20-0264	20-0264	20-0264
1	13	ENCLOSURE, ELECTRICAL (*SEE NOTE 3)	20-1066	20-1066	20-1287	20-1287	20-1287
1	12	MOTOR, HIGH PRESURE PUMP, 5HP	20-0248	20-0500	20-0615	20-0357	20-0615
1	11	TRANSFORMER	N/A	N/A	20-1441	20-1118	20-1440
1	4	VALVE, SOLENOID	20-1131	20-2133	20-1131	20-1131	20-1131
QTY	PC NO	DESCRIPTION	220V/1/60Hz	220V/1/50Hz	220V/3/60Hz	380V/3/50Hz	440V/3/60Hz

1	46	VALVE, 3-WAY, 3/4" FNPT	PVC	—	60-0059	—
1	45	FILTER, CARBON, 4.5" X 10", FRESHWATER FLUSH	CARBON	—	33-0315	—
1	44	FILTER HOUSING, 5" X 10", BIG WHITE	PP	—	33-0011	—
1	43	GAUGE, PRESSURE 0-1000 PSI, BACK CONN.	VARIOUS	—	40-0302	—
1	42	GAUGE, PRESSURE (-30-30) PSI, BACK CONN.	VARIOUS	—	40-0300	—
1	41	VALVE, HIGH PRESSURE BYPASS	316SS	—	60-0064	—
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	WMT P/N	LOC

QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	UNIT	P/N	LOC
1	40	GAUGE, PRESSURE 0-60 PSI, 2.5" BACK CONN.	VARIOUS	-	-	40-0303	-
1	39	VALVE, 3-WAY, 1/2" FNPT, CLEANING VALVE	PVC	-	-	60-0014	-
1	38	FLOWMETER, PRODUCT, 100 GPH	ACRYLIC	-	-	40-0240	-
1	37	FLOWMETER, BRINE 5 GPM	ACRYLIC	-	-	40-0025	-
1	36	PROBE, CONDUCTIVITY 5-WIRE	NYLON	-	-	20-4096	-
1	35	MANIFOLD, PRODUCT/BRINE	NYLON	-	-	30-0392	-
1	34	MASTER CONTROL CENTER	VARIOUS	-	-	20-0386	-
1	33	WATER QUALITY MONITOR	VARIOUS	-	-	40-4097	-
1	32	PULLEY, MOTOR	STEEL	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
2	31	BELT, DRIVE	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	30	PULLEY, HP PUMP	STEEL	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	29	OIL, HIGH PRESSURE PUMP	OIL	-	-	85-0050	-
1	28	PUMP, HIGH PRESSURE, 5 PLUNGER	TITANIUM	-	-	70-6178	-
-	27	NOT APPLICABLE	NYLON	-	-	-	-
1	26	ELEMENT, SEAWATER 2538	VARIOUS	-	*SEE NOTE 1	33-0238	-
1	25	PRESSURE VESSEL 38", VESSEL ONLY	VARIOUS	-	*SEE NOTE 1	32-2228	-
1	24	O-RING, ENDPUG, BRINE	BUNA-N	-	*SEE NOTE 1	32-2228	-
1	23	O-RING, ENDPUG, PRODUCT	BUNA-N	-	*SEE NOTE 1	32-2116	-
1	22	ENDPUG, 2.5" 2PORT	NYLON	-	*SEE NOTE 1	32-2517	-
1	21	RING, ENDPUG, 2.5"	VARIOUS	-	*SEE NOTE 1	32-4013	-
1	20	SCREWS, 316, 10/32" x 1-1/4"	VARIOUS	-	*SEE NOTE 1	86-0106	-
1	19	STRAINER ASSY, 1-TYPE 3/4" FNPT	NYLON	-	-	33-0340	-
1	18	STRAINER SCREEN, 40 MONEL MESH	MONEL	-	-	30-0040	-
1	17	RELAY, OVERLOAD, HP MOTOR	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	16	CONTACTOR, HIGH PRESSURE MOTOR	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	15	RELAY, OVERLOAD, LP PUMP	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	14	CONTACTOR, LP PUMP	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	13	ENCLOSURE, ELECTRICAL, NEMA 4X	ABS PLASTIC	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	12	MOTOR, HIGH PRESSURE PUMP	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	11	TRANSFORMER	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
-	10	NOT APPLICABLE	-	-	-	-	-
1	9	VALVE, REGULATOR, BRINE PRESSURE	316SS	-	-	60-0005	-
1	8	PUMP, LOW PRESSURE BOOST	VARIOUS	-	-	70-1550	-
1	7	FILTER, 5 MIC, 30 SQ FT	VARIOUS	-	-	33-0005	-
1	6	SWITCH, LOW PRESSURE, PUMP SUCTION	VARIOUS	-	-	20-0280	-
1	5	SEPARATOR, AIR/OIL, 2.5" x 10"	PP	-	-	33-0105	-
1	4	VALVE, SOLENOID	VARIOUS	-	*SEE TABLE 1-4, OR 1-5	VARIOUS	-
1	3	FILTER, 20 MIC, 30 SQ FT	VARIOUS	-	-	33-0020	-
2	2	FILTER ASSY, 30 SQ FT	VARIOUS	-	-	30-0030	-
1	1	VALVE, RELIEF, 3/4" FNPT, NYL	VARIOUS	-	-	60-7742	-

DRAWING FILE NO. 13700.DWG		DRAWN bg DATE 11/15/04 CHECKED DATE		Village Marine Technology 2000 West 135th Street - Gardena - California 90249 PURE WATER MODULAR 1600-2000 PARTS LIST PWM: 1600-2000	
APPROVED DATE ISSUE DATE CONTRACT NO.		SIZE CAGE DWG NO 13700 E 62144		REV REV # — 15 OF 16	

NOTES:

1) INCLUDED PER PRESSURE VESSEL ASSEMBLY: 38" (32-2538).
PURE 2000 PRESS VESSEL ASSEMBLY
PURE 2000 PRESS VESSEL ASSEMBLY
MEMBRANE 33-0238 WILL FIT INTO VESSELS 32-2540 AND 32-2538.

REVISIONS			APPROVED
REV	DESCRIPTION	DATE	
-	INITIAL RELEASE	07/11/08	HB

1	52	VALVE, NEEDLE, 1/2" FNPT, GLOBE, CYCLONE	PVC	NOT DEPICTED	60-0500	V7
1	51	FILTER, CARBON, 4.5" x 10", FRESHWATER FLUSH	CARBON	-	33-0315	CF
1	50	FILTER HOUSING, 5" X 10", BIG WHITE	PP	-	33-0011	-
1	49	OIL, HIGH PRESSURE PUMP	OIL	-	85-0050	-
1	48	BELT, DRIVE	VARIOUS	-	70-0360	-
2	47	VALVE, HIGH PRESSURE BYPASS	316SS	-	60-0064	V1
1	46	PROBE, CONDUCTIVITY 5-WIRE	VARIOUS	-	30-4096	SRI
1	45	MANIFOLD, PRODUCT/BRINE	NYLON	-	20-0392	-
1	44	VALVE, 3-WAY, 1/2" FNPT, CLEANING VALVE	PVC	-	60-0014	V2
1	43	TERMINAL MARKING STRIP, 12 PT	VARIOUS	-	20-0208	-
1	42	TERMINAL BLOCK, 12 POINT	VARIOUS	-	20-0207	-
1	41	RELAY, SOCKET, 10 AMP, 120V, MINI 8-PIN	VARIOUS	-	20-1030	-
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	PART NUMBER	P&ID

1	40	SOCKET, RELAY, 8 PIN GOES WITH 20-1030	VARIOUS	-	20-1030	R1
1	39	MASTER CONTROL CENTER	VARIOUS	-	20-0386	-
1	38	WATER QUALITY MONITOR	VARIOUS	-	40-4097	MON
1	37	FLOWMETER, BRINE 5 GPM	ACRYLIC	-	40-0025	FM1
1	36	FLOWMETER, PRODUCT, 100 GPH	ACRYLIC	-	40-0240	FM2
1	35	GAUGE, PRESSURE 0-1000 PSI, BACK CONN.	VARIOUS	-	40-0302	PG1
1	34	GAUGE, PRESSURE (-30, 30) PSI, BACK CONN.	VARIOUS	-	40-0300	PG2
2	33	GAUGE, PRESSURE 0-60 PSI, 2.5" BACK CONN.	VARIOUS	-	40-0303	PG4
1	32	VALVE, SOLENOID	VARIOUS	-	20-1131	V4
1	31	SWITCH, LOW PRESSURE, PUMP SUCTION	VARIOUS	-	20-0280	PS1
1	30	SEPARATOR, AIR/OIL, 2.5" X 10"	PP	-	33-0105	AOS
1	29	FILTER, 5 MIC, 30 SQ FT	VARIOUS	-	33-0005	F1
1	28	VALVE, REGULATOR, BRINE PRESSURE	316SS	-	60-0005	V3
1	27	MOTOR, 2 HP, LP BOOST	VARIOUS	-	20-0234	-
1	26	PUMP, LOW PRESSURE BOOST, NO MOTOR	BRONZE	-	70-1251	P1
1	25	TRANSFORMER	VARIOUS	-	20-1440	-
1	24	ENCLOSURE, ELECTRICAL, NEMA 4X, 8"x6"x5"	ABS PLASTIC	-	20-0865	-
1	23	PULLEY, MOTOR, 2 GRV	STEEL	-	70-1034	-
1	22	PULLEY, HP PUMP, 2 GRV, 7.75"	STEEL	-	70-0775	-
1	21	PUMP, HIGH PRESSURE, 5 PLUNGER	TITANIUM	-	70-6178	P2
1	20	MOTOR, HIGH PRESSURE PUMP, 5HP	VARIOUS	-	20-0615	-
1	19	MANIFOLD, INLET, PW/SPW	NYLON	-	30-0391	-
1	18	STRAINER ASSY, T-TYPE 3/4" FNPT	NYLON	-	33-0340	ST
1	17	STRAINER SCREEN, 40 MONEL MESH	MONEL	-	30-0040	-
1	16	AUXILIARY CONTACT BLOCK, CENTRAL	VARIOUS	-	20-0375	-
1	15	RELAY, OVERLOAD, HP MOTOR	VARIOUS	-	20-0216	-
1	14	CONTACTOR, HIGH PRESSURE MOTOR	VARIOUS	-	20-0276	-
1	13	RELAY, OVERLOAD, LP PUMP	VARIOUS	-	20-1025	-
1	12	CONTACTOR, LP PUMP, 1.5 HP	VARIOUS	-	20-0264	-
1	11	ENCLOSURE, ELECTRICAL, NEMA 4X, 10"x6"x6"	ABS PLASTIC	-	20-1066	-
6	10	ELEMENT, SEAWATER 2538	VARIOUS	*SEE NOTE 1	33-0238	-
6	9	PRESSURE VESSEL, 38", VESSEL ONLY	VARIOUS	*SEE NOTE 1	32-0026	-
12	8	O-RING, ENDPLUG, BRINE	BUHA-N	*SEE NOTE 1	32-2228	-
24	7	O-RING, ENDPLUG, PRODUCT	BUHA-N	*SEE NOTE 1	32-2116	-
12	6	ENDPLUG, 2.5" 2PORT, NEW STYLE	NYLON	*SEE NOTE 1	32-2517	-
72	5	RING, ENDPLUG, 2.5"	VARIOUS	*SEE NOTE 1	32-4013	-
1	4	SCREWS, 316, 10/32" X 1-1/4"	VARIOUS	*SEE NOTE 1	86-0106	-
1	3	FILTER ASSY, 30 SQ FT (4VV)	316SS	-	34-0030	-
1	2	CYCLONE, BODY, 22 CLOUES	NYLON	-	36-2210	CTS
1	1	VALVE, RELIEF, 3/4" FNPT, NYL	VARIOUS	-	60-7742	V6
QTY	PC NO	DESCRIPTION	MATERIAL	REMARKS	PART NUMBER	P&ID

3	2	1	REVISION
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DRAWING FILE NO.
20300.DWG

 Village Marine Technology
2000 West 155th Street - Gardena - California 90249

PURE WATER 2000CS
GENERAL ARRANGEMENT
AND PARTS LIST

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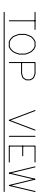
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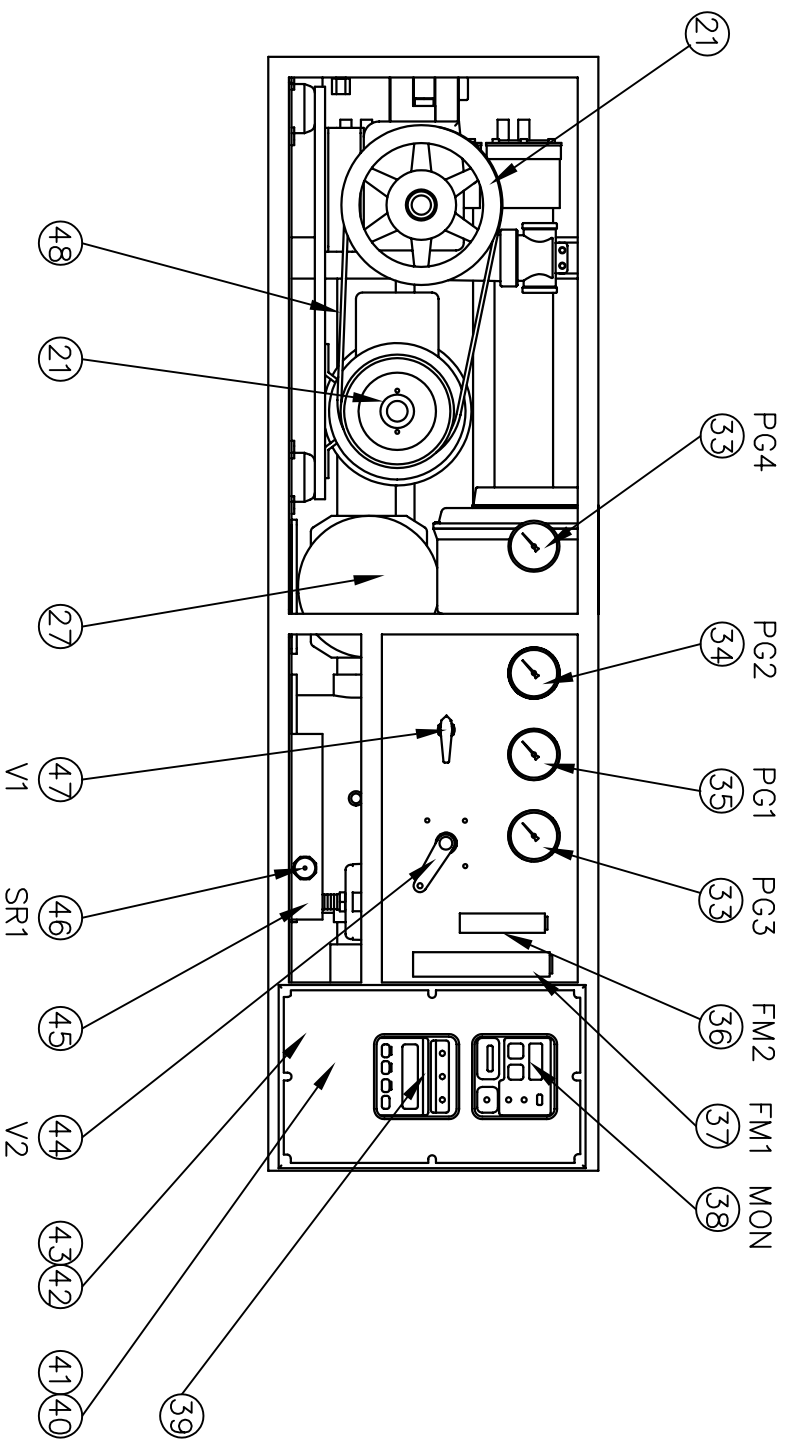
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20300.DWG

 Village Marine Technology
2000 West 135th Street - Gardena - California 90249

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FRONT VIEW

DRAWING FILE NO.
20300.DWG

Village Marine Technology
2000 West 155th Street - Gardena - California 90249

PURE WATER 2000CS
GENERAL ARRANGEMENT
AND PARTS LIST

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07/11/08	07/11/08	07/11/08	07/11/08

DATE	DATE	DATE	DATE
07/11/08	07/11/08	07/11/08	07/11/08

MANUFACTURER'S LITERATURE

11.0 MANUFACTURER'S LITERATURE

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: Parker Racor - 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.	Ø.625
708-1	22 GPH	.50 NPT	.25 NPT	9.125"x 5.5" x 4"	11 lbs.	Ø.625
708-1	29 GPH	.50 NPT	.25 NPT	9.125"x 5.5" x 4"	11 lbs.	Ø.625
708-3	2.3 GPM	.75 NPT	.5" MS16142-8	7.5"x 6" x 4.5"	18.9 lbs.	Ø.625
708-3	3.5 GPM	.75 NPT	.5" MS16142-8	7.5"x 6" x 4.5"	18.9 lbs.	Ø.625
708-5	8 GPM	.75 NPT	.5" MS16142-8	11.5"x 9.5" x 5.5"	27.6 lbs.	Ø.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 Parker Racor - Village Marine Tec's specially blended high pressure pump oil. To check 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).

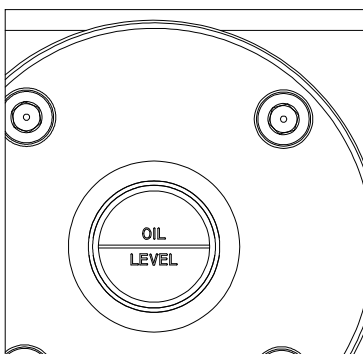


Fig. 1: Oil Level Sight Glass Detail.

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.

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

PULLEY SELECTION

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

CAUTION

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

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

MOTOR SELECTION

To ensure desired pump output, the motor or engine driving the pump must possess sufficient horsepower to maintain full RPM when the pump is under load. Using equation 2.3 an appropriate electric motor can be sized for the application. This motor sizing approach is based on pump discharge volume and maximum pump discharge pressure. The constant in the equation accounts for drive and system losses, 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.

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

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 – 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 – 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 (708-1 – 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 (708-3 – 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 (708-5 – 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

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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 downstream 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 Parker Racor - 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.

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

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

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

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.

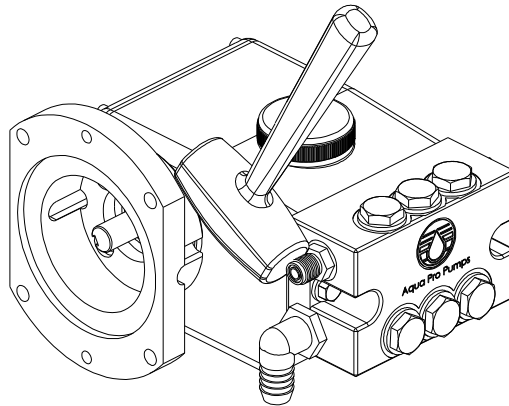


Fig. 2: Manifold Assembly Removal

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

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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.

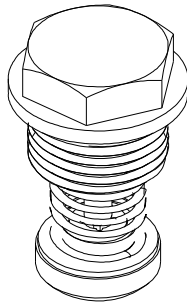


Fig. 3: Valve Assembly
(NOTE: There are two different valve plug designs)

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.

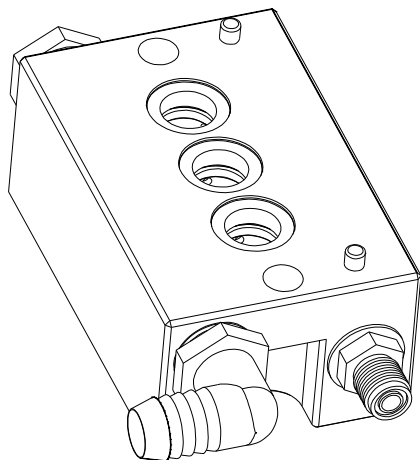


Fig. 4: Orientation for Manifold Seal Servicing

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).

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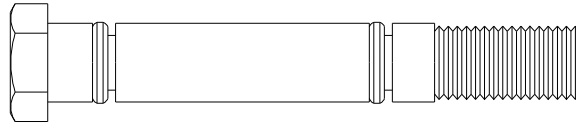


Fig. 5: Plunger Retaining Bolt Assembly

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.

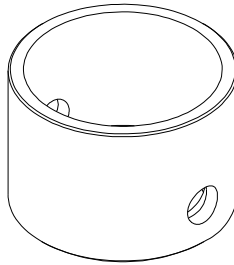


Fig. 6: Seal Retainer

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).

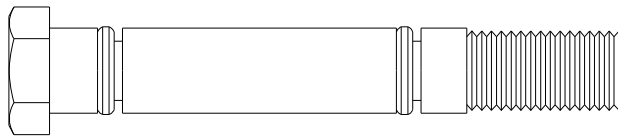


Fig. 5: Plunger Retaining Bolt Assembly

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.

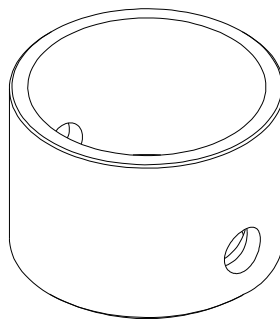


Fig. 6: Seal Retainer

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

708 Series

High Pressure Titanium Positive Displacement Pump

Unscrew the crankcase cover screws (19) with the 3/16" Allen wrench. With the aid 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.

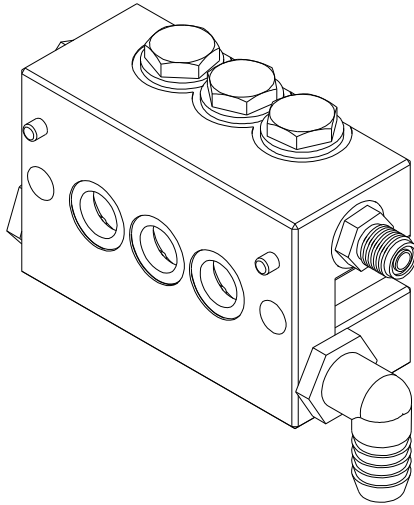


Fig. 7: Manifold Assembly

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

708 Series

High Pressure Titanium Positive Displacement Pump

- 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.

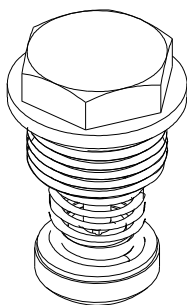


Fig. 8: Valve Assembly
(NOTE: There are two different valve plug designs)

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.

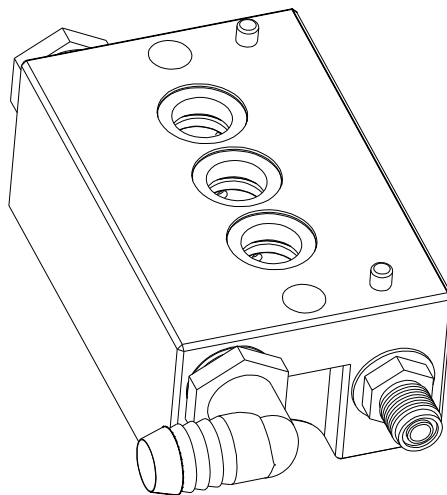


Fig. 9: Orientation for Manifold Seal Servicing

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.

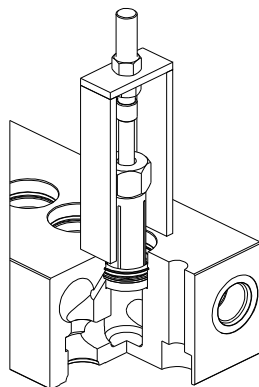


Fig. 10: Weep Ring Extraction

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.

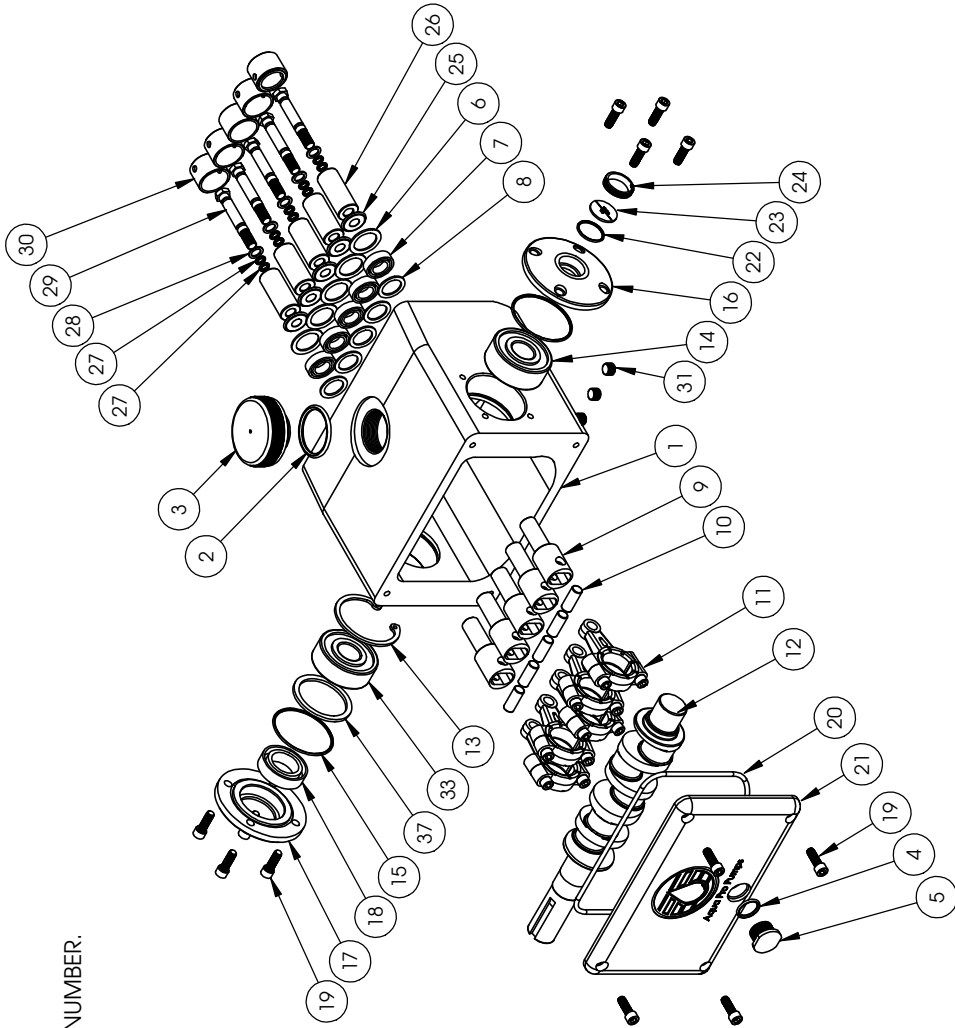
708 Series

High Pressure Titanium Positive Displacement Pump

708-5 DRAWINGS

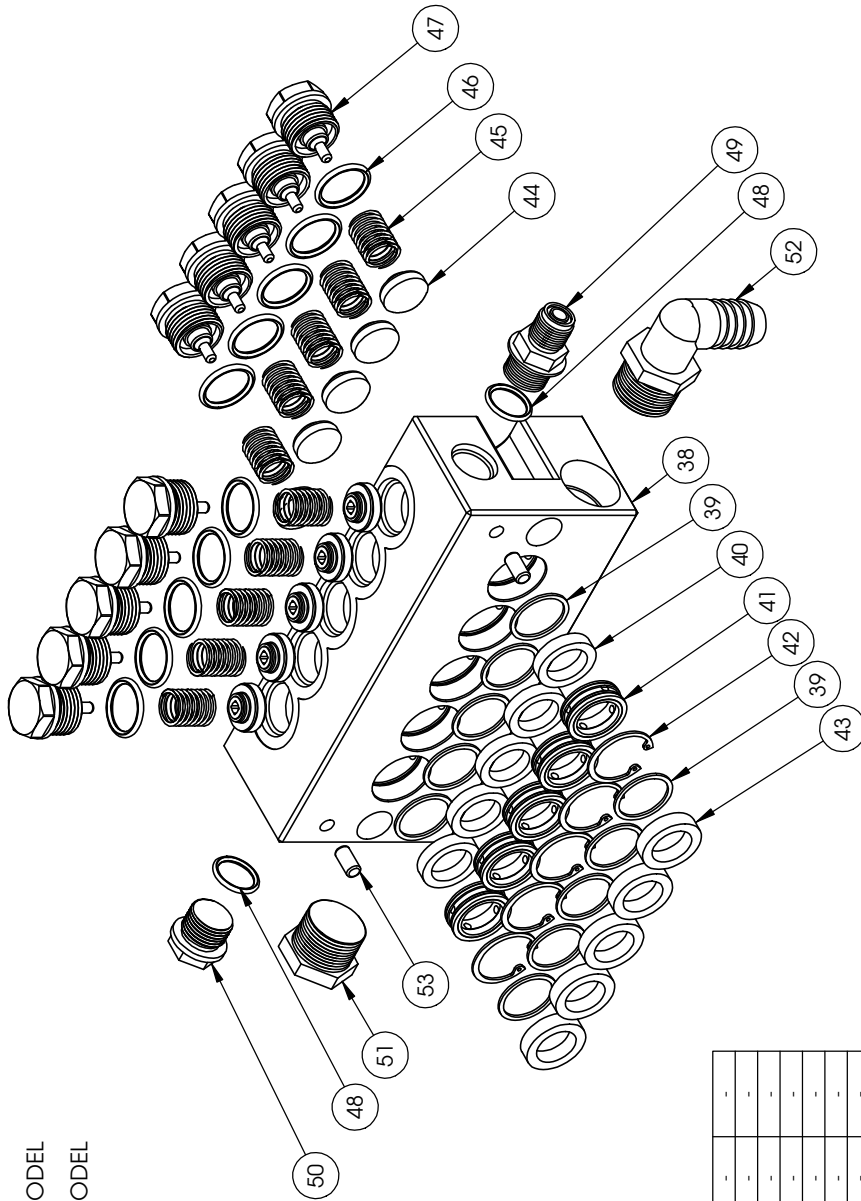
NOTES:
1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6127 ASSY, CRANKCASE, 708-5, 8.0 GPM
70-6107 KIT, REBUILD, CRANKCASE, 708-5
70-6184 KIT, ROUTINE SERVICE, 708-5
2) ITEMS 9, 10 AND 11 MAY BE PURCHASED UNDER THE FOLLOWING PART NUMBER.
70-6128 ASSY, DRIVE, 708 SERIES PUMPS

ITEM	PART NUMBER	DESCRIPTION	QTY	QTY REBUILD KIT	QTY SERVICE KIT
37	70-0412	SPACER, BEARING, PULLEY SIDE, 708-5	1	-	-
36	-	NOT USED	-	-	-
35	-	NOT USED	-	-	-
34	-	NOT USED	-	-	-
33	70-0311	BEARING, PULLEY, 708-5	1	-	-
32	-	NOT USED	-	-	-
31	30-1106	PLUG, CRANKCASE	5	-	-
30	70-6114	RETAINER, SEAL, 708 SERIES	5	5	-
29	70-6011	BOLT, PLUNGER RETAINER, 708 SERIES	5	-	-
28	70-6035	WASHER, PLUNGER RETAINER, 708 SERIES	5	-	-
27	70-6012	O-RING, PLUNGER RETAINER	10	10	-
26	70-6013	PLUNGER, 708 SERIES	5	-	-
25	70-6015	SLINGER, PLUNGER, 708 SERIES	5	-	-
24	70-6043	RETAINER, SIGHTGLASS	1	-	-
23	70-6044	SIGHTGLASS, OIL	1	-	-
22	70-6082	O-RING, OIL SIGHTGLASS	1	1	-
21	70-6057	COVER, CRANKCASE, 708-5	1	-	-
20	70-6058	O-RING, REAR COVER, 708-5	1	1	-
19	86-0151	SCREW, COVER	12	-	-
18	70-6061	SEAL, OIL, CRANKSHAFT, 708-5	1	1	-
17	70-6041	CAP, PULLEY BEARING, 708 SERIES	1	-	-
16	70-6042	CAP, GUIDE BEARING, 708 SERIES	1	-	-
15	70-6039	O-RING, BEARING CAP	2	2	-
14	70-6060	BEARING, GUIDE, 708-5	1	-	-
13	70-1281	RING, SNAP, BEARING, 708 SERIES	1	-	-
12	70-6059	CRANKSHAFT, 708-5, 8 GPM	1	-	-
11	70-6033	ASSY, CONNECTING ROD, 708 SERIES	5	-	-
10	70-0382	PIN, DOWEL, DRIVE ASSY	5	-	-
9	70-6067	PLUNGER, 708 SERIES	5	-	-
8	70-6019	WASHER, OIL SEAL, INNER, 708 SERIES	5	-	-
7	70-6018	SEAL, OIL, 708 SERIES	5	5	5
6	70-6017	WASHER, OIL SEAL, OUTER, 708 SERIES	5	-	-
5	70-0696	PLUG, OIL DRAIN	1	-	-
4	30-1286	O-RING, PLUG, OIL DRAIN/HP DISCHARGE	1	1	-
3	70-6030	CAP, OIL FILLER, PUMP, 708 SERIES	1	-	-
2	70-6029	O-RING, OIL FILLER CAP	1	1	-
1	70-6056	CRANKCASE, 708-5	1	-	-



SIZE	TITLE	REV
B	ASSY, CRANKCASE, 708-5	
DATE: 03-14-05 J RODRIGUEZ		SHEET 1 OF 1

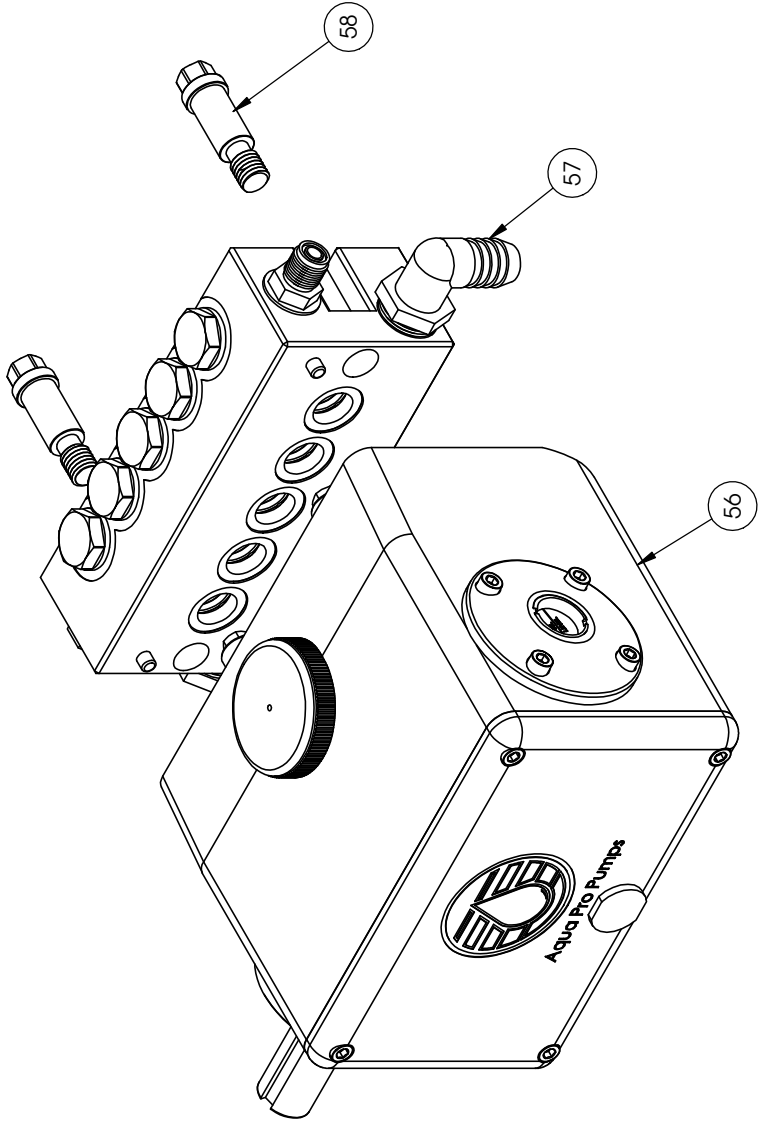
NOTES:
1) ASSEMBLY PART NUMBERS ARE AS FOLLOWS:
70-6123 ASSY, MANIFOLD, 708-5, 8.0 GPM
70-6105 KIT, REBUILD, MANIFOLD, 708-5, 8.0 GPM MODEL
PRODUCTION CUT IN FEB-02
70-6108 KIT, REBUILD, MANIFOLD, 708-5, 7.0 GPM MODEL
PRODUCTION CUT OUT AUG-02
ITEM 44 IS 70-6093 INSTEAD OF 70-6104
70-6184 KIT, ROUTINE SERVICE, 708-5



ITEM	PART NUMBER	DESCRIPTION	QTY.	QTY REBUILD KIT	QTY SERVICE KIT
56	-	NOT USED	-	-	-
54	-	NOT USED	-	-	-
53	70-6087	PIN, MANIFOLD, 708 SERIES	2	-	-
52	30-0441	ADAPTER, LP INLET, 708-3/5	1	-	-
51	30-0573	PLUG, LP INLET, 708-3/5	1	-	-
50	70-3052	PLUG, HP DISCHARGE, 708-3/5	1	-	-
49	30-1082	ADAPTER, HP DISCHARGE, 708 SERIES	1	-	-
48	30-1286	O-RING, PLUG, OIL DRAIN/HP DISCHARGE	2	2	-
47	70-0660	PLUG, VALVE, HD, 708 SERIES	10	-	-
46	70-6002	O-RING, OIL DRAIN/VALVE PLUG	10	10	10
45	70-6003	SPRING, VALVE, 708 SERIES	10	10	10
44	70-6104	ASSY, VALVE, HVY DUTY, 708 SERIES	10	10	10
43	70-6009	SEAL, LP, 708 SERIES	5	5	5
42	70-6010	RING, SNAP, 708 SERIES	5	5	-
41	70-3018	ASSY, WEEP RING, 708 SERIES	5	5	-
40	70-0071	SEAL, HP, 708 SERIES	5	5	-
39	70-6016	RING, SPACER, SEAL, 708 SERIES	10	10	-
38	70-6053	MANIFOLD, 708 SERIES, 5 PLUNGER	1	-	-
ITEM	PART NUMBER	DESCRIPTION	QTY.	QTY REBUILD KIT	QTY SERVICE KIT

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

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



58	70-6055	BOLT, .50-13UNC-2A, SHOULDER	2
57	70-6123	ASSEMBLY, 708-5 MANIFOLD	1
56	70-6127	ASSY, CRANKCASE, 708-5	1
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.

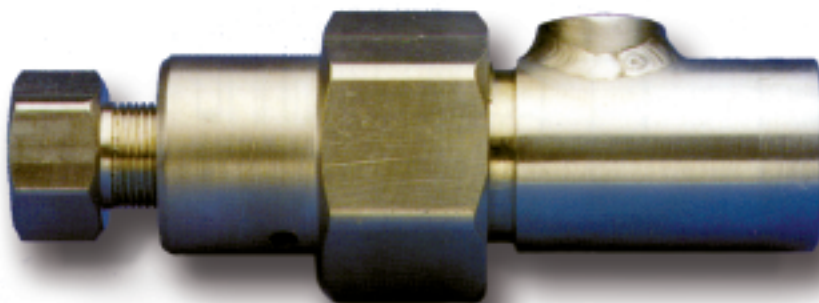
SIZE	TITLE	REV
B	ASSEMBLY, 708-5 MAIN	
DATE: 03-14-05 J RODRIGUEZ SHEET 1 OF 1		



Specifications

ACCESSORIES

PRESSURE REGULATOR



Machined from solid billet stock using the latest in CNC controlled lathe technology, the Village Marine Tec. line of true pressure regulators are the state of the art in design and manufacturing.

This regulator features a solid 316 stainless steel body and wetted parts, with seamless welding. Best choice where reliability is a factor, the regulator comes with a full one year guarantee backed by years of Village Marine Tec. experience and technology.

These pressure regulators come in both 5 gallon per minute and 25 gallons per minute models and feature standard piping connections for fast, smooth installations. Maximum pressure on these units is 1700 psi at full flow.

When you can't afford second best, choose Village Marine Tec. the leader in liquid technology. Designed durable and built to last.

**Designed For Harsh Environments
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VILLAGE MARINE TEC.

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We Produce Over 95% of ALL R.O. Components In-house

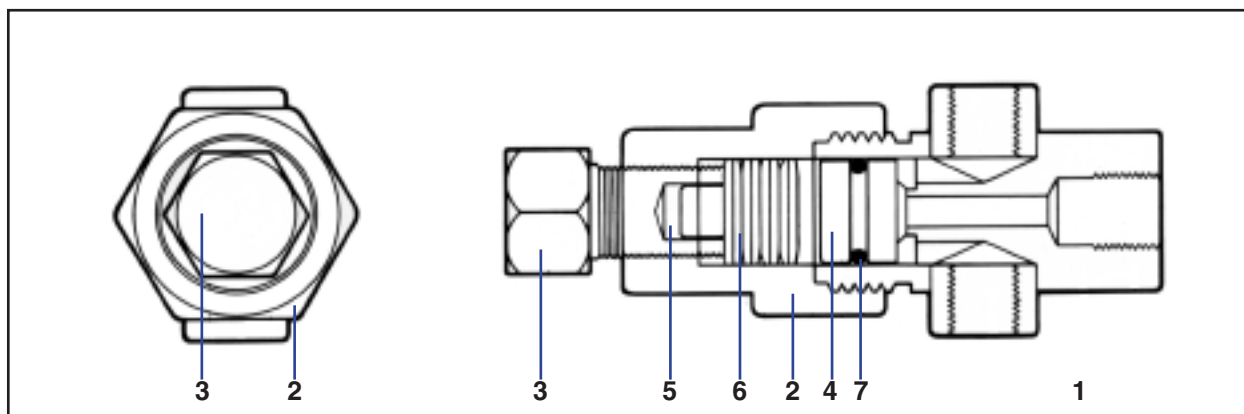
SPECIFICATIONS

Product Bulletin • The Pressure Regulator

Standard Deluxe Features

- Full 316 stainless body.
- 1-year guarantee.
- Maintains constant pressure with varying flow and conditions.
- Precision CNC machined.
- Rated up to 1700 psi.
- Standard connections.
- Made in the U.S.A.

The Pressure Regulator Specifications



Model	GPM	Pressure Range*	Max.Press
60-0005	5	60 psi	1700 psi
60-0040	25	60 psi	1700 psi

* @ 0 lb. preload

Regulator starts to open at 60psi.

#60-0005 uses 1/4" FNPT for both inlet and outlet connections.

#60-0040 uses 3/4" FNPT for both inlet and outlet connections.

Draw #	Description	Material	Req'd
1	Pressure regulator body	316 SS	1
2	Pressure regulator cap	Plated brass	1
3	S/S Hex nut	Plated brass	1
4	S/S regulator piston	316 SS	1
5	Plunger	Steel	1
6	Belville spring washers	316 SS	8
7	O-ring	Buna S or GRS	1

Used On The Following Machines

- Pure Water Series (PW)
- Squirrt Series (SPW)
- The Little Wonders (LW)
- No Frills Series (NF)
- Energy Misers (EM)
- Tap Water Units (TW)
- Brackish Water units (BW)



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www.villagemarine.com

Pressure Vessel Assemblies

For Seawater Elements



Contact Information: Key Features:

Parker Hannifin Corporation
Racor Division/Village Marine Tec.
2000 W. 135th St.
Gardena, CA 90249

phone: 310 516-9911
 800 C-Parker
fax: 310 538-3048
email: racor@parker.com
www.villagemarine.com

www.parker.com/racor

Racor Village Marine RO membrane pressure vessels feature non-metallic wetted surfaces for excellent corrosion resistance.

Simple end plug design allows quick removal for element servicing.

If the size you require is not shown please contact us for custom builds.

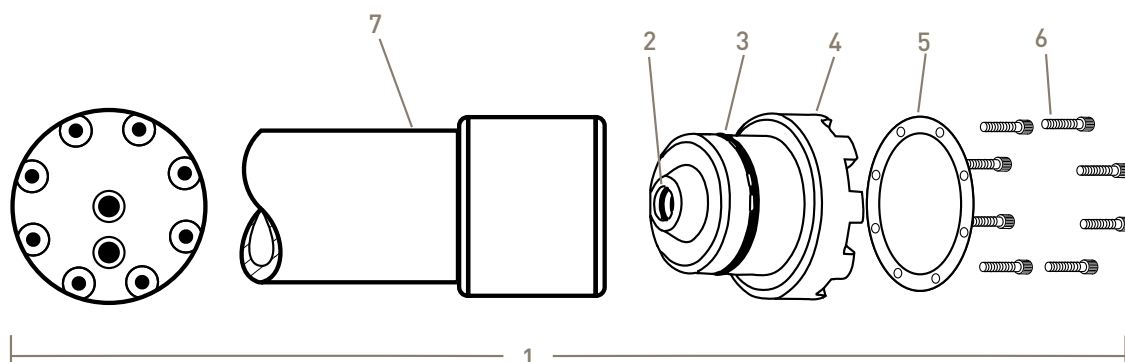
- Operating Pressure: 1000 psi/68 bar
- Shell: Filament Wound fiberglass
- Collars: 6061 T-6 Powdercoated aluminum
- End Plugs: Thermoplastic
- End Ring: 6061 T-6 Anodized aluminum on 2.5" and 4" size
- SS316 on 6" size
- Fasteners: SS316



ENGINEERING YOUR SUCCESS.

Pressure Vessel Assemblies

For Seawater Elements



Part Numbers:

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

Notes:

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

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

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

Pleated Filters and Filter Cartridge Kits



Contact Information:

Parker Hannifin Corporation
Racor Division/Village Marine Tec.
2000 W. 135th St.
Gardena, CA 90249

phone: 310 516-9911
800 C-Parker
fax: 310 538-3048
email: racor@parker.com
www.villagemarine.com

www.parker.com/racor

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" housings and contain the correct amount of chemical for a single use.



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 ranges available
- Pliable plastisol ends ensures filter seal to eliminate bypass
- High packing density reduces filter size while keeping flow rates up
- Filter bands on large diameter elements keep filter shape during system pulsations

Pleated Sediment Elements

Part Number	Microns	Filter Area ft ³ /m ³	Diameter inch/cm	Length inch/cm
33-0118	20	10/0.93	2.75/7	9.75/25
33-0117	5	10/0.93	2.75/7	9.75/25
33-0053	20	18/1.67	4.5/11.4	9.75/25
33-0052	5	18/1.67	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	35/3.25	4.5/11.4	20/51
33-0057	5	35/3.25	4.5/11.4	20/51
35-0020	20	35/3.25	6.12/15.5	11.9/30
35-0001	5	35/3.25	6.12/15.5	11.9/30
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

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

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.