

# Horizon Seafari

## SYSTEM MANUAL



### Horizon Seafari Contained

#### *Single Membrane (-1):*

Seafari SFC-420-1

Seafari SFC-630-1

Seafari SFC-840-1

#### *Double Membrane (-2):*

Seafari SFC-740-2

Seafari SFC-1160-2

Seafari SFC-1480-2

### Horizon Seafari Modular

#### *Single Membrane (-1):*

Seafari SFM-420-1

Seafari SFM-630-1

Seafari SFM-840-1

#### *Double Membrane (-2):*

Seafari SFM-740-2

Seafari SFM-1160-2

Seafari SFM-1480-2

#### **Horizon Reverse Osmosis**

P.O. Box 5463

Carson, California 90745 U.S.A.

Telephone: 1 (310) 631-6300

Facsimile: 1 (310) 631-6395

[www.hrosystems.com](http://www.hrosystems.com)

Copyright 2001 Horizon Reverse Osmosis

Revisions: 3/1/01, 11/1/01, 3/1/02, 5/1/02

B651210001

"Horizon Reverse Osmosis" and the Horizon Reverse Osmosis logo are registered trademarks of and belong to Horizon Reverse Osmosis with all rights reserved. "Horizon Seafari" is a trademark of and belongs to Horizon Reverse Osmosis with all rights reserved.



## INTRODUCTION

Thank you for purchasing an HRO Systems Reverse Osmosis Desalination System. Please read this manual carefully before attempting installation or operation. A better understanding of the system ensures optimum performance and longer service life from the system.

All HRO reverse osmosis desalination systems are designed and engineered to function as a complete working unit. Generally speaking, the performance of each component within the unit is dependent on the component prior to it and governs the performance of all components after it. Proper performance of the system is thus dependent upon proper operation of every single component within the system.

The intent of this manual is to allow the operator to become familiar with each component within the Horizon Seafari system. By understanding the function, importance, and normal operation of each component within each subsystem of the unit, the operator can readily diagnose minor problems. Such problems, when they first develop, usually require minor maintenance and are easily corrected. However, left unattended, a problem in one component affects the rest of the system and leads to further required repairs.

# HRO Systems™

## SYSTEM IDENTIFICATION INFORMATION

INSTRUCTIONS: Please complete the following information at the time of purchase of the Horizon Seafari R.O. Desalinator. This information will be requested to provide better service by the HRO Systems Service Department whenever contacting HRO Systems for technical assistance or by the HRO Systems Marketing Department whenever ordering parts.

### System Information:

Model Number: \_\_\_\_\_ Serial Number: \_\_\_\_\_

### Operating Voltage:

#### Alternating Current Single Phase:

\_\_\_ 120 VAC, 60 Hz; \_\_\_ 230 VAC, 60 Hz; \_\_\_ 220 VAC 50 Hz

#### Alternating Current Three Phase:

\_\_\_ 208/230 VAC, 60 Hz; \_\_\_ 460 VAC, 60 Hz;  
\_\_\_ 220 VAC, 50 Hz; \_\_\_ 380 VAC 50 Hz

Date Purchased: \_\_\_\_\_

Date Commissioned (first tested or operated): \_\_\_\_\_

### Dealer Information:

Dealer's Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_

Country: \_\_\_\_\_ Postal Code: \_\_\_\_\_

Dealer's Invoice Number: \_\_\_\_\_

**KEEP THIS COPY IN THE OWNERS MANUAL**

**HRO Systems™**

P.O. BOX 5463, CARSON, CALIFORNIA 90745-5463

U.S.A.

TELEPHONE 1-310-631-6300 FACSIMILE 1-310-631-6395

World Wide Web Site <http://www.hrosystems.com>

e-mail [hrosystems@hrosystems.com](mailto:hrosystems@hrosystems.com)

# HRO Systems™

## WARRANTY REGISTRATION INFORMATION

INSTRUCTIONS: At the time of purchase of the Horizon Seafari R.O. Desalinator, please complete the warranty information listed below. After completing this form please mail it, in the provided envelope, to HRO Systems. Attn: Warranty Registration.

### System Information:

Model Number: \_\_\_\_\_ Serial Number: \_\_\_\_\_

Date Purchased: \_\_\_\_\_

Date Commissioned: \_\_\_\_\_

### Dealer Information:

Dealer's Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_

Country: \_\_\_\_\_ Postal Code: \_\_\_\_\_

Dealer's Invoice Number: \_\_\_\_\_

### Customer Information:

Customer Name: \_\_\_\_\_

Street Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_

Country: \_\_\_\_\_ Postal Code: \_\_\_\_\_

Mail this copy to:

**HRO Systems™**

P.O. BOX 5463

CARSON, CALIFORNIA 90745-5463 U.S.A.

Attn: Warranty Registration

or visit our World Wide Web Site at <http://www.hrosystems.com>  
and e-mail the Warranty Registration Information to us at

hrosystems@hrosystems.com

Fill Out the front side of this page and Mail it to:

**HRO**Systems™  
P.O. BOX 5463  
CARSON, CALIFORNIA 90745-5463 U.S.A.  
Attn: Warranty Registration

or visit our World Wide Web Site at <http://www.hrosystems.com>  
and e-mail the Warranty Registration Information to us at  
hrosystems @ hrosystems.com

## **TABLE OF CONTENTS**

<b>SECTION</b>	<b>DESCRIPTION</b>
A	INTRODUCTION
B	SPECIFICATIONS
C	INTRODUCTION TO THE REVERSE OSMOSIS PROCESS
D	SYSTEM SCHEMATIC & COMPONENT DESCRIPTIONS INCLUDING ILLUSTRATED P&IDs (Piping and Interconnect Diagrams)
E	SYSTEM INSTALLATION ON SITE STORAGE & PREPARATION INSTALLATION PROCEDURES
F	COMMISSIONING / INITIAL START UP INITIAL START UP INITIAL NEW SYSTEM READINGS
G	START-UP PROCEDURE
H	SHUTDOWN PROCEDURE
I	SYSTEM TROUBLESHOOTING GUIDE
J	STORAGE & CLEANING PROCEDURE OF THE SYSTEM & R.O. MEMBRANE R.O. MEMBRANE ELEMENT PROTECTION SHORT TERM SHUTDOWN STORAGE PROCEDURE LONG TERM SHUTDOWN STORAGE PROCEDURE WINTERIZING AND FREEZING TEMPERATURE STORAGE CLEANING PROCEDURE
K	MAINTENANCE & REPAIR OPERATOR'S PREVENTIVE MAINTENANCE MAINTENANCE TIME CHART OPERATOR MAINTENANCE & CLEANING COMPONENT MAINTENANCE & REPAIR
APPENDIX A	WIRING INFORMATION AND DIAGRAMS ELECTRICAL COMPONENTS SPECIFICATIONS SYSTEM CONTROLLER WIRING MOTOR WIRING
APPENDIX B	CONVERSION CHARTS MEMBRANE PERFORMANCE CHARTS COMMON CONVERSIONS
INDEX	QUICK REFERENCE INDEX

**NOTES:**





**Horizon  
Reverse  
Osmosis™**

Pioneer of fresh water since 1975

## **SECTION A**

### **Introduction**



### LIMITED WARRANTY

HRO Systems warrants that the Horizon Seafari Desalination System performs according to the specifications for a period of twelve (12) months and specifically listed components are warranted for up to 5 years from the date of shipment. HRO Systems, under no circumstances, is liable for damages arising out of or in any way connected with the failure of the system to perform as set forth herein. This limited warranty is in lieu of all other expressed or implied warranties, including those of merchantability and fitness for a particular purpose.

The warranty period is from the date of original shipment from HRO Systems factory.

The following items are covered under warranty for the periods designated:

System and Accessories	1 (one) year
High Pressure Vessel	5 (five) years
HP Pump (manifold)	5 (five) years
Repairs after warranty	3 (three) months

The following items are considered normal user maintenance and are not covered under warranty:

- |                              |                                 |
|------------------------------|---------------------------------|
| 1. Sea Strainer Element      | 7. Pump Crankcase Oil           |
| 2. Cartridge Filter Elements | 8. Gauge Instrument Calibration |
| 3. Sand & Gravel in the MMF  | 9. Fuses                        |
| 4. Pump Packing Assemblies   | 10. Valve Seals and Packings    |
| 5. Pump Seal Assemblies      | 11. Exterior Corrosion          |
| 6. Pump Valve Assemblies     |                                 |

Installation of components not supplied by HRO Systems, are not covered by this or any limited warranty.

Improper installation, resulting in system failure or component failure or decline in performance is not covered by this or any limited warranty.

The Reverse Osmosis Membrane Element is warranted for a period of one year from the date of shipment of the membrane. Any misuse or improper operation or maintenance of the system that causes premature fouling of the Membrane Element is not warranted. The Reverse Osmosis Membrane Element is also guaranteed to be cleanable for a minimum of one year from the date of shipment, providing cleaning periods are adhered to and foulant is acid soluble metal hydroxides and calcium carbonates or alkaline soluble organic, inorganic substances and microbiological slimes. The Membrane Element is not warranted for iron fouling (rust), chemical or petroleum products attack, extreme temperatures (over 120 F/under 32 F), drying out or extreme pressures (over 1000 psi).

In the event of a defect, malfunction or failure, specifically covered by this warranty and during the warranty period, HRO Systems will repair or replace, at its option, the product or component therein, which upon examination by HRO Systems appears to be defective.

To obtain warranty service, the defective product or part must be returned to an authorized HRO Systems Factory Service Center (dealer) or direct to HRO Systems. The end user must pay any transportation and labor expenses incurred in removing and returning the product to the service center or HRO Systems pending evaluation and warranty approval. Upon warranty approval, reasonable expenses will be reimbursed.

The limited warranty does not extend to any system or system component which has been subjected to alteration, misuse, neglect, accident, improper installation, inadequate or improper repair or maintenance or subject to use in violation of instructions furnished by HRO Systems, nor does the warranty extend to components on which the serial number has been removed, defaced or changed.

HRO Systems reserves the right to make changes or improvements in its product, during subsequent production, without incurring the obligation to install such changes or improvements on previously manufactured equipment.

The implied warranties, which the law imposes on the sale of this product, are expressly LIMITED in duration to the time period above. HRO Systems shall not be liable for damages, consequential or otherwise, resulting from the use and operation of this product, or from the breach of this LIMITED WARRANTY.

**CAUTION:** Use of non HRO Systems supplied parts and accessories, including but not limited to maintenance parts, prefilter elements, cleaning and storage chemical, pump oil, spare parts, replacement parts, system components, installation components and/or system accessories, shall void all warranty expressed or implied.

**NOTES:**



**Horizon  
Reverse  
Osmosis™**

Pioneer of fresh water since 1975

# **SECTION B**

## **Specifications**

## SPECIFICATIONS

### Single Membrane (-1)

- HRO Seafari SFC-420-1
- HRO Seafari SFC-630-1
- HRO Seafari SFC-840-1

### Single Membrane (-1)

- HRO Seafari SFM-420-1
- HRO Seafari SFM-630-1
- HRO Seafari SFM-840-1

### Double Membrane (-2)

- HRO Seafari SFC-740-2
- HRO Seafari SFC-1160-2
- HRO Seafari SFC-1480-2

### Double Membrane (-2)

- HRO Seafari SFM-740-2
- HRO Seafari SFM-1160-2
- HRO Seafari SFM-1480-2

## PERFORMANCE:

### PRODUCT WATER PRODUCED PER 24 HOURS OF OPERATION:

(+/-15% at 850 psig / 56 BAR, 77°F / 25°C & 35,000 ppm TDS Feed Water Salinity)

Model Number	Production per 24 hours of operation:
HRO Seafari (SF) 420-1	420 U.S. Gallons / 1,590 liters
HRO Seafari (SF) 740-2	740 U.S. Gallons / 2804 liters
HRO Seafari (SF) 630-1	630 U.S. Gallons / 2,387 liters
HRO Seafari (SF) 1160-2	1160 U.S. Gallons / 4,395 liters
HRO Seafari (SF) 840-1	840 U.S. Gallons / 3,183 liters
HRO Seafari (SF) 1480-2	1480 U.S. Gallons / 5,608 liters

### PRODUCT WATER PRODUCED PER HOUR OF OPERATION:

(+/-15% at 850 psi / 56.5 bar, 77°F / 25°C & 35,000 ppm TDS Feed Water Salinity)

Model Number	Production per 1 hour of operation:
HRO Seafari (SF) 420-1	18 U.S. Gallons / 66 liters
HRO Seafari (SF) 740-2	31 U.S. Gallons / 117 liters
HRO Seafari (SF) 630-1	26 U.S. Gallons / 99 liters
HRO Seafari (SF) 1160-2	48 U.S. Gallons / 183 liters
HRO Seafari (SF) 840-1	35 U.S. Gallons / 133 liters
HRO Seafari (SF) 1480-2	62 U.S. Gallons / 234 liters

**SALT REJECTION (CHLORIDE-ION):** Minimum 99.2 %; Average 99.4%

**PRODUCT WATER TEMPERATURE:** Ambient to feed water temperature

**SPECIFICATIONS:**

**SALINITY MONITORING:**

Automatic computer controlled electronic monitoring. Temperature compensated with the Water Quality Indicator. The salinity monitoring components of the system give a continuous readout in micromhos per cubic centimeter, are temperature compensated and of a fail-safe design.

**SALINITY RANGE OF FEED WATER:**

Seawater up to 50,000 ppm TDS (NaCl) (typical seawater salinity is 35,000 ppm)

**TEMPERATURE RANGE:** Max. 122°F / 50°C, Min. 33°F / .5°C

**SYSTEM FEED WATER:**

Model Number	Power Source	
	Cycles (Hz)	Feed Water Flow Per Minute:
HRO SFC 420-1 & 740-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFM 420-1 & 740-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFC 630-1 & 1160-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFM 630-1 & 1160-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFC 840-1 & 1480-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFM 840-1 & 1480-2	50Hz	3.5 U.S. Gallons / 13.2 liters
HRO SFC 420-1 & 740-2	60Hz	3.0 U.S. Gallons / 11.4 liters
HRO SFM 420-1 & 740-2	60Hz	3.0 U.S. Gallons / 11.4 liters
HRO SFC 630-1 & 1160-2	60Hz	4.2 U.S. Gallons / 15.9 liters
HRO SFM 630-1 & 1160-2	60Hz	4.2 U.S. Gallons / 15.9 liters
HRO SFC 840-1 & 1480-2	60Hz	4.2 U.S. Gallons / 15.9 liters
HRO SFM 840-1 & 1480-2	60Hz	4.2 U.S. Gallons / 15.9 liters

**REVERSE OSMOSIS MEMBRANE:**

**TYPE:** Specifically selected High Rejection / High Yield aromatic tri-polyamid, thin film composite, spiral wound, single pass reverse osmosis membrane element.

**CHLORINE TOLERANCE:** 0.1 PPM.

**pH RANGE:** 3-11 (typical seawater pH is 8)

**SYSTEM PRESSURE:**

**FEED WATER:** Minimum 6 psi / .41 bar / .42 Kg/cm<sup>2</sup>. Maximum 35 psi / 2.41 bar / 2.46 Kg/cm<sup>2</sup>

**OPERATION:** Seawater nominal 850 psi / 56.5 bar / 57.66 Kg/cm<sup>2</sup>. Brackish Varies w/ppm

**DIMENSIONS & WEIGHT:**

MODEL	WEIGHT	MODEL	WEIGHT
HRO SFC 420-1	147 lbs / 67 kg	HRO SFM 420-1	113 lbs / 51 kg
HRO SFC 740-2	159 lbs / 72 kg	HRO SFM 740-2	125 lbs / 57 kg
HRO SFC 630-1	150 lbs / 68 kg	HRO SFM 630-1	116 lbs / 53 kg
HRO SFC 1160-2	165 lbs / 75 kg	HRO SFM 1160-2	131 lbs / 59 kg
HRO SFC 840-1	152 lbs / 69 kg	HRO SFM 840-1	118 lbs / 54 kg
HRO SFC 1480-2	170 lbs / 77 kg	HRO SFM 1480-2	136 lbs / 62 kg

**EXTERNAL INSTALLATION WATER CONNECTIONS:** Pipe sizes to be supplied by the installer for connection of the Sea Recovery supplied components

Feed Inlet:	3/4 MNPT	(Male National Pipe Thread, American Standard).
Brine Discharge	1/2 FNPT	(Male National Pipe Thread, American Standard).
Product	3/8 FNPT	(Female National Pipe Thread, American Standard)

**CAUTION:** The Horizon Seafari Reverse Osmosis Desalination Systems are designed to be as electrically efficient as possible. RPM supplied to and Pressure created by the High Pressure Pump govern the amount of energy required by the High Pressure Pump's Electric Motor. In order to maintain a sufficient flow of feed water into the Reverse Osmosis Membrane Element, Horizon Seafari utilizes several different High Pressure Pumps with different displacement characteristics. These different High Pressure Pumps, in turn, have different power requirements.

As such, several different Electric Motors are used in the Horizon Seafari Systems. In order to maintain maximum operational versatility HRO Seafari Systems utilize dual Cycle (Hz) Electric Motors capable of operating from both 50 Hz and 60 Hz.

In a Boat application, use caution when switching from your auxiliary AC on board generator to shore power. In many cases, due to insufficient wiring or long distances from the power source to the end of the dock, shore power from a Marina may be insufficient to operate your Horizon Seafari System. Low voltage to the Horizon Seafari System causes damage to the electric motor. Damage caused to the system due to low voltage is not covered by Warranty.

**ELECTRICAL MOTOR SPECIFICATIONS:**

(H.P. = Horse Power; FLA = Full Load Amperes; LRA = Locked Rotor Amperes @ Start Up)

**HIGH PRESSURE PUMP MOTOR:**

**420-1 & 740-2 SYSTEMS**

PHASE	50 Hz			60 Hz				
	VAC	H.P.	FLA	LRA	VAC	H.P.	FLA	LRA
Single	110	2.2	21	121	115	2.2	18	94
Single	220	2.2	10.5	60.5	230	2.2	9	47
Three	220	3.0	9.2	78	230	3.0	8.2	70
Three	380	3.0	4.6	39	460	3.0	4.1	35

**630-1 & 1160-2, and 840-1 & 1480-2 SYSTEMS**

PHASE	50 Hz			60 Hz				
	VAC	H.P.	FLA	LRA	VAC	H.P.	FLA	LRA
Single	110	2.2	21	121	115	2.6	21.2	109
Single	220	2.2	10.5	60.5	230	2.6	10.6	54.5
Three	220	3.0	9.2	78	230	3.0	8.2	70
Three	380	3.0	4.6	39	460	3.0	4.1	35

**BOOSTER PUMP MOTOR:**

1/2 horse power

PHASE	Hz	VAC	H.P.	FLA	LRA
Single	50/60	115	.5	7.4	34
Single	50/60	220/230	.5	3.7	17
Three	50/60	220/230	.5	2	12
Three	50/60	380/460	.5	1	6

**RECOMMENDED CIRCUIT BREAKER:**

Operating Voltage Hz & Phase	Recommended Circuit Breaker Size
115 VAC Single Phase	35 Amperes
230 VAC Single Phase	15 Amperes
208/230 VAC Three Phase	10 Amperes
380 VAC Three Phase	7.5 Amperes
460 VAC Three Phase	7.5 Amperes

Additional specifications to this system are provided in the Supplemental Specification Sheet. Further operation requirements are given in the Installation Section. Also, consult the Temperature vs. Production Chart near the back of this manual.



**HIGH PRESSURE PUMP ELECTRICAL MOTOR SPECIFICATIONS WITH SOFT MOTOR STARTER (SINGLE PHASE ONLY):**

(H.P. = Horse Power; FLA = Full Load Amperes; LRA = Locked Rotor Amperes @ Start Up)

**420-1 & 740-2 SYSTEMS**

PHASE	50 Hz	H.P.	FLA	LRA	60 Hz	H.P.	FLA	LRA
	VAC	50 Hz			VAC	60 Hz		
Single	110	2.2	21	54.5	115	2.2	18	42.3
Single	220	2.2	10.5	27.2	230	2.2	9	21.2

**630-1 & 1160-2, and 840-1 & 1480-2 SYSTEMS**

PHASE	50 Hz	H.P.	FLA	LRA	60 Hz	H.P.	FLA	LRA
	VAC	50 Hz			VAC	60 Hz		
Single	110	2.2	21	54.5	115	2.6	21.2	49.1
Single	220	2.2	10.5	27.2	230	2.6	10.6	24.5

**BOOSTER PUMP MOTOR:**

1/2 horse power

PHASE	Hz	VAC	H.P.	FLA	LRA
Single	50/60	115	.5	7.4	34
Single	50/60	220/230	.5	3.7	17
Three	50/60	220/230	.5	2	12
Three	50/60	380/460	.5	1	6

**RECOMMENDED CIRCUIT BREAKER:**

Operating Voltage Hz & Phase  
 115 VAC Single Phase  
 230 VAC Single Phase

Recommended Circuit Breaker Size  
 35 Amperes  
 15 Amperes

Soft Motor starters are available for single phase only. The Soft Start lowers the starting torque of the high-pressure pump motor only. This reduces the locked rotor amps required to start the system. These reduced locked rotor amp values are shown in the above High Pressure Pump Motor Specifications with Soft Motor Starter.

**NOTES:**



**Horizon  
Reverse  
Osmosis™**

Pioneer of fresh water since 1975

## **SECTION C**

# **Introduction to Reverse Osmosis Process**

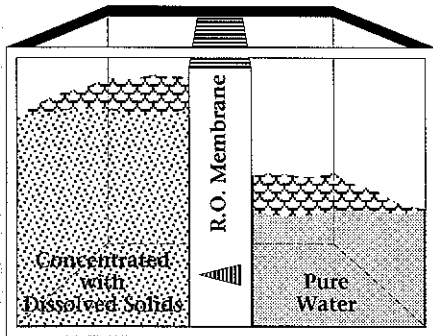
## C. INTRODUCTION

### The Obstacle:

Osmosis is the naturally occurring diffusion of two miscible (mixable) solutions through a semipermeable membrane in such a manner as to equalize their concentration by allowing a lesser concentration, potable water, to naturally diffuse through a semipermeable membrane into a higher concentration, sea or brackish water.

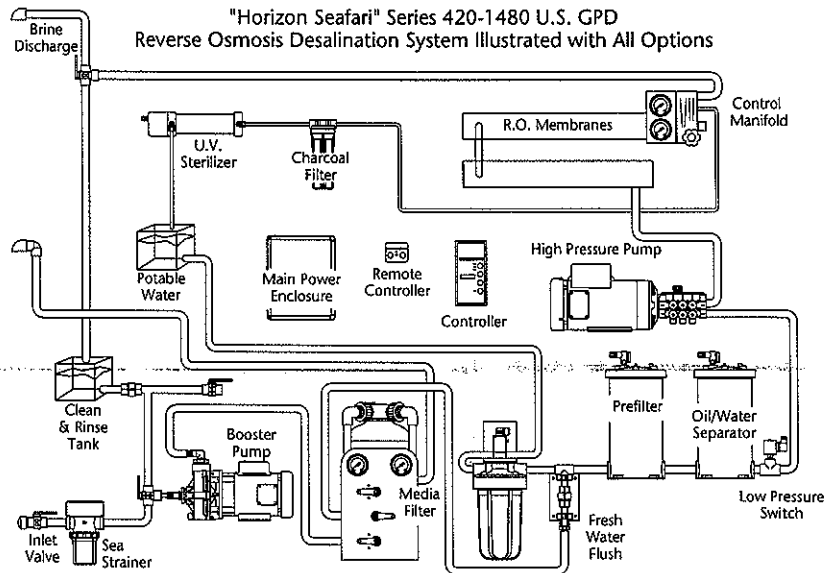
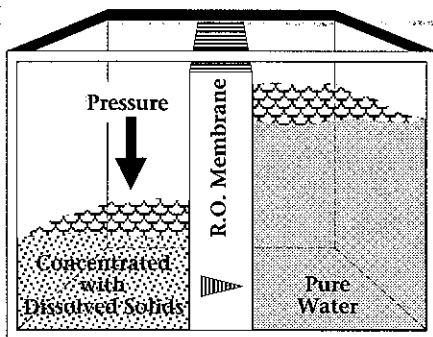
Sea water or brackish water is a high concentration solution. Potable water is a low concentration solution.

Therefore, sea water or brackish water cannot naturally diffuse through a semipermeable membrane to provide potable, or drinking water.



### The HRO Solution:

A manmade process, Reverse Osmosis, overcomes this natural phenomenon. By forcing sea or brackish water (under high pressure) through a semipermeable membrane, potable water can be realized. Reverse Osmosis Desalination Systems by HROSystems make possible the once impossible, potable water from undrinkable water sources.



**Low Pressure:** Feed Water (Salt Water or Brackish Water) enters the system through an Inlet Valve and is then filtered by a raw water Sea Strainer. The pressure of the Feed water is increased by the Booster Pump and filtered several more times through standard and optional prefiltration units including Media Filter, Plankton Filter, Prefilter and Oil Water Separator.

**High Pressure:** The Stainless Steel High Pressure Pump then increases the filtered feed water to a high pressure level and forces it into the Reinforced Fiberglass Membrane Vessel Assembly. The Back Pressure Regulator controls and automatically maintains the necessary high pressure level in the membrane. Concentrated brine enters the Brine Water Flow Meter which allows observation of the condition of the High Pressure Pump. The Brine Water is then discharged through the Brine Discharge Connector and diverted back to the feed source.

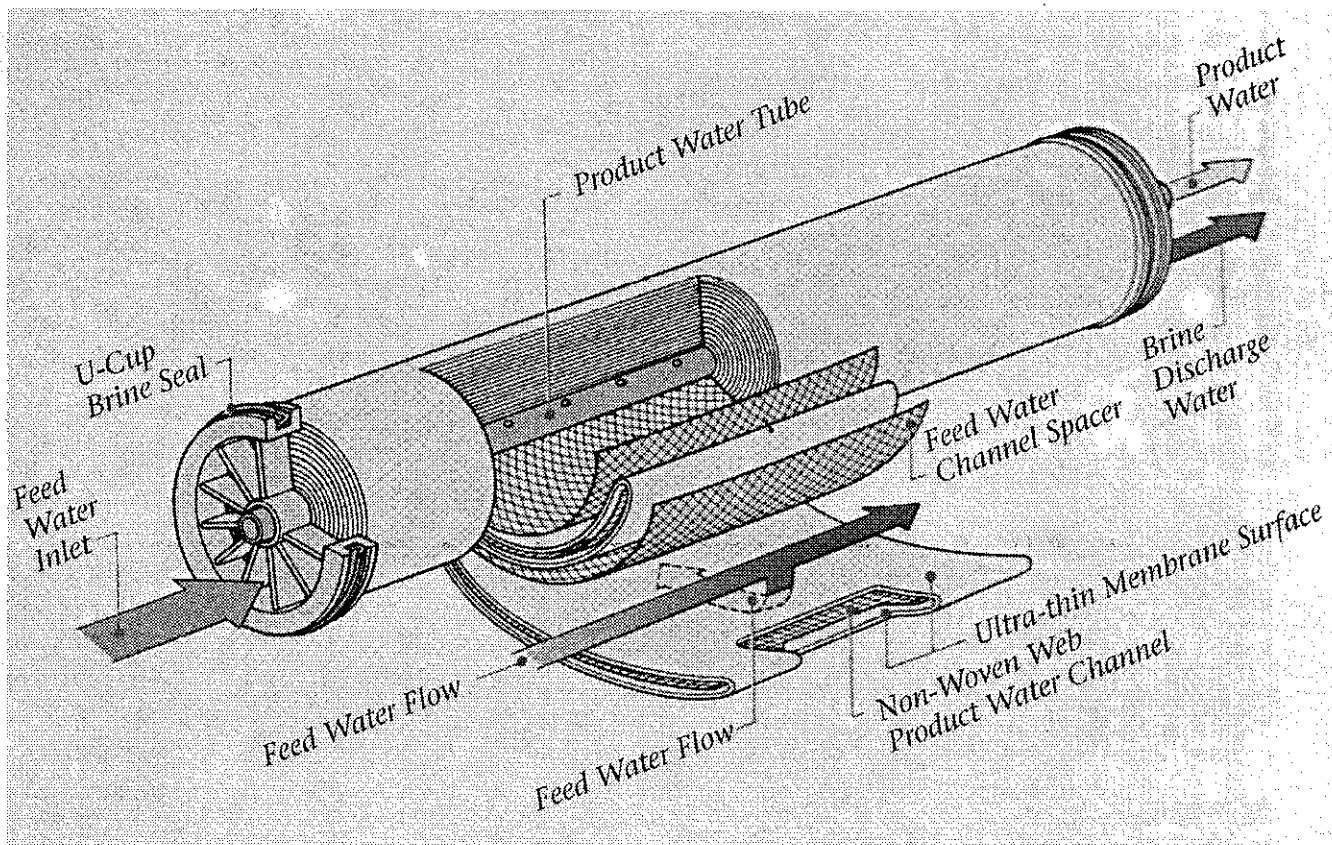
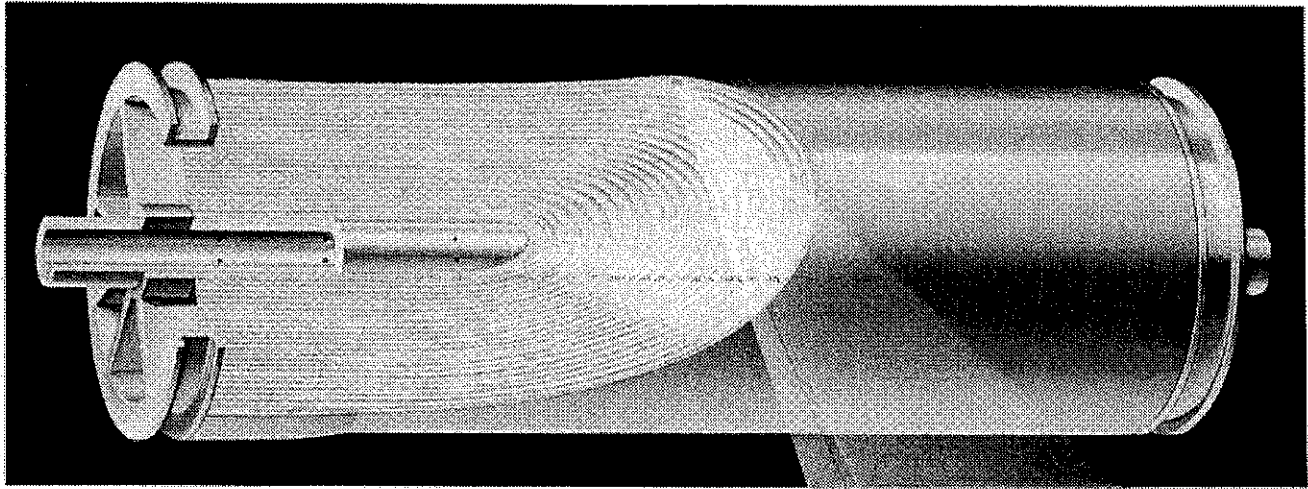
**Product Water:** The product water flows out of the R.O. Membrane and passes into a Salinity Probe which adjusts automatically for temperature

changes and registers, electronically, the salt content of the product water. Next, the Product Flow Meter registers the amount of potable water being produced. The product water then proceeds into the 3-Way Solenoid Diversion Valve. Here, potable water is diverted to the Charcoal Filter where gasses or odors present are absorbed and removed from the product water. The final filtration process occurs in the Ultraviolet Sterilizer where 99.9 % of all microorganisms, including viruses and bacteria, are destroyed.

**Rinsing and Cleaning:** Two 3-way valves are provided for System Rinsing and Cleaning. The Automatic Fresh Water Flush System maintains fresh water within the System during shut down periods.

**Electronics:** All electrical connections terminate at the Salinity Controller. Highly advanced, the Salinity Controller features computer controlled reliable solid state electronics with advanced proprietary logic features found in no other desalination system. Various Remote Control units are available for remote operation of the System.

# 1. ANATOMY OF A REVERSE OSMOSIS MEMBRANE ELEMENT:



## 2. PRINCIPLES OF REVERSE OSMOSIS:

**A. OSMOSIS:** Osmosis can be defined as the spontaneous passage of a liquid from a dilute to a more concentrated solution across an ideal semi-permeable membrane which allows the passage of the solvent (water) but not the dissolved solids (solutes).

**B. OSMOTIC PRESSURE:** The transfer of the water from one side of the membrane to the other continues until the head (pressure) is large enough to prevent any net transfer of the solvent (water) to the more concentrated solution. At equilibrium, the quantity of water passing in either direction is equal, and the pressure is then defined as the Osmotic Pressure of the solution having that particular concentration of dissolved solids.

**C. REVERSE OSMOSIS:** As described above, water continues to flow from the pure water side of the membrane to the saline solution side until the pressure created by the high pressure pump on the saline solution side of the membrane equals the osmotic pressure. If the pressure of the saline solution is increased until it exceeds the osmotic pressure, water is forced to flow through the membrane from the solution containing the higher salt concentration into the solution with the lower salt concentration. The process is called Reverse Osmosis.

**D. SPIRAL-WOUND MEMBRANE:** The spiral-wound membrane consists of one or more membrane envelopes each formed by enclosing a channelized product water carrying material between two large flat membrane sheets. The membrane envelope is sealed on three edges with a special adhesive and attached with the adhesive to a small diameter pipe to form a cylinder 2, 4, 6, 8, or 12 inches in diameter and up to 40 inches in length. A polypropylene screen is used to form the feed water channel between the membrane envelopes. A wrap is applied to the membrane element to maintain the cylindrical configuration. The center tube is also the permeate (product water) collecting channel. Several elements may be connected in series within a single or multiple pressure vessel(s).

## E. BOUNDARY LAYER CONCENTRATION

**POLARIZATION:** When water permeates through the membrane, nearly all the salt is left behind in the brine channel. In any dynamic hydraulic system the fluid adjacent to the wall of the vessel is moving relatively slowly. Even though the main body of the stream is turbulent, a thin film adjacent to the wall (membrane) is laminar. This thin film is called the boundary layer. When the dissolved salts, at the Boundary Layer become concentrated beyond permissible limits then these salts adhere to the membrane surface. This concentration of salts at the membrane surface is referred to as Concentration Polarization. Concentration Polarization is caused by excessive recovery (percentage of product water recovered from the feed water).

**F. COMPACTION:** Some densification of the membrane structure may take place while operating at elevated pressures, above 1000 psi. The change is known as compaction and is accompanied by a reduction in the water permeation rate.

**G. WATER TEMPERATURE EFFECT** The product water flow through the membrane is significantly affected by the water temperature. At any given pressure this flow increases with increasing water temperature and is reduced at lower temperatures.

**H. PRESSURE:** The operating pressure has a direct affect on product water quality and quantity. Both factors increase as the system pressure increases (within design limits). The system must be operated at the lowest pressure required to achieve the designed product water flow rate. This parameter also affects compaction, which proceeds at a faster rate at higher pressures as well as at higher temperatures.

**I. BRINE VELOCITY:** The brine flow over the membrane surface is very important to both product water quality and quantity. At low flows, concentration polarization occurs, causing the water quality to decline. In addition to inferior product water quality, low brine flows can increase the precipitation of sparingly soluble salts, which foul the membrane surface. If this occurs, the product water flux (production) declines.

**NOTES:**



## **SECTION D**

# **System Schematic with Component Identifications & Descriptions**



## COMPONENT DESCRIPTIONS

All components supplied by HRO, both standard and optional, are described below along with items required or desired by the installer. The ID numbers used correspond to the System Schematic numbers from page D - 2.

\*\* Denotes items supplied by installer;

\*\*\* denotes optional equipment.

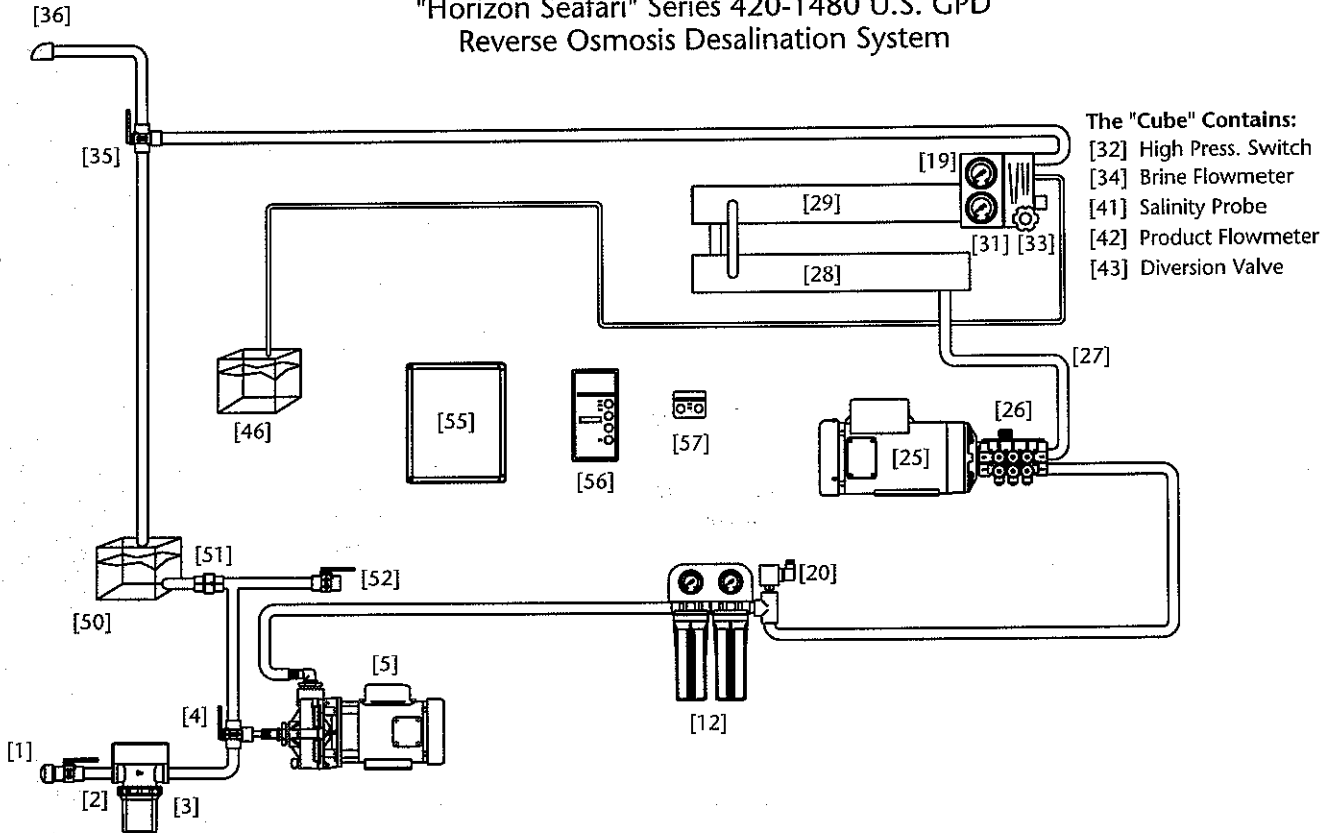
### A. PREFILTRATION SUBSYSTEM:

This section of the system pre-treats and delivers the Feed Water into the System. The Feed Water may be collected directly from the source, from a well, or through a ship's Sea Chest / Inlet Thru Hull Fitting. The raw feed water is filtered to remove suspended solids larger than 5 Micron size (5/1,000,000 of a meter). The pre-filtration protects the HRO Systems Membrane Element from undue fouling.

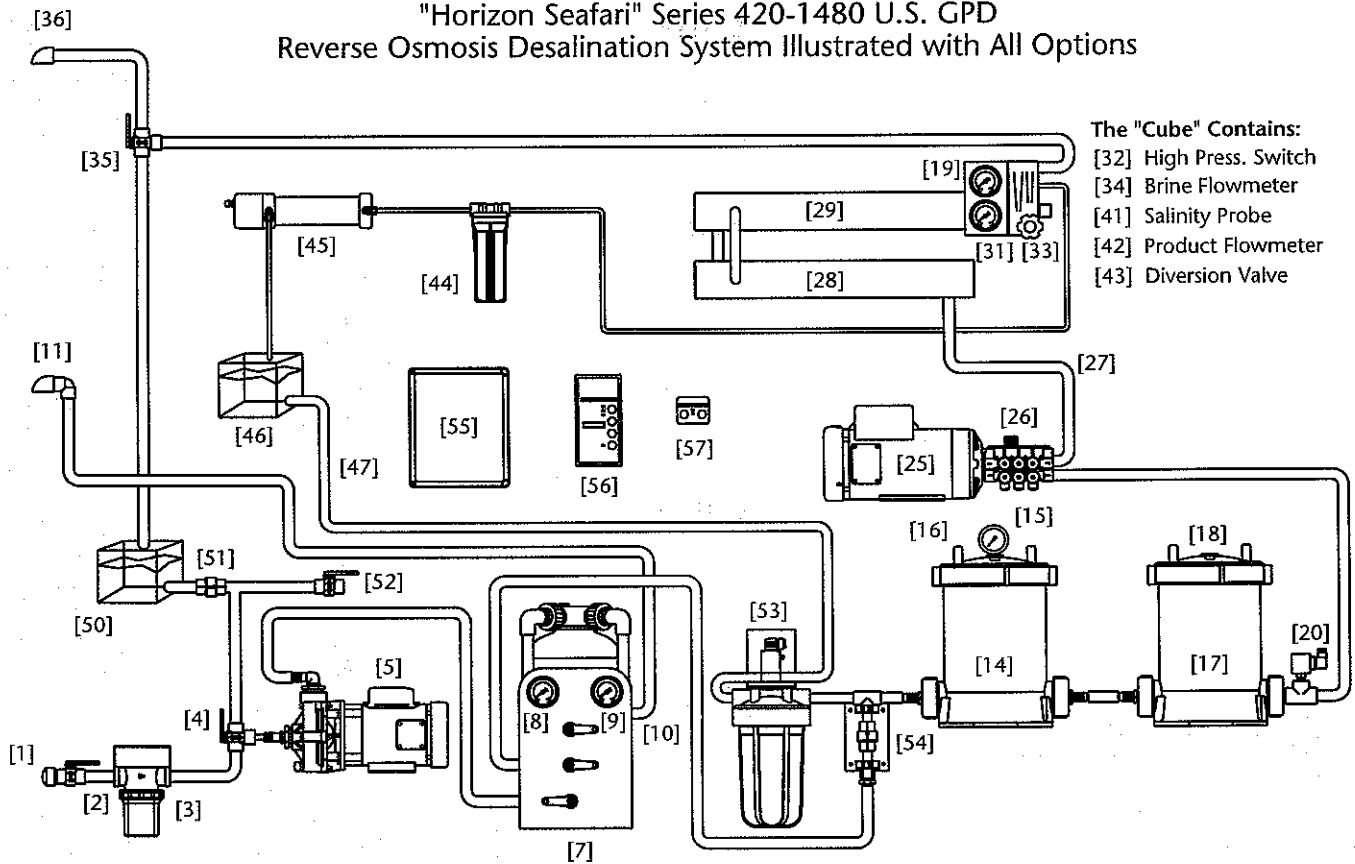
A plugged Pre-Filtration Subsystem causes cavitation damage to the High Pressure Pump. Always ensure that the Pre-Filtration Subsystem is clear and monitor it frequently.

1. **Inlet Thru Hull Fitting with Forward Facing Scoop \*\*** is the point at which the feed water enters the system. It is the installer's responsibility to arrange for and configure this feed water pick up point. If the pick up point is a thru hull fitting on a boat it must be a forward facing scoop well below water level. If the pick up is from a sea chest it must be connected at a low point in the sea chest or stand up pipe so that no air enters the system.
2. **Sea Cock Valve \*\*** is used in a ship installation for safety reasons to close the feed water line during nonuse of the Horizon Seafari System. In some installations this valve may be complemented with a check valve in order to maintain prime in the feed water line.
3. **Sea Strainer** has a clear bowl with nylon body filter housing or optional bronze body containing a cleanable monel fine mesh filter screen. The Sea Strainer filters out large particulate matter and suspended particles that would otherwise damage the Booster Pump.
4. **Rinse/Clean Inlet Valve (optional)** is used to change the system from an operational mode to a rinse, storage or cleaning mode. This valve directs water into the Booster Pump from either the raw water feed line or the Rinse/Clean Tank.
5. **Booster Pump** supplies a positive pressure to the Pre-filters, and through to the High Pressure Pump. The Horizon Seafari utilizes a pump with a performance curve of 80 Ft Head (35 psi) at 4.2 GPM. The resulting pressure at the High Pressure Pump depends on the final configuration.
6. **Plankton Filter \*\*\*** This filter assembly contains a cleanable ultra fine monel mesh screen. The mesh screen removes suspended solids or biological growth such as plankton and provides longer life to the Pre-filter Elements and in turn provide lower system maintenance costs.
7. **Multi Media Filter \*\*\*** contains a media filter bed (gravel and sand). The media traps suspended solids larger than 30 micron. The Multi Media Filter is back washable.
8. **Low Pressure Gauge, Booster Pump Outlet / Multi Media Filter Inlet \*\*\*** displays the Inlet Pressure to the Multi Media Filter. In correlation with Low Pressure Gauge [9] the operator can easily view the condition of the Multi Media Filter and determine when back washing is necessary.
9. **Low Pressure Gauge, Multi Media Filter Outlet / Cartridge Pre-Filter Inlet \*\*\*** displays the Outlet Pressure of the Multi Media Filter across the filter bed. In correlation with Low Pressure Gauge [7] the operator can easily view the pressure differential across the media and determine when back washing is necessary.
10. **Multi Media Filter Waste Connection \*\*\*** is the waste line connection to the Multi Media Filter Thru Hull Discharge Fitting.
11. **Multi Media Filter Thru Hull Discharge Fitting \*\*** must be provided for discharge of the Multi Media Discharge Water.
12. **Standard 25 to 5 micron Pre-Filters** consists of two filter housings connected in series with each other. The filter elements remove suspended solids from the System Feed Water. The first Pre-filter contains a filter element, which filters the feed water to 25 micron. The second Pre-filter contains a finer element, which filters the feed water to 5 micron.
13. **Future reference**

"Horizon Seafari" Series 420-1480 U.S. GPD  
Reverse Osmosis Desalination System



"Horizon Seafari" Series 420-1480 U.S. GPD  
Reverse Osmosis Desalination System Illustrated with All Options



14. **Commercial Pre-Filter\*\*\*** provides extended periods between filter element changes. The Commercial Pre-filter contains a filter element with 50 square feet of filtering area. This filter removes suspended solids 5 Microns and larger.
15. **Air Bleed** allows the operator to purge the Commercial Pre-Filter Housing of any air introduced from the feed line.
16. **Low Pressure Gauge, Commercial Pre-Filter Inlet** provides visual indication of the pressure into the Commercial Pre-filter Housing from the Booster Pump.
17. **Oil/Water Separator Filter** The separator element separates oil and suspended solids from the System Feed Water. Oil permanently destroys the R.O. Membrane Element, therefore, it is recommended that the user avoid operating the Horizon Seafari in oily, polluted waters.
18. **Air Bleed Valve** allows the operator to purge the Oil Water Separator Filter Housing of any air and collated oil introduced from the feed line.
19. **Low Pressure Gauge** displays the Inlet Pressure to the High Pressure Pump. The gauge assists the operator in diagnosing the Sea Strainer, Booster Pump, Plankton Filter Element, Commercial Prefilter Element, and Oil/Water Separator Element condition.
20. **Low Pressure Switch** shuts the System off automatically when a plugged filter element or other condition causes a low flow situation. This protects the High Pressure Pump, the R.O. Membrane Element and the Booster Pump from damage.
21. - 23. **Future reference**

## **B. PRESSURIZATION SUBSYSTEM:**

Proper pressure and proper flow across the HROSystems Membrane Element are two basic requirements of Reverse Osmosis. Refer to Chapter B for correct flow specifications and to the Temperature Effect Chart in Section M of this Manual for temperature corrections.

### **24. Future Reference**

25. **Electric Motor** is directly coupled to the High Pressure Pump. Single Phase Systems utilize specially designed electric motors, which include a thermal overload protection switch which shuts the System off due to low voltage or over loading.
26. **High Pressure Pump** is a marine quality, positive displacement, ceramic plunger pump. The High Pressure Pump lasts for years with proper use and maintenance.
27. **High Pressure Hose, HP Pump Outlet MVA Inlet** transfers pressurized Sea Water from the High Pressure Pump to the inlet of the R.O. Membrane Element.
- 28 & 29. **R.O. Membrane Element & Vessel** The Membrane Element allows potable water molecules to pass through while rejecting the salt ions. Only about 10% of the System Feed Water becomes fresh Product Water (per membrane element). The remainder carries the rejected salt ions out of the R.O. Membrane Element in a concentrated brine stream.
31. **High Pressure Gauge** displays the R.O. Membrane Vessel outlet pressure.
32. **High Pressure Switch** is used to automatically turn the System off in case of over-pressurization during operation.
33. **Back Pressure Regulator** By turning the valve adjustment handle clockwise and counterclockwise pressure is increased and decreased accordingly. This increases and decreases the production capability of the R.O. Membrane Element.

### C. BRINE DISCHARGE SUBSYSTEM:

This section of the System carries the Brine Discharge expelled from the R.O. Membrane Element back to the feed source.

34. **Flow Meter, Brine Discharge Water** measures Brine Flow of the System and is located on the left side of the dual port Brine/Product Water Flow Meter. This is one of the most important visual checkpoints of the HRO system and should be monitored on a regular basis.
35. **Clean/Rinse Outlet Valve** (optional) is used in conjunction with the Clean/Rinse Inlet Valve to set the System Brine Discharge Line into a normal, storage or cleaning mode.
36. **Thru Hull Discharge Fitting** \*\* should be installed above water level for discharge of the Brine Discharge Water from the System.

37. - 39. Future Reference

### D. PRODUCT WATER MONITORING

**SUBSYSTEM:** This section of the System gives a visual indication of the clarity, quantity, and quality of the product water. Post Filtration of the HRO system is the final step in Product Water quality control. The Post Filtration Subsystem is designed to limit unpleasant odor, taste, and biological matter, which may have passed through the R.O. Membrane Element.

40. Future reference.

41. **Temperature Compensated Salinity Probe** electrically determines whether the salinity content of the Product Water is acceptable. This Salinity Probe compensates for water temperature variations, and provides an accurate measurement of the quality of the Product Water.

42. **Flow Meter, Product Water** The flow-through design of the meter allows it to measure the rate of Product Water flow from the R.O. Membrane Element toward the Product Water Post Filtration Components.

43. **3-Way Electric Product Diversion Valve** the Controller energizes this valve to the "Potable" position when the system produces water, which meets or exceeds the salinity requirement. If the Product Water being produced is "Un-potable" then no signal is sent to the valve and it thus remains in the

normally open position. The normally open position diverts the un-potable Product Water to discharge.

44. **Charcoal Filter\*\*\*** is designed to assist in the removal of foul odors from the Product Water.
45. **Ultra Violet Sterilizer \*\*\*** destroys at least 99.9% of any virus, bacteria and other micro-organisms which may pass through the HRO R.O. Membrane Element. The U.V. sterilizer is highly recommended if the Product Water Storage Tank is not otherwise treated by means such as chlorination. Use of the U.V. Sterilizer is also recommended if the System Feed Inlet is near a polluted source such as a raw sewage outlet.
46. **Potable Water Storage Tank \*\*** may be any container suitable for storing Potable Water, i.e. existing water storage tank.
47. **Ships Fresh Water Pressure System \*\*** is the existing pumping/pressurizing system for distribution of the fresh water on to all of the various faucets and fixtures.

48 - 49. Future Reference

### E. RINSE & CLEAN TANK SUBSYSTEM:

Consists of supplied valves and required tank or container for the cleaning, rinsing or storage of the R.O. System. The Horizon Seafari should be rinsed, stored, and cleaned from time to time or as appropriate.

50. **Rinse/Clean Tank \*\*** is any container, permanent or temporary, which can hold from 5 to 20 gallons of water.
51. **Check Valve, Non Return \*\*** is desired if Valve [52] is used for Dock Side water flushing of the System. This valve prevents Dock Side Rinse Water from entering the Clean/Rinse tank.
52. **Filtered Dock Water Isolation Valve \*\*** controls the flow of Dock Side rinse water.
53. **Fresh Water Flush Charcoal Filter and Solenoid Valve\*\*\*** is the main component of the optional Fresh Water Flush System, which flushes the system with fresh water. The Solenoid Valve controls the flow of fresh water through the system. The charcoal filter removes particulate matter and chlorine from the fresh water to prevent damage to the R.O. membrane element(s). Fresh Water Flushing replaces the seawater in the system with less corrosive fresh water.

54. **Fresh Water Flush Check Valve Assembly\*\*\*** This check valve assembly isolates the Fresh Water Flush system, preventing seawater from flowing in the reverse direction through the Charcoal Filter.

**F. ELECTRONIC SUBSYSTEM:**

This subsystem measures water quality, controls the direction of Product Water flow, and contains the central electrical connection point of the System. It also ensures only potable Product Water passes into the Product Water Storage Tank.

55. **Main Power Enclosure** This enclosure houses the high-voltage components of the system. It serves as the connection point for all the electrical systems such as the motors, switches, valves, and the controller.

56. **Salinity Controller** The controller monitors the salt content of the product water, and signals the 3-Way Product Diversion Valve when Potable Water is being produced. The 3-Way Product Diversion Valve, Motors, Remote Control and U.V. Sterilizer are each governed by this Controller.

57. **Remote Controller \*\*\*** (optional) allows for remote monitoring and or controlling of the system.

**TOUCH PAD CONTROL DESCRIPTIONS:**

**1. SWITCHES** The Touch Pad contains all of the system control switches. The system switches are identified and described below.



**START:** This switch initiates the start cycle. The Booster Pump [5] starts first and after a short delay, the High Pressure Pump Motor [25] starts.

**BOOST PUMP:** This switch controls the Booster Pump [5] independent of the High Pressure Pump [26]. When pressed, the booster pump starts and runs by itself, until the "Start" switch is pressed.

**STOP:** This switch stops all of the system functions when pressed. Each time the system is stopped, the Fresh Water Flush system is initiated. The Fresh Water Flush cycle is aborted by pressing the Stop switch a second time.

**FAULT RESET:** This switch resets the High/Low Pressure fault and allows the system to start.

**2. INDICATOR LAMPS** Above and to the left of the switches on the Touch Pad are the indicator lamps. These lamps either indicate the operation of the corresponding equipment or a fault condition. The following are descriptions of the indicator lamps.

**Power:** This indicator is lit when power is supplied to the controller. This indicates that the main power breaker has been switched on.

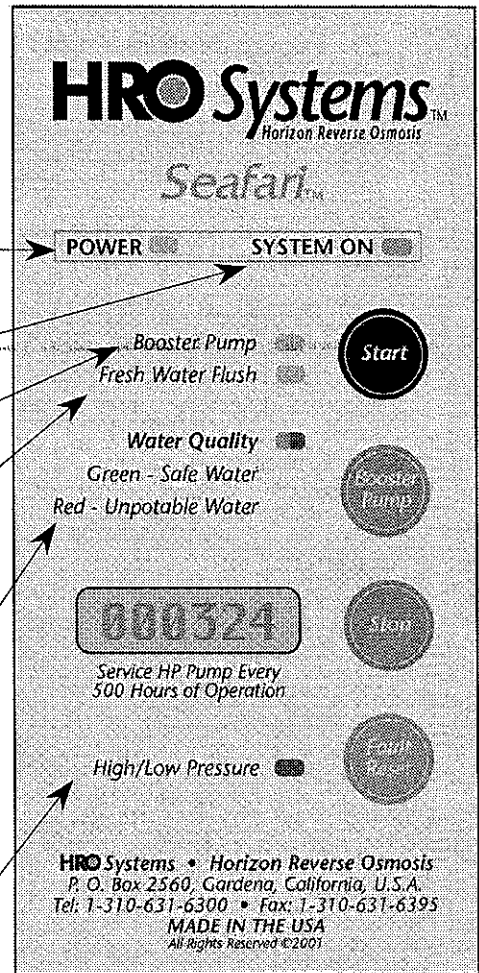
**System On:** This lamp illuminates when the High Pressure Pump is operating.

**Booster Pump:** This lamp illuminates when the booster pump is operating.

**Fresh Water Flush:** This indicator illuminates solidly during the Fresh Water Flushing operation. When the Fresh Water Flush is between the ten minute flushings, which repeat every seven days, this lamp blinks on and off.

**Water Quality:** This lamp indicates the quality of the water being produced by the system. A red lamp illuminates when the system is producing un-potable water. A green lamp illuminates when the system is producing potable water.

**High/Low Pressure:** The High/Low pressure fault lamp illuminates when the system shuts down due to either a low-pressure condition, or a high-pressure condition. If the Low Pressure Switch senses a low-pressure condition, this lamp blinks for twenty seconds, and then the system shuts down.



## G. OPTIONAL EQUIPMENT

**Soft Start\*\*\*** The soft start lowers the starting torque of the high-pressure pump motor, and gradually brings the motor to full speed. This reduces the initial startup amps required to start the motor. The soft start is available on single-phase systems and allows starting of the system when the power/source, i.e. generator, is marginal or insufficient to start the system un-assisted. By reducing the starting torque of the motor, the system demands lower initial power at startup and can operate on an otherwise insufficient power source.

**NOTES:**





## **SECTION E**

# **System Installation Procedure**

## E. INSTALLATION OF HORIZON SEAFARI SYSTEMS

### ON SITE STORAGE & PREPARATION FOR INSTALLATION:

#### A. STORAGE PRIOR TO UNCRATING:

1. Adhere to crate markings:
  - **DO NOT** store in direct sunlight;
  - **DO NOT** store above 120 degrees F / 50 degrees C;
  - **DO NOT** freeze; STORE ONLY on base with ARROWS UP;
  - **DO NOT** store longer than 3 months without additional storage chemical rinsing.
2. Refer to Section J of this manual for further cautions of the R.O. Membrane Element.

#### B. AVOID CHEMICAL ATTACK TO THE SYSTEM:

CAUTION: Do not expose the Horizon Seafari System to:

hydrogen peroxide	chloramine
chloramine-T	N-chloroisocyanurates
chlorine dioxide	hypochlorite, chlorine
iodine	bromine
bromide	phenolic disinfectants

or any other specific chemical not approved in writing by HRO Systems. Use of unauthorized or misuse of authorized chemicals voids system warranty.

*Numbers in [ brackets ] refer to the I.D. numbers illustrated on page D-2.*

#### C. COMPONENTS SUPPLIED BY OWNER:

1. **Inlet Thru Hull Fitting with Inlet Sea Cock Valve [1&2]**
  - ¼ - turn ball valve min. ¾" size, with a ¾" MNPT connection for the supplied HRO fitting.
  - This inlet must be installed below water level and must never be able to draw air
  - The system intake must be located toward the bottom when a stand up pipe is used.

#### 2. Brine Thru Hull Fitting [36]

- A minimum ½" size with a ½" MNPT connection.
- Must be located above water level.
- If a Multi-Media Filter is installed, an additional waste fitting, minimum ½" size with ½" MNPT for connection to the supplied HRO fittings.

#### 3. Potable Water Storage Tank [46]

- The installation fitting must be at least a 3/8" NPT with 3/8" FNPT for connection of the HRO fittings.
- The fitting must terminate above the maximum water level.
- No valves should be installed in this line.

#### 4. Properly sized Power Cable:

Operating Voltage 115 VAC, Single Phase,  
Recommended Minimum Size Power Cable:  
10 AWG

Operating Voltage 230 VAC, Single Phase,  
Recommended Minimum Size Power Cable:  
12 AWG

Operating Voltage 230 VAC, Three Phase,  
Recommended Minimum Size Power Cable:  
12 AWG

Operating Voltage 380-460 VAC, Three Phase,  
Recommended Minimum Size Power Cable:  
14 AWG

5. **An electrical power source** capable of supplying the proper current at the proper Voltage to the Horizon Seafari System.

#### D. TOOLS REQUIRED FOR INSTALLATION:

1. Of course, not all installations are typical. For this reason, it is recommended to have a full set of mechanic's electrician's tools available. However, no special system tools are required for installation. Though not always necessary, a separate DS Meter, available from HRO Systems, and a volt/ohm meter (VOM) are beneficial and useful tools for system installation and initial start-up.

#### E. SPECIAL CONSIDERATIONS:

##### 1. LENGTH OF CONNECTION LINES:

- All connection lines should be as short as possible. Increased length causes line-loss from the system.
- The connection lines must be as straight as possible with minimum number of fittings.

##### 2. PLACEMENT AND ROUTING OF THE FEED WATER LINE:

- Always plumb the line so that all air may naturally bleed from the feed water line. (Excessive bends and elbows in the Feed Line results in pressure loss)
- Pressure losses cause inefficiency and shorter pre-filter life.

##### 3. SYSTEM FEED INLET

- Must be in constant contact with the feed water.
- The Horizon Seafari system must receive an uninterrupted supply of air free feed water.
- The Inlet Thru Hull Fitting should be dedicated for only the Horizon Seafari R.O. System.
- DO NOT use one Thru Hull Fitting for several auxiliary systems.

#### 4. ACCESS FOR MAINTENANCE

- Give careful consideration to access to items for maintenance purposes.
- Hidden or out of reach items may become forgotten and cause damage to other system components.

#### 5. THE CONTROL PANEL

- Must be accessible for operation and viewing.

#### F. DISTANCE BETWEEN COMPONENTS:

1. Inlet Sea Cock Valve [2] through the Pre-filtration and into the inlet of the High Pressure Pump:

12.5 feet of 3/4" I.D. (3.8 meters of 19 mm ID) flexible rigid wall tubing is supplied for the plumbing of the feed water line from the Inlet Sea Cock to the Inlet of the High Pressure Pump.

Caution must be exercised in extending the length of the feed water line. Feed pressure loss from the Booster Pump causes shorter Pre-filter Element life

Keep the distance from the Sea Cock valve to the High Pressure Pump as short and straight as possible.

Non-Standard applications may require a larger booster pump. *This is determined best by the installer prior to system purchase.*

2. Brine Dump Tubing from the System to the Brine Discharge Outlet Fitting [36]:

20 feet of 1/2" OD (15 meters of 12.7 mm OD) tubing is supplied to connect the Brine Discharge Line components.

Ensure that no backpressure is present on this line as backpressure causes bypassing at the 3-way product water diversion valve.

3. Product water tubing from the Product Water outlet connection to the Product Water Storage Tank Inlet [46]:

50 feet of 3/8" OD (15 meters of 9.5 mm OD) tubing is supplied for this purpose.

Keep the product water tubing as straight and short as possible.

**Do Not Install Any Valves in this line. Blockage of the Product Water Line causes extensive damage to the System and the R.O. Membrane Element.**

**G. UNCRATING:**

DO NOT DISCARD ANY PACKAGING MATERIAL UNTIL YOU HAVE FOUND AND IDENTIFIED ALL PARTS!

Remove the Horizon Seafari system from the shipping crate.

Some of the components are loose or separately packaged in the shipping container.

Do Not discard any packaging or boxes as they may contain small mounting hardware pieces or small system components.

**H. HIGH PRESSURE PUMP PREPARATION:**

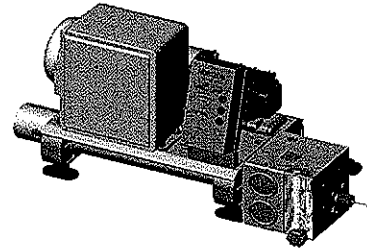
1. Remove the orange shipping plug from the high-pressure pump and replace with the orange, vented cap.

It is very important that the vented cap is installed or pressure builds up within the pump crankcase, which may lead to pump damage

2. Ensure that the pump oil level is at the center of the pump sight glass.

The pump oil must be filled with HRO Systems supplied pump oil.

**SELF-CONTAINED SYSTEMS PACKAGED COMPONENTS**  
**(NO OPTIONS SHOWN)**



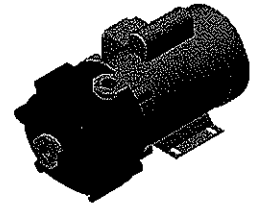
INSTALLATION KIT

Main System

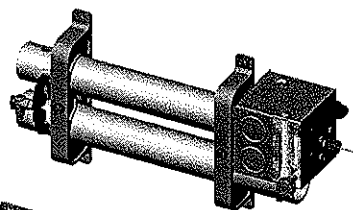


Pre-filters

Booster Pump



**MODULAR SYSTEMS PACKAGED COMPONENTS**  
**(NO OPTIONS SHOWN)**

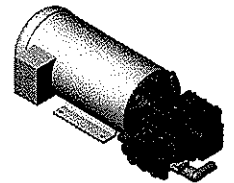


INSTALLATION KIT

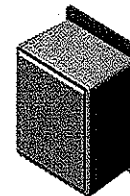
Main System



Pre-filters



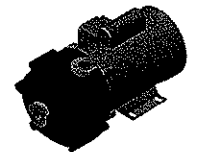
High-Pressure Pump



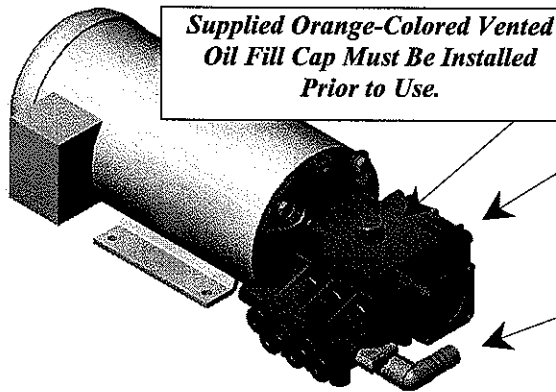
Main Power Enclosure



Controller



Booster Pump



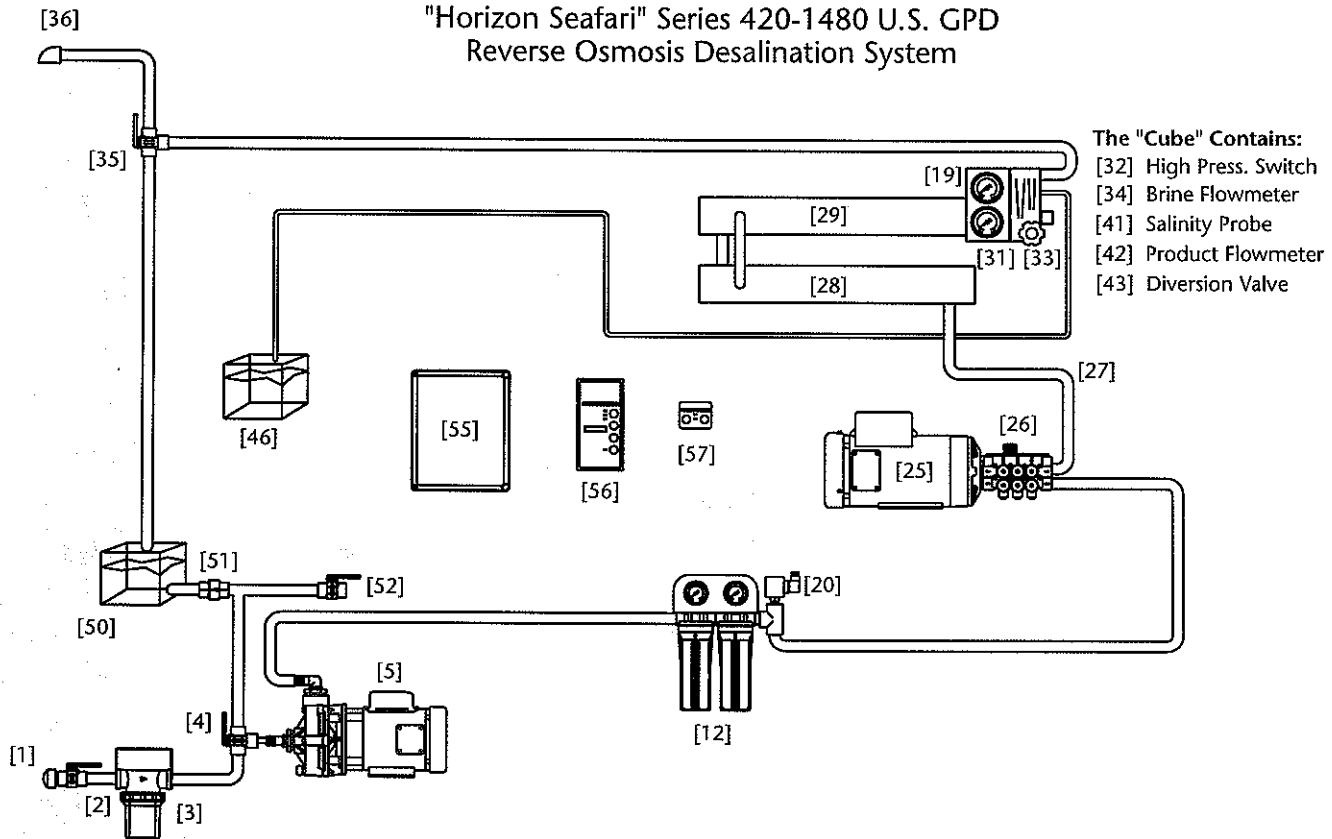
**Supplied Orange-Colored Vented Oil Fill Cap Must Be Installed Prior to Use.**

**Location of Oil Sight Plug. (Pump oil must be filled to middle of glass prior to operation.)**

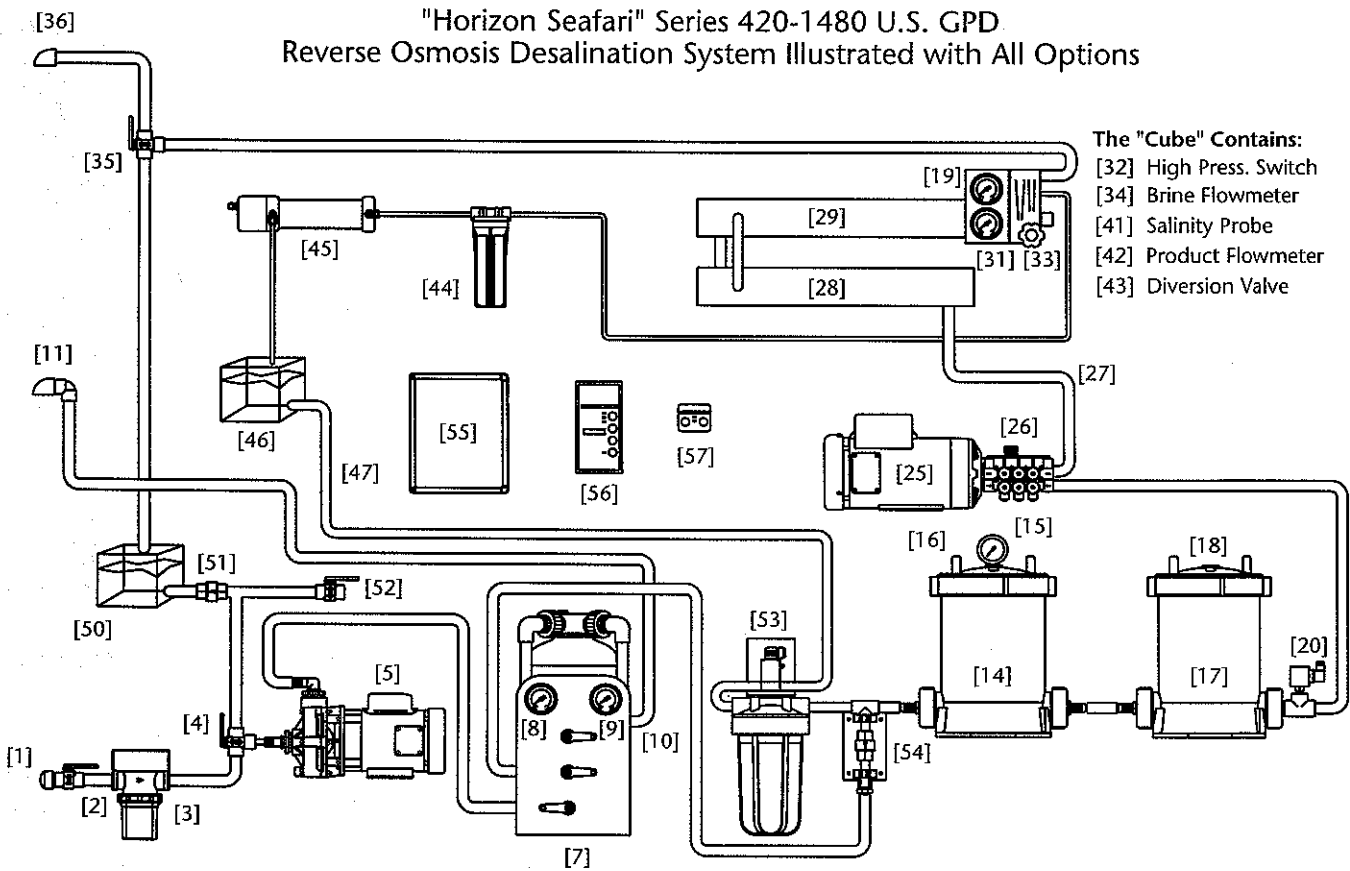
**Feed Water Inlet to High Pressure Pump (From Pre-filter or Oil/Water Separator)**

**High Pressure Hose Connection (To R.O. Membrane Inlet)**

"Horizon Seafari" Series 420-1480 U.S. GPD  
Reverse Osmosis Desalination System



"Horizon Seafari" Series 420-1480 U.S. GPD  
Reverse Osmosis Desalination System Illustrated with All Options



### FAST-N-TITE TUBING CONNECTIONS:

#### CROSS SECTION OF FAST-N-TIGHT TUBE FITTING

#### TUBE FITTING ASSEMBLY AND DISASSEMBLY INSTRUCTIONS

STEP 1

STEP 2

STEP 3

STEP 4



DWG #B00480XXXX-A1

#### ASSEMBLY:

- Step 1
- Step 2
- Step 3

Cut tube end square and clean.

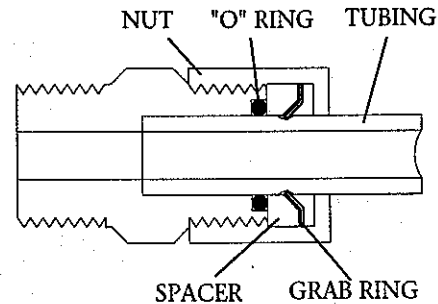
Loosen nut on fitting three turns.

Insert tube into fitting until it bottoms. Loosen nut completely and remove tube with attached parts from body. Check to ensure that the "O" ring is seated onto the tube under the spacer (and not pinched into the body). Insert tube with attached parts into the body and tighten nut finger tight.

#### DISASSEMBLY:

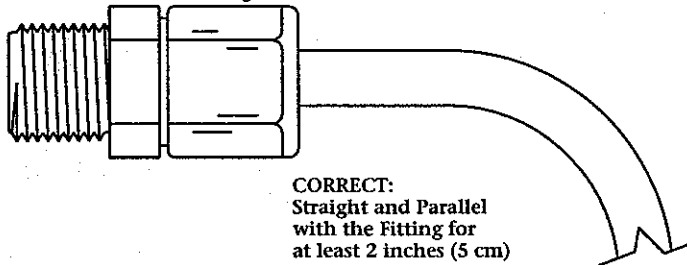
- Step 4

To remove tubing in order to reuse the fitting assembly, cut tubing close to nut, push tubing through nut, grab ring and spacer.



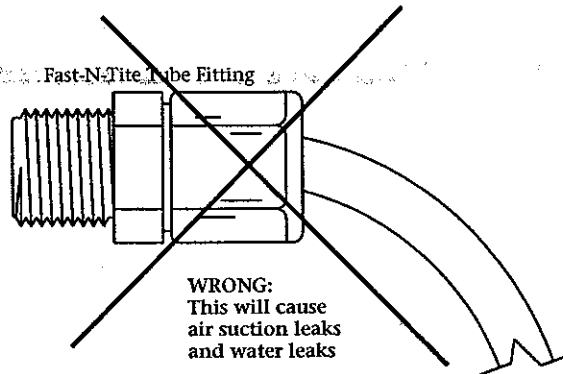
**Always allow the tube to enter and exit straight from the tube fitting for a minimum of one inch prior to starting a bend. If the tube is immediately bent from the tube fitting then leaks result due to unnatural O-ring side compression.**

Fast-N-Tite Tube Fitting



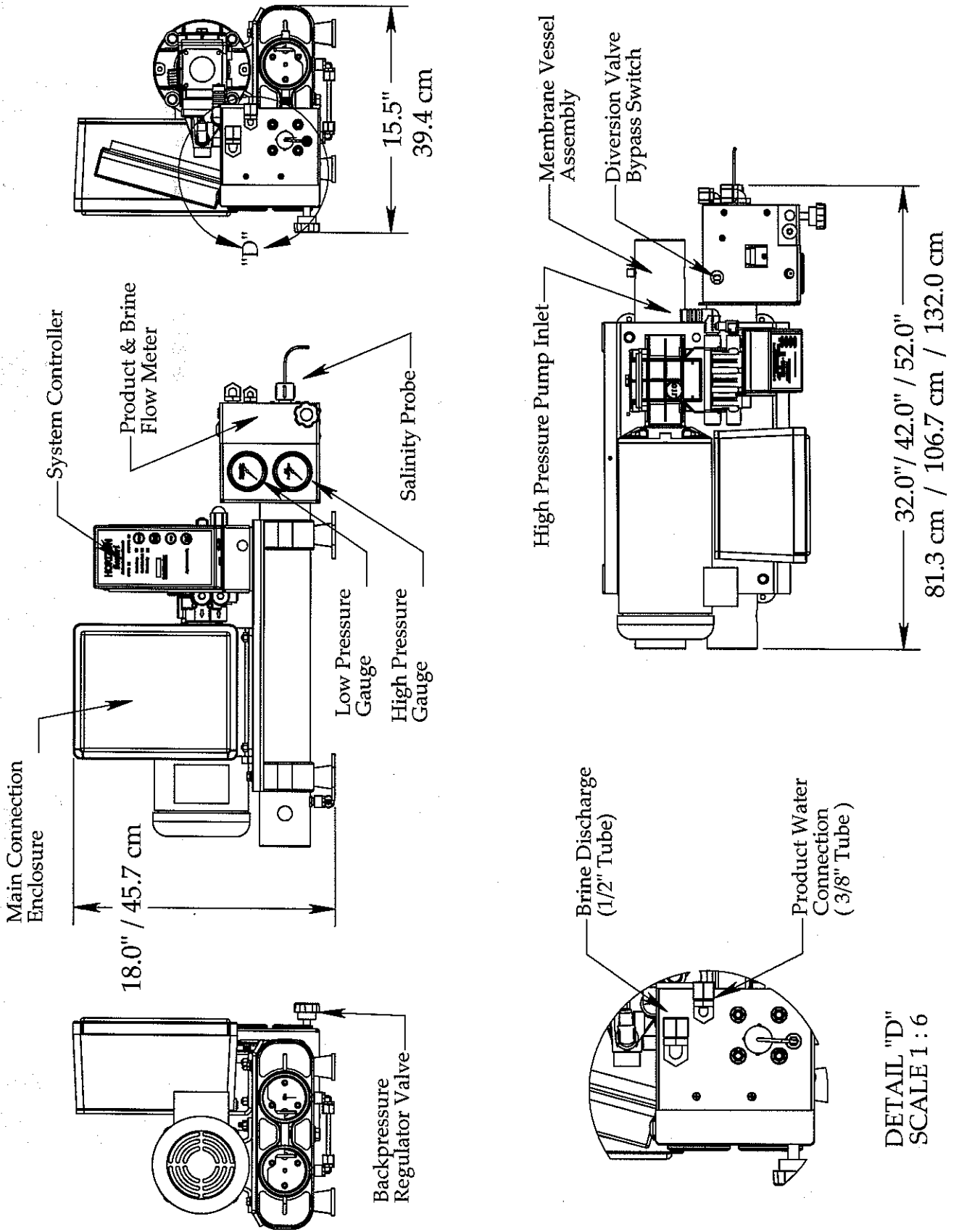
**CORRECT:**  
Straight and Parallel  
with the Fitting for  
at least 2 inches (5 cm)

Fast-N-Tite Tube Fitting



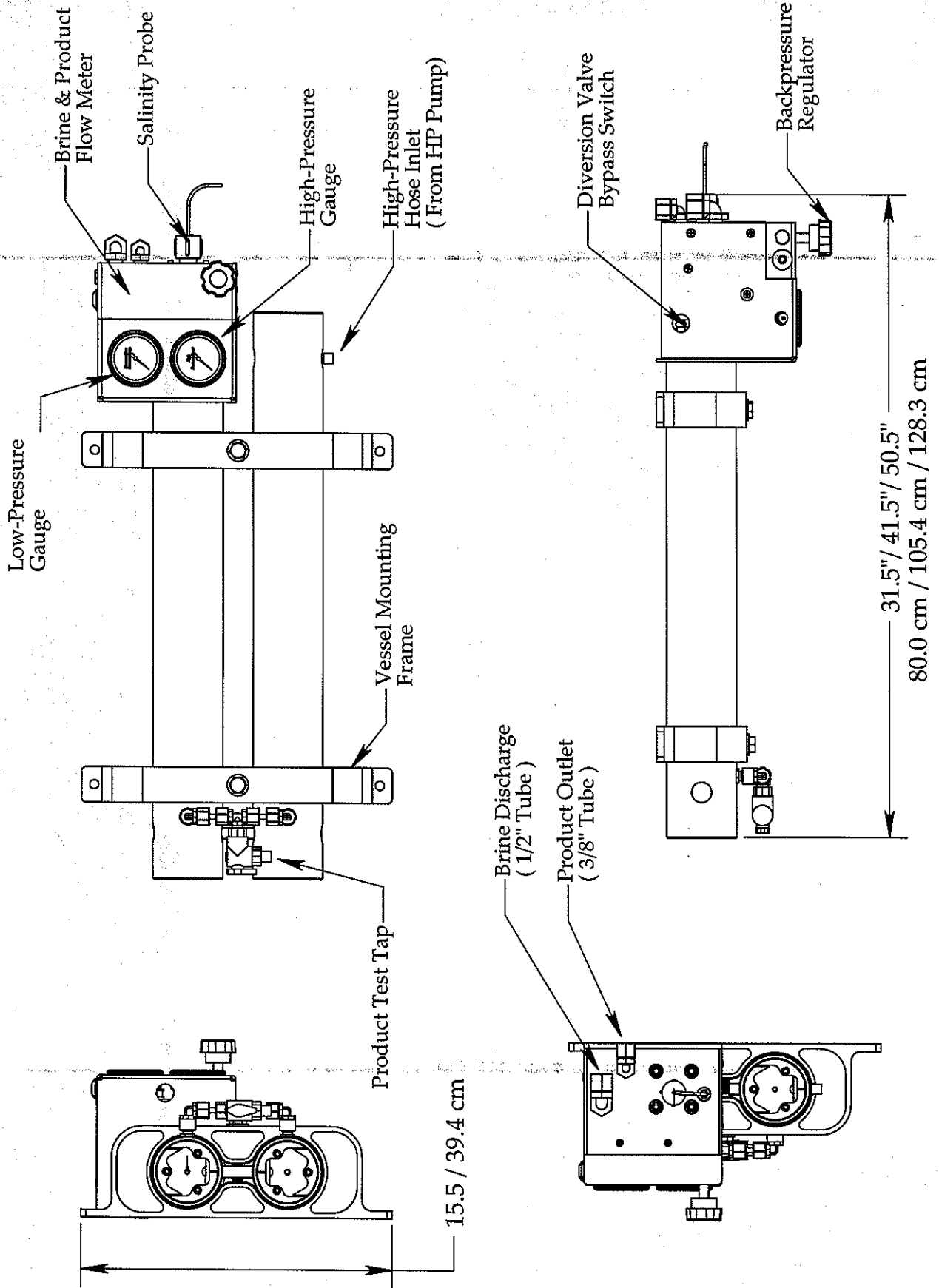
**WRONG:**  
This will cause  
air suction leaks  
and water leaks

# Horizon Seafari Self-Contained Components Identification



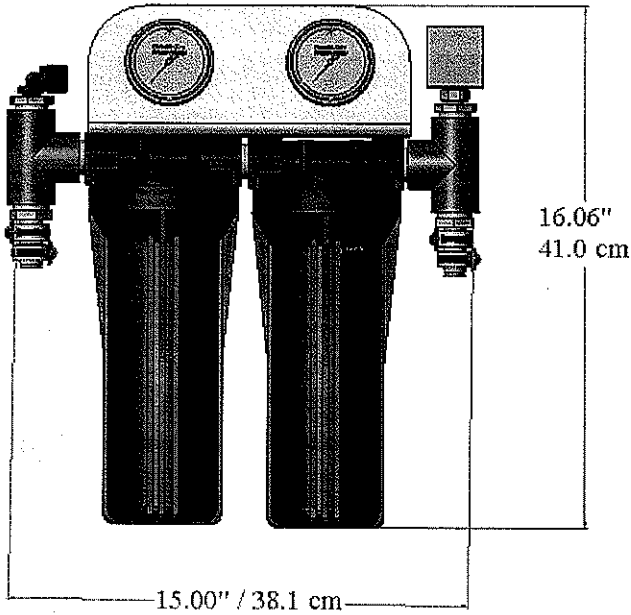
DETAIL "D"  
SCALE 1:6

# Horizon Seafari Modular Components Identification

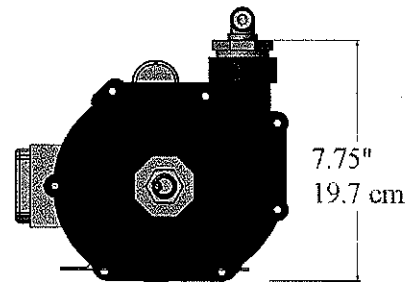
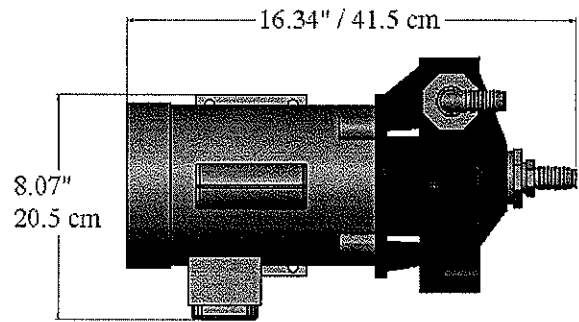




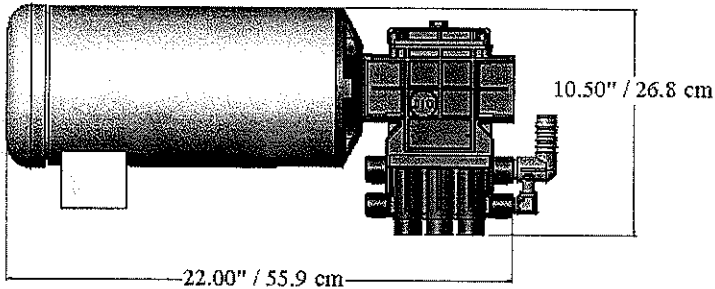
# Component Dimensions



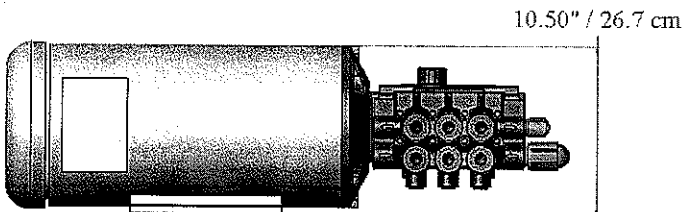
**Standard Pre-filters**  
(Leave 4" Below for Element Removal)



**Booster Pump**

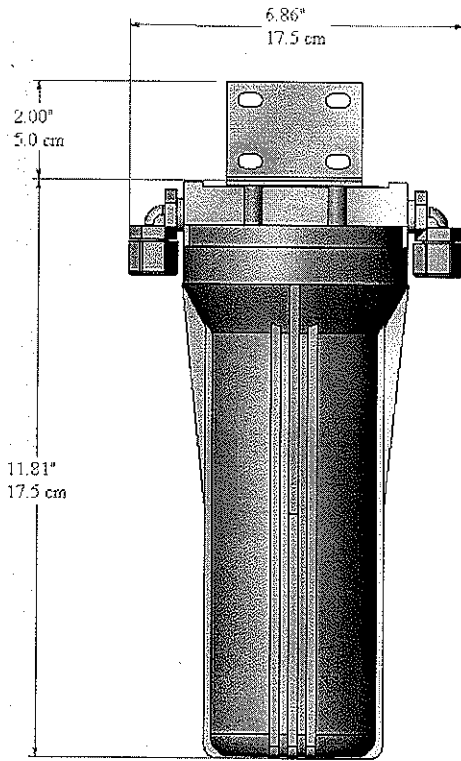


**High Pressure Pump**



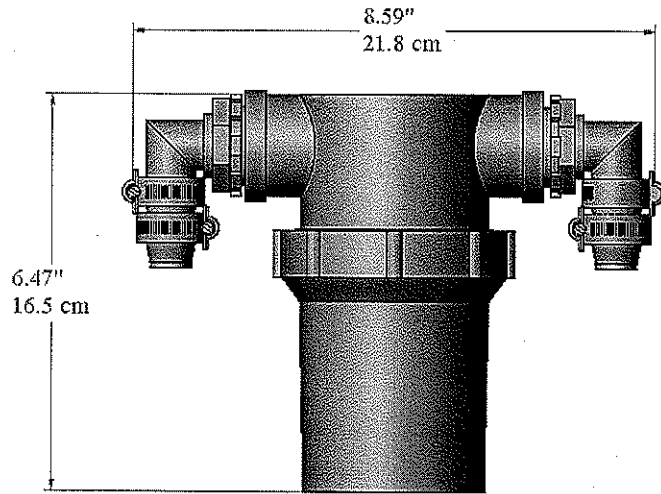
**Charcoal Filter**

(Add 4" Below for Element Removal)

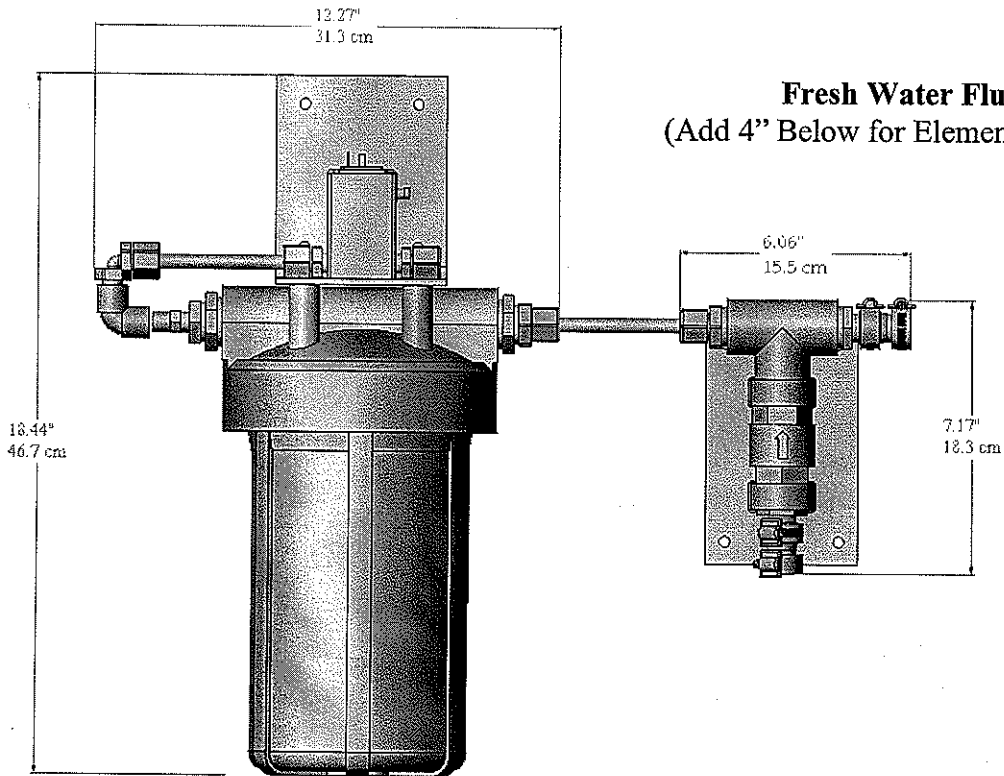


**Sea Strainer**

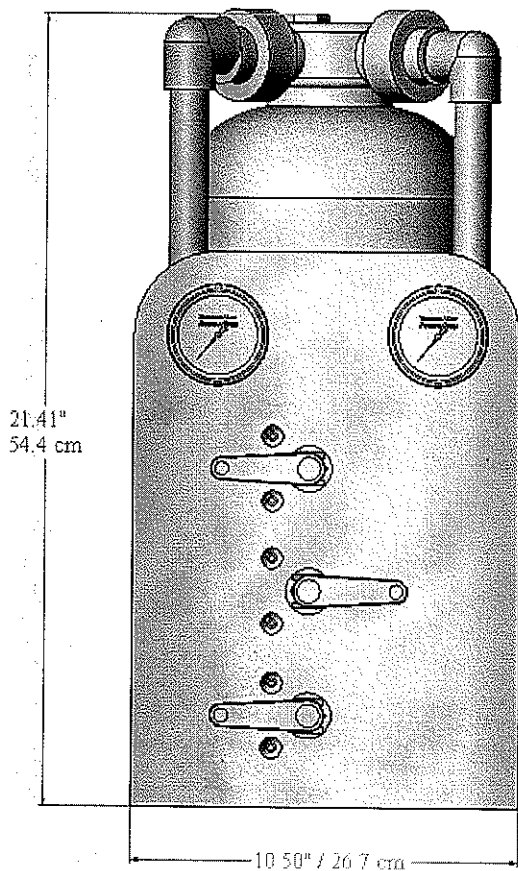
(Add 4" Below for Screen Removal)



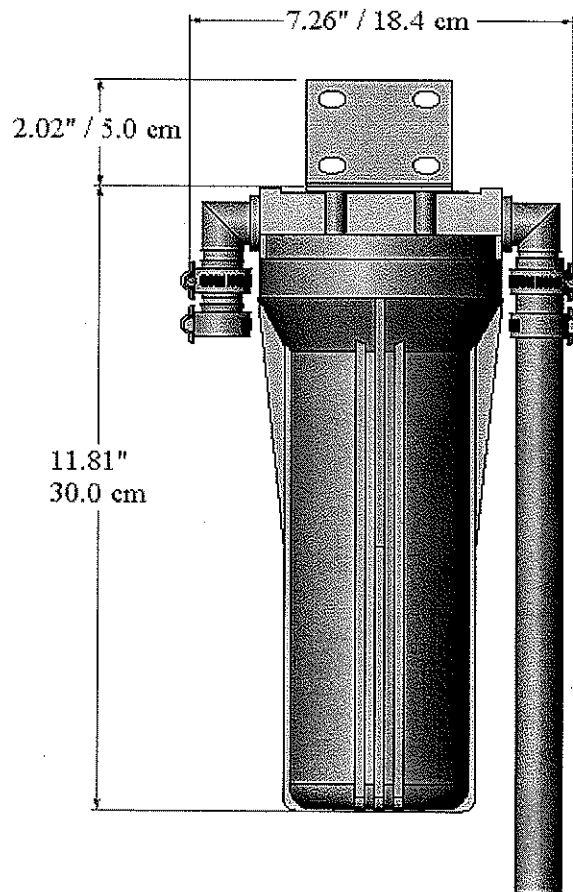
**Fresh Water Flush**  
(Add 4" Below for Element Removal)



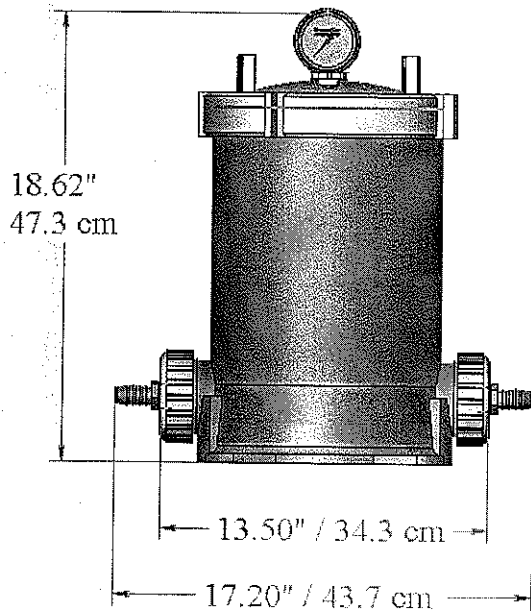
**Multi-Media Filter**  
(15" Deep)



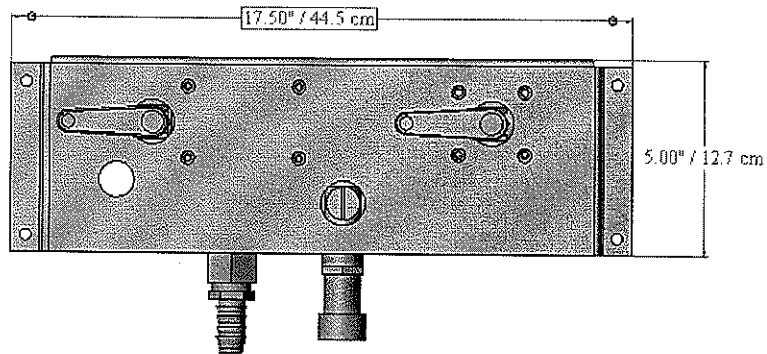
**Plankton Filter**  
(Add 4" Below for Element Removal)



**Commercial Prefilter – Oil/Water Separator**  
(Add 12" above for filter removal)



**Clean & Rinse Panel**  
(Add 12" Below for Tubing & Hose)



## I. COMPONENT INSTALLATION:

### INSTALLATION CAUTIONS:

Do not over tighten PVC fittings. If threaded pipe fittings leak after installation then remove the fitting, clean the male mating threads, apply 3 to 4 wraps of Teflon tape to the male threads and then thread the parts back together.

The Inlet Connection [1], Sea Strainer [3], Inlet Clean/Rinse Valve [4] and Booster Pump [5] must be mounted below water level to operate properly.

### REMOVE ALL TUBE SHIPPING PLUGS FROM THE RIGHT SIDE OF THE HORIZON SEAFARI.

Always use 2 supplied Hose Clamps at each connection to secure the hose to its respective Hose Barb Fitting and seal it from leaks.

Always allow the tube to enter and exit straight from the tube fitting for a minimum of one inch prior to starting a bend.

**DO NOT** tie or tee the Horizon Seafari System Feed Line into another line that already feeds another auxiliary system.

**DO NOT** tie or tee another auxiliary system into the Horizon Seafari System Feed Line.

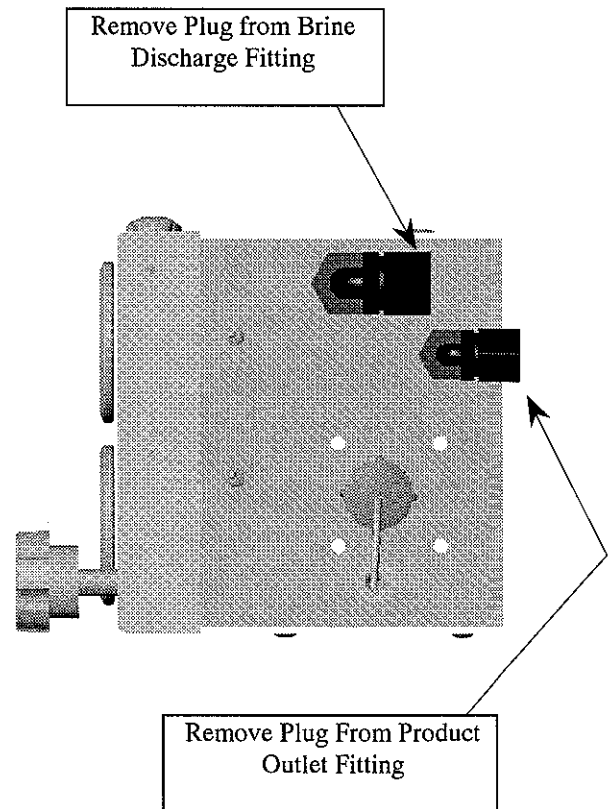
**DO NOT** mount the R.O. Membrane assembly in areas with temperatures above 120°F / 40 C or in freezing temperatures. Do not mount the MVA in areas exposed to radiant heat above 120° F / 40 C.

Avoid skin and eye contact with the storage solution the membrane is packaged in. In case of skin contact, rinse the skin thoroughly with water. In case of eye contact, flush repeatedly with water and notify a physician immediately.

### 1. Inlet Thru Hull Fitting [1] with Inlet Sea Cock Valve [2]

The Sea Cock Valve [2] must be fitted with 3/4" MNPT (Male National Pipe Taper, i.e. American Standard Tapered Pipe Thread) at the Sea Cock Valve's outlet.

The Thru Hull Fitting must be located well below the water line so the inlet remains in constant contact with the feed water even while vessel is under way.



**NOTE:** ON THE REAR OF THE CONTROL MANIFOLD THERE IS A PIGTAIL WHICH IS CONNECTED TO THE LOW PRESSURE GAUGE. CONNECT THIS PIGTAIL TO THE OUTLET OF THE FINAL FILTER PRIOR TO THE HIGH PRESSURE PUMP.

It must be of a forward facing scoop type. The Sea Cock Valve, ¼" turn ball valve, normally attached to the Thru Hull Fitting must be accessible for daily and emergency closure.

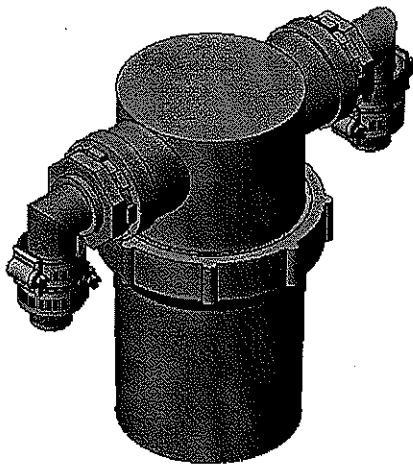
If the Intake is from a Sea Chest or Stand Up Pipe then the connection must be made low, close to the hull, in order to avoid air from entering the Horizon Seafari System Feed Line.

**2. Inlet Connection**

This fitting, supplied in the installation kit, is a ¾" FNPT (Female National Pipe Taper, American Standard Tapered Pipe Thread) PVC 90° elbow with a ¾" Hose Barb fitting.

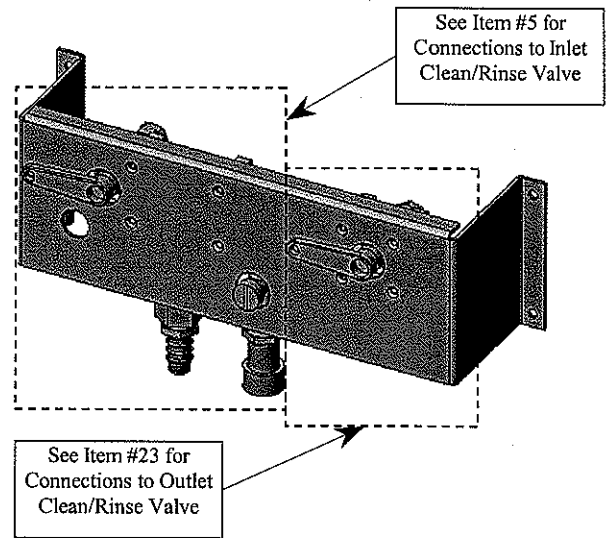
Attach to the Thru-Hull fitting and align the outlet of the fitting so that it points toward the Sea Strainer [3] inlet.

**3. Sea Strainer [3] (optional) must be mounted well below water level.**



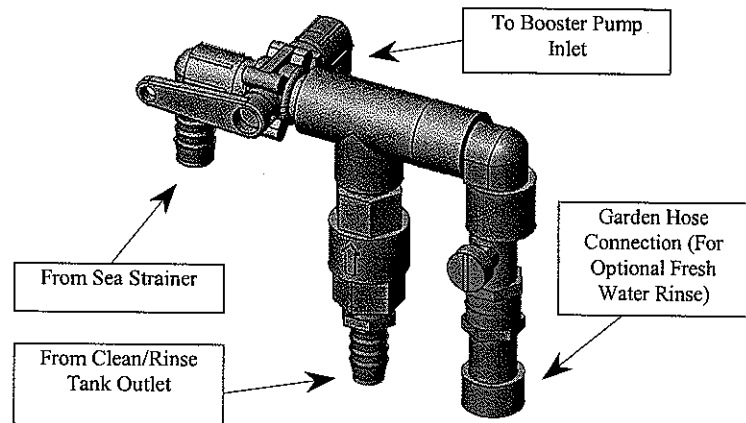
Allow a minimum of 4" (50mm) clearance below the bottom of the bowl for screen removal. Connect the Outlet of the Sea Cock Valve to the Inlet of the Sea Strainer.

**4. Clean/Rinse Panel (optional) with Inlet Clean/Rinse Valve [4], Outlet Clean/Rinse Valve [35], and Garden Hose Valve for Pressurized Fresh Water Rinse Connection:**



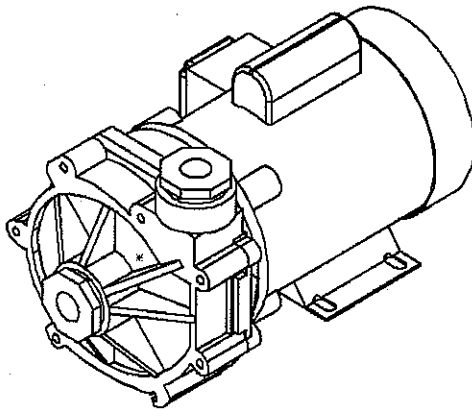
This valve panel assembly replaces the individual Clean/Rinse Valves. See Items 5 and 24 in this section for plumbing instructions.

**5. Inlet Clean/Rinse Valve [4] (optional) This valve, when used in conjunction with the Outlet Clean/Rinse Valve [35], assists in rinsing and cleaning of the System.**



Install between the Sea Strainer and the Booster Pump in an area that is accessible. The Valve may be directly mounted to the Outlet Port of the Sea Strainer or the Inlet Port of the Booster Pump. If used, connect one side port of the Inlet Clean/Rinse Valve to the Outlet of the Sea Strainer. Connect the other side port to a Clean/Rinse Tank [50] or to a length of hose that can later be placed into a temporary Clean/Rinse Tank, Container or Bucket. Connect the Center (common) port to the Inlet of the Booster Pump [5].

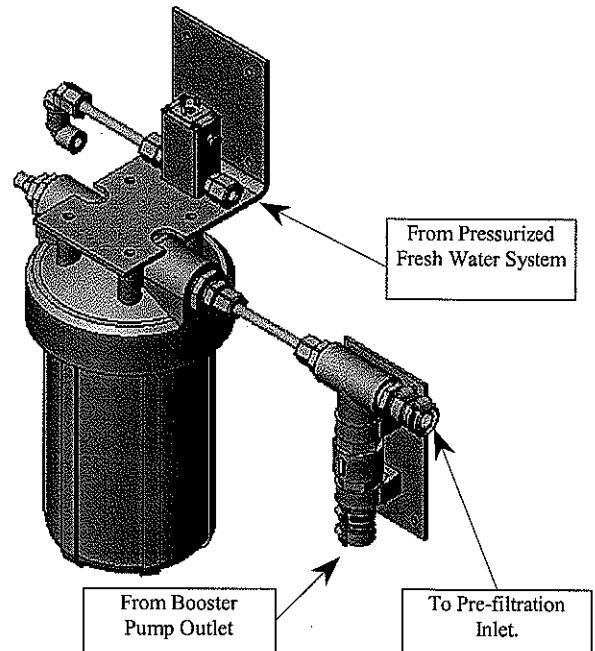
### 6. Booster Pump [5]



The Booster Pump is a centrifugal pump and it is not self-priming. The booster pump volute must be fully filled with water in order for the booster pump to operate properly. Any air present in the pump prevents the water from flowing. Mounting the booster pump below water level ensures that air never enters the booster pump volute. For best results, install the Booster Pump Below Water Level and close to the Sea Strainer, if installed.

The Booster Pump may be mounted either horizontally or vertically. If mounted vertically, the Wet End MUST be mounted DOWN (on bottom). If mounted vertically (with the wet end on top) the motor may develop an electrical short should the wet end of the Booster Pump leak. Connect the Booster Pump inlet to the Sea Strainer Outlet or Sea Cock valve, or if the Inlet Rinse/Clean Valve is installed then connect the Booster Pump Inlet to the Center (common) port of the Inlet Clean/Rinse Valve [4]. Keep this line as short and straight as possible. Avoid up and down loops, 90° elbows, and hose kinks.

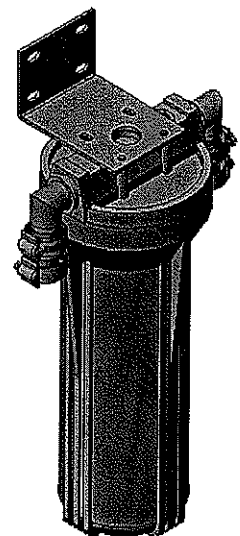
### 7. Fresh Water Flush Assembly [53 & 54]\*\*\*



May be installed anywhere in the feed line. However, for optimum rinsing results this Check Valve Tee must be plumbed into the Feed Water Line immediately after the Booster Pump outlet. Mount the Fresh Water Flush System with the mounting hardware included in the kit. With the supplied 3/4" I.D. Hose connect the Inlet port of the Check Valve (bottom port) to the Outlet of the Booster Pump. With the supplied 1/4" O.D. tube connect the solenoid valve inlet to the existing pressurized fresh water system.

### 8. Plankton Filter [6] (optional)

Must be mounted against a flat vertical surface using the supplied mounting brackets and hardware. Mount the assembly below water level to minimize feed pressure loss. Allow minimum 4" below the bottom of the bowl for mesh screen element removal. Connect the inlet to the Booster Pump Outlet or the Fresh Water Flush Outlet.



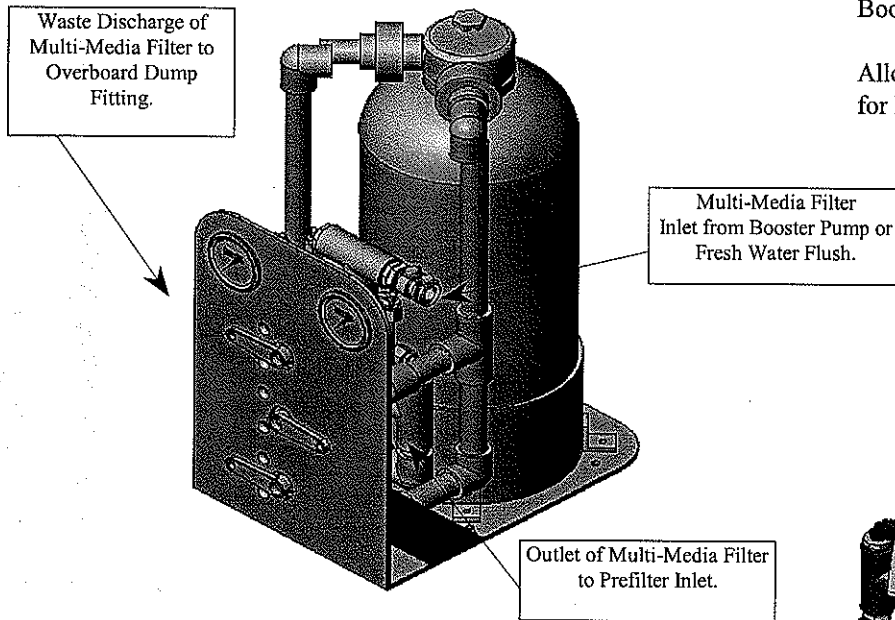
9. **Multi Media Filter [7]** (optional) is supplied pre-mounted to its own base. Mount the Multi Media Filter base onto a flat horizontal surface and secure the base in place using the supplied mounting hardware. Mount the assembly below water level to minimize feed pressure loss.

10. **Standard Pre-filter [12]:**

Must be mounted against a flat vertical surface using the supplied hardware.

It is preferable to mount the Standard Pre-filters in a straight line with and in close proximity to the Booster Pump.

Allow minimum 4" below the bottom of the bowl for Pre-filter Element removal.

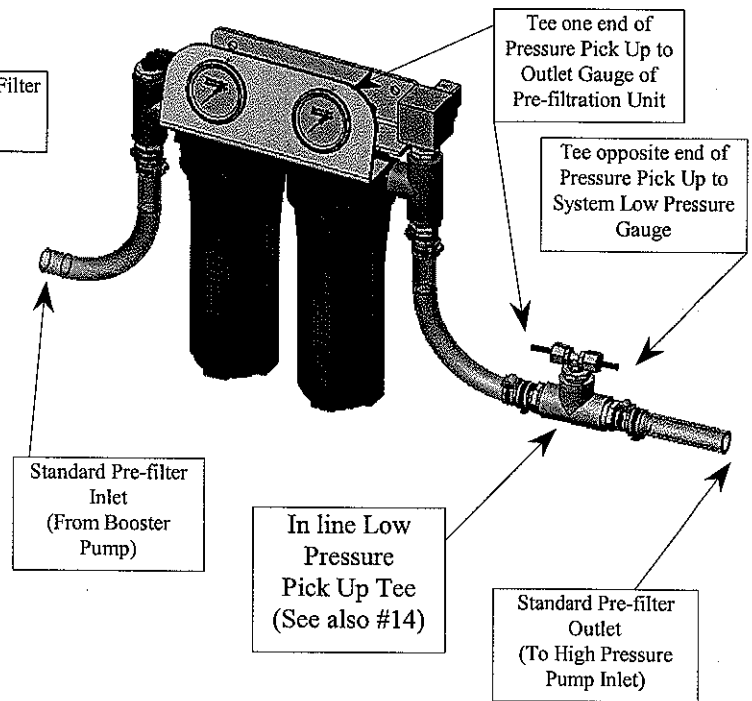


Connect the inlet to the Booster Pump Outlet or Fresh Water Flush Outlet.

Connect the Outlet to the Commercial Pre-filter Inlet. Connect the Media Filter Waste Discharge Fitting [10] to the Over Board Dump Waste Fitting [11].

Unscrew the Multi Media Fill Plug, located on top of the Multi Media Filter Lid. Place a funnel over the Fill Hole. Pour into the funnel approximately 15 lbs (7 kg) of small gravel (1/8 x 1/4 inch) first (on the bottom) then approximately 26 lbs (12 kg) of #20 silica sand last (on top of the small gravel). Remove the funnel and clean the Fill Plug female threads. Screw the Fill Plug back onto the Lid and tighten lightly with a wrench. Note this Fill Plug is O-ring sealed and requires only light tightening to seal the O-ring.

Backwash Multi-Media Filter before operating the system.

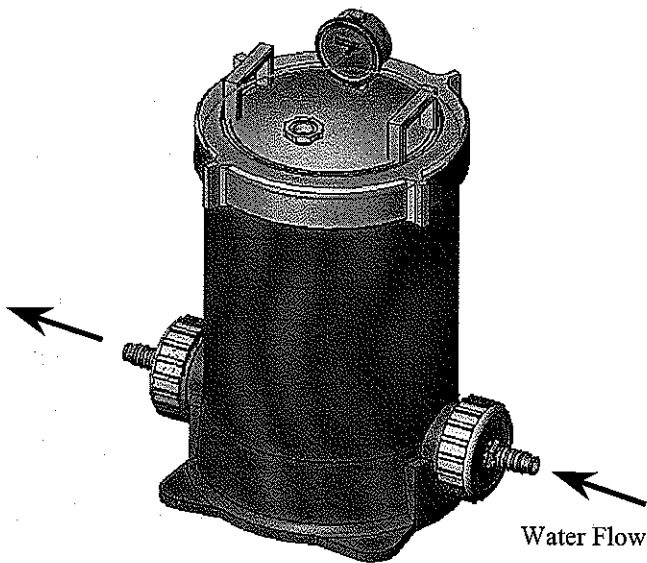


See also Item #14 (page E - 16) for close up of the Low Pressure Pick Up Tee.

Connect the Booster Pump Outlet (or Plankton Filter Outlet if used or Multi Media Filter Outlet if used) to the Pre-filter Inlet.

If the Oil/Water Separator is not used then connect the Standard Pre-filters Outlet to the High Pressure Pump Inlet.

11. **Commercial Pre-filter** [14] replaces the Standard Pre-filters.



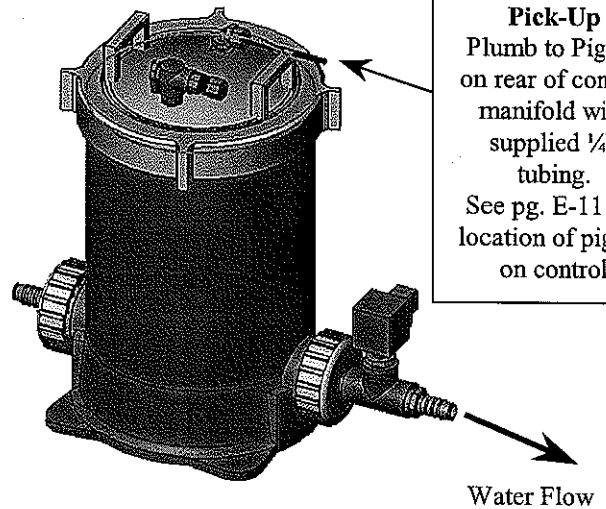
It is not necessary to use both the Commercial Pre-filter and Standard Pre-filters.

The Commercial Pre-filter, must be positioned on a firm, flat surface and mounted in place with the supplied hardware.

Allow 12 inches above the Commercial Pre-filter assembly for filter element removal.

Connect the Commercial Pre-filter Inlet Port to the Booster Pump Outlet (or Plankton Filter Outlet if used or Multi Media Filter Outlet if used).

12. **Oil/Water Separator** [17] follows the Commercial Pre-filter.



The Oil/Water Separator Assembly is plumbed for water flow in the opposite direction as the Pre-filter.

Using the supplied 3/4" hose, connect the Oil/Water Separator Inlet to the Standard or Commercial Pre-filter Outlet.

Connect the Oil/Water Separator Outlet to the High Pressure Pump Inlet.

13. **Self-Contained or Modular System mounting:**

Must be readily accessible for daily operation and periodic maintenance.

Components within the system must be readily access able for maintenance.

Ensure that all tubing and hoses are routed without kinks or sharp bends.

Mount the System on a firm flat surface and secure in place.

Modular System mounting:

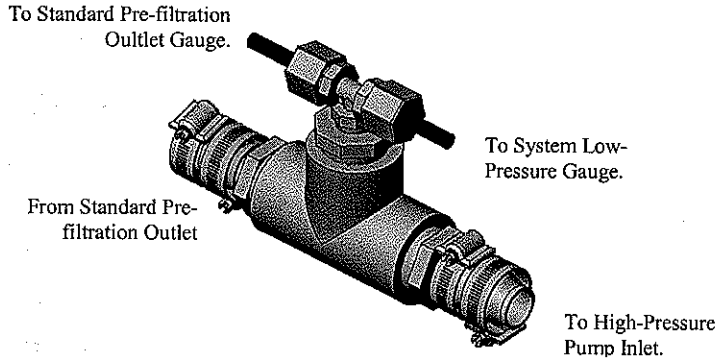
The controls within the System must be readily accessible for daily operation.

Ensure that all tubing and hose connections have sufficient space to be routed without kinks or sharp bends.



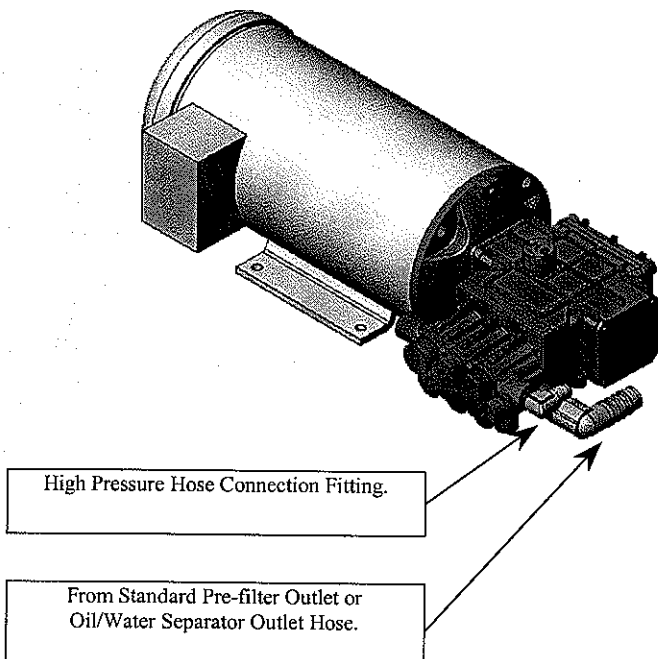
Keep the system within close proximity to the Pre-filtration Components and High Pressure Pump to ensure minimal line loss.

**14. Low Pressure Pick Up Tee**



The Low Pressure Pick Up Tee is supplied with the Standard Pre-filters. It installs in line with the hose leading from the outlet of the Standard Pre-filters to the inlet of the High-Pressure Pump. The 1/4" Tube supplied is connected to both the Outlet Low Pressure Gauge on the Standard Pre-filters and High Pressure Pump Inlet Gauge on the Control Panel.

**15. High Pressure Pump with Electric Motor Assy. [25 & 26]** The Modular Style System High Pressure Pump and Motor Assembly require installation on a flat horizontal base.



Ensure easy access to pump crankcase oil changes and motor bearing grease fittings.

Use the supplied Rubber Isolation Mounts and hardware for mounting the Assembly.

Connect the Inlet of the High Pressure Pump to the Outlet of the Low Pressure Pick Up Tee.

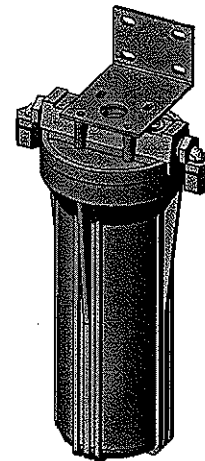
**16. R.O. Membrane/Vessel Assy [28 & 29]** Remove all Shipping Tube Plugs from the Membrane Vessel Assembly and from the side of the System.

Connect the Inlet High Pressure Hose from the Inlet of the R.O. Membrane Vessel Assembly to the High Pressure Pump outlet.

**17. Future Reference**

**18. 3-Way Product Water Diversion Solenoid Valve [43]:** This valve is integrated in the control manifold assembly. It does not require individual installation.

**19. Charcoal Filter [44]:**

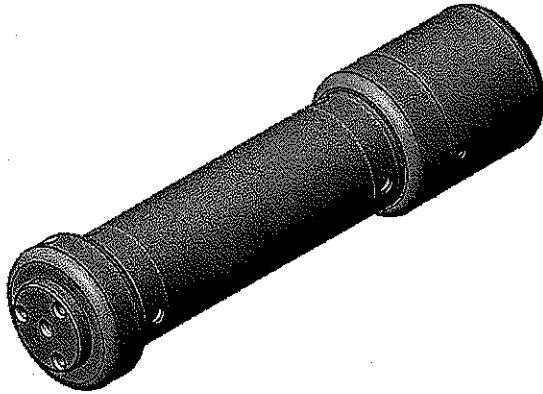


Use the supplied mounting hardware to secure the filter to a flat vertical surface.

Leave a minimum 4" space below the bowl for removal of the Charcoal Filter Element.

Connect the Charcoal Filter Inlet to the product water outlet on the system manifold.

20. **U.V. Sterilizer [45]:** (optional) is the last Product Water component prior to the Product Water Storage Tank.



Mount the U.V. Sterilizer in a vertical position, with the Inlet port at the bottom and the Outlet at the top.

Horizontal mounting is also acceptable and either port may act as the Inlet or Outlet if mounted Horizontally.

The UV sterilizer should be mounted to a flat surface with the supplied two mounting saddles.

Using the supplied 3/8" O.D. tubing connect the Inlet (bottom if mounted vertically) to the Outlet of the Charcoal Filter.

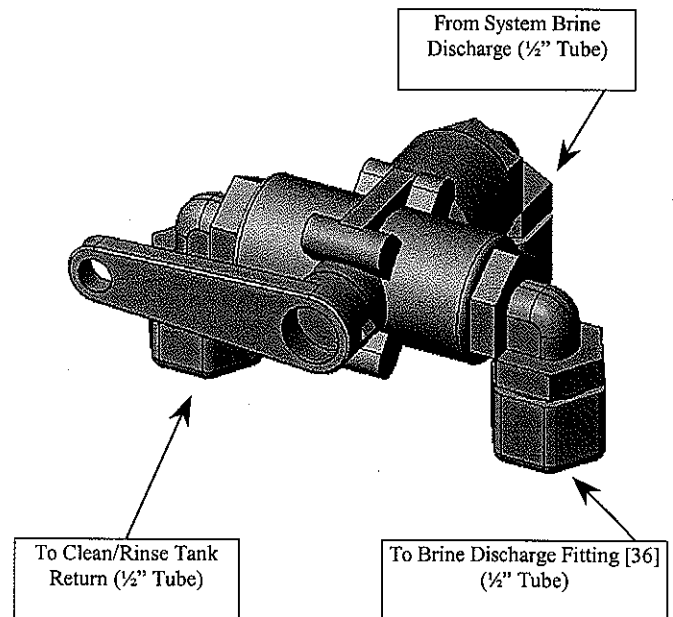
21. **Product Water Storage Tank Connector:** is a black 3/8" O.D. elbow tube fitting with 3/8" male pipe thread.

The easiest mounting method is to create a 3/8" female national pipe thread in the Ship's Product Water Storage Tank Fill Line or in the top of the tank itself. Using the supplied 3/8" tubing, connect the outlet of the Charcoal Filter to the connector.

If a U.V. Sterilizer is the final post-filtration component, connect the outlet of the U.V. to the product water storage tank connector.

22. **Brine Thru Hull Fitting [37]** must have a 1/2" MNPT nipple fitting inside the hull for connection of the Brine Discharge Tee [36]. It must be above Sea Level.

23. **Clean/Rinse Outlet Valve [35]** This optional valve is used with the Inlet Clean/Rinse Valve #4 to assist in rinsing and cleaning of the System.



Install the Outlet Clean/Rinse Valve between the Brine Discharge and the Brine Discharge Tee Connector [36]. Using the Supplied 1/2 inch O.D. Tubing.

Connect one side port of the Outlet Clean/Rinse Valve to the Brine Discharge Tee Connector [36].

Connect the other side port to a Clean/Rinse Tank [50] Return or to a length of hose that can later be placed into a temporary Clean/Rinse Tank, Container or Bucket.

Connect the Center port to the Brine Discharge Tee Connector [36].

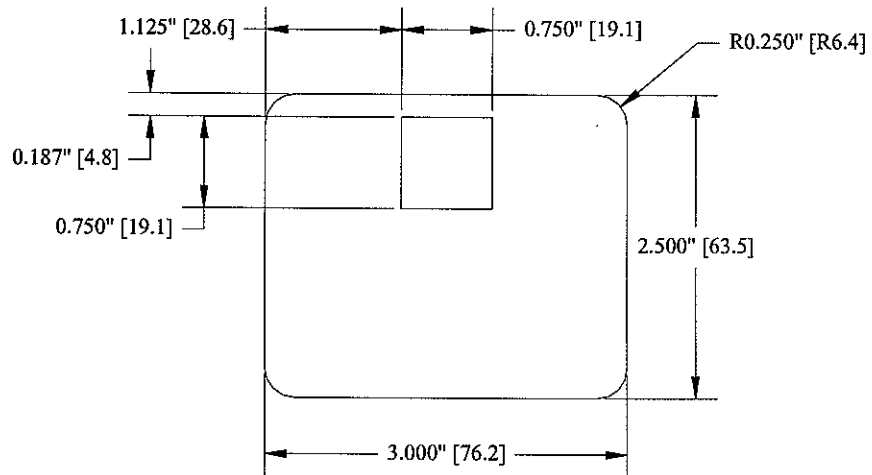
**Remote:**

Often, the Remote Control Touch Pad is mounted in a recessed hole. After measuring the Remote Control Panel, routing out the indent and cutting the Cable hole, place the Touch Pad into the indent and check for sizing. Clean up the indent as required for a good fit. If the indent was made in wood or other porous surface then it is best to seal the surface of the indent so that the Touch Pad properly adheres to the indent surface. Once the indent hole has been sized and sealed ensure that the indent is "squeaky clean" and free of dust so that the double stick tape attached to the Touch Pad properly adheres to the indent surface. Remove the green paper from the back of the Touch Pad to expose the double stick tape attached to the back of the Touch Pad. Position the Touch Pad directly over the Indent and press firmly into place for a permanent bond.



### Remote Touch Pad Cut Out Dimensions For Mounting

HRO-RCU "Remote"  
VIEW IS FROM TOP OF PAD  
Pad Thickness = 0.100" / 2.5 mm



24. **Electrical Connections:** Electrically connect, if not already connected, the following to the Horizon Seafari Controller:

- Optional U.V. Sterilizer
- Optional Remote Unit
- Booster Pump Motor
- High Pressure Pump Thermal (Modular)
- Salinity Probe (Modular)

- Optional Fresh Water Flush Valve
- Main Incoming Power
- High Pressure Pump (Modular)
- Low Pressure Switch
- Soft Motor Starter (See Appendix A-4 for Installation Instructions)

**Refer to Appendix A for electrical information and wiring diagrams.**



## **SECTION F**

# **System Commissioning & Initial Start Up Of A New Horizon Seafari System With Initial New System Readings Form**

## F. SYSTEM COMMISSIONING

### INITIAL START-UP PROCEDURE OF A NEW HRO Systems Horizon Seafari.

Throughout this Manual, Numbers in [ brackets ] refer to the I.D. numbers illustrated on page F - 2.

The following instructions must be carried out for initial start-up of a NEW system. For every day use starting

procedures, refer to Section "G" "Start-Up Procedure" of this manual.

Failure to follow these instructions exactly leads to system failure, and causes damage to the components. Read this section and other appropriate sections of the manual in order to gain familiarity with the requirements of the system and functions of each component.

### AVOID CHEMICAL ATTACK TO THE SYSTEM

**CAUTION:** Do Not expose the Horizon Seafari system to intake Feed Water that contains:

Hydrogen peroxide	chloramines	chloramines-T	N-chloroisocyanurates
Chlorine dioxide	hypochlorite	chlorine	iodine
Bromine	Bromide	phenolic disinfectants	petroleum products

Any chemical, not approved in writing by HRO Systems.

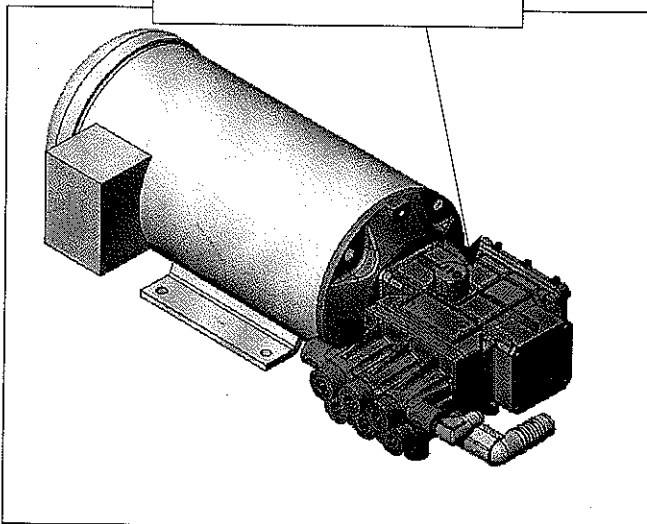
**USE OF NON-AUTHORIZED OR MISUSE OF AUTHORIZED CHEMICALS VOIDS SYSTEM WARRANTY.**

**Do not connect any water line to the Horizon Seafari system that may contain any of the above listed chemicals.**

**Example:** Do not connect the inlet of the Horizon Seafari system to the ships potable water system if the system contains chlorinated or brominated water. These chemicals destroy the copolymer components within the system. These oxidants and others also damage the R.O. Membrane Element.

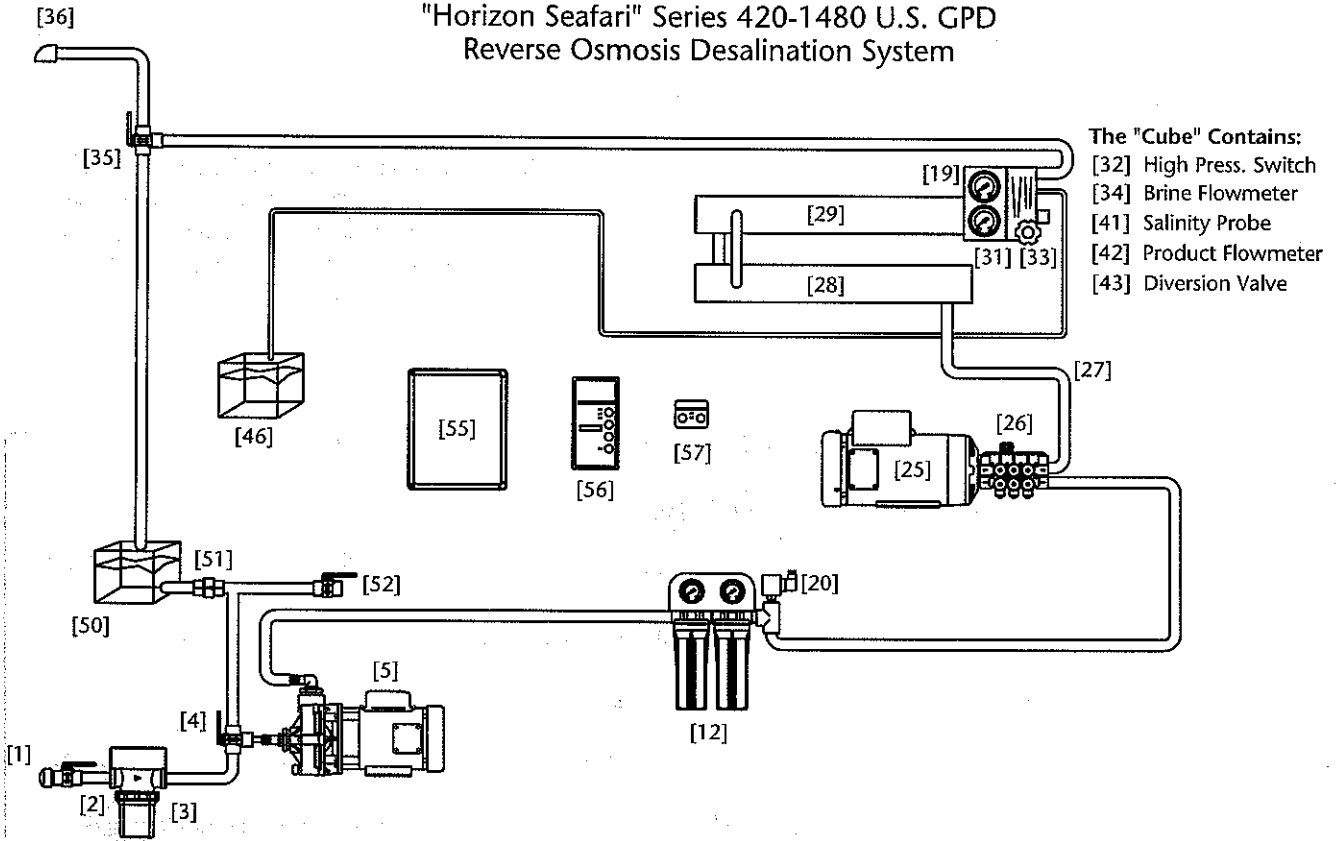
### High Pressure Pump Preparation:

*Supplied Orange-Colored Vented Oil Fill Cap Must Be Installed Prior to Use.*



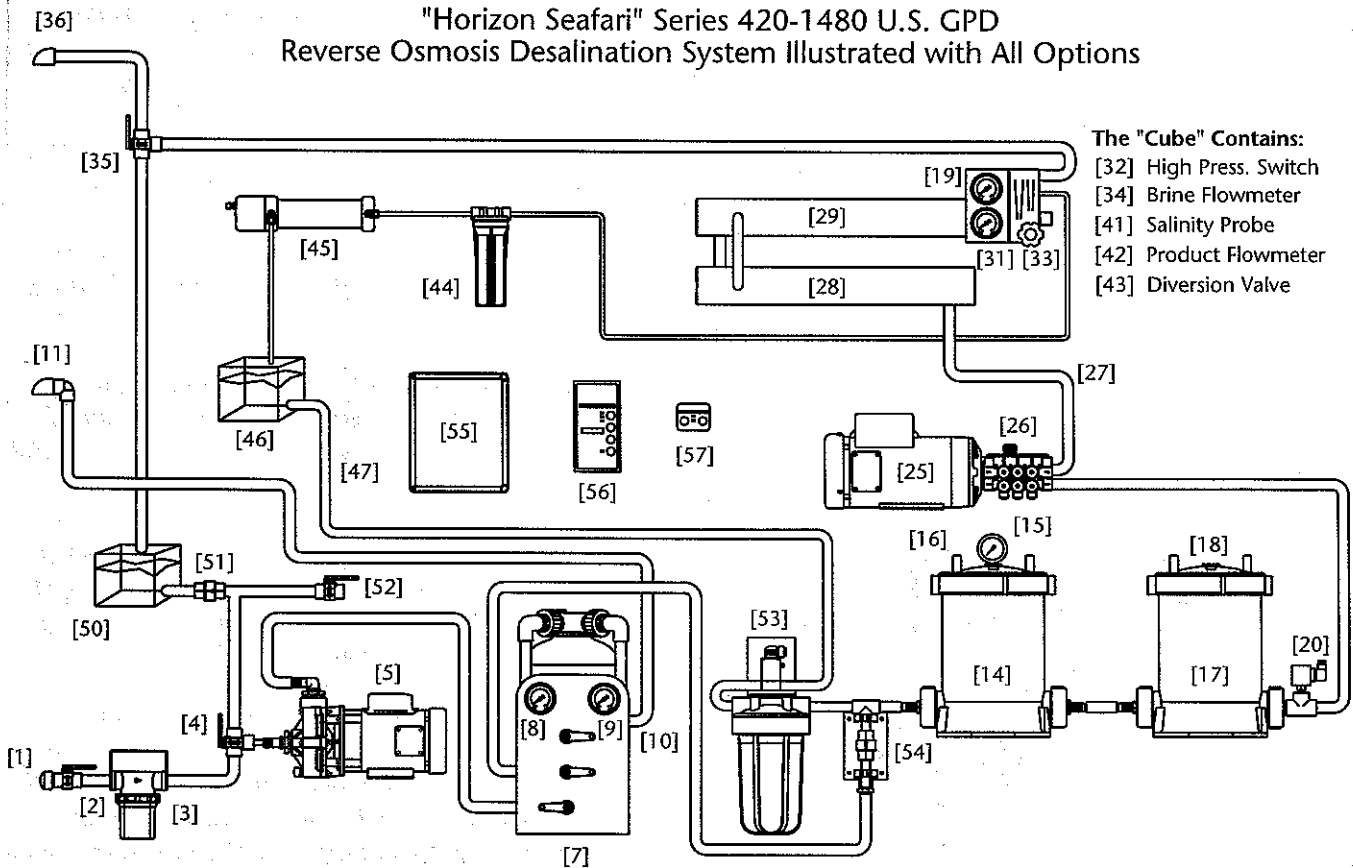
- *The high Pressure Pump is shipped with a red Non-Vented Plug so that oil does not leak during shipment.*
- *This red color Non-Vented Plug (located on the top of the black color rear crankcase section) must be replaced with the supplied Vented Oil Fill Cap.*
- *If the crankcase is not vented with the proper cap, pressure builds within the crankcase and causes seal failure, loss of oil, and ultimately failure of the High Pressure Pump.*
- *Failure to replace the shipping cap with the supplied Vented Oil Fill cap voids all Warranty of the High Pressure Pump. Installer will bear full responsibility for all damages resulting from failure to install the supplied High Pressure Pump Oil Fill Vented Cap.*

"Horizon Seafari" Series 420-1480 U.S. GPD  
Reverse Osmosis Desalination System



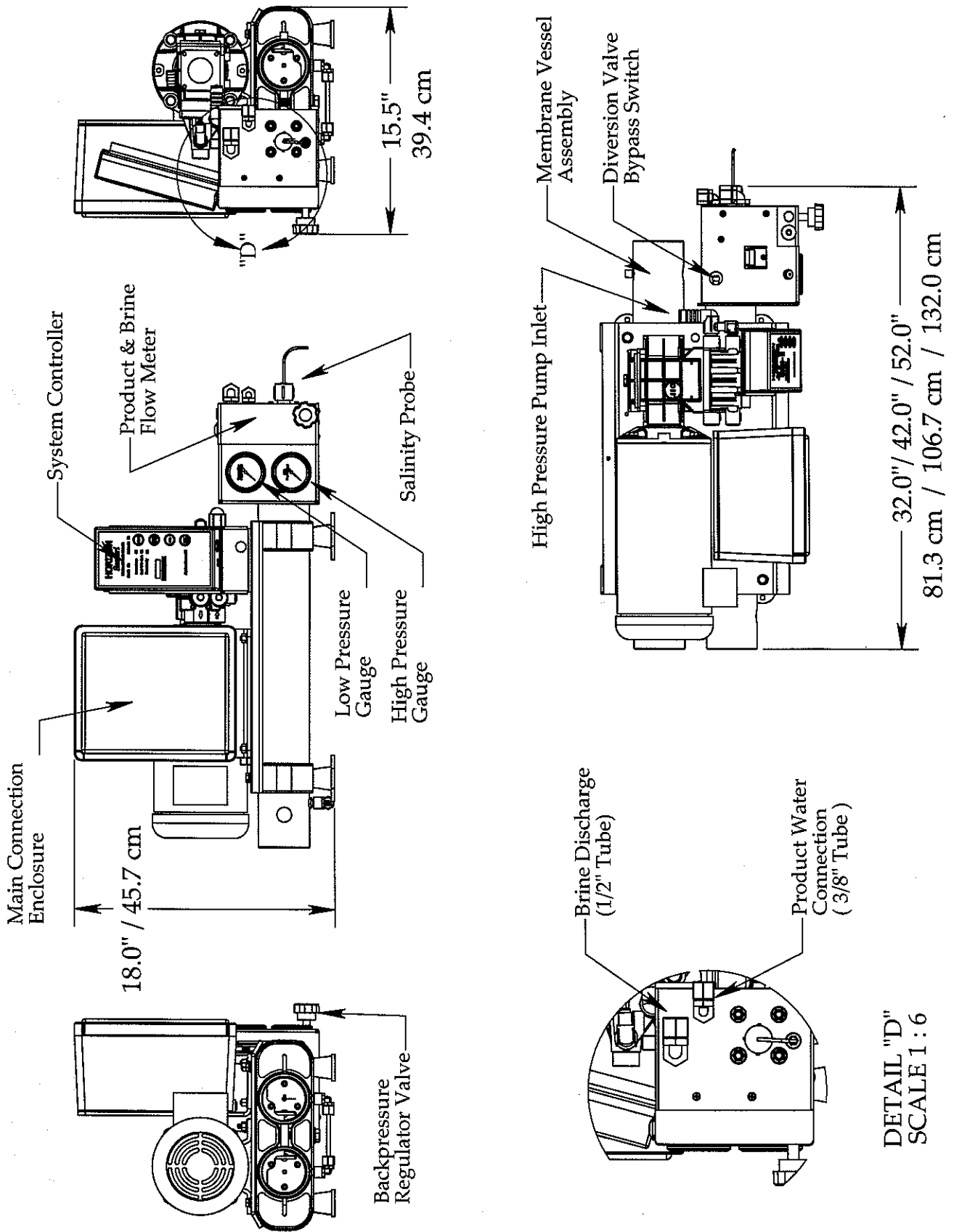
- The "Cube" Contains:
- [32] High Press. Switch
  - [34] Brine Flowmeter
  - [41] Salinity Probe
  - [42] Product Flowmeter
  - [43] Diversion Valve

"Horizon Seafari" Series 420-1480 U.S. GPD  
Reverse Osmosis Desalination System Illustrated with All Options

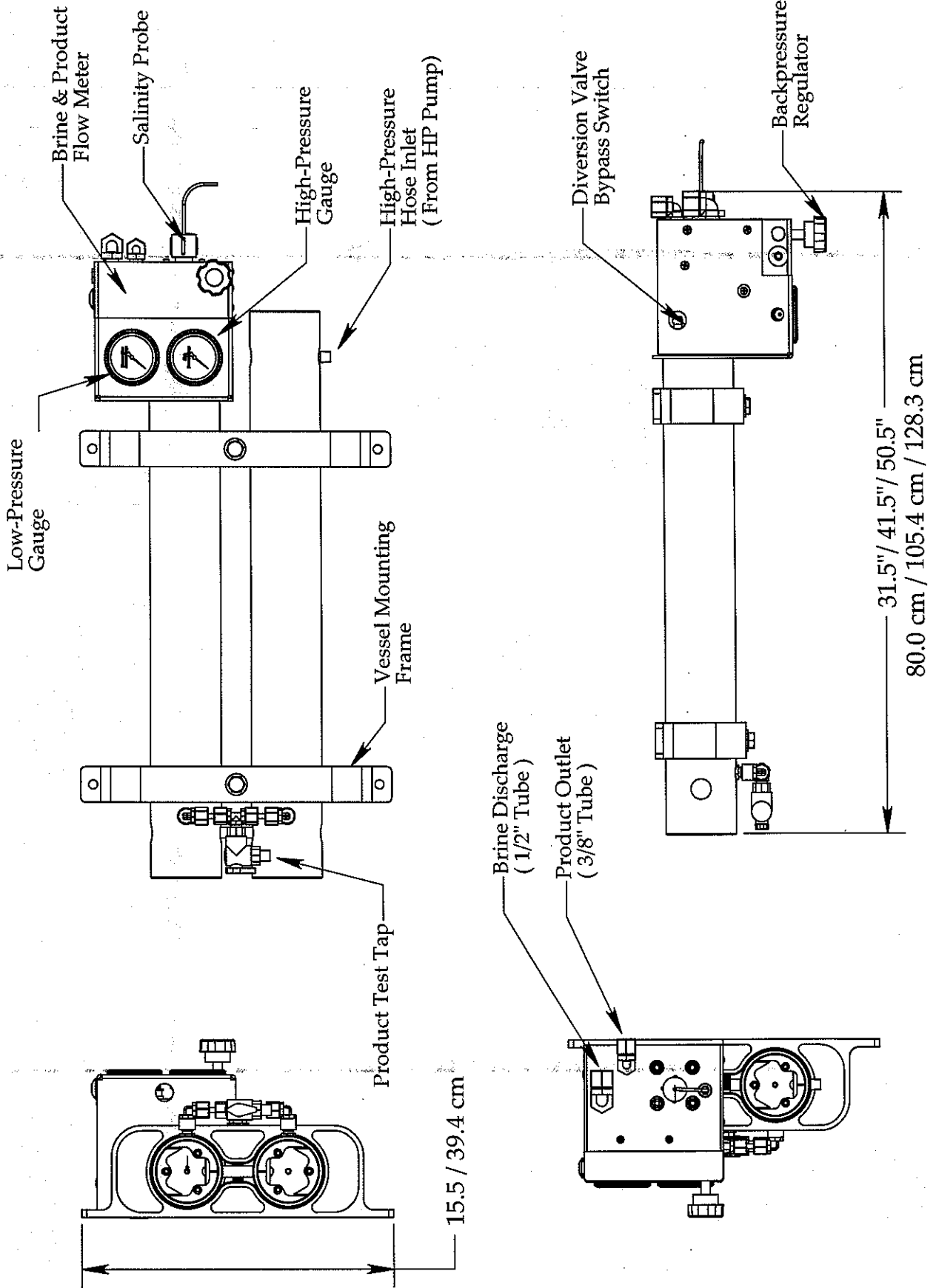


- The "Cube" Contains:
- [32] High Press. Switch
  - [34] Brine Flowmeter
  - [41] Salinity Probe
  - [42] Product Flowmeter
  - [43] Diversion Valve

# Horizon Seafari Self-Contained Components Identification



# Horizon Seafari Modular Components Identification





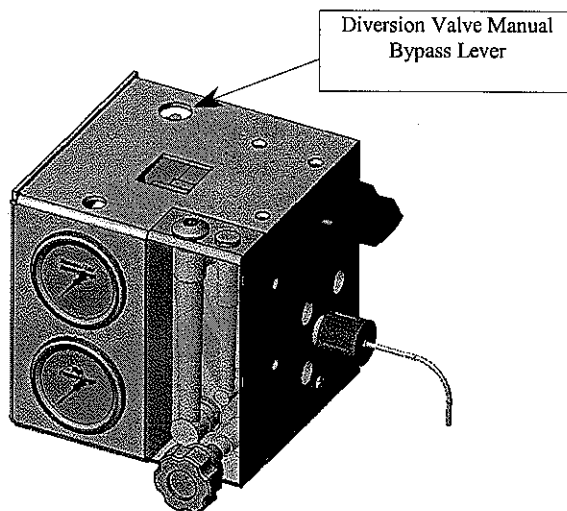
1. Ensure that all Tube Plugs and shipping caps have been removed prior to commissioning. Failure to remove these caps could cause damage to the system.
2. Check the level of the oil in the High Pressure Pump crankcase. Ensure that the oil level is higher than the center of the sight glass.

Use only HRO supplied Pump Oil as it is special hydraulic oil, which contains anti rust and wear inhibitors essential to the high-pressure pump crankcase section.

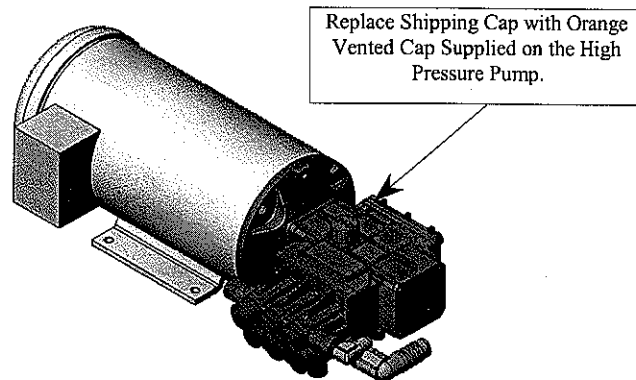
3. Check each tube connection at the side panel of the System to ensure that the installer has properly connected and properly routed each tube. Improper routing and any blockage in any line causes damage to the system. Do not rely on the installers word, check it yourself.
4. Make sure that the Electrical Power Source to the System is switched "OFF".
5. Open the front panel of the Main Power Enclosure. Check all connections for proper wiring and attachment. Refer to the wiring diagrams in APPENDIX A - 3 through A - 6.
6. Close the Main Power Enclosure front panel.
7. Ensure that the manual By-Pass lever on the Diversion Valve [43] is positioned outward (away from the coil body). The manual bypass lever may be locked in the bypass position by pressing it in fully and then twisting 90° clockwise. To unlock, twist the button 90° counter-clockwise. See diagram to the right for location of the access hole to the Diversion Valve [43].
8. Close the Commercial Pre-filter [14] drain valve, if installed.
9. Close the Oil/Water Separator [17] Drain Valve, if installed.
10. Close the air bleed valve located on top of the Commercial Pre-filter [15], if installed.

11. Close the air bleed valve located on top of the Oil/Water Separator [17], if installed. Open the Inlet Sea Cock Valve [2] fully.
12. Position the Clean/Rinse Inlet Valve [4], if installed, to the normal operating position towards the Sea Strainer [3] Outlet.
13. Position the Clean/Rinse Outlet Valve [35], if installed, to the normal operating position towards the Brine Discharge Outlet [36].
14. Open any auxiliary Valve within the incoming Feed Line; Outgoing Brine Discharge Line; and Outgoing Product Water Line.

**CAUTION:** Any auxiliary Valve in these lines damages the Horizon Seafari if left closed during starting and or operation of the System.



Horizon Seafari Control Panel



High-Pressure Pump Assembly.

15. Open the Back Pressure Regulator Valve [33] FULL OPEN by turning counter clockwise.

**CAUTION:** The Back Pressure Regulator Valve [33] must be full open when starting the Horizon Seafari System. If this valve is left closed, it may cause extensive damage to the system.

16. Switch the Electrical Power Source to the Salinity Controller "ON".
17. **ELECTRIC MOTOR ROTATIONAL CHECK:** Ask an assistant to view the fan section of the Electric Motors, (High Pressure Pump Electric Motor [25] and Booster Pump Electric Motor [5]) while you Jog the System.

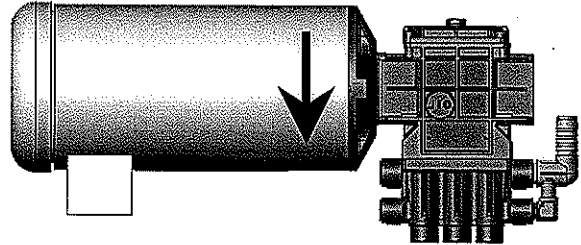
Press the "Booster Pump" switch, then the "Start" switch, and finally the "Stop" switch. Ensure that the High Pressure Pump Electric Motor and the Booster Pump Electric Motor turned in the proper rotation. If either or both motors turned in the wrong direction refer to the wiring diagrams in *APPENDIX A* to correct.

18. Multi Media Filter Preparation.

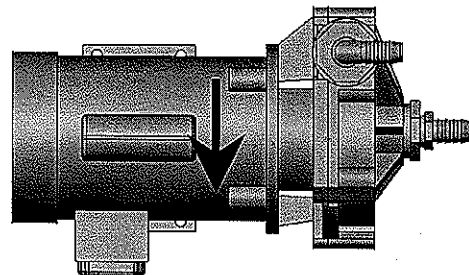
The Multi Media Filter should be loaded with gravel and #20 silica sand. When new, the media must be back washed then rinsed prior to use. These procedures fluff and clean the silica sand base. During back washing the suspended solids are discharged. Follow the Backwashing Instructions on **Page K - 5**.

When Backwashing is complete, make sure to position the Multi Media Filter Valves for Normal Operation.

### HIGH PRESSURE PUMP & MOTOR:



### BOOSTER PUMP & MOTOR:



19. To start the system press the "Start" Switch, or press the "Booster Pump" Switch and then the "Start" switch.

If the system automatically shuts off after several seconds of operation this may be due to a system fault. Look at the Touch Pad to confirm whether a fault has occurred.

20. Bleed all air from the Commercial Pre-filter [14] and Oil/Water Separator [17] by opening the air bleed valve located at the top of the each housing [16 & 18] and close when water displaces all of the air.

21. Slowly adjust the Back Pressure Regulator Valve [33] by turning clockwise to increase the pressure to the proper setting (850 psi for 35,000 ppm seawater).

For BRACKISH WATER operation, adjust the pressure from 100 to 850 psi so the product water output, is within the system specifications.

	Hourly Production Gallons / Liters
Horizon Seafari 420	16 / 63
Horizon Seafari 630	25 / 94
Horizon Seafari 840	33 / 126
Horizon Seafari 1160	50 / 189
Horizon Seafari 1480	66 / 252

**DO NOT EXCEED PRODUCT WATER FLOW SPECIFICATIONS.**

22. If any abnormality develops, stop the System and correct the problem.
23. Use the Product Water Flow Meter [42] to measure the product flow. The system may not produce "potable" water for up to 30 minutes. The salinity of the Product Water diminishes gradually, until it reaches the factory setting at which time it is directed to the "potable" (good water) position. This allows product water to pass into the Post Filtration components, & onto the Ship's Storage Tank [46].

16. Check for:

- a. A constant feed water flow.
- b. A consistent system pressure.
- c. Leaks in the system.
- d. Unusual noises or other occurrences.

## HIGH/LOW PRESSURE FAULT LAMP EXPLANATION:

- a. Low Pressure Fault: The System is equipped with a Low Pressure Switch. With no pressure applied to the Low Pressure Switch it does not allow the System to operate. With pressure above 6 psi applied the switch closes and allows the System to operate. If the system pressure should fall below 6 psi, the "HIGH/LOW PRESSURE" lamp blinks. After 20 seconds, the system shuts down completely. The "HIGH/LOW PRESSURE" lamp remains solidly lit until the "Fault Reset" button is pressed, or the system power is interrupted.
- b. High Pressure Fault Lamp: The System is equipped with a High Pressure Switch, which stops the system if pressure exceeds 950 psi.

After a fault has been corrected and the "Fault Reset" switch has been pressed, repeat Step 19.

**The person commissioning the New Horizon Seafari system should, at this time, fill out the two INITIAL SYSTEM READINGS forms located on Pages F – 9 and F –11.**

**Retain in this Manual the form on page F – 9 for the owner and future operator's reference. This information is valuable to the servicing technicians in providing technical support to the owner and future operators of the Horizon Seafari system.**

**The person or company who performed the commissioning of the New Horizon Seafari system should retain the form on page F - 11. This information is valuable to the servicing technicians in providing technical support to the owner and future operators of the Horizon Seafari system.**

**HRO Systems™ Horizon Seafari NEW SYSTEM INITIAL READINGS**  
**KEEP THIS COPY IN THE OWNER'S MANUAL.**

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Record at the time of initial system commissioning the following after one hour continuous proper running of the system. Maintain this original form with the System Owner's Manual for future reference and troubleshooting.

Serial Number: \_\_\_\_\_ Model Number: \_\_\_\_\_

Name of Operator: \_\_\_\_\_ Date: \_\_\_\_\_

Name & Company of Installer: \_\_\_\_\_

Name of Owner: \_\_\_\_\_

System Power: \_\_\_\_\_ VAC, \_\_\_\_\_ Hz, \_\_\_\_\_ Phase

Feed Water Temperature: \_\_\_\_\_ ° Fahrenheit or \_\_\_\_\_ Centigrade

Hour Meter Reading: \_\_\_\_\_ Hours

**PRESSURE GAUGE READINGS:**

Commercial Pre-filter (if used) Low Pressure Gauge Reading: \_\_\_\_\_ psi

Control Panel Low Pressure Gauge Reading: \_\_\_\_\_ psi

High Pressure Gauge reading: \_\_\_\_\_ psi

**WATER FLOW METER READINGS:**

Brine Flow Meter \_\_\_\_\_ US gpm or \_\_\_\_\_ Liters Per Min.

Product Water Flow Meter: \_\_\_\_\_ US gph or \_\_\_\_\_ Liters Per Hr.

**WATER QUALITY:**

Feed Water Salinity: \_\_\_\_\_ ppm or Location of use \_\_\_\_\_

Product Water Salinity: \_\_\_\_\_ ppm

Unusual occurrences: \_\_\_\_\_

**NOTES:**

**HRO Systems™ Horizon Seafari NEW SYSTEM INITIAL READINGS**  
**THIS COPY IS FOR THE INSTALLER, DEALER, OR COMMISSIONER.**

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Record at the time of initial system commissioning the following after one hour continuous proper running of the system. The commissioning person, or company should maintain this original form for future reference and troubleshooting.

Serial Number: \_\_\_\_\_ Model Number: \_\_\_\_\_

Name of Operator: \_\_\_\_\_ Date: \_\_\_\_\_

Name & Company of Installer: \_\_\_\_\_

Name of Owner: \_\_\_\_\_

System Power: \_\_\_\_\_ VAC, \_\_\_\_\_ Hz, \_\_\_\_\_ Phase

Feed Water Temperature: \_\_\_\_\_ ° Fahrenheit or \_\_\_\_\_ Centigrade

Hour Meter Reading: \_\_\_\_\_ Hours

**PRESSURE GAUGE READINGS:**

Commercial Pre-filter (if used) Low Pressure Gauge Reading: \_\_\_\_\_ psi

Control Panel Low Pressure Gauge Reading: \_\_\_\_\_ psi

High Pressure Gauge reading: \_\_\_\_\_ psi

**WATER FLOW METER READINGS:**

Brine Flow Meter \_\_\_\_\_ US gpm or \_\_\_\_\_ Liters Per Min.

Product Water Flow Meter: \_\_\_\_\_ US gph or \_\_\_\_\_ Liters Per Hr.

**WATER QUALITY:**

Feed Water Salinity: \_\_\_\_\_ ppm or Location of use \_\_\_\_\_

Product Water Salinity: \_\_\_\_\_ ppm

Unusual occurrences: \_\_\_\_\_

**NOTES:**





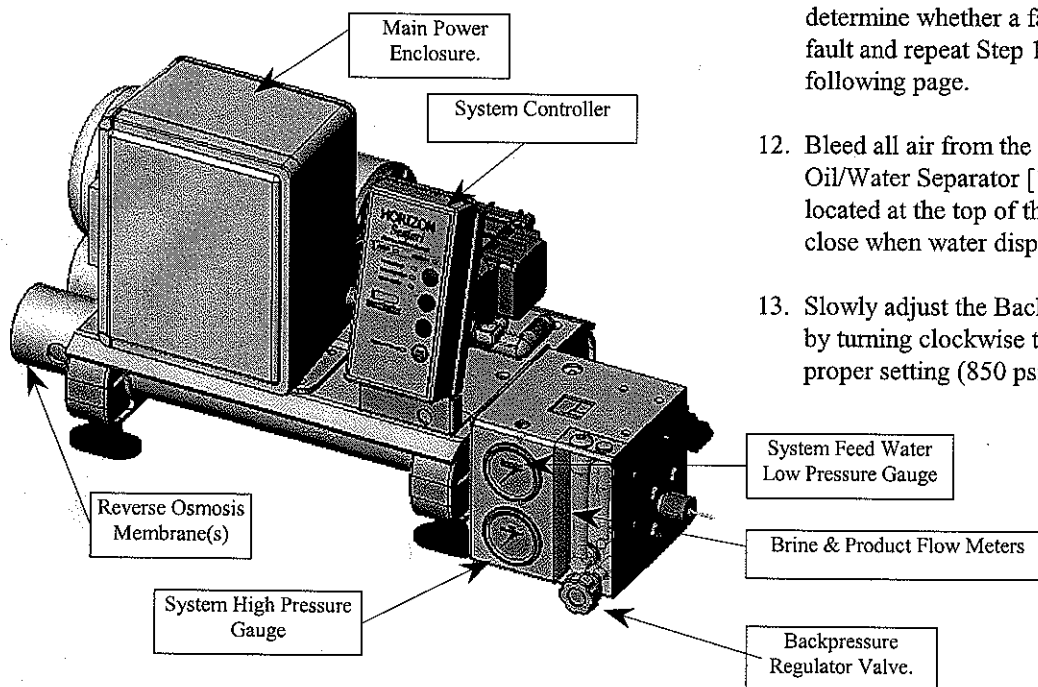
**Horizon  
Reverse  
Osmosis™**

Pioneer of fresh water since 1975

## **SECTION G**

# **System Start Up Procedure**

## G. STARTUP PROCEDURE



1. Check the level of the oil in the High Pressure Pump crankcase. Ensure that the oil level is higher than the center of the sight glass.
2. Open the Inlet Sea Cock Valve [2] fully.
3. Position the Clean/Rinse Inlet Valve [4], if installed, to the normal operating position.
4. Position the Clean/Rinse Outlet Valve [35], if installed, to the normal operating position.
5. Open any auxiliary Valve within the incoming Feed Line.
6. Open any auxiliary Valve in the Outgoing Brine Discharge Line.
7. Open any auxiliary Valve in the Outgoing Product Water Line.
8. Set the Multi Media Filter Valves, if installed, for the Normal Operating Position.
9. Fully Open the Back Pressure Regulator Valve [33].
10. Switch the Electrical Power Source to the Salinity Controller [56] "ON".
11. To start the system press the "Start" switch, or press the "Booster Pump" switch and then the "Start" switch.

If the System automatically shuts off after several seconds of operation, look at the Touch Pad to determine whether a fault has occurred. If so, correct fault and repeat Step 11. For fault explanation, see following page.

12. Bleed all air from the Commercial Pre-filter [14] and Oil/Water Separator [17] by opening the air bleed valve located at the top of the each housing [15 & 18] and close when water displaces all of the air.
13. Slowly adjust the Back Pressure Regulator Valve [33] by turning clockwise to increase the pressure up to the proper setting (850 psi for 35,000 ppm seawater).

For **BRACKISH WATER** operation, adjust the pressure from 100 PSI to 850 so the product water output, is within system specifications.

	Hourly Production	
	Gallons	Liters
Horizon Seafari 420-1	18	66
Horizon Seafari 630-1	26	99
Horizon Seafari 840-1	35	133
Horizon Seafari 740-2	31	189
Horizon Seafari 1160-2	48	183
Horizon Seafari 1480-2	62	234

### DO NOT EXCEED FLOW SPECIFICATIONS.

14. If any abnormality develops, stop the System and correct the problem.
15. Use the Product Water Flow Meter [42] to measure the product flow. The salinity of the Product Water diminishes gradually, until the product water reaches the factory setting at which time the product water passes into the Post Filtration components, & onto the Ship's Storage Tank [46].
16. Check for unusual noises or other occurrences.

## HIGH/LOW PRESSURE FAULT LAMP EXPLANATION:

- a. **Low Pressure Fault:** The System is equipped with a Low Pressure Switch. With no pressure applied to the Low Pressure Switch it does not allow the System to operate. With pressure above 6 psi applied the switch closes and allows the System to operate. If the system pressure should fall below 6 psi, the "HIGH/LOW PRESSURE" lamp blinks. After 20 seconds, the system shuts down completely. The "HIGH/LOW PRESSURE" lamp remains lit until the "Fault Reset" button is pressed, or the system power is interrupted.
- b. **High Pressure Fault Lamp:** The System is equipped with a High Pressure Switch, which stops the system if pressure exceeds 950 psi.

After a fault has been corrected and the "Fault Reset" switch has been pressed, repeat Step 11.

## SOFT START OPERATION:

The Horizon Seafari system may have a Soft Start installed. This Soft Start reduces the current (amps) required at startup for single-phase systems. This is accomplished by reducing the startup torque of the motor. There are a few things one should know when operating a system equipped with a motor Soft Start.

Never start the system without the Back Pressure Regulator Valve [33] open fully. The reduced torque available to the motor is not sufficient to turn the high-pressure pump when the Back Pressure Regulator Valve is adjusted to 850 psi. Starting while the Back Pressure Regulator is not fully open causes damage to the motor.

The Start Sequence for a system equipped with a Soft Motor Starter is as follows:

1. When the "Start" switch is pressed, power is present at the Soft Start.
2. The Soft Start immediately begins its starting cycle.
3. After a few seconds, the motor reaches full speed and the High Pressure Pump contactor makes an audible click and is switched on.

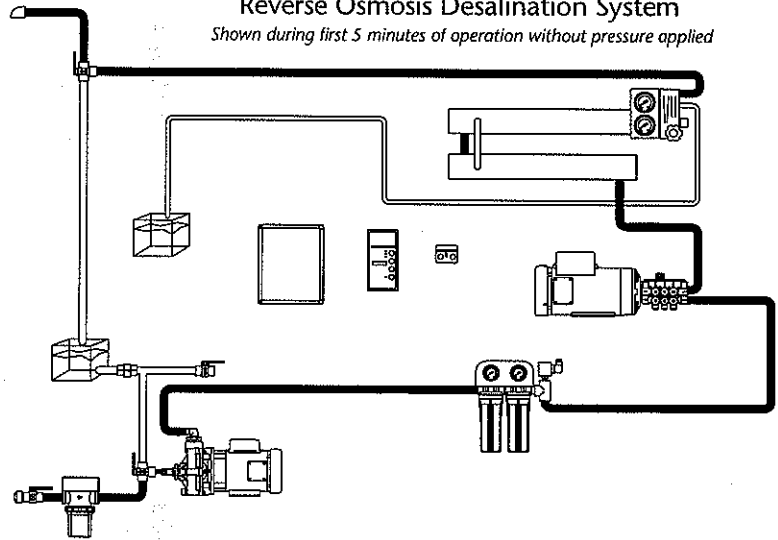
The Soft Motor Starter has a 30 Amp circuit breaker on its enclosure. When the circuit breaker trips, the Soft Starter power does not ramp properly. Check the motor wiring and Soft Start to spot any wiring problems. Reset the breaker inside the controller before repeating the start sequence. If the circuit breaker interrupts power repeatedly, the system may require service.

The Soft Starter is equipped with a temperature sensor. The temperature sensor is designed to stop operation when the Soft Start overheats. Before restarting the system, the main power must be disconnected to reset the Soft Start's logic. *Overheating occurs when the system is exposed to extreme heat or it is started and stopped repeatedly over a brief span of time.*

The System Illustrated in the 3 separate stages of Start Up Operation. The System is shown with Rinse/Clean Valves and Plankton Filter Optional Equipment.

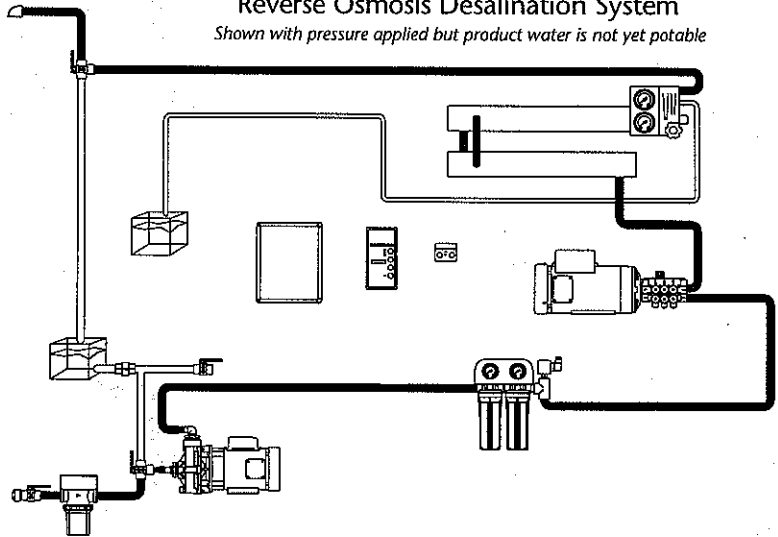
In operation without pressure applied to the R.O. Membrane Elements.

"Horizon Seafari" Series 420-1480 U.S. GPD Reverse Osmosis Desalination System  
*Shown during first 5 minutes of operation without pressure applied*



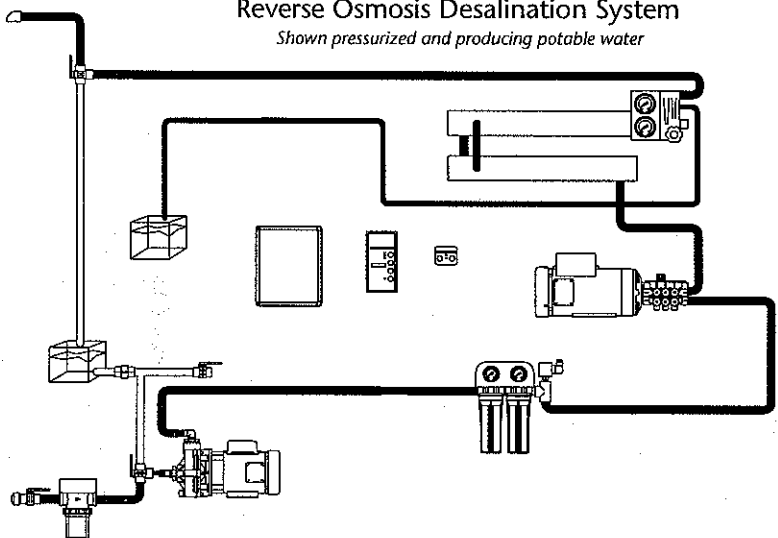
In operation with pressure applied to the R.O. Membrane Elements. Product Water is being produced, however the Product Water is not yet Potable.

"Horizon Seafari" Series 420-1480 U.S. GPD Reverse Osmosis Desalination System  
*Shown with pressure applied but product water is not yet potable*



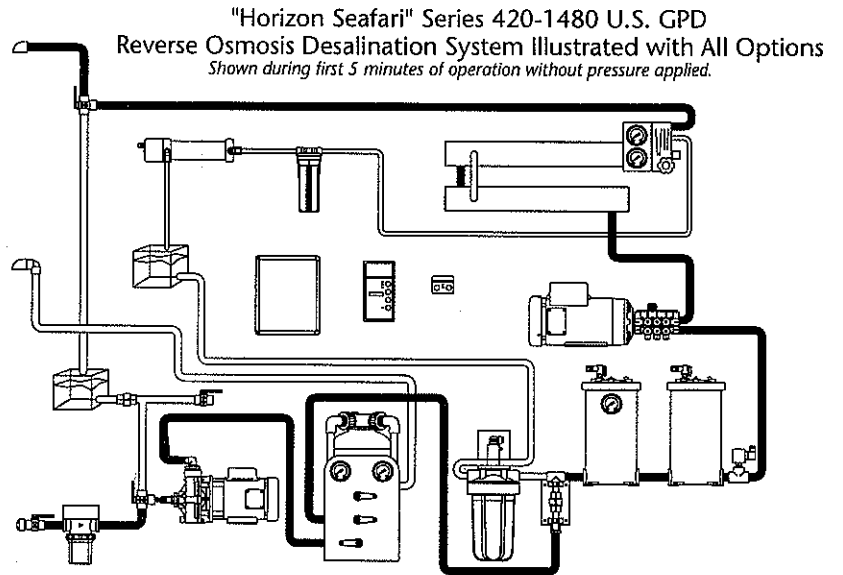
In operation with pressure applied to the R.O. Membrane Elements and the Product Water that is being produced is Potable.

"Horizon Seafari" Series 420-1480 U.S. GPD Reverse Osmosis Desalination System  
*Shown pressurized and producing potable water*

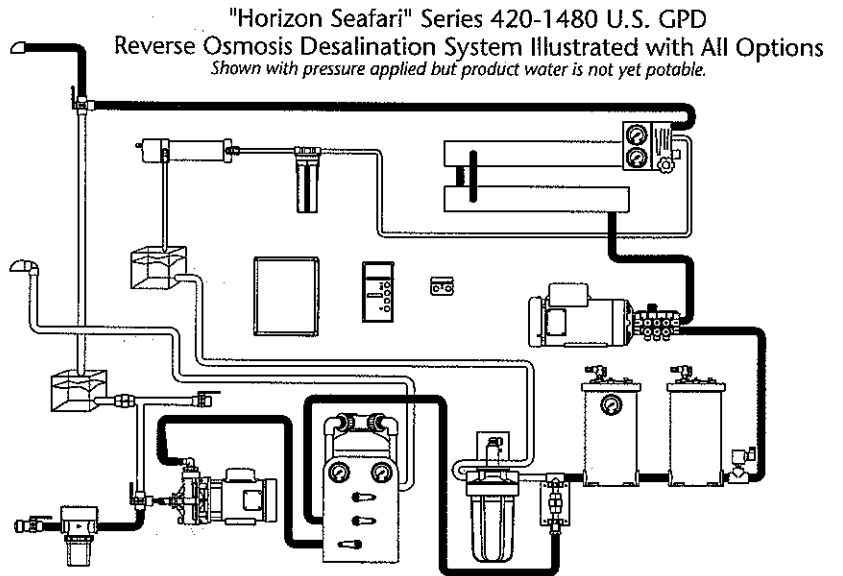


The System Illustrated in the 3 separate stages of Start Up Operation. The System is shown with All Optional Equipment except the Plankton Filter.

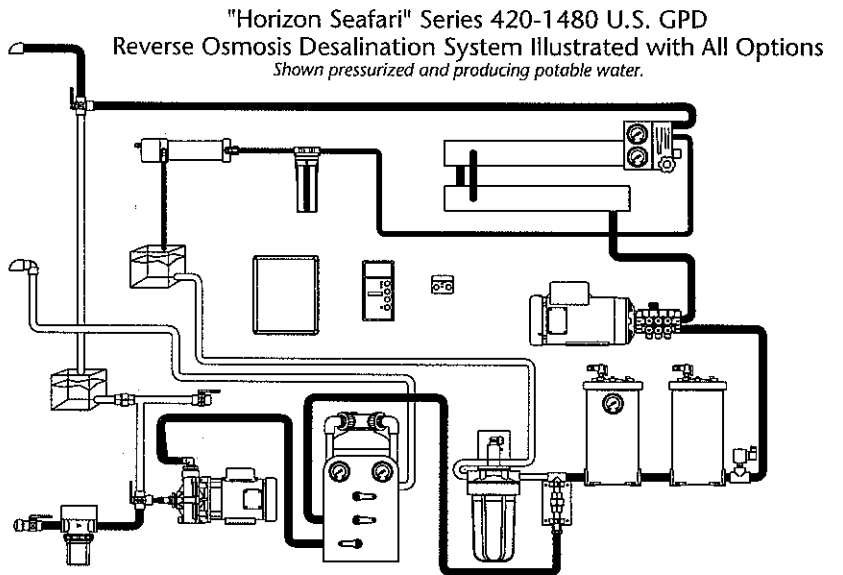
In operation without pressure applied to the R.O. Membrane Elements.



In operation with pressure applied to the R.O. Membrane Elements. Product Water is being produced, however the Product Water is not yet Potable.



In operation with pressure applied to the R.O. Membrane Elements and the Product Water that is being produced, is Potable.





**Horizon  
Reverse  
Osmosis™**

Pioneer of fresh water since 1975

## **SECTION H**

# **Shutdown Procedure**

## H. SHUTDOWN PROCEDURES:

### SHUTDOWN CAUTIONS

Prior to system shutdown, it is strongly recommended that the operator observe and compare the performance of the Horizon Seafari system with the normal operation specifications listed in Section "B" and Initial New System Readings from the end of Section "F" of this manual.

By checking the system performance prior to shutdown, any deviations from normal operation are identified and corrected prior to the next use of the system. This ensures a properly functioning system when it's needed. If an observed problem is easily defined as a minor one, which does not affect other system components, wait until the product water storage tank(s) is (are) full before shutdown.

**High Temperature Condition:** The Pre-filtration Subsystem, High Pressure Pump and/or R.O. Membrane Elements may have been mounted in a location that is subject to excessive heat. As an example, overheating may occur when the components are mounted in a vessel's engine compartment, or in an unventilated building. The transfer of atmospheric heat could raise the standing water temperature in the components above 122° F/50 C. At or above this high temperature, pressurized hot water could cause irreversible damage to the HRO R.O. Membrane Elements. Therefore, the Back Pressure Regulator Valve [33] must be opened at the time of shutdown. This ensures that, at the next start-up, new water may enter and cool the system while it is unpressurized.

### SHUTDOWN SEQUENCE

1. Open the Back Pressure Regulator Valve [33] fully.

2. Momentarily depress the "Stop" switch on the System's front panel Touch Pad.

Check to make sure that both the Booster Pump and the High Pressure Pump have stopped rotating.

3. Close the Inlet Sea Cock Valve [2]. This is a safeguard for vessel installations.

4. If installed, the Fresh Water Flush (FWF) system is initiated when the "Stop" switch is pressed. The fresh water flush lasts for 10 minutes. After 10 minutes, the fresh water flush stops but remains in FWF mode. In this mode, the fresh water flush repeats the ten-minute rinse every 7 days. To continue the 7-day cycle, do not proceed to *Step 5*.

5. Press the "Stop" switch to cancel the Fresh Water Flush mode.

6. Turn off the electrical power source (circuit breaker) to the system. This eliminates the chance of inadvertently starting the system.

7. Refer to Section "J", "Storage & Cleaning Procedure" in this manual.

**HRO Systems™ Horizon Seafari DAILY OPERATIONAL LOG RECORD**  
**KEEP THIS COPY IN THE OWNER'S MANUAL UNTOUCHED AS A**  
**MASTER FOR ADDITIONAL COPIES**

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Serial Number: \_\_\_\_\_ Model Number: \_\_\_\_\_

Name of Operator: \_\_\_\_\_ Date: \_\_\_\_\_

Name & Company of Installer: \_\_\_\_\_

Name of Owner: \_\_\_\_\_

System Power: \_\_\_\_\_ VAC, \_\_\_\_\_ Hz, \_\_\_\_\_ Phase

Feed Water Temperature: \_\_\_\_\_ ° Farenheit or \_\_\_\_\_ Centigrade

Hour Meter Reading: \_\_\_\_\_ Hours

**PRESSURE GAUGE READINGS:**

Commercial Pre-filter (if used) Low Pressure Gauge Reading: \_\_\_\_\_ psi

Control Panel Low Pressure Gauge Reading: \_\_\_\_\_ psi

High Pressure Gauge reading: \_\_\_\_\_ psi

**WATER FLOW METER READINGS:**

Brine Flow Meter \_\_\_\_\_ US gpm or \_\_\_\_\_ Liters Per Min.

Product Water Flow Meter: \_\_\_\_\_ US gph or \_\_\_\_\_ Liters Per Hr.

**WATER QUALITY:**

Feed Water Salinity: \_\_\_\_\_ ppm or Location of use \_\_\_\_\_

Product Water Salinity: \_\_\_\_\_ ppm

Unusual occurrences: \_\_\_\_\_



**HRO Systems™ Horizon Seafari DAILY OPERATIONAL LOG RECORD**  
**KEEP THIS COPY IN THE OWNER'S MANUAL UNTOUCHED AS A**  
**MASTER FOR ADDITIONAL COPIES**

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the Systems Owner's Manual for future reference and troubleshooting. This information should be given to the HRO Systems Technical Service Technician, when requesting assistance from HRO Systems.

Serial Number: \_\_\_\_\_ Model Number: \_\_\_\_\_

Name of Operator: \_\_\_\_\_ Date: \_\_\_\_\_

Name & Company of Installer: \_\_\_\_\_

Name of Owner: \_\_\_\_\_

System Power: \_\_\_\_\_ VAC, \_\_\_\_\_ Hz, \_\_\_\_\_ Phase

Feed Water Temperature: \_\_\_\_\_ ° Fahrenheit or \_\_\_\_\_ Centigrade

Hour Meter Reading: \_\_\_\_\_ Hours

**PRESSURE GAUGE READINGS:**

Commercial Pre-filter (if used) Low Pressure Gauge Reading: \_\_\_\_\_ psi

Control Panel Low Pressure Gauge Reading: \_\_\_\_\_ psi

High Pressure Gauge reading: \_\_\_\_\_ psi

**WATER FLOW METER READINGS:**

Brine Flow Meter \_\_\_\_\_ US gpm or \_\_\_\_\_ Liters Per Min.

Product Water Flow Meter: \_\_\_\_\_ US gph or \_\_\_\_\_ Liters Per Hr.

**WATER QUALITY:**

Feed Water Salinity: \_\_\_\_\_ ppm or Location of use \_\_\_\_\_

Product Water Salinity: \_\_\_\_\_ ppm

Unusual occurrences: \_\_\_\_\_

**NOTES:**



## **SECTION I**

# **System Troubleshooting Guide**

## I. SYSTEM TROUBLESHOOTING GUIDE

Some system problems have possible causes located in more than one subsystem, and are categorized here according to the subsystem in which they are indicated or most likely to be located. Where two or more possible causes are listed for a problem, it is advised that they be checked in the order listed. This Troubleshooting Guide lists the abnormal symptom and its possible cause. In order to correct the problem or repair the part, refer to the Maintenance and Repair Section K of this manual.

### A. SYSTEM SHUTS DOWN BY ITSELF AND A FAULT LAMP IS ILLUMINATED:

View the Touch Pad Fault Indication Lamps.

If the High/Low Pressure Fault Lamp is Illuminated:

**NOTE:** This indicator may illuminate due to either a Low Pressure Fault or due to a High Pressure Fault. The two causes are examined below.

**LOW PRESSURE CAUSES:** The High/Low Pressure Fault Lamp illuminates when the Low Pressure Switch is OPEN and after 10 seconds of illumination the System shuts off.

Press the Fault Reset Switch then Start the System. Take note of the Low Pressure Gauge reading at the control panel.

1. If the Low Pressure Gauge does not move from zero this indicates that there is air entering the System intake line.

Correct any air suction leaks.

2. If the Low Pressure Gauge needle moves and registers below 6 psi or draws a vacuum this indicates one or more dirty Pre-filtration components.

Open the Inlet Seacock Valve.

Clean the Sea Strainer Mesh Screen.

Back Wash the Multi Media Filter.

Clean the Plankton Mesh Screen

Change the Pre-filter Element(s).

Change the Oil/Water Separator Element.

**Note:** After the last shutdown and after the system has sat for some time, the debris clogging the particular filter element becomes loose and settles to the bottom of the filter bowl. There may be sufficient pressure at the Low Pressure Gauge immediately after starting the system, but within 30 to 60 minutes the system shuts down again because debris is stirred up and clogs the filter element.

**HIGH PRESSURE CAUSES:** This may be due to pressurizing the System above 950 psi. The High/Low Pressure Fault Lamp illuminates immediately when the High Pressure Switch is OPEN and the system shuts off immediately.

Follow the Brine Discharge Line and ensure that there is no kink or blockage in this line. Ensure that any Valve in the Brine Discharge Line is fully OPEN.

Follow the Product Water Line and ensure that there is no kink or blockage in this line. Ensure that any Valve in the Product Water Line is fully OPEN.

Open the Back Pressure Regulator Valve fully.

Press the Fault Reset Switch then Start the System. The High Pressure Gauge reading at the control panel should be below 50 psi at this time.

Adjust the Back Pressure Regulator as explained in the Start Up Procedure in Section G of this manual.

## **B. SYSTEM SHUTS DOWN BY ITSELF AND A FAULT LAMP IS NOT ILLUMINATED:**

If the system shut down but a Fault Lamp is not illuminated, then the cause would be electrical.

Power loss caused the system to shut down.

The Power Source Circuit Breaker feeding the system has tripped and requires resetting, or it is weak and not passing full voltage, or it is rated too low for the full load amperage of the system.

Reset the Circuit Breaker and check the circuit breaker to ensure that it passes full voltage across all legs when the system is fully pressurized.

Ensure that the Circuit Breaker is of the proper amperage rating for the System.

The Line Power had a temporary drop out or voltage fluctuation caused by other auxiliary equipment pulling current exceeding the permissible load on the Power Source.

There is a loose wire from the Power Source to the System or within the System Electronic Controller, which is intermittently opening the power to the System.

## **C. VACUUM / LOW PRESSURE GAUGE READINGS:**

The System is equipped with one or more Low Pressure Gauges depending upon which Pre-filtration equipment is installed. Always correlate each of these Low Pressure Gauges to determine which Pre-filtration component is dirty and requires maintenance. The inlet pressure minus the outlet pressure of any component is known as the differential pressure.

The pressure gauges used through the System contain a small orifice at the pressure port stem. This orifice can become plugged up with debris or corrosion. If the gauge fails to register then clean the pressure pick up orifice with a thin stiff wire or small drill bit. Use caution when inserting the cleaning wire or drill bit into the orifice.

#### D. HIGH PRESSURE GAUGE READING:

Use caution in diagnosing the reading of the High Pressure Gauge. If the gauge is reading low it may simply be that the Back Pressure Regulator requires adjustment. However, there may be a problem with the High Pressure Pump or the High Pressure Pump Electric Motor, Back Pressure Regulator Valve, the High Pressure Gauge, or the R.O. Membrane. A high, full load, amperage draw at the High Pressure Pump Electric Motor indicates that the High Pressure Pump is applying pressure within the System.

1. High Pressure Gauge reading is low with normal Brine Discharge Flow Meter reading and low or no product water flow meter reading:

Back Pressure Regulator requires adjustment to normal System operating pressure.

2. High Pressure Gauge reading is low with normal Brine Discharge Flow Meter reading and normal product water flow meter reading:

Dirty orifice in the High Pressure Gauge pressure port requires cleaning.

3. High Pressure Gauge reading is low, Brine Discharge Flow Meter reading is low, and Product Water Flow Meter reading is either normal or low:

High Pressure Pump has a problem within the manifold

Worn Seals are allowing internal bypassing

Broken or stuck valve or valve spring or debris in the valve chamber is allowing internal bypassing

4. Product water flow meter registers flow and the Salinity Meter Red LED is illuminated:

R.O. Membrane Vessel Assembly is bypassing Feed Water into the Product Water.

The R.O. Membrane Element has a cracked product water tube.

A cracked product water tube is caused by a blockage in the Product Water line. Ensure that there are no blockages, valves or kinks in this line.

The End Cap Product Water O-Ring is cut or worn.

A worn product water O-Ring allows Feed Water to enter the Product Water.

**E. FLOW METER READINGS:** In diagnosing flow meter readings always correlate the reading with both the Brine Discharge Flow Meter reading and the Product Water Flow Meter reading. Consider the Pressure Gauge readings as well. Prior to diagnosing flow meter readings, always check first to ensure that the pressure gauge readings are normal. The symptoms and causes listed below assume that all pressure gauge readings are normal.

**Brine Discharge Water Flow Meter:** At zero system pressure, the Brine Discharge Flow Meter registers the Feed Water flow through the system. With High Pressure applied, the Brine Discharge Flow Meter registers the Brine discharge flow, which is feed flow minus the product water being produced.

The High Pressure Pump is a positive displacement pump. It pumps a fixed amount of water unless there is a problem with the High Pressure Pump itself. Therefore, a drop from normal reading on the Brine Discharge Flow Meter indicates the High Pressure Pump is not functioning properly.

Brine Discharge Water Flow Meter reading is less than normal and the Product Water Flow Meter registers flow even with no operating pressure applied to the system:

R.O. Membrane Vessel Assembly is allowing bypassing of Feed Water into the Product Water.

The R.O. Membrane Element has a cracked product water tube.

A cracked or broken product water tube is caused by a blockage in the Product Water line. Ensure that there are no blockages, valves or kinks in this line.

The End Cap Product Water O-Ring is cut or worn which allows Feed Water to enter into the Product Water.

Brine Discharge Water Flow Meter reading is normal with no pressure applied to the system but as pressure is increased, the Brine Discharge Water Flow Meter drops below normal flow.

High Pressure Pump has a problem within the manifold

Worn Seals are allowing internal bypassing

Broken or stuck valve or valve spring or debris in the valve chamber is allowing internal bypassing

Brine Discharge Water Flow Meter reading is normal with no pressure applied, but the bobbin is pulsating up and down and as pressure is applied the pulsation increases.

High Pressure Pump has a broken or stuck valve or valve spring, or debris in one of the discharge valve chambers, which is causing a valve to not properly seat.

**Product Water Flow Meter** The Product Water Flow Meter registers the amount of Product Water being produced by the R.O. Membrane Element. In Sea Water applications the Product Water Flow Meter does not register until the System Pressure exceeds 420 PSI. Therefore, if full production registers on the Product Water Flow Meter at or below 420 PSI operating pressure, in full salinity seawater, this indicates that the R.O. Membrane Vessel Assembly has a problem, such

as a defective O-Ring, defective Membrane Element, broken product water tube, cracked end plug or damaged High Pressure Vessel.

If the operating pressure of 850 psi produces a Product Flow Meter reading below normal this indicates one or more of the following causes:

- The system Feed Water is at a low temperature;
- The salinity of the Feed Water is greater than 35,000 ppm (typical Sea Water);
- The R.O. Membrane Element is fouled and requires cleaning;
- The R.O. Membrane Element has dried out and requires replacement;
- The R.O. Membrane Element has been subjected to chemical fouling and requires replacement;
- The R.O. Membrane Element has been exposed to temperatures above 140° F and requires replacement;
- The R.O. Membrane Element has been subjected to pressures above 1000 PSI, has been compacted and requires replacement.

Product Water Flow Meter registers substantial flow when the system operating pressure is below 420 PSI and the system is operating in full salinity seawater.

The R.O. Membrane Element has a cracked product water tube.

A cracked or broken product water tube is caused by a blockage in the Product Water line. Ensure that there are no blockages, valves or kinks in this line.

The End Cap Product Water O-Ring is cut or worn.

A worn product water O-Ring allows Feed Water to enter into the Product Water.

After compensating for Temperature of the Feed Water, the Product Water Flow Meter registers lower than normal flow when the system operating pressure is 850 PSI and the system is operating in seawater.

Membrane Element is fouled or has been damaged and requires cleaning or replacement.

There is a restriction in the Product Water Line.

Temperature and Pressure correction has not been properly calculated. Refer to Appendix B.

High Pressure Gauge is defective and registering higher than the actual applied pressure.



**F. PRODUCT WATER QUANTITY AND QUALITY:** The R.O. Membrane Element requires a specified amount of Feed Water flow in order to reject impurities. Less than required Feed Water flow causes the R.O. Membrane Element to recover a high percentage of Product Water (ratio of Feed Water to Product Water) and causes the R.O. Membrane Element to foul quickly. It is, therefore, important to maintain the Feed Water Flow into the R.O. Membrane Element to prevent mineral build up fouling. If the High Pressure Pump is damaged, do not operate the system until the Feed Flow problem is corrected.

The clarity of the Feed Water affects the R.O. Membrane Element performance. If the Pre-filtration Section is not trapping the suspended solids, the R.O. Membrane Element quickly becomes fouled.

Always ensure that there are clean Pre-filter Elements and change them frequently.

Always use genuine HRO Pre-filter Elements as they last longer and are FDA approved. Non HRO Pre-filter Elements are less efficient causing more frequent changing. This may lead to neglect and fouling of the R.O. Membrane Element.

Sea Water (35,000 ppm TDS) applications operate at 850 PSI to gain optimal performance. Pressures below 850 PSI cause low Product Water Production and poor Product Water Quality. The Operating Pressure is correlated to the Feed Water Temperature, production rate, and Feed salinity.

When operating from typical 35,000 ppm TDS Sea Water and a Feed Water Temperature below 77°F / 25 C, the system may be operated at higher pressures not to exceed 1000 psi, in order to gain optimal performance. With a Feed Water Temperature above 77° F / 25 C, the system must be operated at lower pressures in order to prevent excessive Product Water recovery and fouling. There is a decline in Product Water Quality with Feed Water Temperatures above 77° F / 25 C. This is natural and expected with the Reverse Osmosis process, and does not indicate a problem.

Water Quality is higher than normal or the red light does not go out.

The system pressure is below normal. Adjust it accordingly.

The Feed Water Temperature is above 77° F / 25 C

The Feed Water Salinity is above 35,000 ppm TDS due to operation in a high salinity sea

The Brine Discharge Water Flow Meter is reading lower than normal.

Refer to the Brine Discharge Water Flow Meter troubleshooting.

A product water "O" ring within the R.O. Membrane Element Vessel requires replacement.

The R.O. Membrane Element has developed a hole or cracked product water tube. (This also causes higher product water flow, and high product water salinity.)

**G. HIGH PRESSURE PUMP:** The high-pressure pump is a positive displacement triplex plunger pump. The pump always delivers the normal amount of water flow unless a problem develops within the pump, the pump is being subjected to an extreme vacuum at its inlet, or the RPM from the Electric Motor has changed due to low or high Cycles from the Power Source.

High Pressure Pump flow is normal when the system operating pressure is at zero, but the flow drops below normal as pressure is applied: Keep in mind that the Brine Discharge Flow Meter registers full feed water flow when there is no pressure applied to the system and as pressure is applied to the system the Brine Discharge Flow Meter drops in relationship to the amount of product water that is then being produced. Therefore, as pressure is applied to the system this Brine Discharge Flow Meter drops in predictable flow registration by design. That would not indicate a problem. However, if flow drops beyond the normal decrease then:

Worn High Pressure Pump seals are allowing internal bypassing and require replacement.

Worn High Pressure Pump valves, valve seats, valve springs and or valve seat "O" rings are allowing internal by-passing and require replacement.

Worn, corroded or eroded manifold is allowing internal by-passing and requires replacement.

There is debris in the valve chamber(s) causing one or more valve to remain open.

The Electric Motor RPM is low due to improper Cycles from the Power Source to the System.

High Pressure Pump flow is normal (at the Brine Discharge Flow Meter) when the system operating pressure is at zero, but the flow becomes erratic and pulsating as pressure to the system is applied:

Worn or broken High Pressure Pump Discharge Valves, Discharge Valve seats, Discharge Valve springs and or debris is trapped within a High Pressure Pump Discharge Valve chamber.

High Pressure Pump flow is erratic and worsens with increased system pressure:

Worn or broken High Pressure Pump Inlet Valves, Inlet Valve seats, Inlet Valve springs and or debris is trapped within a High Pressure Pump Inlet Valve chamber.

High Pressure Pump flow is normal when the system operating pressure is at zero, but the High Pressure Gauge does not register pressure as the the Back Pressure Regulator Valve is adjusted. The Feed Water Flow Meter reads normal and normal Product Water Flow registers on the Product Water Flow Meter as the Back Pressure Regulator Valve is adjusted clockwise:

Clean the debris from the High Pressure Gauge orifice or replace the gauge.

High Pressure Pump leaks oil:

Locate the leak source and repair as required.

High-pressure pump leaks water from between the manifold and the crankcase housing:

Worn inlet packings due to operating the High Pressure Pump dry or at a vacuum.

Worn seals from normal wear, or degraded from age.

Replace the High and Low Pressure Seals and associated O-Rings together as a set. Change these seals every 2,000 - 4,000 hrs depending upon age and operating conditions.

## H. PRESSURE SWITCHES:

**High Pressure Switch** The High Pressure Switch shuts the System down as the System Pressure into the Back Pressure Regulator reaches 950 psi  $\pm$  50 psi ( 900 to 1000 psi setting is acceptable )

The System shuts down and the Low/High Pressure Fault Lamp illuminates when operating pressure does not exceed 900 psi

The High Pressure Switch has drifted from its factory setting and requires adjustment upward.

The System does not shut down when the operating pressure applied exceeds 1000 psi.

The High-Pressure Switch has drifted from its factory setting and requires adjustment downward.

**Low Pressure Switch** The Low Pressure Switch closes as the Pre-filtration pressure rises above 6 psi ( $\pm$  2 psi ) in order to maintain the System in operation. The Low Pressure Switch opens and shuts the System off as the Pre-filtration pressure drops, due to dirty Pre-filtration, below 4 psi ( $\pm$  2 psi).

Note: To prevent mistaking dirty Pre-filtration for a malfunctioning Low Pressure Switch, physically check the Low Pressure Switch Setting.

In order to check the Low Pressure Switch Setting:

With the system operating, slowly close the Inlet Sea Cock Valve. While closing this valve, view the Low Pressure (LP) Gauge while simultaneously viewing the LP/HP Fault Lamp. If the LP Switch is properly adjusted, the LP/HP Fault Lamp blinks on and off as the Feed Water Pressure drops to between 6 to 2 psi. If the LP Fault Lamp blinks prior to 6 psi, the LP Switch is set too high. If the LP Fault Lamp blinks only after pressure drops below 2 psi or does not blink at all, then the LP Switch is set too low.

Adjust or replace the LP Switch but first refer to: A. SYSTEM SHUTS DOWN BY ITSELF AND A FAULT LAMP IS ILLUMINATED

## I. POST FILTRATION SUBSYSTEM:

Product water leaks from Product Water Tubing when 3 Way Product Diversion Valve energizes to direct water to Post Filtration:

There is a blockage in the product water line from the system. Locate the blockage and correct it so that the Product Water Line is free and clear from the system to the product water storage tank.

One or more of the post filters are plugged, change the plugged filter element(s).

Sulfurous (rotten egg) smell in the Product Water Storage Tank:

The system has sat for an extended period of time without operation and the biological slimes trapped within the Pre-filter have decayed and are producing hydrogen sulfite.

Replace the Pre-filter Element(s) and clean their respective housings.

Saturated Charcoal Filter Element, replace the element.

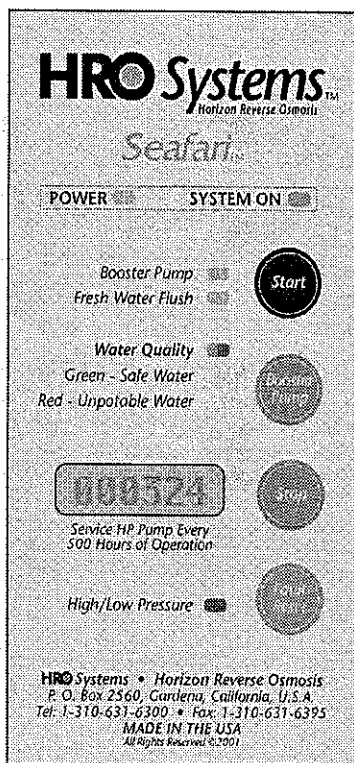
Contaminated product storage tank(s), clean and chlorinate storage tank(s) as required.

The Ultra Violet Sterilizer lamp continuously flickers or does not illuminate.

Change the U.V. Lamp.

The Voltage to the U.V. Sterilizer is too low. The U.V. Sterilizer ballast is very voltage sensitive. High voltage destroys the ballast, low voltage causes the lamp to continually flicker and eventually burn out. Ensure that the Voltage supplied is correct and within specifications.

## J. ELECTRONIC SUBSYSTEM:& TROUBLESHOOTING GUIDE



HRO Control Touchpad.

### Water Quality Indicator remains Red (Un-potable Water) for Extended Period.

The R.O. Membrane Element is fouled or has been attacked by chemicals.

The R.O. Membrane Element has a broken product water tube caused by a restriction in the Product Water Line.

The R.O. Membrane Element Product Water O-Ring is worn, cut or pinched and requires replacement.

The Salinity Probe may have debris on it and requires cleaning.

The Salinity Meter may require calibration. Check the actual salinity content of the product water with a portable TDS meter to determine if the R.O. Membrane Element is fouled.

### Booster Pump:

If the Booster Pump fails to operate, follow these steps to isolate the problem.

1. Make sure the system is receiving proper power and the "POWER" LED is on.
2. Press "Booster Pump" switch to activate the motor. Do not press any other switch.
3. Measure the AC voltage between terminals 1 and 3 (single phase) or 1, 3 and 5 (3 phase) on TB-1 in the main power enclosure.

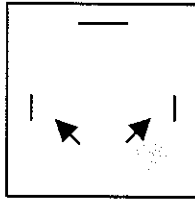
4. If the voltage measured in the step 3 matches the system voltage, then problems may be in the motor wiring or the motor itself.
5. If low or no voltage present in the step 3 above, then check for proper operation of the Booster Pump Contactor. To deactivate the contactor, press the "Stop" switch twice. To activate the contactor again press "Booster Pump" switch.
6. If the contactor is mechanically operating, but no voltage present at the motor terminal (step 3 above), then the contactor may be at fault.
7. If the contactor does not operate mechanically, then measure DC voltage between A1 and A2 terminals. It should read 12V DC when activated.
8. If the contactor gets 12V DC, but inoperative, then its coil may be open. Replace the contactor.
9. If 12V DC is not present when the booster pump is activated, trace yellow and yellow/black wires to TB-2 and measure the DC voltage at the terminals. It should read 12V when activated.
10. If 12V DC is not present at the Booster Pump terminals, then disassemble Controller Enclosure and open the shell by removing 4 screws. This exposes the main controller circuit board.
11. Confirm the "BOOSTER PUMP (BP)" LED, as shown in the Fig. 1, is on when the Booster Pump is activated. Whenever this LED is on, BP terminals on the circuit board has 12V. If it is not the case, replace the controller circuit board.
12. If the voltage is present but the Booster Pump Contactor does not activate, then check cable connections between the Controller Enclosure and Main Power Enclosure.

### **Diversion Valve (3-Way Valve) Troubleshooting**

If the Diversion Valve fails to operate, follow these steps to isolate the problem.

1. Disassemble Controller Enclosure and open the shell by removing 4 screws. This exposes the main controller circuit board.
2. Disconnect 3 wires from "SAL PROBE" terminals temporarily after noting wire connections. (Fig. 1) This fools the controller to "think" there is good water.
3. Start the system.
4. Approximately 10 seconds after the system starts, the Water Quality LED turns green from red. If this is not observed, then go to Salinity Level Calibration procedure.
5. When the Water Quality LED is illuminating in green, disconnect a control cable connector at the Diversion Valve. If the solenoid inside of the valve is functioning, a distinct click sound is heard.

- If the valve is silent, measure the continuity of its solenoid coil as shown below.

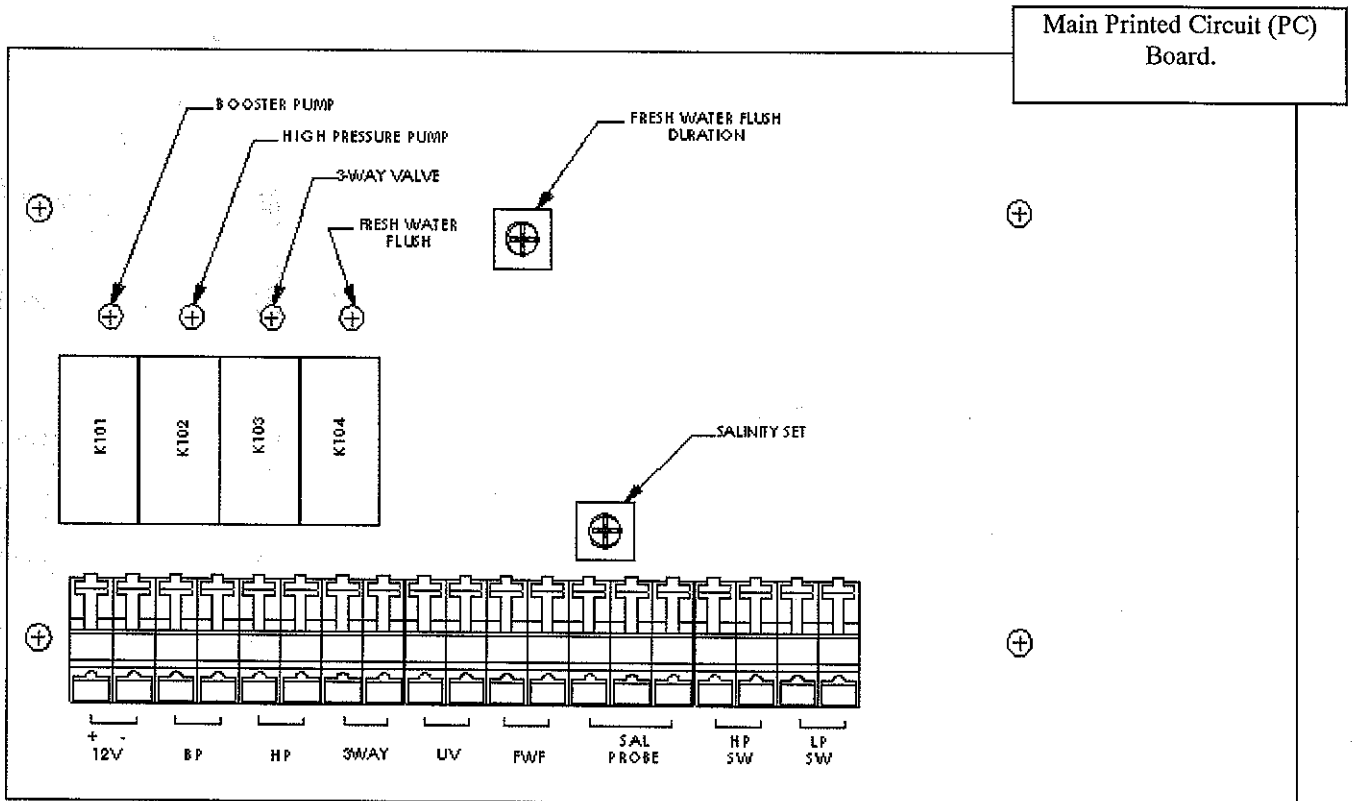


Measure the DC resistance between pins 1 & 2. It is approx. 12 to 15  $\Omega$ .

- If the resistance value is abnormal (shorted or open), then replace the Valve.
- If resistance value is OK, then measure the DC voltage at the connector, pins between 1 & 2. This should be 12V.
- If the voltage is 0 on the step above, measure a DC voltage on the terminals marked as "3WAY" on the Control Circuit board. If there is 12V present, then check the connecting cable between the Valve and Circuit board.
- If no voltage indication on the terminals, check to see if the "3-WAY VALVE" LED is illuminated on the board. If it is off, then replace the Control board.

### Fresh Water Flush Adjustment

- Disassemble the Controller Enclosure and open it by removing 4 screws.
- Press the "Start" switch, then the "Stop" switch.
- Note that the "Fresh Water Flush" LED is either on or flashing.



4. Adjust "FRESH WATER FLUSH DURATION" control (shown below) to obtain a desired length of operation. Full counter clockwise position is approximately 6 minutes and full clockwise position gives approximately 14 minutes.
5. To time the duration, repeat the step 2 above.
6. This completes the adjustment.
7. Reassemble the Controller Enclosure.

### **High Pressure Pump:**

If the High Pressure Pump fails to operate, follow these steps to isolate the problem.

1. Make sure the system is receiving a proper power and the "POWER" LED is on.
2. Press "Start" switch to activate the motor. It will take approximately 5 seconds before the High Pressure Pump Motor to start. Do not press any other switch.
3. Measure the AC voltage between terminals 8 and 10 (single phase) or 8, 10 and 12 (3 phase) on TB-1 in the main power enclosure.
4. If the voltage measured in the step 3 above matches the system voltage, then problems may be in the motor wiring or the motor itself.
5. If low or no voltage present in the step 3 above, then check for a proper operation of the High Pressure Pump Contactor. To deactivate the contactor, press the "Stop" switch twice. To activate the contactor again press "Start" switch.
6. If the contactor is mechanically operating, but no voltage present at the motor terminal (step 3 above), then the contactor may be at fault.
7. If the contactor does not operate mechanically, then measure DC voltage between A1 and A2 terminals. It should read 12V DC when activated.
8. If the contactor gets 12V DC, but inoperative, then its coil may be open. Replace the contactor.
9. If 12V DC is not present when the High Pressure Pump is activated, trace orange and orange/black wires to TB-2 and measure the DC voltage at the terminals. It should read 12V when activated.
10. If 12V DC is not present at the High Pressure Pump terminals, then disassemble Controller Enclosure and open the shell by removing 4 screws. This exposes the main controller circuit board.
11. Confirm the "HIGH PRESSURE PUMP (HP)" LED, as shown in the Fig. 1, is on when the High Pressure Pump is activated. Whenever this LED is on, HP terminals on the circuit board has 12V. If it is not the case, replace the controller circuit board.

If the voltage is present but the High Pressure Pump Contactor does not activate, then check cable connections between the Controller Enclosure and Main Power Enclosure.



**Salinity Meter registers potable water, but the product water has a definite salt taste.**

There is a blockage in the Brine Discharge Line causing Brine Discharge Water intrusion into the 3-way Product Water Diversion Valve. The 3-way Product Water Diversion Valve Seats have been tampered with and require proper adjustment.

The Salinity Probe may be dirty and require cleaning

**Salinity Level Calibration**

Note: In order to set the Diversion Valve trip point precisely, the following procedures must be followed using a known test solution of 1,000 ppm TDS.

1. Disconnect the system from power source.
2. To facilitate the calibration and test, temporarily disable the Booster Pump and High Pressure Pump by removing power cords at TB-1 in the Main Power Enclosure, after noting the original connections.
3. Remove the Salinity Probe from its mounting tee, and wipe electrodes clean with a clean soft cloth or paper towel.
4. Disassemble the Controller Enclosure and open the enclosure by 4 screws.
5. Restore the power to the system and press the "Start" switch. Wait for approximately 10 seconds.
6. If the Salinity Probe is exposed in the air and it is dry, the "Water Quality" LED turns green.
7. If the LED does not turn on green, disconnect probe cable from the circuit board terminals (refer to the Main Board figure on page I - 12). If the LED comes on green, inspect the Salinity Probe thoroughly and replace it if necessary.
8. Dip the Salinity Probe electrodes well into the test solution of 1,000 ppm.
9. Turn the "SALINITY SET" control to fully clockwise position, then slowly turn back counter clockwise until the LED turn red. Do not over turn. Note that there is a 5 second delay for the LED to change from red to green, no delays from green to red.
10. This completes the calibration of the Salinity Level.
11. Disconnect the system from power source and revert disconnected wires to original terminals, and assemble enclosures.

**"Start" switch is depressed but the system does not attempt to start:**

Fault LED lamp is illuminated and requires resetting by pressing Fault Reset Switch at the touch pad.

Power Source Line is switched off, reset the Power Source Circuit Breaker.

Blown fuse in the controller, check fuse condition.

Micro Processor has locked up due to a voltage spike from the Power Source. Turn power off for a minimum of 20 seconds to reset the Micro Processor.

Power source is dropping below the industry standard of 15%, at the instant of starting, preventing the electronic circuit from latching. Check the power source to ensure that it continually delivers the proper power to the System. If voltage drops below acceptable standards for even a micro second this causes the electronic circuit to not latch.

Controller is wired improperly or there are loose wires, check wiring with proper wiring diagram

Start switch at the touch pad is defective and not closing to make the circuit.

**"Stop" switch is depressed but the system does not attempt to stop:**

Micro Processor has locked up. Turn power off for a minimum of 20 seconds to reset the Main PCB.

Stop switch at the touch pad is defective and not closing to make the circuit.

Water damage to the printed circuit board is shorting the stop circuit and causing the system to remain in operation.

**Fuse in controller blows at start up:**

Low or high voltage into the system, correct at the source into the system.

Defective component that relies on the fuse for power:

3-way solenoid valve

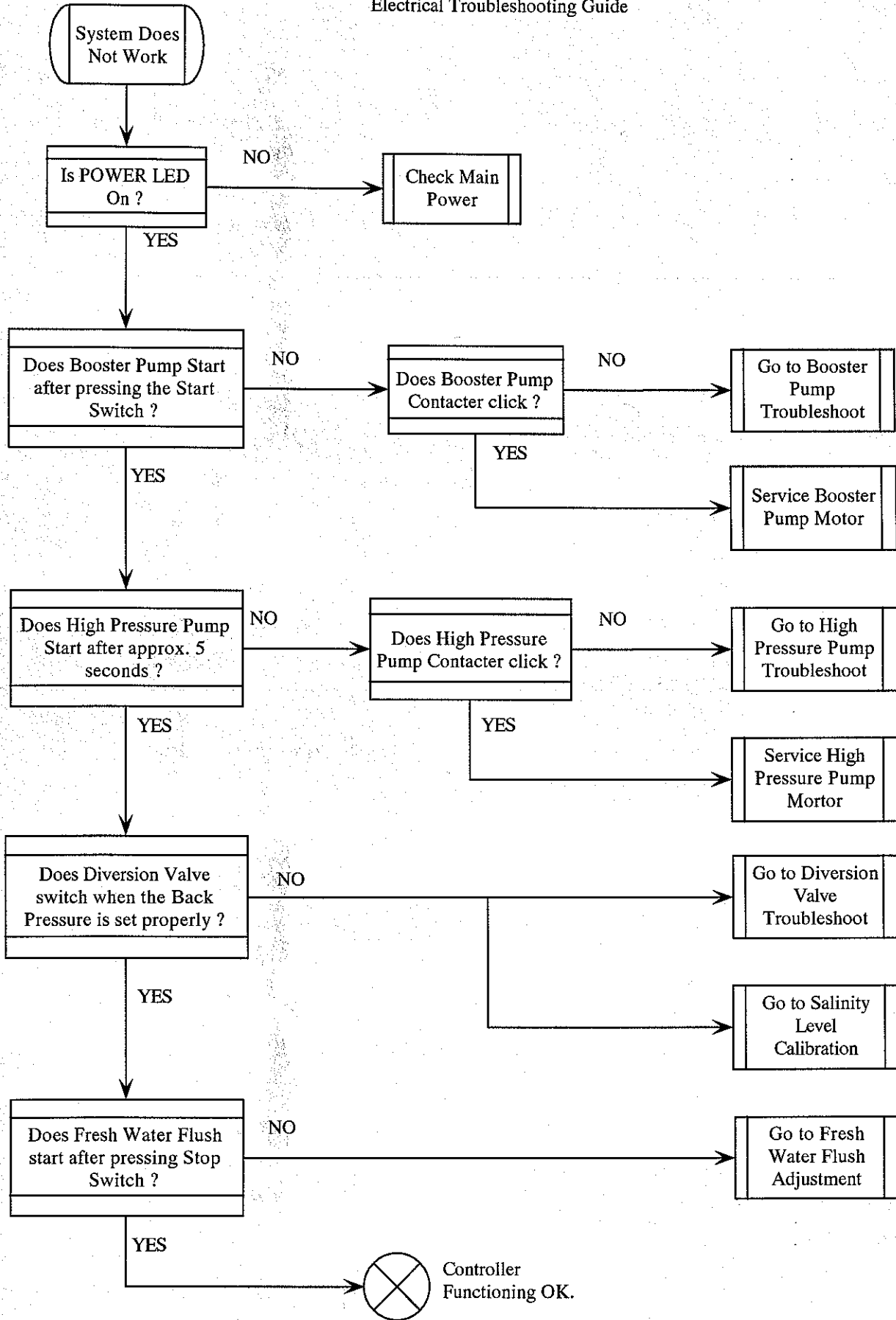
U.V. Sterilizer

Printed Circuit Boards

Touch Pad

Shorted wire, locate shorted wire and repair it.

Electrical Troubleshooting Guide





## **SECTION J**

### **System & RO Membrane Element**

#### **Storage Procedure**

#### **Winterizing & Freezing Temperature Storage**

**&**

#### **Cleaning Procedure**

**HORIZON**  
*Seafari*<sup>TM</sup>  
*Horizon Reverse Osmosis*<sup>TM</sup>

SECTION "J"

SYSTEM & RO MEMBRANE ELEMENT

STORAGE PROCEDURE

WINTERIZING & FREEZING  
TEMPERATURE STORAGE  
&  
CLEANING PROCEDURE

## J. SYSTEM & RO MEMBRANE ELEMENT STORAGE PROCEDURE

### 1. SYSTEM STORAGE:

#### R.O. MEMBRANE ELEMENT HANDLING & SYSTEM STORAGE CAUTIONS:

**TEMPERATURE CAUTION:** Never expose the HRO R.O. membrane(s) to storage temperatures above 122° F / 50 C or below 32° F / 0 C. Never store the R.O. membrane assembly in direct sunlight. High temperature causes up to 40% flux loss (loss of production) of the R.O. membrane element(s). This damage is irreversible. Freezing temperatures cause mechanical damage to the HRO system. This damage is irreversible to the R.O. membrane element.

**DRYING OUT CAUTION:** Never allow the R.O. membrane element to dry out, as 40% flux loss occurs. This damage may be irreversible to the R.O. membrane element. The R.O. membrane element(s) must remain wet at all times.

**BIOLOGICAL FOULING CAUTION:** Protect the R.O. membrane element from biological fouling. Up to 40% flux loss occurs if the element becomes fouled by biological slimes. Some, but not all, flux may be regained after thorough cleaning.

**CHEMICAL FOULING CAUTION:** Never expose the R.O. Membrane Element to chemicals other than those supplied by HRO. Use caution when operating the System in harbors that may be polluted with chemicals, oil, or fuel. Chemical attack to the R.O. Membrane Element may damage the element beyond repair. Chemical attack of the R.O. Membrane Element is not covered by warranty.

**STORAGE CAUTION:** The interior of a membrane element, being dark and moist, is an excellent breeding ground for microorganisms. Simply operating the system does not protect the R.O. Membrane Element(s) from biological fouling. Up to 40% flux loss due to biological fouling occurs in the element if it is not stored properly. During short-term shutdowns the membrane element must be rinsed as explained in the following pages. During long-term shutdowns the membrane element must be rinsed as well as chemically treated as explained later in this chapter.

**NEW SYSTEM STORAGE CAUTION:** The Horizon Seafari system has been tested at the factory and rinsed with a mild mixture of storage chemical. This allows the system to be stored for up to 3 months if kept in a cool place. Do not store the system for longer than 3 months prior to actual use. If storage of the new system is longer than 3 months the system must be rinsed with fresh water and restored with storage solution every 3 months otherwise biological fouling and or drying out damages the R.O. Membrane Element.

Illustration on Page J - 2  
shows the  
Horizon Seafari  
With  
Rinse/Clean Valves

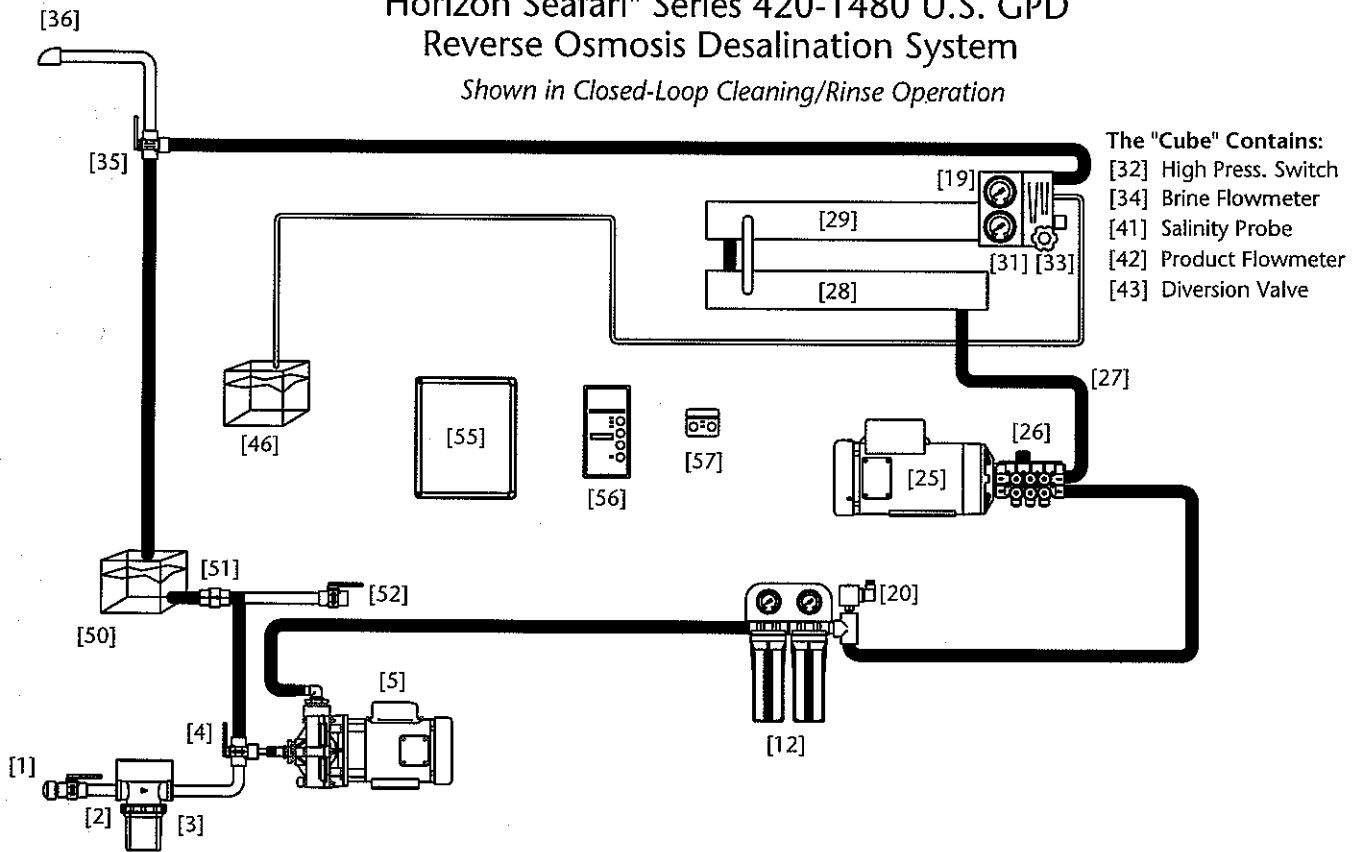
in a Once Through Rinse/Open-Loop Cleaning Mode.

Illustration on Page J - 3  
shows the  
Horizon Seafari  
With  
Rinse/Clean Valves  
in a Closed Loop Cleaning/Rinse Mode.



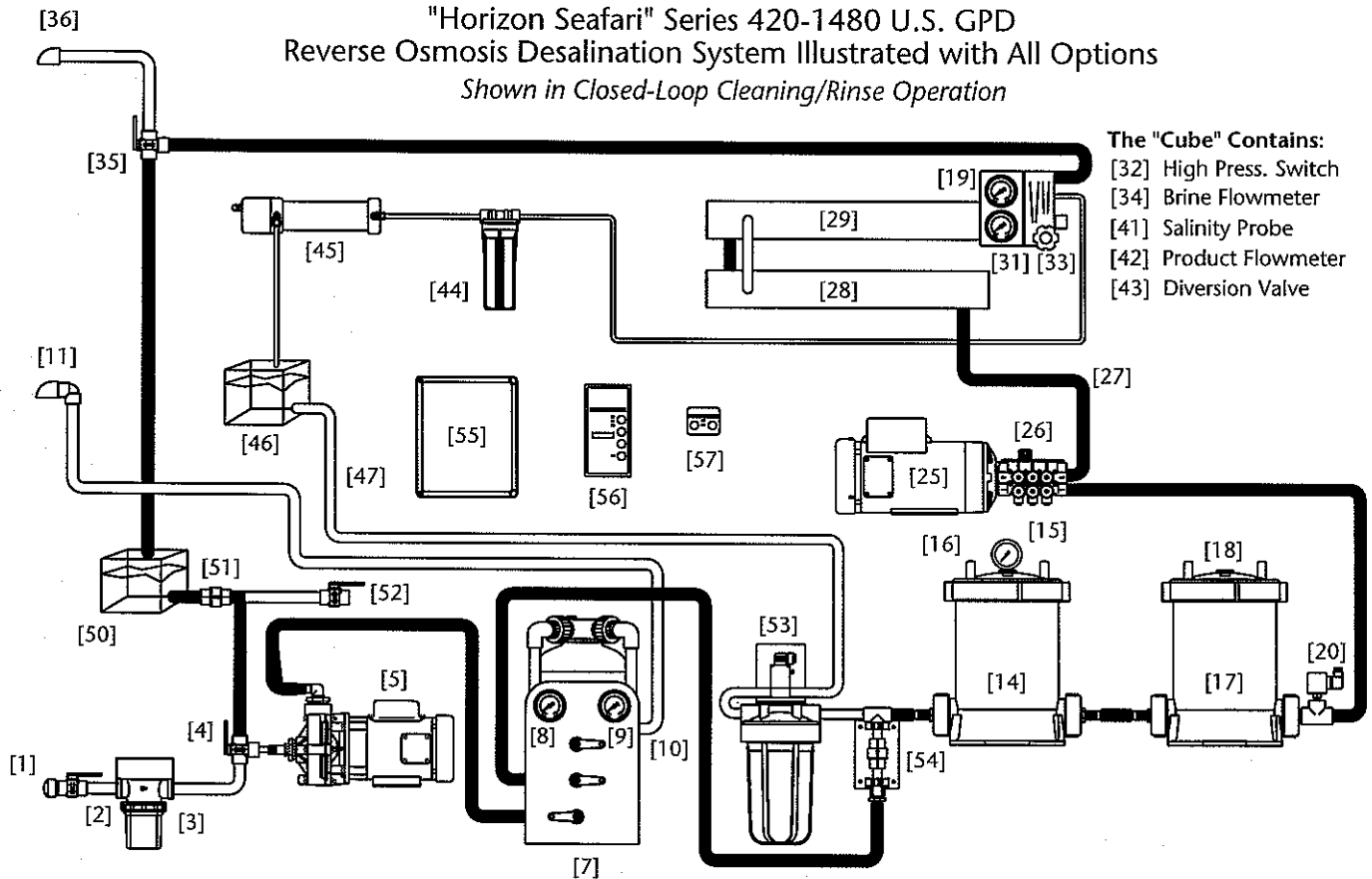
### "Horizon Seafari" Series 420-1480 U.S. GPD Reverse Osmosis Desalination System

*Shown in Closed-Loop Cleaning/Rinse Operation*



### "Horizon Seafari" Series 420-1480 U.S. GPD Reverse Osmosis Desalination System Illustrated with All Options

*Shown in Closed-Loop Cleaning/Rinse Operation*





## A. SHORT-TERM SHUTDOWN:

A short-term shutdown is defined as a period of time in which the Horizon Seafari system is not utilized for two to fourteen days. An efficient short-term method of protecting the HRO system and R.O. membrane element is to perform a "once through" Fresh Water Rinse of the entire system with fresh water (product water from the system). This prolongs the system life by minimizing electrolysis and retarding biological growth. *Refer to page H - 1 for complete explanation of the Fresh Water Flush System.*

**ONE TIME THROUGH FRESH WATER RINSE PROCEDURE:** Follow the directions below. This procedure displaces the system feed water with fresh water and allows a short-term shutdown for up to two weeks. 10 to 20 gallons (38 to 75 liters) of fresh product or potable water is required depending upon the Optional Pre-filtration included with the system. Refer to the Once Through Rinse diagram on page J - 2.

1. Close the Inlet Sea Cock Valve [2].
2. If not already connected, connect the RINSE/CLEAN INLET line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].
3. Fill the Rinse/Clean Tank [50] full with non-chlorinated product water. The cleaning tank must contain enough product water to sustain rinsing of the system until all of the feed water is displaced. This process requires approximately 10 to 20 gallons (38 to 75 liters).

### WINTERIZING AND FREEZING TEMPERATURE STORAGE NOTE:

If the system is exposed to freezing temperatures add twenty percent (2 to 4 gallons / 8 to 15 liters) food grade glycerin (propylene glycol) to the rinse water. This prevents the water in the system from freezing.

4. Position the Rinse/Clean Inlet Valve [4] to the Rinse/Clean Tank position.
5. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position.
6. Fully open the Back Pressure Regulating Valve [33].

7. Operate the system by pressing the "Start" switch. The fresh water rinses the entire Horizon Seafari system and discharges out to waste.
8. Apply 200 psi of pressure to the System by turning the Back Pressure Regulator Clockwise. This allows the system to produce a minimal amount of product water, which ensures that the product water line remains wet.
9. Just prior to depleting the rinse water from the tank, stop the system.
10. Position the Rinse/Clean Inlet Valve [4] to the Normal Operating Position towards the Sea Strainer [3]. The system is now exposed to fresh rinse water and may be left unattended for up to two weeks. This procedure should be repeated every two weeks if the system is not in use.

**NOTE:** If the Horizon Seafari is equipped with a Fresh Water Flush system, the fresh water flush is a substitute for the above procedure. The Fresh Water Flush is timed and repeats every seventh day unless the "Stop" switch is pressed, or the power supply is interrupted.

## B. LONG TERM SHUTDOWN:

A Long Term or Prolonged Shutdown is defined as a period in which the HRO system is shut down for longer than three months. For a such a shut down, the system should first be rinsed with fresh water, then stored with HRO SC System and Membrane Element Storage Chemical. This chemical inhibits bacterial growth while maintaining the high flux and salt rejection of the HRO R.O. Membrane Element. Follow the directions listed below.

The Long Term Shutdown procedure requires 20 - 40 gal. (75 - 150 liters) of potable water.

1. Backwash and rinse the Multi Media Filter, if installed.
2. Close the Inlet Sea Cock Valve [2].
3. Replace all of the Pre-filtration Cartridges with new HRO Pre-filtration Elements.
4. If not already connected, connect the RINSE/CLEAN INLET line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].

5. Fill the Rinse/Clean Tank [50] full with non-chlorinated product water. The cleaning tank must contain enough product water to displace all of the feed water. This requires approximately 10 - 20 gallons (38 - 75 liters).
6. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position.
7. Open the Back Pressure Regulating Valve [33] full open counter clockwise.
8. Start the system. The rinse water is now rinsing the entire system and discharging to waste.
9. Apply 200 psi of pressure to the System. This produces a minimal amount of product water, which ensures the product water line remains wet.
10. Just prior to depleting the rinse water from the tank, stop the system.
11. Open the Back Pressure Regulating Valve [33] full open.
12. Add 10 - 20 gal. (8 - 15 liters) of product water to the Rinse/Clean Tank.
13. Fill a separate plastic bucket or container with 1 to 2 gallons of product water. Add the HRO SC Storage Chemical to the water in the bucket as follows:

Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution contents into the Rinse/Clean Tank [50].

**NOTE:** The correct mixture ratio for the Storage Chemical (SC) is one bottle per 20 gallons of product water. The chemical is mixed first in a small bucket and then added to the water in the tank. This makes the chemical easier to dissolve into the water.

**Mixture example 1:** If the Rinse/Clean Tank [50] contains 10 gallons of product water then add 1/2 bottle of the SC Storage Chemical.

**Mixture example 2:** If the Rinse/Clean Tank [50] contains 20 gallons of product water then add a full bottle of the SC Storage Chemical.

## WINTERIZING AND FREEZING

**TEMPERATURE STORAGE NOTE:** If the system is exposed to freezing temperatures, 2 - 4 gal. (8 to 15 liters) of food grade glycerin (propylene glycol) is also added to the final storage chemical mixture to prevent the water in the system from freezing.

14. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] return for a Closed Loop re-circulation.
15. Operate the system by pressing the System Start Switch. The Storage Chemical Solution is now flows from the Clean/Rinse Tank, through the System and back into the Clean/Rinse Tank in a Closed Loop configuration. *Do not pressurize the system above 50 psi maximum.*
16. After approximately 20 minutes of re-circulation, stop the system.
17. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
18. Operate the system, which discharges the Storage Chemical Mixture through the Brine Discharge Thru Hull Fitting.
19. Stop the system just before depleting the Storage Chemical Solution from the tank.
20. Position the Rinse/Clean Inlet Valve [4] to the normal operating position.

The system may now be left unattended for up to 3 to 6 months. With ideal conditions including a relatively new R.O. Membrane Element, a clean system prior to storage, cool temperatures, and no leakage of storage chemical within the system, it provides protection for up to 6 months. Adverse conditions provide only a month or less of safe storage. Evaluate these factors before determining the proper interval between repeated rinsing and storage periods.

## 2. HRO R.O. MEMBRANE ELEMENT CLEANING PROCEDURES

Do not arbitrarily clean a New System. Low product water production and or High Salinity Product Water readings from a New System is likely due to factors other than fouling. If a New System experiences low production or high salinity then the New System should be operated for up to 12 or more hours continuously to clear the R.O. Membrane Element and product water channel. If, after 12 hours of continual operation, the system still experiences low production and or high salinity then contact the factory.

The membrane elements require cleaning from time to time. Biological growth and salt accumulation eventually make replacement necessary. The frequency of required cleaning is dependent on the rate of production loss and salt rejection loss caused by normal use. In order to properly assess performance changes, it is important that daily log readings be made and referred to for comparison.

When determining the percentage of performance changes, Feed Water Temp, Feed Water Salinity, and System Operating Pressure must be taken into consideration (Refer to APPENDIX B) and compensate for those variables. After compensations, a 10% decline in productivity (GPH Flow) and/or a 10% increase in salt passage indicate that the R.O. Membrane Element requires cleaning.

If Production rate has dropped dramatically since the last time the system was used, this may be due to drying out of the R.O. Membrane Element(s) and/or fouling during storage. If the system has not been used for several months and the production rate has dropped dramatically since the last time used, try operating it for 12 or more continuous hours to saturate the Product Water Channel within the R.O. Membrane Element.

If Production rate has dropped dramatically from one day to another then the reason for production drop may be due to chemical attack or suspended solids fouling, which is not likely cleanable. Chemical attack can be from sewage chemicals or petroleum products. Suspended solids fouling usually consists of silt, coral dust, or debris in rivers or inland waterways, or any other small solid matter.

## A. R.O. MEMBRANE ELEMENT CLEANING CAUTIONS AND INFORMATION:

The Horizon Seafari R.O. system must be rinsed with fresh water before beginning any cleaning procedure. Cleaning of the R.O. Membrane Element(s) with the HRO CC R.O. Membrane Element Cleaning Chemical is performed as follows: (Refer to the diagrams on page J-3 when rinsing and closed loop cleaning the system.)

The process of rinsing and cleaning the R.O. Membrane Elements requires 40 to 200 gallons / 151 to 757 liters of fresh non-chlorinated product water. The amount of fresh water required depends upon which cleaning chemicals are used and the different Pre-filtration equipment installed.

Product Water Required For Cleaning of the R.O. Membrane Element(s):

System with the Standard Pre-filtration only:

Chemical	Rinse	Clean	Recirc. Rinse	Final	Total Water Used
HRO CC-1	10	10	10	10	40
HRO CC-2	--	10	10	10	70
HRO CC-3	--	10	10	10	100

If the System Includes Commercial Pre-filtration and Oil Water Separator:

Chemical	Rinse	Clean	Recirc. Rinse	Final	Total Water Used
HRO CC-1	20	20	20	20	80
HRO CC-2	--	20	20	20	140
HRO CC-3	--	20	20	20	200

The cleaning compounds available from HRO are designed to clean the R.O. membrane elements in a closed-loop configuration. These Chemicals are designed to clean moderate fouling. If the R.O. Membrane Elements are excessively fouled and in-field cleaning is not successful the R.O. Membrane Element(s) may be returned to HRO Systems or to one of HRO Systems' many Service Dealers for more controlled and stronger chemical cleaning. If you wish HRO Systems to perform cleaning of the R.O. Membrane Element, contact us for a Return Authorization Number, price quotation and return instructions.

**HRO CC-1**, Cleaning Compound "# 1" is an alkaline cleaner designed to clean biological fouling and slight oil fouling from the R.O. Membrane Element. Biological fouling is usually the first cause of the R.O. Membrane Element fouling. The system is constantly exposed to seawater, and biological growth occurs from the first day forward. If exposed to seawater and left to sit, the R.O. Membrane Elements become unusable and un-cleanable even with no actual system use. This fouling can only be minimized with fresh water rinsing whenever the system is not in use.

**HRO CC-2**, Cleaning Compound "# 2" is an acid cleaner designed to clean calcium carbonate and other mineral deposits from the R.O. Membrane Element. Mineral fouling is usually a very slow process, which takes place over many hours of use. Therefore, if the System has relatively few hours of use yet shows signs of R.O. Membrane Element fouling then that fouling is likely biological fouling. If the System has in excess of 1000 hours of use then there may be some mineral fouling combined with biological fouling.

**HRO CC-3**, Cleaning Compound "# 3" is used for iron fouling only and is not included in the HRO CC kit. If the HRO R.O. membrane elements are fouled with rust from iron piping then HRO CC-3 may be used for effective rust removal of lightly or moderate rust fouling. R.O. Membrane Elements, which are heavily fouled with rust may not be recoverable as rust not only fouls the Membrane Element but also damages the membrane surface.

**CAUTION: DO NOT MIX DIFFERENT CLEANING CHEMICALS TOGETHER. DO NOT USE DIFFERENT CLEANING CHEMICALS TOGETHER AT THE SAME TIME. MIX THE CLEANING CHEMICALS SEPARATELY AND USE THEM SEPARATELY.**

## **B. R.O. MEMBRANE ELEMENT CLEANING INSTRUCTIONS:**

1. Back Wash and rinse the Multi Media Filter, if installed.
2. Close the Inlet Sea Cock Valve [2].
3. Replace all of the Pre-filtration Cartridges with new HRO Systems supplied Pre-filtration Elements. **DO NOT INSTALL THE OIL/WATER SEPARATOR ELEMENT AT THIS TIME.**
4. If not already connected, connect the RINSE/CLEAN INLET line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].  
  
**The Rinse/Clean Tank should be minimum 10 to maximum 20 gallons in size.**
5. Fill the Rinse/Clean Tank [50] full with non-chlorinated product water. The cleaning tank must contain enough product water to rinse the system until all of the feed water is displaced.
6. Position the Rinse/Clean Outlet Valve [4] to the Brine Discharge (normal operation) position.
7. Open the Back Pressure Regulating Valve [33] full open counter clockwise.
8. Operate the system by pressing the "Start" switch. The rinse water rinses the entire Horizon Seafari system and discharges out to waste.
9. Just prior to depleting the rinse water from the tank stop the system.
10. Refill the Rinse/Clean Tank [50] with 10 -20 gallons (38 - 75 liters) of non-chlorinated product water.

11. Fill a separate plastic bucket or container (1/2 to 2 gallons) 1/2 full with product water. Add the full contents of the HRO CC-1, CC-2, or CC-3 Cleaning Chemical to the water in the plastic bucket. **USE ONLY ONE CHEMICAL AT A TIME.**

Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution into the Rinse/Clean Tank [50].

**NOTE:** The correct mixture ratio for the Cleaning Chemical (CC) is one bottle per 20 gallons of product water. The chemical is mixed first in a small bucket and then added to the water in the tank. This makes the chemical easier to dissolve into the water in the tank.

12. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] return for a closed-loop re-circulation to and from the Clean/Rinse Tank [50].
13. Press the "Start" switch to begin re-circulating the Cleaning Chemical solution from the Clean/Rinse Tank, through the System and back into the Clean/Rinse Tank. **Do not pressurize the system above 50 psi maximum.**
14. After approximately 60 minutes of re-circulation, stop the system.
15. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
16. Press the "Start" switch to discharge the solution out the Brine Discharge Thru Hull Fitting [36].
17. Just prior to depleting the Cleaning Chemical solution from the tank, stop the system.
18. Refill the Rinse/Clean Tank [50] with non-chlorinated product water.
19. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] for Rinse Re-circulation.

20. Press the "Start" switch to re-circulate the water from the Rinse/Clean Tank, through the system, and back into the Rinse/Clean Tank. Continue rinsing for 20 minutes.
21. After 20 minutes stop the system by pressing the "Stop" switch.
22. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
23. Press the "Start" switch to discharge the rinse water out the Brine Discharge Thru Hull Fitting [36].
24. Just prior to depleting the rinse water from the tank, stop the system.
25. Refill the Rinse/Clean Tank [50] with non-chlorinated product water.
26. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge, normal operating position.
27. Start the system to begin rinsing the System, and discharging out the Brine Discharge Thru Hull Fitting to waste.
28. Just prior to depleting the Final Rinse Water from the tank stop the system.

**The System is now ready for additional cleaning, Storage, or use.**

If further cleaning is necessary, repeat steps 10 through 28 for each additional cleaning.

If cleaning is completed and the System is to be stored, go to the beginning of this section and review the **Storage Procedures and Cautions.**

If cleaning is complete and the System will be operated again within a short period of time, proceed to step 29 below.

29. Position the Clean/Rinse Inlet Valve [4] towards the Sea Strainer, normal operating position.



## **SECTION K**

### **Maintenance Time Chart**

### **Operator's Preventative Maintenance**

### **Component Maintenance & Repair**

## K. MAINTENANCE AND REPAIR

### OPERATORS PREVENTIVE MAINTENANCE

Weekly or approximately every 50 hours of use, the Horizon Seafari system should be inspected as part of a preventive maintenance program. The following steps ensure that potential problems are resolved preventing major repairs.

1. Inspect all fasteners for tightness including brackets, screws, nuts, and bolts. Pay special attention to the High Pressure Pump [26] and Electric Motor [25] since they are subject to increased vibration.
2. High Pressure Pump [26]: Regularly check the level of the crankcase oil. The minimum oil level is the center of the sight glass, located at the rear of the High Pressure Pump. The maximum oil level is the top of the sight glass and this level does not harm the pump.

Use only HRO PO High Pressure Pump oil. **DO NOT USE MOTOR OIL OR OTHER HYDRAULIC OIL.**

3. Regularly clean any salt water or salt deposits from the system with a wetted rag.
4. Check regularly for fluid leaks; either oil from the High Pressure Pump or water from anywhere in the system.
5. Regularly check all tubing and high-pressure hoses for wear and friction against abrasive surfaces. Do not allow hoses to come in contact with heated or abrasive surfaces.

**CAUTION:** Make sure that the System Feed Water Sea Cock Valve [2] is closed prior to performing maintenance on the Horizon Seafari system. Also, make sure that the system main electrical disconnect switch is switched "OFF", LOCKED, and TAGGED FOR MAINTENANCE prior to performing maintenance or repairs.

**NOTE:** Refer to Section "L" "EXPLODED PARTS VIEWS" of the USERS MANUAL while performing maintenance or repairs of the individual components and subassemblies. Always observe position of all parts during disassembly.





### OPERATOR MAINTENANCE TIMETABLE

The frequency of required maintenance is dependent on the regularity of usage, the condition of the intake water (the location of use), the length of time the system is exposed to water, the total running time and, in some cases, the manner in which the System is installed. Because of these factors, it is virtually impossible to comprise an exact timetable for required maintenance. The following maintenance timetable is an estimate of the time intervals at which maintenance may be required on the various systems components. This is based upon factual data compiled from HRO system installations around the world. However, this schedule must be adjusted to each individual system depending upon the variables listed.

COMPONENT	MAINTENANCE REQUIRED	TIME INTERVAL	
		INTERMITTANT DUTY	CONTINUAL DUTY
Sea Strainer	Inspect & Clean Screen & Housing	weekly	100 hrs.
Booster Pump	Replace Seal	2000 hrs. or if seal leaks	2000 hrs. or if seal leaks
Plankton Filter	Inspect & clean	weekly	100 hrs.
Media Filter	Backwash Media	weekly	> 20 psi differential
Pre-filter	Replace elements & clean housings	Low Pressure is <10 psi	Low Pressure is < 10 psi
Flow Meters	Clean Inside of the clear tube	As required when dirty	As Required When Dirty
High Pressure Pump	Change oil	500 hrs.	500 hrs.
	Replace Seal Kit	2000 hrs. / as required	2000 hrs. / as required
	Replace Valve Kit	2000 hrs. / as required	2000 hrs. / as required
Electric Motors	Lubricate Bearings	6 months	4000 hrs.
R. O. Membrane	Clean Element	When production or salt rejection decreases by 10%	
Salinity Probe	Clean Probes	Annually	Annually
Charcoal Filter	Replace Element	3 months	3 months
U.V. Sterilizer	Replace lamp & clean quartz sleeve	2000 Hours	4000 Hours
Other	_____		
Other	_____		
Other	_____		

## COMPONENT MAINTENANCE & REPAIR

1. **Inlet Thru Hull Fitting [1]:** Keep the Inlet Thru Hull Fitting free and clear of debris and marine growth. If the Inlet Thru Hull Fitting is clogged, this results in a low feed pressure condition, which causes the System to shut off.
2. **Inlet Sea Cock Valve [2]:** The packings and connections of the Inlet Sea Cock Valve must be tight and must properly seal. Clean the valve cavity of debris or replace the seal and seat, or the entire valve, as required.
3. **Sea Strainer [3]:** Keep the mesh screen free and clear of debris. The Sea Strainer contains a very fine monel mesh screen designed to trap marine debris prior to entering the Booster Pump and Pre-filters. If the mesh screen becomes clogged, it results in a low-pressure condition causing system shut off.

### Standard Sea Strainer

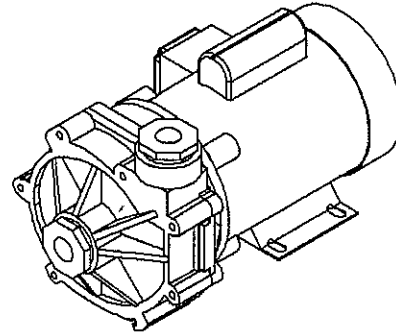
To clean or replace the standard mesh screen remove the bowl by turning it counter clockwise. Remove the Mesh Screen from the bowl. Remove the flat sealing gasket from the bowl and take care to not damage it.

Wipe the sealing gasket with a damp cloth. Lubricate it sparingly with Parker "O" ring lubricant. Place the seal back onto the bowl. Seat the mesh screen back into the bowl. Screw the lid on clockwise. Hand-tighten only enough to seal water in and air out.

### Commercial Sea Strainer

To clean or replace the mesh screen remove the cap on the top by turning it counterclockwise by hand or with a spanner tool. Lift the Mesh Screen from the bowl. Clean the mesh screen and lower it back into the bowl. Ensure that the seal on the cap is undamaged and free from debris. Replace the cap making sure the seal is seated properly.

4. **Booster Pump [5]:** Replace the ceramic seal approximately every 2000 hours, or at the sign of leakage. (P/N HRO BPSK-5):



**DISASSEMBLY:** Remove the seven bolts holding the volute to the motor bracket. To remove the impeller, hold the motor shaft with a large screwdriver and remove the impeller by grasping it with your hand and turning the impeller counter clockwise. Remove the Seal.

**REASSEMBLY:** Clean the motor shaft and the bracket of any corrosion or salt deposits. Place the ceramic seal into the cavity over the shaft. Make sure that the polished side is toward the end of the shaft. Tap into place evenly using a hollow piece of wood or plastic tool. Lubricate the shaft with light oil and slip the rotating portion of the seal over the shaft with the carbon element toward the ceramic. Slide it onto the shaft as far as possible. Apply blue Loctite to the motor shaft threads. Hold the Motor shaft and reinstall the impeller. Tighten the impeller by turning it clockwise until it is snug. Reinstall the volute. Tighten the bolts evenly. Thoroughly prime the pump.

The Electric Motor requires front and rear shaft bearing lubrication every 6 months. Give three pumps of high temperature motor bearing lubricant into each grease jerk. Use a Polyurea Base Grease such as Chevron SRI (Polyurea Base) or Shell Dolium R (Polyurea Base). **DO NOT USE LITHIUM OR SILICONE BASE GREASE.**

5. **Plankton Filter [6] Element Cleaning:**  
To clean the element, unscrew the blue bowl counter clockwise. Remove the Plankton Filter Element from the bowl. Remove the O-Ring from

the top of the bowl and take care to not damage it. Clean the mesh screen filter element with a bristle brush and water spray.

Wipe the O-Ring with a damp cloth. Lubricate it sparingly with O-Ring lubricant. Place the O-Ring back onto the bowl. Insert the cleaned, or a new, plankton filter element into the bowl. Screw the bowl on clockwise.

**6. Multi Media Filter [6]: Backwashing:**

When the Media Filter becomes packed with suspended solids, it must be backwashed. This process unpacks the silica sand and dislodges the suspended solids from the sand.

If replacing the media, the Multi Media Filter requires approximately 15 lbs (7 kg) of small gravel (1/8 x 1/4 inch) on the bottom then approximately 26 lbs (12 kg) of #20 silica sand on top of the small gravel.

To backwash the Multi Media Filter: Open the Inlet Sea Cock Valve [2]. Position the Inlet Clean/Rinse Valve [5], if installed, to the normal operating position towards the Sea Strainer [3].

Position the Multi Media Filter Valves (3 each valves) as shown in the diagram on the right for Multi Media Filter Back Wash. Press the "Booster Pump" switch. Allow this back washing to continue for 10 minutes.

After 10 minutes of back washing press the "Stop" switch to stop the Booster Pump.

Position the Media Filter Valves as shown in the diagram below for Multi Media Filter Rinse.

Press the "Booster Pump" switch. The Booster Pump [5] now rinses the Multi Media Filter [7] to waste [11].

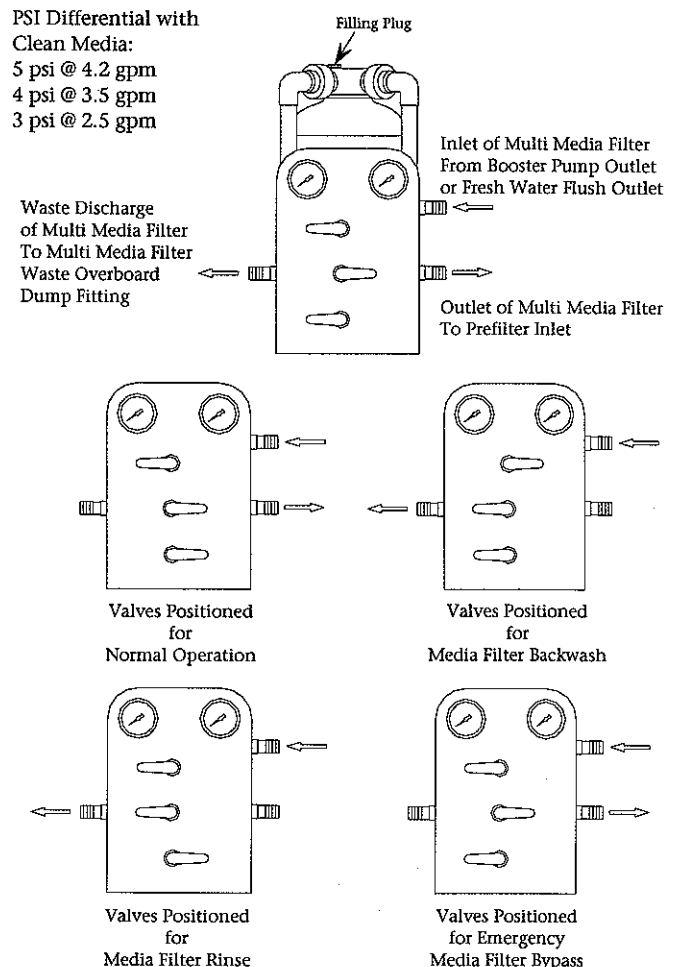
After 5 minutes of rinsing press the "Stop" switch to stop the Booster Pump.

Position the Multi Media Filter Valves as shown in the diagram below.

**7. Pre-filter Element Replacement:** The pre-filter elements must be cleaned, or replaced, when plugged to the extent that the Low Pressure Gauge at the control panel reads below 10 PSI. At or

slightly below 6 PSI the Low Pressure Switch shuts the System off. The standard Pre-filters and the commercial Pre-filter are both discussed on the following page.

VALVE POSITIONING OF THE MULTI MEDIA FILTER DURING 4 SEPARATE MODES OF OPERATION



a. **Standard Pre-filters [12]:**

**Element Replacement:** To replace each individual element, unscrew the blue bowl by hand. Take care not to spill the feed water from the bowl. Remove the element from the bowls and discard them. Remove the O-Ring from the bowl and take care to not damage it. Clean the bowl with a mild detergent and rinse out thoroughly. Wipe the O-Ring with a damp cloth.

Lubricate the O-Ring sparingly with O-Ring lubricant. Place the O-Ring back onto the bowl. Place new HRO Supplied Elements into the appropriate bowls. The first Pre-filter receives an HRO PFE 10/25 Pre-filter Element. The second receives an HRO PFE 10/05 Pre-filter Element.

Screw the bowl on clockwise. Hand-tighten only enough to seat the O-Ring.

b. **Commercial Pre-filter [14] Element Replacement:**

**Element Replacement:** Open the air bleed on top of the housing to allow the filter to drain. Open the drain valve located near the bottom of the base, if installed. After the water and residue have drained from the housing, unscrew the lid clamp. Remove the lid and attached O-Ring. Remove the pre-filter element and discard it. Clean the assembly with product water and a cloth. Insert a new Pre-filter Element HRO CPFE into the housing. Lubricate the O-Ring with O-Ring lubricant, replace the lid, and replace the lid clamp hand tight.

**DO NOT OVER TIGHTEN THE LID CLAMP. SNUG THE LID CLAMP HAND TIGHT ONLY.**

Close the drain valve. Close the air bleed on top of the housing.

8. **Oil/Water Separator [17] Element Replacement:**

**Element Replacement:** Open the air release valve on top of the housing. Open the drain valve located near the bottom of the base, if a drain valve is installed. After the water and residue have drained from the housing, unscrew the lid clamp. Remove the lid and attached O-Ring. Remove the Oil/Water Separator Element and discard it. Clean the assembly with product water and a cloth. Insert a new Oil/Water Separator Element (HRO OWSE) into the housing. Lubricate the O-Ring with O-Ring lubricant, replace the lid, and replace the lid clamp hand tight.

**DO NOT OVER TIGHTEN THE LID CLAMP. SNUG THE LID CLAMP HAND TIGHT ONLY.**

Close the drain valve. Close the air release valve on top of the housing.

9 **Low Pressure Gauge [19]:** If the pressure gauge fails to register the orifice may be corroded with debris. Use a thin wire to dislodge any debris trapped within the pressure port orifice.

10. **Low Pressure Switch [20]:** The Low Pressure Switch contains one N.O. (Normally Open) contact. As the Booster Pump builds pressure on the Pre-filtration Section the Low Pressure Switch closes at 6 PSI (+- 2 psi). After the Low Pressure Switch closes, the system then remains in operation. The Low Pressure Switch opens and shuts the system off, as pressure decreases below 6 PSI (+2 PSI). The internal switching mechanism is very sensitive and adjustment of the Low Pressure Switch is not recommended.

If in field adjustment is absolutely necessary: Stop the Horizon Seafari system. Remove the cap located in the center top of the pressure switch to expose the calibration screw. Adjust the calibration screw, maximum 1/8th turn (45 degrees) at a time, clockwise to increase and counter clockwise to decrease the set point. Restart the system and check the setting by slowly closing the Inlet Sea cock Valve while observing the Low Pressure Gauge at the point of shut down. Repeat as necessary to calibrate the switch.

11. **High Pressure Pump** [26]: refer to page L – 10 and L – 11 in the Users Manual:

Problem or Failure Signs and possible causes (troubleshooting):

**Problem:** Pulsations at the low pressure gauge, at the High Pressure Gauge and/or at the Brine Discharge Flow Meter.

**Possible Cause(s):**

- Worn or broken Valve
- Worn or broken Valve Spring
- Worn or broken Valve Seat
- Debris in Valve Chamber

Check Valve Chambers for debris and inspect Valves. Replace Valve assemblies as necessary

**Problem:** Water Leak between the High Pressure Pump Manifold and Rear Section.

**Possible Cause:** Worn Seals or Seals damaged due to running dry. Inspect Seals and change if necessary.

**Problem:** Flow drops dramatically when attempting to pressurize and there is no flow at the Product Flow Meter.

**Possible Cause(s)**

- Worn Seals
- Seals damaged due to running dry
- Broken Valve
- Broken Valve Spring
- Debris in Valve Chamber

Check Seals and Valve Chambers.

**TORQUE SPECIFICATIONS:**

Item Description	Qty	Ft. Lbs of Torque
9 Screw SHCS 18mm Long	4	7.3
12 Screw SHCS 16mm Long	8	7.3
17 Screw HHCS 20mm long	1	10
29 Nut, Plunger Rod	3	7.3
45 Valve Plug	6	3.5
47 Screw SHCS 25mm Long	4	8
48 Screw SHCS 35mm Long	4	8

High Pressure Pump Drive End Disassembly for Servicing & Trouble Shooting

**a. Servicing The Valves:**

**Tools required:** 3/8" Drive Ratchet; 3/8" Hex Socket; O-Ring Pick; Torque Wrench; Needle Noise Pliers.

- 1) Only one valve kit is required to repair all of the valves in one pump. The Valve Kit (HRO HPP VK 4.2/SS) includes new valve O-Rings, valve seats, valves, springs, and cages, all pre-assembled.
- 2) All of the inlet and discharge valves can be serviced without disrupting the inlet or discharge plumbing.
- 3) To service any valve, remove the valve plug.
- 4) Examine the valve plug O-Rings and replace them if there is any evidence of cuts, abrasions or distortion.
- 5) Remove the valve assemblies (cage, spring & valve seat) by pushing the valve cage in any direction to unseat it then lift the valve cage assembly out with needle noise pliers.
- 6) Clean the Valve Seat Chamber of all debris, deposit build up and corrosion.
- 7) Inspect the manifold for wear or damage.
- 8) Insert a new valve assembly and squarely push it into place in the valve cavity.
- 9) Replace the valve plug and tighten it to the proper torque specification.

**b. Removing The Manifold & Seals:**

**Tools Required:** 3/8" Drive Ratchet; 5mm Hex Socket; Packing Extractor; and Colette.

- 1) Remove the manifold bolts and locking washers
- 2) To separate the manifold from the crankcase, grasp the manifold with both hands and pull straight off.

- 3) Normally the seal assemblies remain in the manifold, however part of the assembly may remain on the plunger. CAREFULLY slide off these pieces.

To remove the seals insert a slide hammer/extraction collet into the seal. Tighten and pull up on the slide hammer weight. The seal assembly should come completely out.

- 4) Thoroughly clean the seal cavity.
- 5) Inspect the seal cavity for signs of damage.

#### c. Packing Installation:

**Tools required:** Seal Insertion Tool

- 1) Ensure that the seal cavities are clean and dry. Do not use lubricant.
- 2) Place a seal insertion tool in the seal cavity, and place one high-pressure seal squarely into the tool. The high-pressure seal consists of two pieces, the inner seal and the outer retainer. These parts are fragile so handle them with care.

Place the seal push tool on top of the seal and push the seal assembly into place. Repeat the process for the remaining cylinders.

- 3) Install the O-Ring in the outside groove on the low-pressure seal retainer. Next, install the low-pressure seal into the retainer with the closed portion of the seal being placed into the retainer, and push into place. Install the entire housing into the seal cavity with the seal opening in first.
- 4) Finally, install the seal retainer with the smooth side against the low-pressure seal retainer. The manifold is now fitted with new seals.

#### d. Plunger Inspection and removal:

**Tools required:** 3/8" Ratchet Driver; 13mm Socket; O-Ring Pick.

- 1) Inspect the plunger for any sign of damage (Surface scuffing/ scoring, cracks, or pitting). The surface must be absolutely smooth.
- 2) Remove the plunger retaining nut and stainless steel washer (Note: This is the only area in the pump where a thread locker is used.) The washer may be stuck to the plunger. Use the O-Ring pick to clean off the thread locker and free the washer.
- 3) To remove the plunger, twist in either direction and pull straight off. **DO NOT USE** any type of pliers or metal tools on the plunger as they are ceramic and are brittle. Inspect the plunger again for any sign of damage also look into the bore of the plunger for any sign of rust. Rust here indicates that the plunger retainer O-Rings have failed, allowing water to leak between the manifold and crankcase and allowing for water to enter the crankcase section. Check the Crankcase Section for signs of water intrusion.
- 4) Remove the plunger O-Ring and anti-extrusion ring (Note: The anti-extrusion ring is cut at an angle) with the O-Ring pick. Once these are off, remove the slinger using needle nose pliers.

**Note:** Discard the slingers, DO NOT reuse them. They lose their original dimensions after use.

#### e. Plunger Installation:

**Tools required:** 3/8" drive Ratchet; 13mm socket; Torque Wrench; Medium Strength Thread Lock

- 1) Clean the old thread lock off the plunger rods. Do not use assembly lubricant.
- 2) Push the new slingers into place at the bottom of the plunger rods.
- 3) Carefully slide the new O-Ring into the groove on the plunger rods
- 4) Slide the anti-extrusion ring into the groove behind the O-Rings

- 5) Push the plungers onto the rods with a twisting motion until they are seated completely on the rods.
- 6) Place a new washer on the rod and apply a small amount of Loctite Medium thread locker. Install the plunger retaining nut and torque to specification.

**f. Manifold Installation:**

**Tools required:** 3/8" drive Ratchet; 5mm socket; Soft Faced Hammer; Torque Wrench

- 1) Place the manifold squarely on the plungers and push with even tension until the manifold is seated against the crankcase. Do not use any lubricant.
- 2) Replace the manifold bolts and washers. Torque to specification.

Torque sequence for tightening the manifold:

1	8	6	4
X	X	X	X
X	X	X	X
3	5	7	2

**12. Electric Motor [25]:** The Electric Motor requires front and rear bearing lubrication every 6 months. Give three pumps of high temperature motor bearing lubricant into each grease zerc fitting. Use a Polyurea Base Grease such as Chevron SRI (Polyurea Base) or Shell Dolium R (Polyurea Base). **DO NOT USE LITHIUM OR SILICONE BASE GREASE.**

**13. High Pressure Hose [27]:** The High Pressure Hoses have no adjustment or repairable parts. For removal and replacement of a High Pressure Hose continue here.

**a. Removal:** When removing a High Pressure Hose use two open end wrenches. Hold the male flare fitting with one wrench while loosening the female swivel nut.

**b. Replacement:** When replacing a High Pressure Hose use two open end wrenches. Hold the male flare fitting with one wrench while tightening the female flare swivel nut clockwise. Snug finger tight then, with the open-end wrench, tighten 1/4

turn (90°) to obtain a metal-on-metal seal. Never use Teflon tape or pipe sealant on the flare surface or on the swivel nut threads.

**14. Reverse Osmosis Membrane Element [28 & 29]:** For cleaning of the Reverse Osmosis Membrane Element refer to Section J of this Manual. For installation/replacement of the Reverse Osmosis Membrane Element continue here.

The Membrane Vessel Assemblies have a side port design. As such, dual membrane systems (740-2, 1160-2, and 1480-2) require the Membrane Vessel Assemblies to be removed from their respective frames prior to servicing. Access permitting, single R.O. element systems (420-1, 630-1, and 840-1) may be serviced in place.

**Dual Vessel System Preparation:**

- 1.) Disconnect the Brine and Product tube connections located on the right side of the Control Manifold. Next, remove the four 1/4" nuts from the right side of the Control Manifold Assembly that hold it to the Membrane Vessel Assembly. Slide the assembly from the vessel and set in a secure place.

**CAUTION:** Electrical Connections to the High Pressure Switch [32], the Diversion Valve [43], and the Salinity Probe [41] remain connected.

- 2.) Disconnect the High Pressure Hose [27].
- 3.) Remove the product tubing, black plastic fittings, and stainless steel nipple from the Membrane Vessel end plugs. (The vessels cannot slide out from the Vessel Frames if the product fittings remain attached)
- 4.) Next, loosen and remove the two 1/2"-13 hex cinch bolts on the Vessel Frame/Wall Mounted Vessel Frames. (These bolts slightly deflect these Vessel Frames to clamp the vessel. As such, the bolts are very snug.)
- 5.) Slide the Membrane Vessel out from the Vessel Frames. They may now be serviced.

**a. Removal of the Reverse Osmosis Membrane Element:**

**NOTE:** It is highly recommended to replace all O-Rings within the High Pressure Vessel assembly each time the Reverse Osmosis Membrane Element is removed or replaced. Each single High Pressure Vessel assembly contains a total of 6 O-Rings (4 each Brine O rings and 2 each Product Water O rings). Ensure that you have these O-Rings on hand prior to opening the High Pressure Vessel. One O-Ring kit is required for each High Pressure Vessel assembly.

The Pressure Vessel has a side port configuration, requiring removal of the port fittings prior to End Plug removal.

Disconnect the High Pressure Hose from the inlet end of the High Pressure Vessel Assembly.

**Membranes are only installed and removed from the Inlet side of the High Pressure Vessel.**

Using a 5/16" Allen wrench remove the 3 each Socket Head Cap Screws from the three-piece Segment Ring located at the end of the Pressure Vessel.

Push inward on the End Plug and Remove the three-piece segment ring.

Remove the Port Retainer.

Remove the High Pressure Port.

Insert all three of the Socket Head Cap Screws back into the End Plug. These Socket Head Cap Screws are used as a handle to remove the End Plug. Grasp one or more of the Socket Head Cap Screws with a pair of pliers and pull outward to remove the End Plug. There is some resistance due to the two Brine O-Rings exerting friction against the Vessel wall.

After the End Plug is removed, the R.O. Membrane Element End and Product Water Tube are exposed within the Vessel.

**CAUTION:** At each end of the Reverse Osmosis Membrane Element is a Product Water Tube approximately 3/4" diameter by 1" long. The outside diameter surface of this product water tube is a

sealing surface, which isolates the Product Water from the Feed Water. The surface of the Product Water Tube must be scratch free. Never use pliers or other grabbing tools on or near the Product Water Tube.

With the End Plug removed from the High Pressure Vessel, the Reverse Osmosis Membrane Element is now visible in the exposed end of the High Pressure Vessel. With your fingers grasp the Product Water Tube and pull outward. If resistance is met then cup the open end of the High Pressure Vessel with one hand and shake downward to dislodge the R.O. Membrane Element. Do not drop the R.O. Membrane onto a hard surface as the Product Water Tube may be damaged.

Run a rag through the High Pressure Vessel to remove any biological film or debris from the High Pressure Vessel.

**b. Inspection and O-Ring replacement:** Inspect each End Plug assembly and its High Pressure Fittings for signs of wear. Inspect the O rings in the High Pressure Port fittings and replace them if they show signs of wear.

Remove the 2 Brine O-Rings and one Product Water O-Ring from all End Plugs removed from the High Pressure Vessel.

Clean the end plugs with a cloth and sparingly lubricate 2 new Brine O-Rings and one new Product Water O-Ring with O-Ring lubricant. Place them onto the End Plug.

**c. Installation/Replacement of the Reverse Osmosis Membrane Element:**

A new HRO Reverse Osmosis Membrane Element comes from complete with a "U" cup Brine Seal at one end of the Element. This Brine Seal must be at the inlet end of the High Pressure Vessel. Refer to the Cross Sectional View on page C - 2.

Insert the down stream end (end without a brine seal) of the Reverse Osmosis Membrane Element into the upstream inlet end of the High Pressure Vessel. Slide the Membrane Element into the High Pressure Vessel, past the brine seal, until the Membrane Element product water tube is 4 inches past the end lip of the High Pressure Vessel.



Insert the End Plug with new attached O-Rings into the High Pressure Vessel while aligning the High Pressure Port and Product Water Port to the respective holes in the High Pressure Vessel. Continue pushing inward on the End Plug until it's exposed end travels just past the Segment Ring Groove in the Pressure Vessel. Ensure that the Ports of the End Plug are aligned with the Port Holes of the High Pressure Vessel.

Insert the High Pressure Port Fitting with attached O-Rings into the High Pressure Port.

Replace the Port Retainer.

Clean the threads of the Product Water Port Nipple and apply three wraps of new Teflon sealing tape to the threads. Screw the Product Port Nipple into the Product Port clockwise until only 2 or 3 threads are exposed from the End Plug. Do not over tighten or use a wrench.

Insert the three-piece Segment Ring Set into the Segment Ring Groove of the High Pressure Vessel. Align the Segment Ring Set with the tapped holes in the End Plug for insertion of the three Socket Head Cap Screws. Attach the three Socket Head Cap Screws and tighten.

Reconnect the Plastic Product Water Tube. Screw the hex nut clockwise finger tight.

Connect the High Pressure Hose to both the leading end and discharge end of the High Pressure Vessel Assembly. Do not over tighten the female swivel nut.

15. **High Pressure Switch [32]:** The High Pressure switch remains closed and keeps the system in operation when high pressure is below 950 PSI ( $\pm 50$  psi). When the high pressure reaches 950 PSI ( $\pm 50$  psi) the High Pressure Switch shuts the System off.

The internal switching mechanism is very sensitive and improper adjustment may damage the switch. In field, adjustment of the High Pressure Switch is not recommended.

If adjustment is absolutely necessary: Open fully the Back Pressure Regulator [33]. Start the Horizon Seafari system. Remove the sealing cap located on the top of the pressure switch to expose the

calibration screw. Using a 3/16" hex wrench, gently adjust the calibration screw, maximum 1/8th turn (45 degrees) at a time. Turn the screw clockwise to increase and counter clockwise to decrease as appropriate.

Slowly increase operating pressure while observing the High Pressure Gauge. The High Pressure Switch should stop the system at 950 PSI ( $\pm 50$  PSI). If the system shuts off below 900 PSI or above 1000 PSI, then repeat the adjustment procedure and retest the set point. Once the High Pressure Switch is properly set replace the adjustment screw cover.

16. **High Pressure Gauge [31]:** If the pressure gauge fails to register, the orifice may be corroded with debris. Use a thin wire to dislodge debris trapped in the orifice.
17. **Back Pressure Regulator [33]:** The Back Pressure Regulator Stem does not require maintenance. Should the O-Rings need replacement, remove the control manifold from the end of the Membrane Vessel Assembly. Carefully unscrew the High Pressure Gauge [31] and remove the cover. Remove the Flow Meter to access the Back Pressure Regulator shaft. Use customary care when replacing the O-Rings on the Back Pressure Regulator shaft.
18. **Flow Meter [34 & 42]:** Since the flow meter body is clear, light penetrates it and supports biological growth. To clean the flow meter body, remove the top access fitting, the guide rod, float and O-Ring bumpers and tube stops. Clean the interior of the tube using a bottlebrush, soft rag, cotton swab or other soft item. Reassemble the unit.
19. **Salinity Probe [41]:** The salinity probe requires cleaning once a year. To clean the probe, unscrew the probe from its tee housing. Using a soft bristle brush, scrub the probes to remove any built up debris. Remove all old Teflon tape from the male pipe threads of the Salinity Probe and clean the threads before reinstalling hand tight only.
20. **Charcoal Filter [44]:** A sulfurous (rotten egg) smell from the product water requires the replacement of the Charcoal Element. Otherwise, the Charcoal Element should be replaced every 3 to 4 months. It is not cleanable.

To replace the element, unscrew the blue bowl counter clockwise by hand. Avoid spilling the product water from the bowl. Remove the Charcoal Filter Element from the bowl and discard. Remove the O-Ring from the bowl and take care to not damage it. Clean the bowl with a mild detergent and rinse out thoroughly.

Wipe the O-Ring with a damp cloth and lubricate it sparingly with O-Ring lubricant and reinstall. Rinse a new HRO CFE Charcoal Filter Element with fresh water to remove the carbon fines from the Element. Insert it into the bowl. Screw the bowl on clockwise. Hand-tighten only enough to seat the O-Ring.

**CAUTION:** If the O-Ring is missing, not properly seated, or if the bowl is over tightened, leaks develop.

21. **Ultraviolet Sterilizer [45]:** The UV Sterilizer lamp emits a low frequency form of light. This light degrades the lamp glass during use. As it degrades, the glass begins to prevent the transmission of the UV light into the water, reducing the efficiency of the sterilizer. Therefore, the lamp may remain lit, but requires replacement every 2000-4000 hrs.

**CAUTION:** *Make sure that system power is turned off before beginning sterilizer maintenance.*

**Lamp Replacement:**

To replace the lamp, remove the top lid. The ballast should remain in the lid. Remove the lamp and the lamp plug from the quartz sleeve. Replace the lamp. During lamp replacement, it is also a good idea to clean the quartz sleeve as well. The quartz sleeve should be crystal clear, if it has yellowed, it should be replaced.

**Quartz Sleeve Cleaning:**

Remove the top cap (cap, ballast, and lamp). Remove the three Phillips-head screws on the top end bushing. Remove the top bushing and the top O-Ring and place in a safe place. Remove the three Phillips-head screws on the bottom bushing (Do not remove the center screw). When you lower the bottom bushing, the quartz sleeve should slide out as well. Remove the bottom O-Ring and clean it with a damp cloth. Clean the quartz tube with water and a bottlebrush. Dry with a soft cloth. Handle the quartz sleeve carefully.

**Reassembly:**

Insert the quartz tube into the Bottom End Plug and seat it into the center O-Ring. Attach a new U.V. Lamp into the plug. Slide the lamp into the Quartz Tube and seat the Top end plug into the vessel. Replace the three 1/4-20 cap head screws.

22. **Controller [56]:** The salinity controller does not require any routine maintenance.



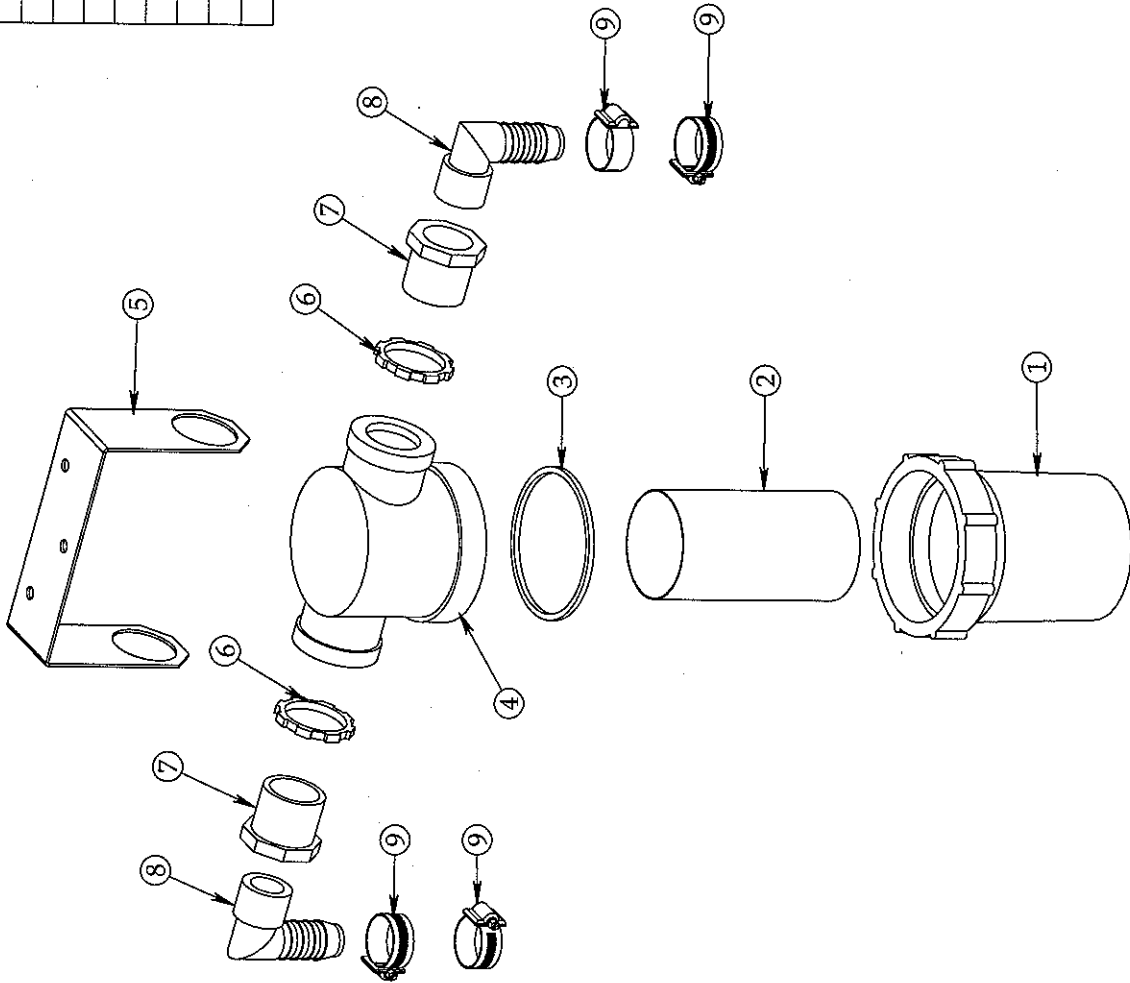
**Horizon  
Reverse  
Osmosis™**

Pioneer of fresh water since 1975

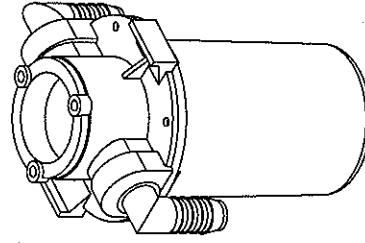
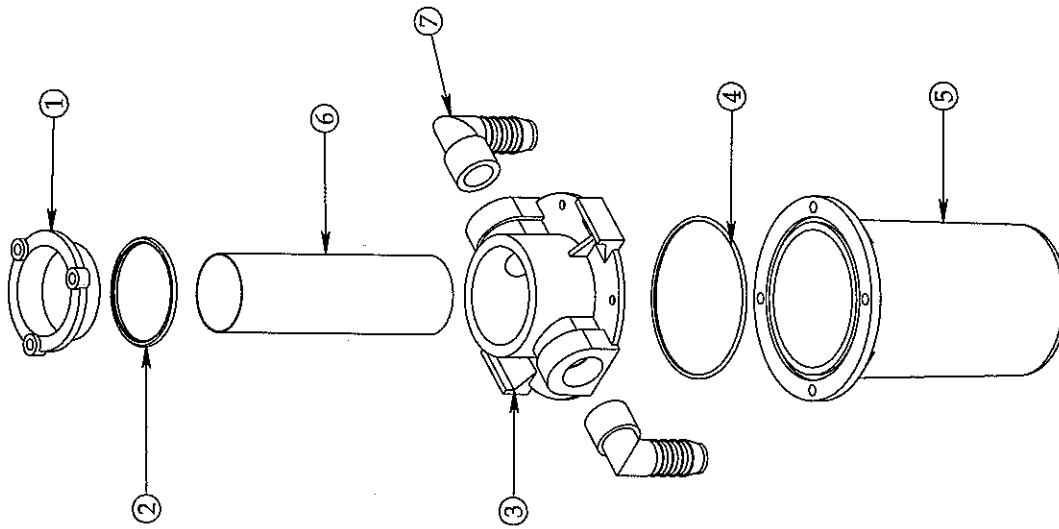
## **SECTION L**

# **Exploded Parts Views With Description & Part Numbers**

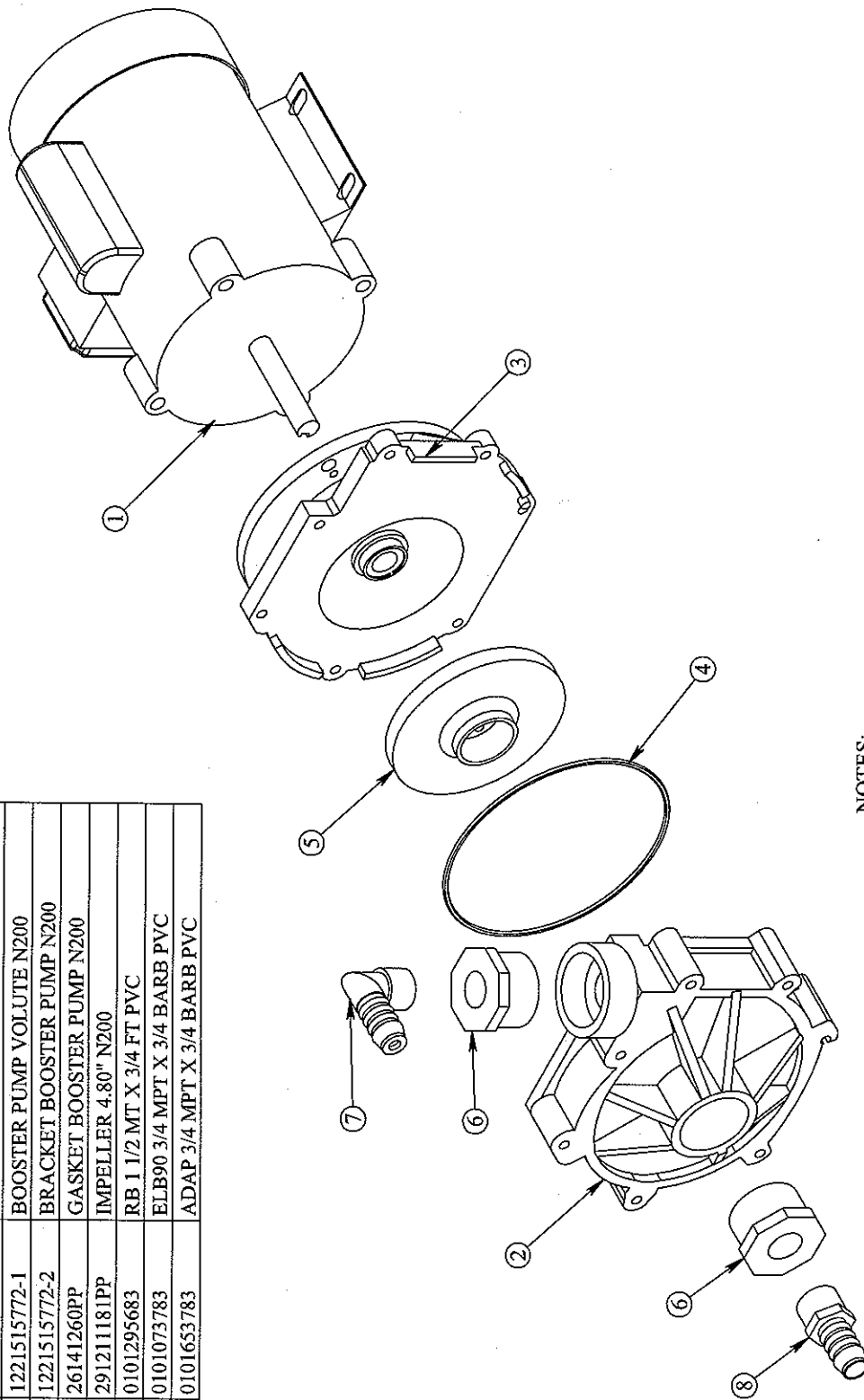
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	0412061278-5	SEA STRAINER BOWL
2	1	0804702578	MESH SCREEN -3
3	1	2614100178	O-RING SEA STRAINER MS-3
4	1	0412061278-2	SEA STRAINER-3 LID
5	1	20200402010	BRACKET SEA STRAINER -3
6	2	063200084000	NUT LOCK 1" STEEL
7	2	0101294383	RB 1 MT X 3/4 FT PVC
8	2	0101073783	ELB90 3/4 MPT X 3/4 BARB PVC
9	4	05181434AA	HOSE CLAMP 3/4" SS



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	0421051239-1	SEA STRAINER-7 LID
2	1	0421051239-2	SEA STRAINER-7 O-RING
3	1	0421051239-3	SEA STRAINER-7 HEAD
4	1	0421051239-4	SEA STRAINER-7 O-RING BOWL
5	1	0421051239-5	SEA STRAINER-7 BOWL
6	1	0804703139	MESH SCREEN 60 MONEL 3/4"
7	2	0101073783	ELB90 3/4 MPT X 3/4 BARB PVC
8	4	05181434AA	HOSE CLAMP 3/4" SS



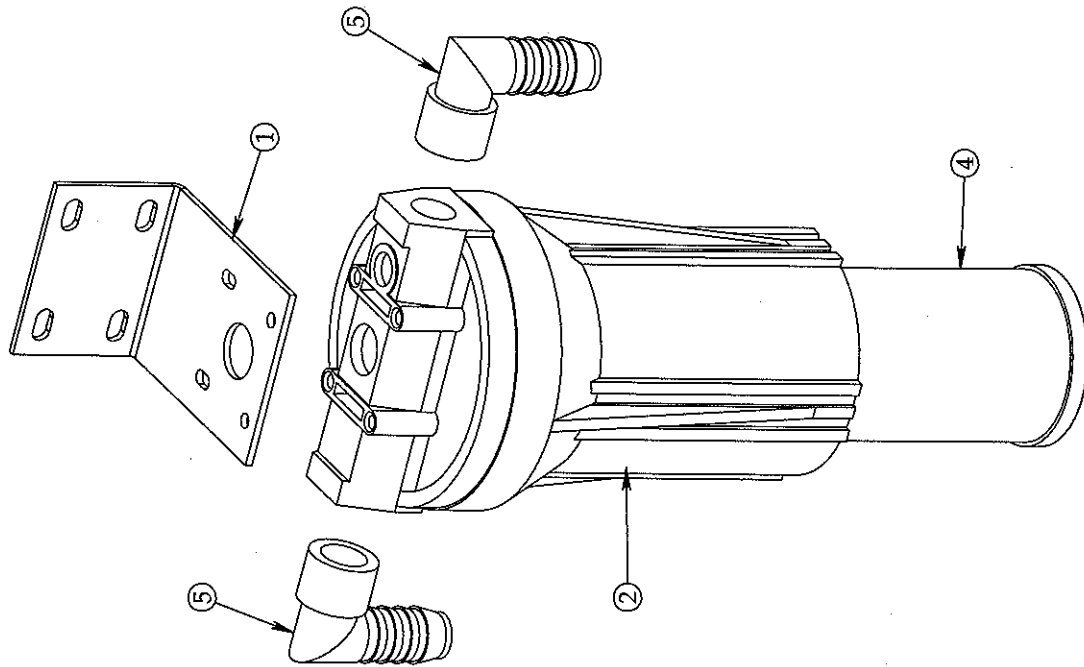
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	1519081110	MOTOR 1/2 HP 110/230-50/60/1PH
2	1	1221515772-1	BOOSTER PUMP VOLUTE N200
3	1	1221515772-2	BRACKET BOOSTER PUMP N200
4	1	26141260PP	GASKET BOOSTER PUMP N200
5	1	29121118IPP	IMPELLER 4.80" N200
6	2	0101295683	RB 1 1/2 MT X 3/4 FT PVC
7	1	0101073783	ELB90 3/4 MPT X 3/4 BARB PVC
8	1	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC



NOTES:

1. NOT SHOWN: P/N B655800009 SEAL KIT BOOSTER PUMP N200
2. BOOSTER PUMP ASSEMBLY SHOWN IS SINGLE PHASE
3. BOOSTER PUMP ASSEMBLY NOT SHOWN: P/N H2016210002 (THREE PHASE)
4. THREE PHASE MOTOR: P/N 1520181110

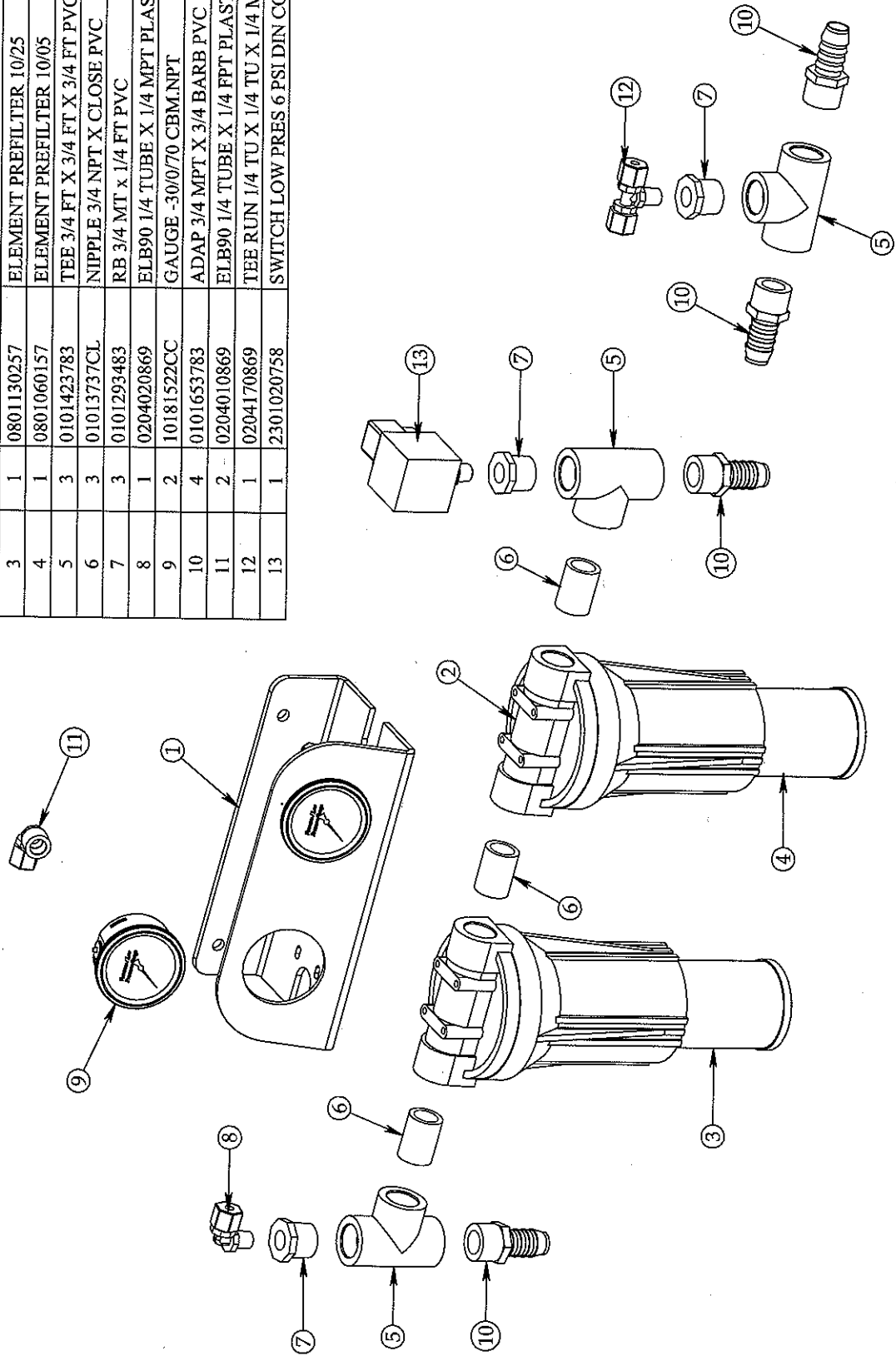
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	20200402100	BRACKET PREFILTER/CHRCL/PLNKTN
2	1	0713020473	FILTER HOUSING/LID 3/4 X 10
3	1	2614010473	O-RING BLUE HOUSING
4	1	0805823578	ELEMENT PLANKTON
5	2	0101073783	ELB90 3/4 MPT X 3/4 BARB PVC



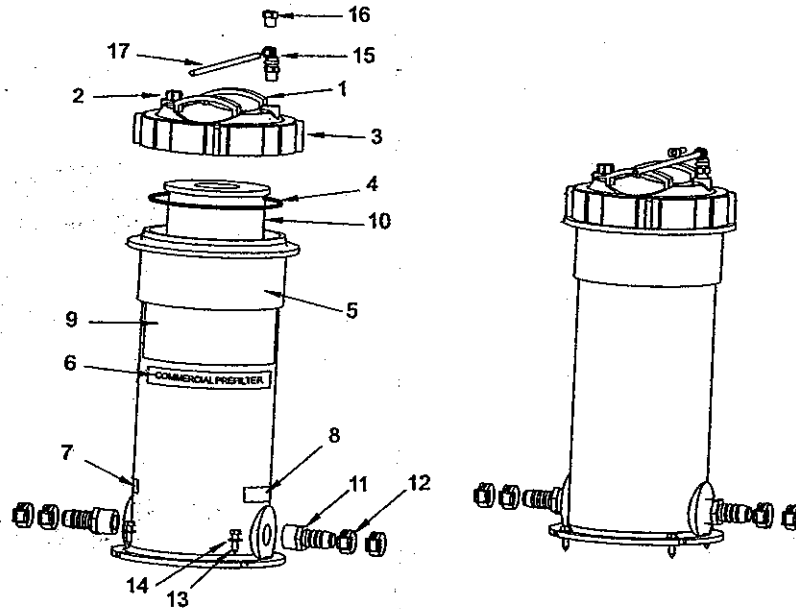




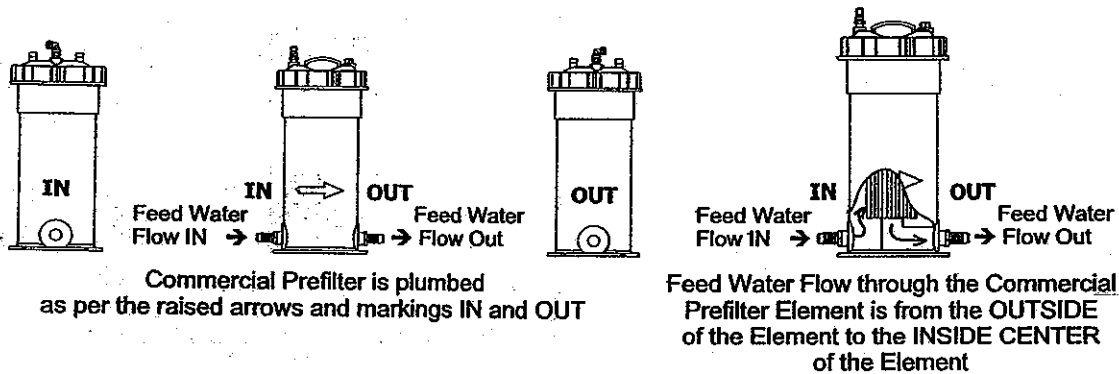
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	H31740040001	DELUXE DUAL PREFILTER BRACKET, SEAFARI
2	2	0713020473	FILTER HOUSING/LID 3/4 X 10
3	1	0801130257	ELEMENT PREFILTER 10/25
4	1	0801060157	ELEMENT PREFILTER 10/05
5	3	0101423783	TEE 3/4 FT X 3/4 FT X 3/4 FT PVC
6	3	01013737CL	NIPPLE 3/4 NPT X CLOSE PVC
7	3	0101293483	RB 3/4 MT x 1/4 FT PVC
8	1	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLASTIC
9	2	10181522CC	GAUGE -30/0/70 CBM.NPT
10	4	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC
11	2	0204010869	ELB90 1/4 TUBE X 1/4 FT PLASTIC
12	1	0204170869	TEE RUN 1/4 TU X 1/4 TU X 1/4 MT
13	1	2301020758	SWITCH LOW PRES 6 PSI/DIN CONN



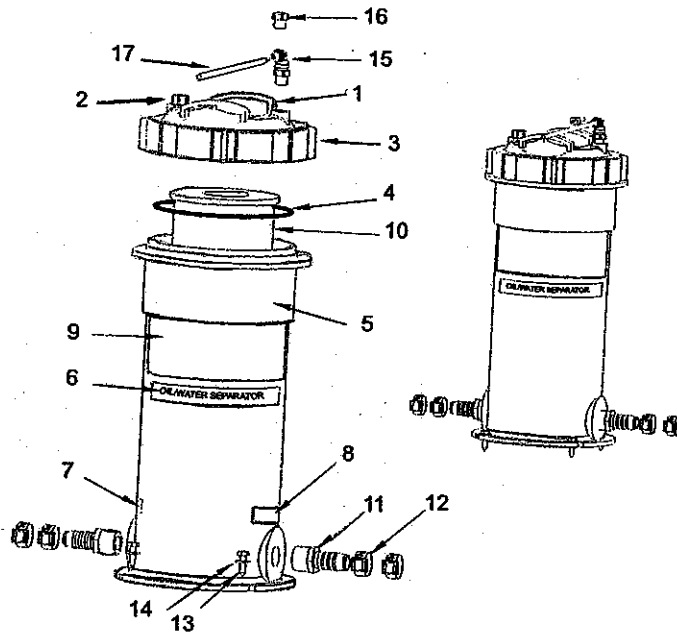
ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1-16	B109120001	COMMERCIAL PREFILTER ASSY 32.5 SQ FT		
1-9	07620310WA	FILTER HOUSING 32.5 SQFT >10/05	1	EA
1		LID FILTER HOUSING 32.5 SQ FT		
2		SAFETY AIR BLEED VALVE FLTR HOUSING 32.5 SQ FT		
3		LID LOCK RING FILTER HOUSING 32.5 SQ FT		
4	07620310WA-06	O-RING LID CPF/OWS 32.5 SQ FT		
5		BASE FILTER HOUSING 32.5 SQ FT		
6	22130102BE	LABEL COMM PRE FILTER	2	EA
7	2234011260	LABEL INLET(SRC BLUE)	1	EA
8	2234011360	LABEL OUTLET ( SRC BLUE)	1	EA
9	2234010460	LABEL SEA RECOVERY CORP LARGE	2	EA
10	0801063357	ELEMENT CPFE AW 5 MIC 32.5 SQFT	1	EA
11	0101653783	ADAP 3/4" MPT X 3/4" BARB PVC	2	EA
12	05181434AA	HOSE CLAMP 3/4" SS	4	EA
13	061172143016	SC HEX "A" 1/4" X 1" SS	4	EA
14	061100043000	WASHER FLAT OS 1/4" SS	4	EA
15	0204020100	ELB90 1/4 TUBE JGX 1/4" MNPT	1	EA
16	0204990300	PLUG 1/4JG	1	EA
17	0312121969	TUBE 1/4" BLACK	15	FT



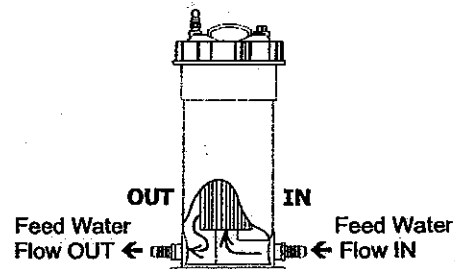
**COMMERCIAL PREFILTER CONNECTION AND WATER FLOW**



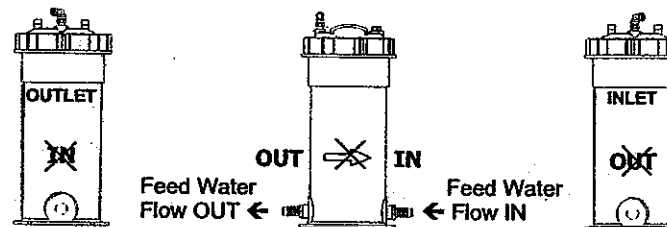
ITEM	PART NUMBER	DESCRIPTION	QTY	U/M
1-16	B111120001	OIL WATER SEPRATOR ASSY 32.5 SQ FT		
1-9	07620310WA	FILTER HOUSING 32.5 SQFT >10/05	1	EA
1		LID FILTER HOUSING 32.5 SQ FT		
2		SAFETY AIR BLEED VALVE FLTR HOUSING 32.5 SQ FT		
3		LID LOCK RING FILTER HOUSING 32.5 SQ FT		
4	07620310WA-06	O-RING LID CPF/OWS 32.5 SQ FT		
5		BASE FILTER HOUSING 32.5 SQ FT		
6	22130101BE	LABEL OIL WATER SEPERATOR	2	EA
7	2234011260	LABEL INLET(SRC BLUE)	1	EA
8	2234011360	LABEL OUTLET ( SRC BLUE)	1	EA
9	2234010460	LABEL SEA RECOVERY CORP LARGE	2	EA
10	08020723KD	ELEMENT OWSE 32.5 SQ FT	1	EA
11	0101653783	ADAP 3/4" MPT X 3/4" BARB PVC	2	EA
12	05181434AA	HOSE CLAMP 3/4" SS	4	EA
13	061172143016	SC HEX "A" 1/4" X 1" SS	4	EA
14	061100043000	WASHER FLAT OS 1/4" SS	4	EA
15	0204020100	ELB90 1/4" TUBE JGX 1/4" MNPT	1	EA
16	0204990300	PLUG 1/4"JG	1	EA
17	0312121969	TUBE 1/4" BLACK	15	FT



### OIL/WATER SEPARATOR CONNECTION & WATER FLOW

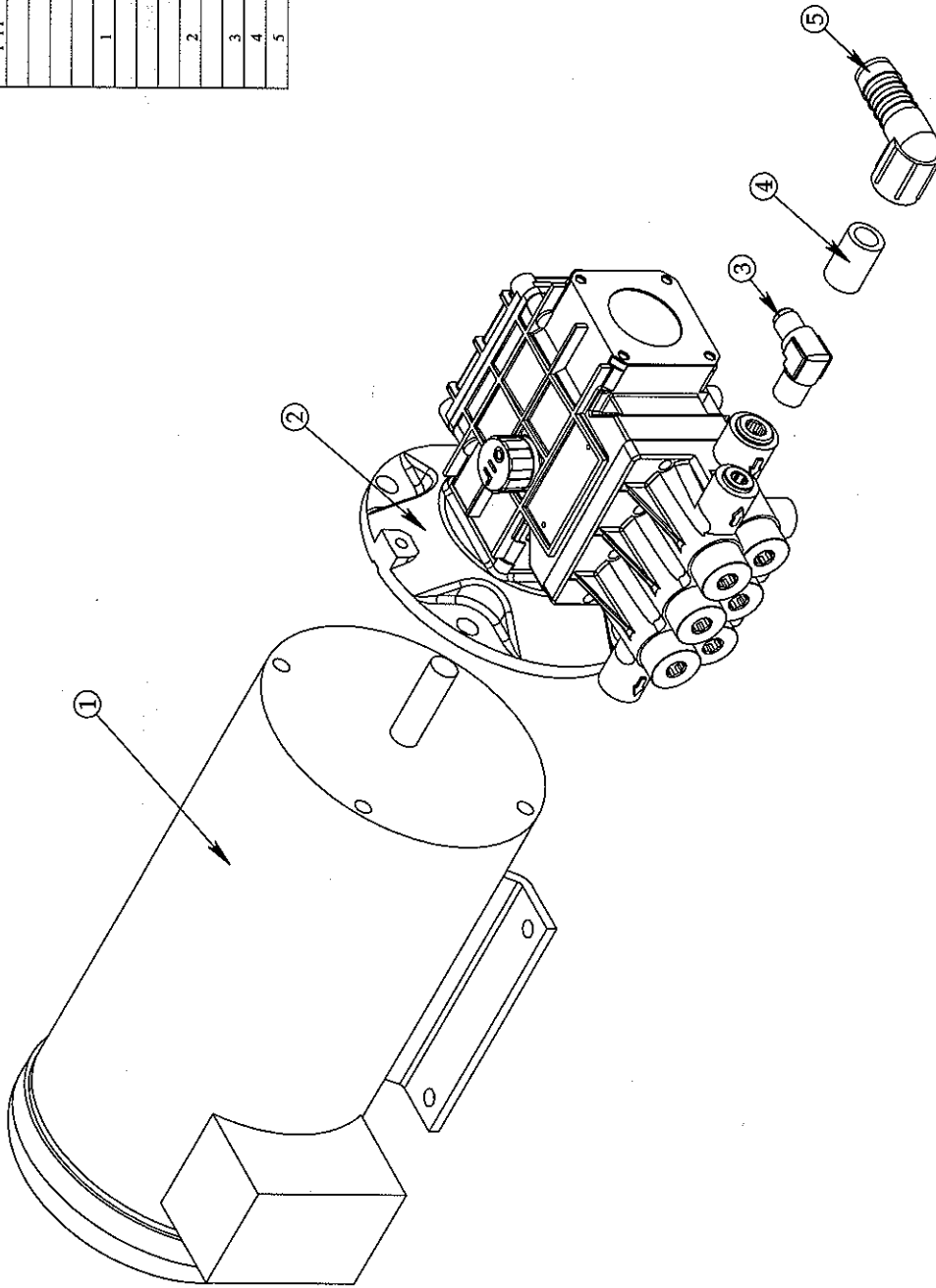


Feed Water Flow through the Oil/Water Separator Element is from the **INSIDE CENTER** of the Element to the **OUTSIDE** of the element



Oil/Water Separator utilizes the same housing as the Commercial Prefilter, however it is plumbed **OPPOSITE** of the Commercial Prefilter and **OPPOSITE** of the raised arrows and markings IN and OUT. Separate Labels are placed on the Oil/Water Separator indicating correct **INLET** and **OUTLET**

ITEM NO.	QTY.	PART NO.	DESCRIPTION
1-11	1	H2156210001	HP PMA 2.1 HP/50/60/3.0 GPM 1 PH
	1	H2156210002	HP PMA 2.5 HP/50/60/4.2 GPM 1 PH
	1	H2156210004	HP PMA 3.0 HP/60/3.0 GPM 3 PH
	1	H2156210005	HP PMA 3.0 HP/50/4.2 GPM 3 PH
	1	H2156210006	HP PMA 3.0 HP/60/4.2 GPM 3 PH
	1	15AD062412	MOTOR 2.1 HP 50/60 110/220 1 PH
	1	15AC062412	MOTOR 2.5 HP 50/60 110/220 1 PH
	1	15AE231012	MOTOR 3.0 HP 220/380/50/3
	1	15AF241012	MOTOR 3.0 HP 220/460/60/3
2	1	12180511CO	HP PUMP/ 3.0 GPM SS
	1	12180512CO	HP PUMP/ 4.2 GPM SS
3	1	1317021969	ELB90 -6 FLARE x 3/8 MPT SS
4	1	01013725CL	NIPPLE 1/2 NPT x CLOSE PVC
5	1	0101062683	ELB90 1/2 FPT x 3/4 BARB PVC



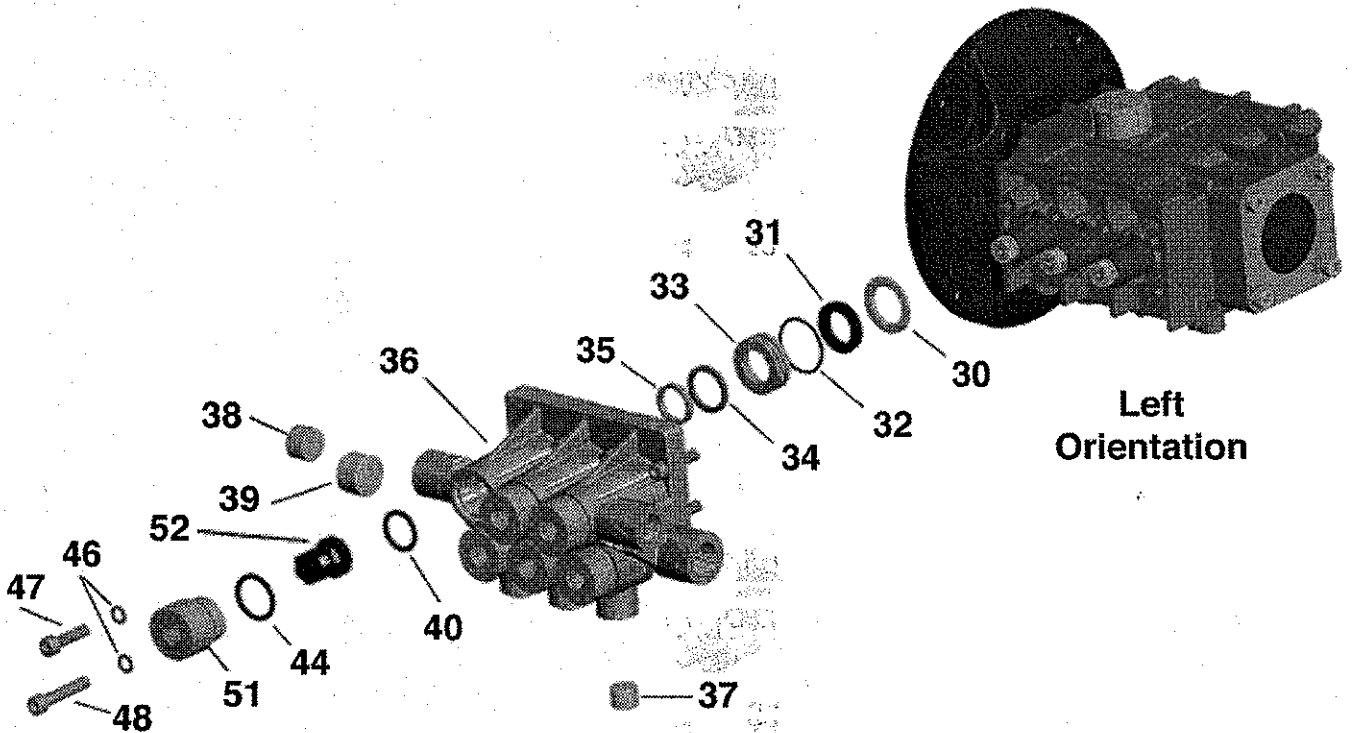
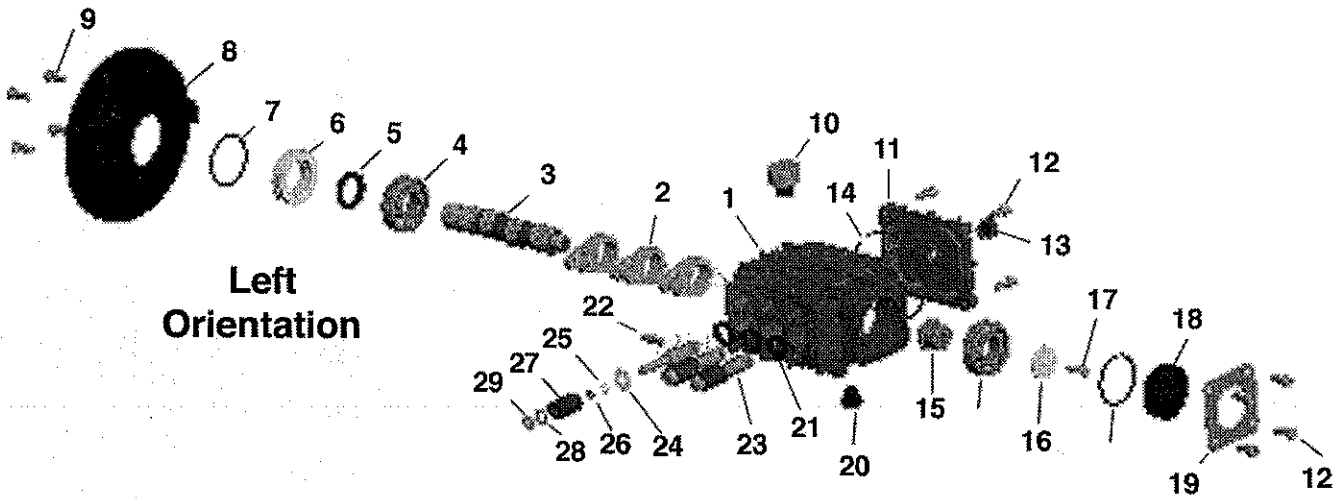
HRO Systems Horizon *Seafari* Self Contained and Modular Style

ITEM	PART NUMBER	DESCRIPTION	QTY
1 - 52	<b>12180511CO</b>	<b>HP PUMP-GP/ 3.0 GPM SS LEFTHAND</b>	1
	<b>12180512CO</b>	<b>HP PUMP-GP/ 4.2 GPM SS LEFTHAND</b>	
1 - 29	<b>12180511CO-CCAL</b>	<b>HP PUMP-GP/ 3.0 GPM CRANKCASE ASSY</b>	1
	<b>12180512CO-CCAL</b>	<b>HP PUMP-GP/ 4.2 GPM CRANKCASE ASSY</b>	
30 - 52	<b>12180511CO-WE</b>	<b>HP PUMP-GP/ COMPLETE MANIFOLD ASSY</b>	1
1	not sold separately	Crankcase	1
2	not sold separately	Connecting Rod	3
3	not sold separately	Crankshaft 5/8" Hollow 3.0 gpm	1
	not sold separately	Crankshaft 5/8" Hollow 4.2 gpm	1
4	not sold separately	Bearing	2
5	not sold separately	Oil Seal, Crankshaft	1
6	not sold separately	Retainer Oil Seal	1
7	not sold separately	O-Ring, Oil Seal Retainer/Side Cover	2
8	not sold separately	Flange, NEMA 56C Face	1
9	not sold separately	Screw SCHS 18mm Long	4
10	not sold separately	Oil Cap Vented	1
11	not sold separately	Rear Cover	1
12	not sold separately	Screw SCHS 16mm Long	8
13	not sold separately	Sight Glass	1
14	not sold separately	O-Ring, Rear Cover	1
15	not sold separately	Bushing	1
16	not sold separately	Washer	1
17	not sold separately	Screw SCHS 20mm Long	1
18	not sold separately	Side Cover	1
19	not sold separately	Side Plate	1
20	not sold separately	Oil Drain Plug	1
21	not sold separately	Oil Seal Plunger	3
22	not sold separately	Wrist Pin	3
23	not sold separately	Plunger Rod	3
24	not sold separately	Slinger	3
25	not sold separately	Anti-Extrusion Ring	3
26	not sold separately	O-Ring Plunger	3
27	not sold separately	Plunger 18mm	3
28	not sold separately	Washer, Plunger Rod	3
29	not sold separately	Nut, Plunger Rod	3
30	not sold separately	Seal Retainer	3
31	not sold separately	Low Pressure Seal	3
32	not sold separately	O-Ring Seal Case	3
33	not sold separately	Seal Case	3
34	not sold separately	Square Ring, High Pressure Seal	3
35	not sold separately	Glide Ring, High Pressure Seal	3
36	<b>12180510CO-36</b>	<b>HP PUMP-GP MANIFOLD</b>	1
37	not sold separately	1/4 NPT Plug	3
38	not sold separately	3/8 NPT Plug	1
39	not sold separately	1/2 NPT Plug	1
40	not sold separately	O-Ring Valve Spacer	6
44	not sold separately	O-Ring Valve Plug	6
46	not sold separately	Washer, Ribbed Lock	8
47	not sold separately	Screw SHCS M5 x 25mm Long	4
48	not sold separately	Screw SHCS M5 x 35mm Long	4
51	not sold separately	Valve Plug	6
52	not sold separately	Valve Assembly 3.0 gpm / 4.2 gpm	6
30 - 55, 40, 44, 52	<b>B652090002</b>	<b>HP PUMP-GP PUMP KIT (SEALS &amp; VALVES)</b>	3 Seals, 6 Valves
30 - 35	<b>B653090001</b>	<b>HP PUMP-GP SEAL KIT</b>	3 Seals
40, 44, & 52	<b>B654080002</b>	<b>HP PUMP-GP VALVE REBUILD KIT</b>	6 Valves
7, 26, 40, 44	<b>H2665210005</b>	<b>HP PUMP-GP O-RING KIT</b>	O-Ring Kit

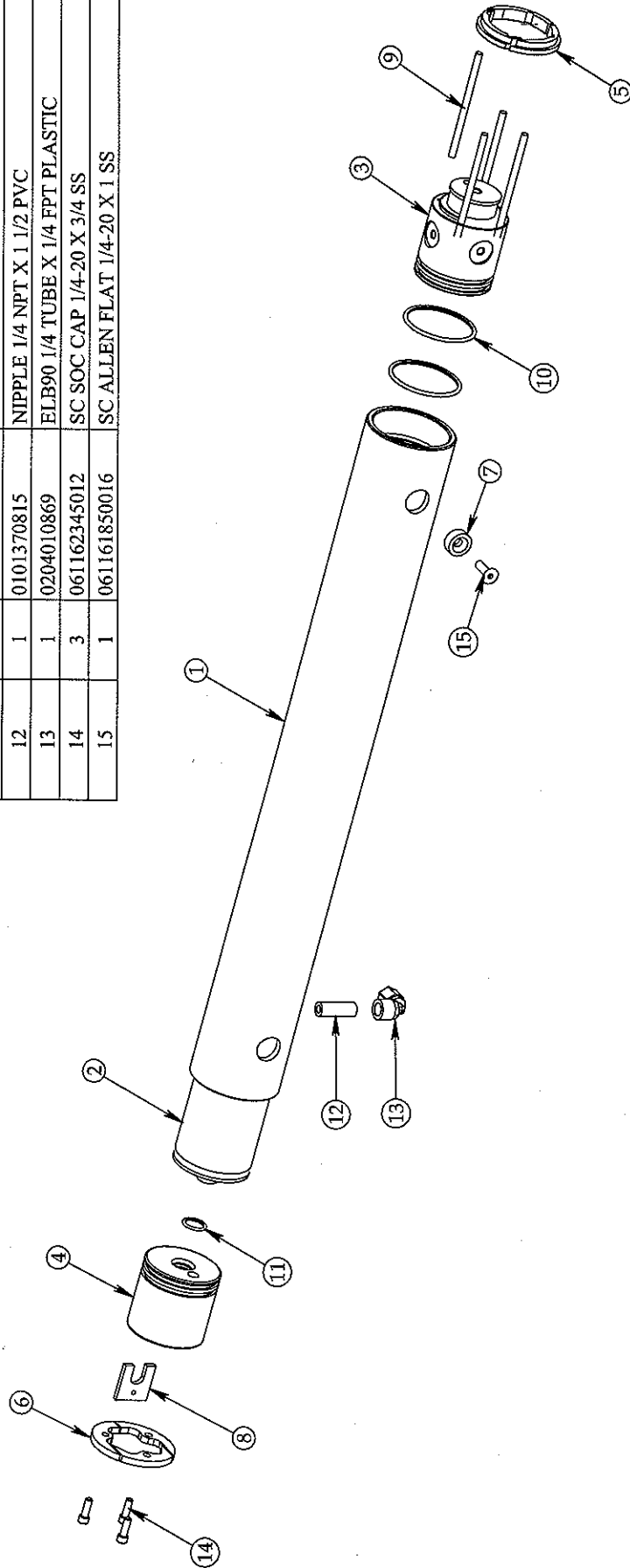
NOTE: Above Items in **BOLD CAPS** are available from HRO Systems.

## HIGH PRESSURE PUMP HORIZON SEAFARI LEFT ORIENTATION

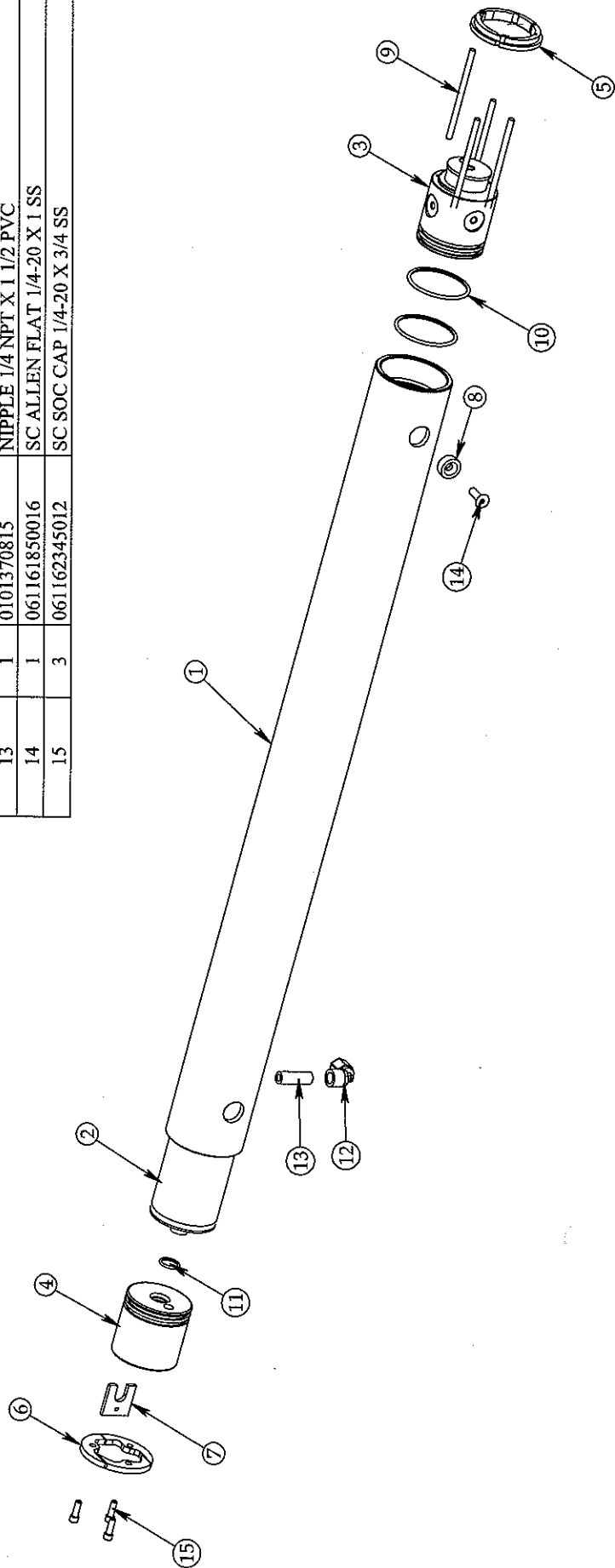
Capacities available in 3.0 GPM and 4.2 GPM



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2408132500	VESSEL HIGH PRESSURE 400GPD SF
2	1	2724011233	MEMBRANE 400GPD SF W/SEAL
3	1	H36160532400	END PLUG 3" THRU HOLE, HORIZON SEAFARI
4	1	H36160522400	END PLUG 3" DUAL, HORIZON SEAFARI
5	1	H31740100006	SPLIT-RING, HORIZON SEAFARI
6	1	20201030000	SEGMENT RING MVA
7	1	H31740092115	END PLUG BUSHING, HORIZON SEAFARI
8	1	0520210600	RETAINER PORT MVA SF
9	4	061240043078	THREADED ROD (STUD) 1/4-20 x 4 3/8 SS
10	4	2614014900	O-RING BRINE 3" END PLUG
11	2	2614010100	O-RING PRODUCT/BRINE CAP
12	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
13	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
14	3	061162345012	SC SOC CAP 1/4-20 X 3/4 SS
15	1	061161850016	SC ALLEN FLAT 1/4-20 X 1 SS

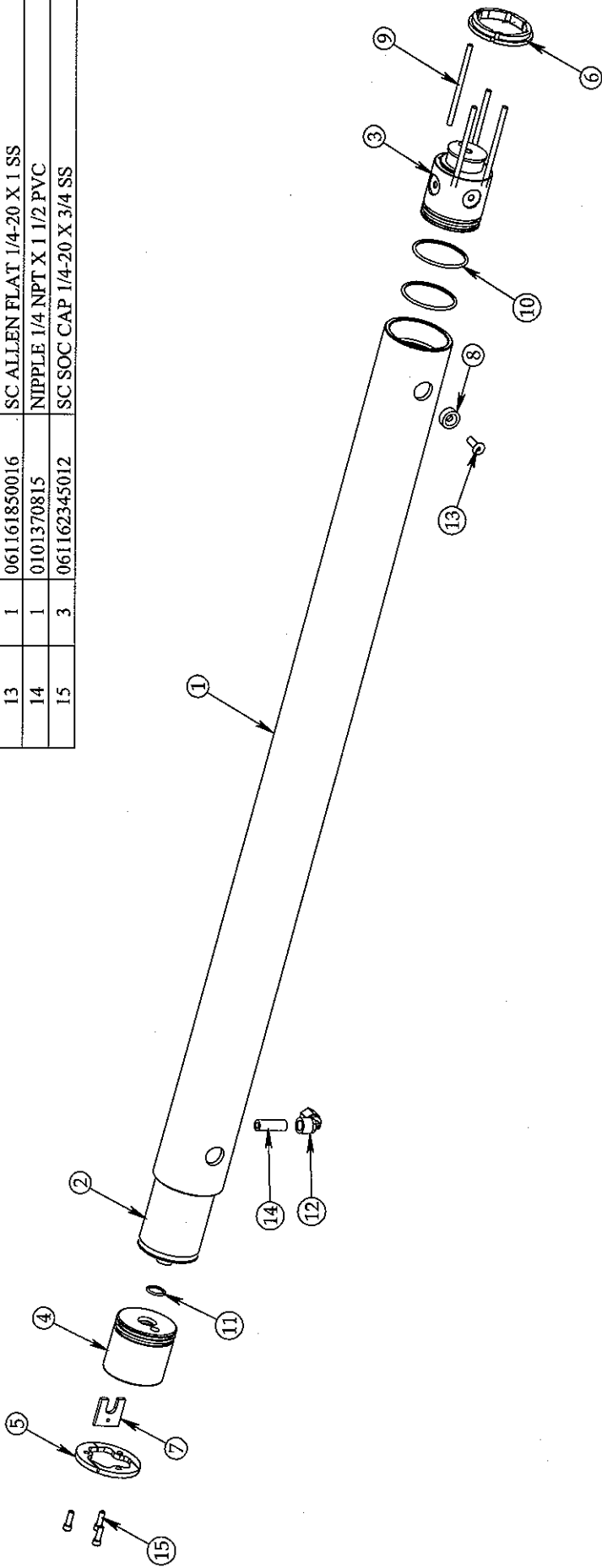


ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2408132500-01	VESSEL HIGH PRESSURE 600GPD SF
2	1	2724011333	MEMBRANE 600GPD SF W/ SEAL
3	1	H36160532400	END PLUG 3" THRU HOLE, HORIZON SEAFARI
4	1	H36160522400	END PLUG 3" DUAL, HORIZON SEAFARI
5	1	H31740100006	SPLIT-RING, HORIZON SEAFARI
6	1	20201030000	SEGMENT RING MVA
7	1	0520210600	RETAINER PORT MVA SF
8	1	H31740092115	END PLUG BUSHING, HORIZON SEAFARI
9	4	061240043078	THREADED ROD (STUD) 1/4-20 x 4 3/8 SS
10	4	2614014900	O-RING BRINE 3" END PLUG
11	2	2614010100	O-RING PRODUCT/BRINE CAP
12	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
13	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
14	1	061161850016	SC ALLEN FLAT 1/4-20 X 1 SS
15	3	061162345012	SC SOC CAP 1/4-20 X 3/4 SS

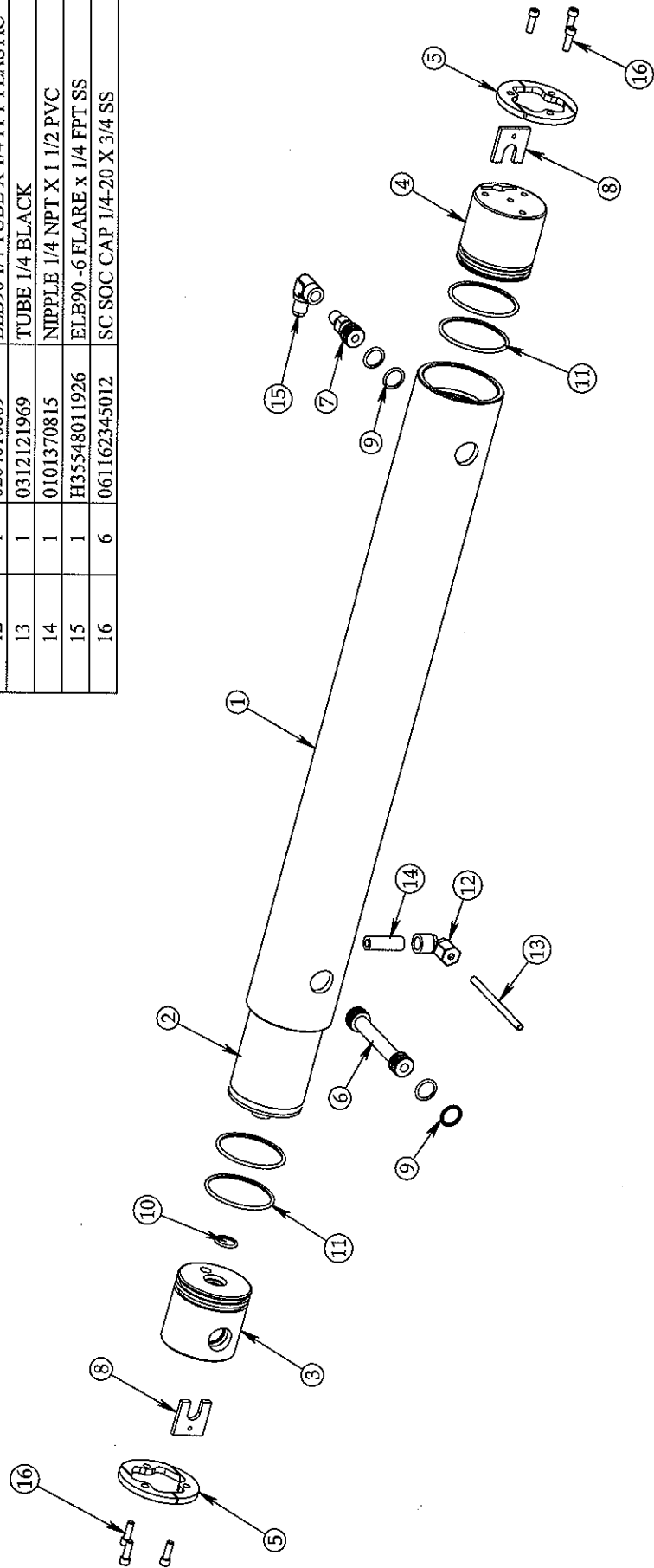




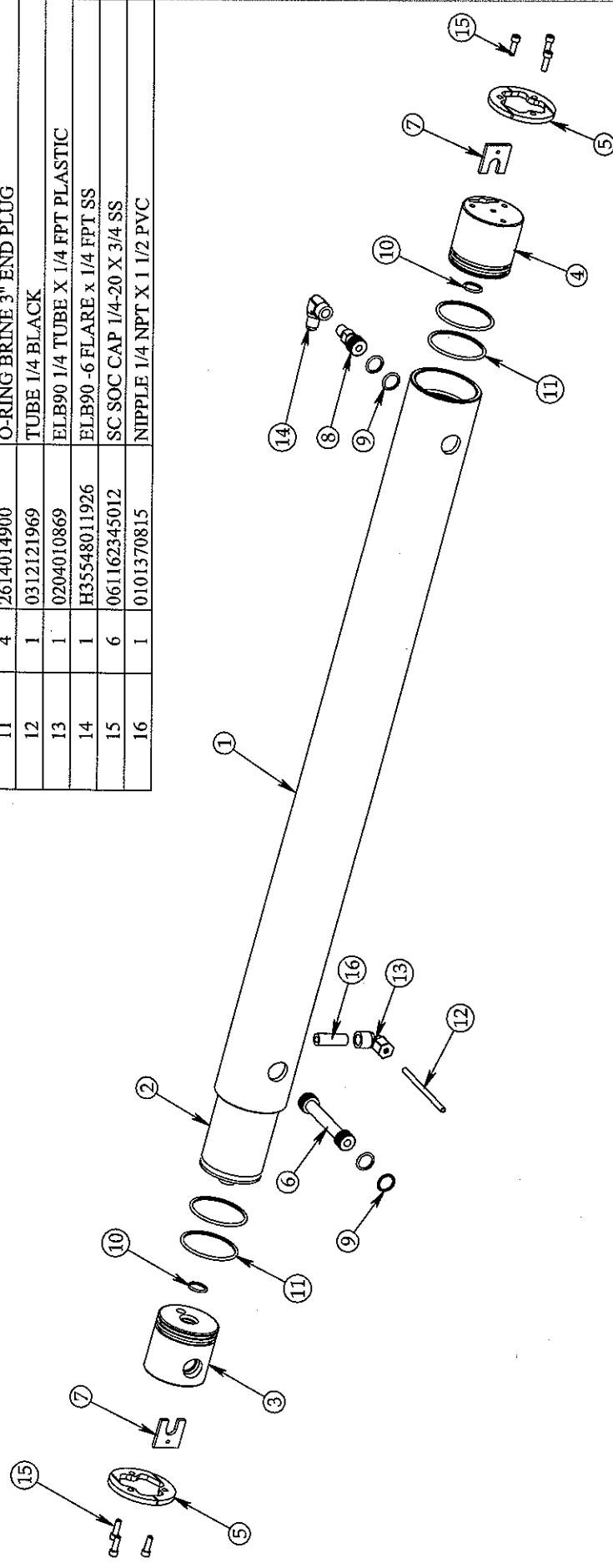
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2408132500-02	VESSEL HIGH PRESSURE 800GPD 3"
2	1	2724011433	MEMBRANE 800GPD SF W/ SEAL
3	1	H36160532400	END PLUG 3" THRU HOLE, HORIZON SEAFARI
4	1	H36160522400	END PLUG 3" DUAL, HORIZON SEAFARI
5	1	20201030000	SEGMENT RING MVA
6	1	H31740100006	SPLIT-RING, HORIZON SEAFARI
7	1	0520210600	RETAINER PORT MVA SF
8	1	H31740092115	END PLUG BUSHING, HORIZON SEAFARI
9	4	061240043078	THREADED ROD (STUD) 1/4-20 x 4 3/8 SS
10	4	2614014900	O-RING BRINE 3" END PLUG
11	2	2614010100	O-RING PRODUCT/BRINE CAP
12	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
13	1	061161850016	SC ALLEN FLAT 1/4-20 X 1 SS
14	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
15	3	061162345012	SC SOC CAP 1/4-20 X 3/4 SS



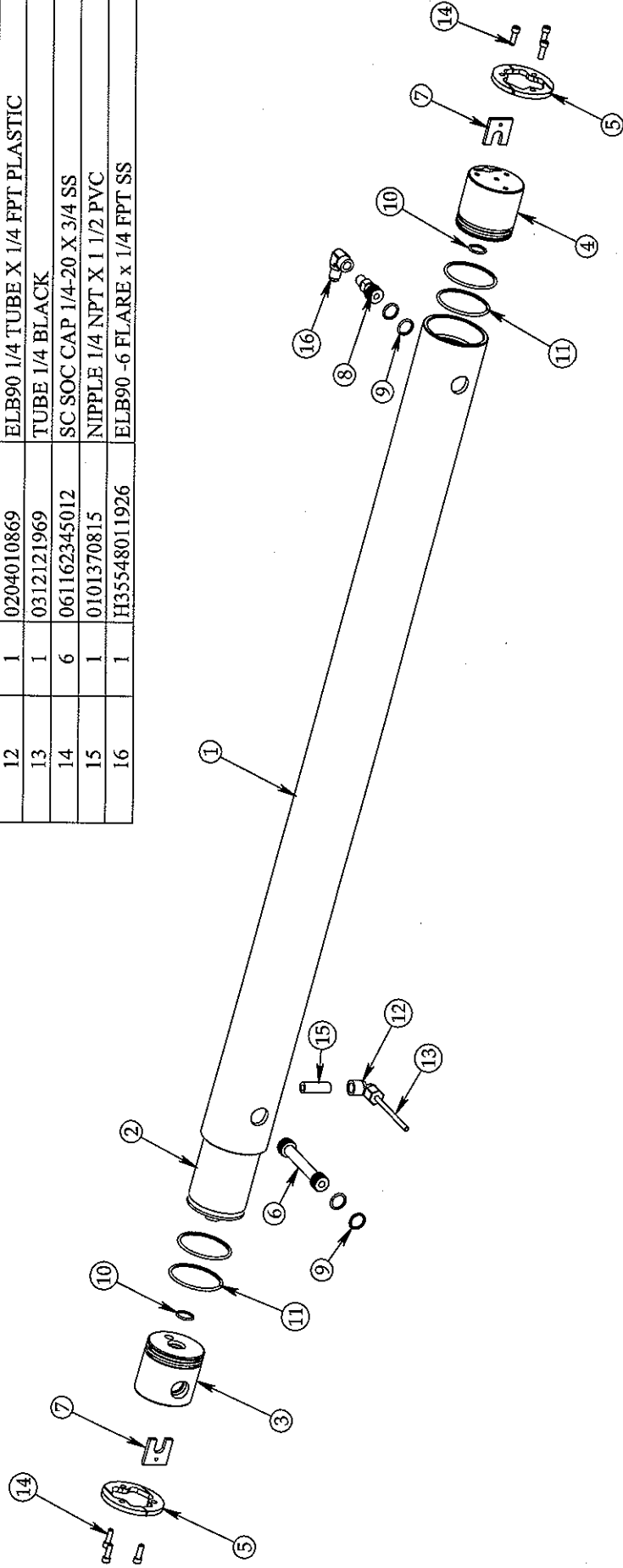
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2408132500	VESSEL HIGH PRESSURE 400GPD SF
2	1	2724011233	MEMBRANE 400GPD SF W/SEAL
3	1	2453512400	END PLUG DUAL 3" SF
4	1	2453502400	END PLUG SINGLE 3" SF
5	2	20201030000	SEGMENT RING MVA
6	1	2417430800	INTERCONNECT MVA SS
7	1	0117410800	NIPPLE HP MVA SF
8	2	0520210600	RETAINER PORT MVA SF
9	6	2614017900	O-RING INTERCONNECT
10	2	2614010100	O-RING PRODUCT/BRINE CAP
11	4	2614014900	O-RING BRINE 3" END PLUG
12	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
13	1	0312121969	TUBE 1/4 BLACK
14	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
15	1	H35548011926	ELB90 -6 FLARE x 1/4 FPT SS
16	6	061162345012	SC SOC CAP 1/4-20 X 3/4 SS



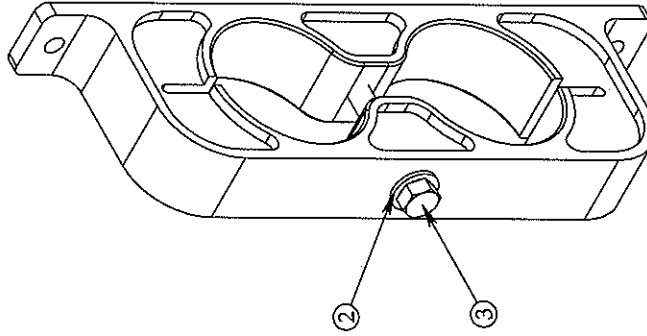
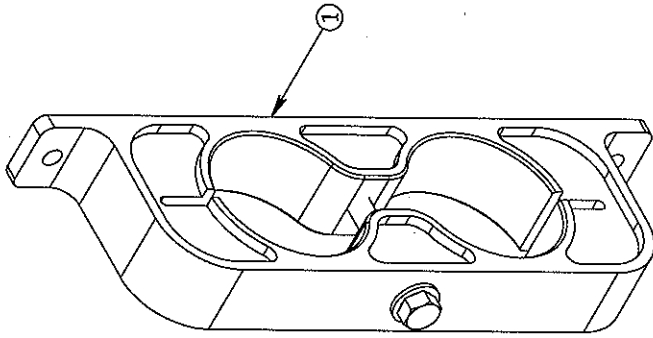
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2408132500-01	VESSEL HIGH PRESSURE 600GPD SF
2	1	2724011333	MEMBRANE 600GPD SF W/ SEAL
3	1	2453512400	END PLUG DUAL 3" SF
4	1	2453502400	END PLUG SINGLE 3"
5	2	20201030000	SEGMENT RING MVA
6	1	2417430800	INTERCONNECT MVA SS
7	2	0520210600	RETAINER PORT MVA SF
8	1	0117410800	NIPPLE HP MVA SF
9	6	2614017900	O-RING INTERCONNECT
10	2	2614010100	O-RING PRODUCT/BRINE CAP
11	4	2614014900	O-RING BRINE 3" END PLUG
12	1	0312121969	TUBE 1/4 BLACK
13	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
14	1	H35548011926	ELB90 -6 FLARE x 1/4 FPT SS
15	6	061162345012	SC SOC CAP 1/4-20 X 3/4 SS
16	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC



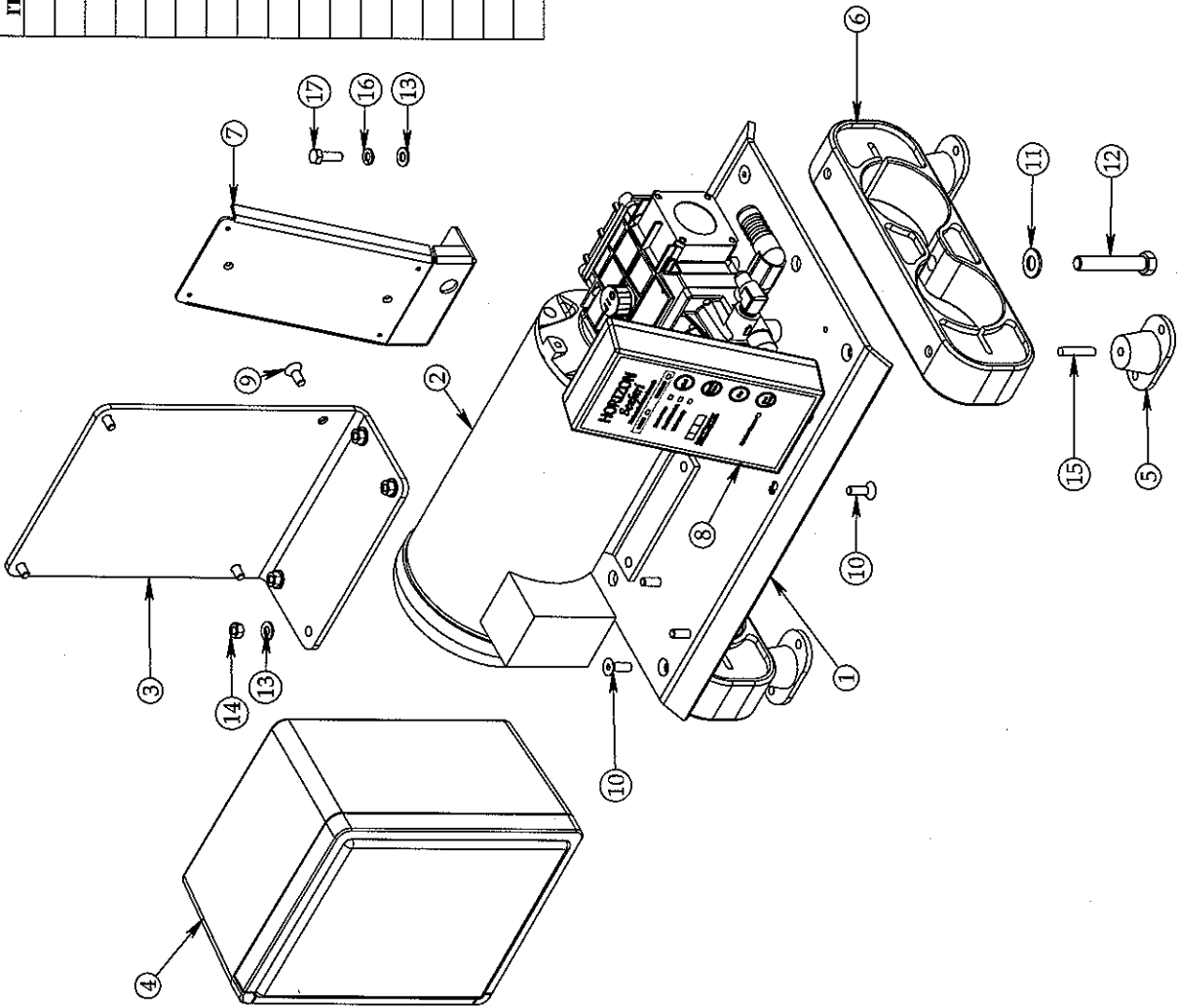
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2408132500-02	VESSEL HIGH PRESSURE 800GPD 3"
2	1	2724011433	MEMBRANE 800GPD SF W/ SEAL
3	1	2453512400	END PLUG DUAL 3" SF
4	1	2453502400	END PLUG SINGLE 3" SF
5	2	20201030000	SEGMENT RING MVA
6	1	2417430800	INTERCONNECT MVA SS
7	2	0520210600	RETAINER PORT MVA SF
8	1	0117410800	NIPPLE HP MVA SF
9	6	2614017900	O-RING INTERCONNECT
10	2	2614010100	O-RING PRODUCT/BRINE CAP
11	4	2614014900	O-RING BRINE 3" END PLUG
12	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
13	1	0312121969	TUBE 1/4 BLACK
14	6	061162345012	SC SOC CAP 1/4-20 X 3/4 SS
15	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
16	1	H35548011926	ELB90 -6 FLARE x 1/4 FPT SS



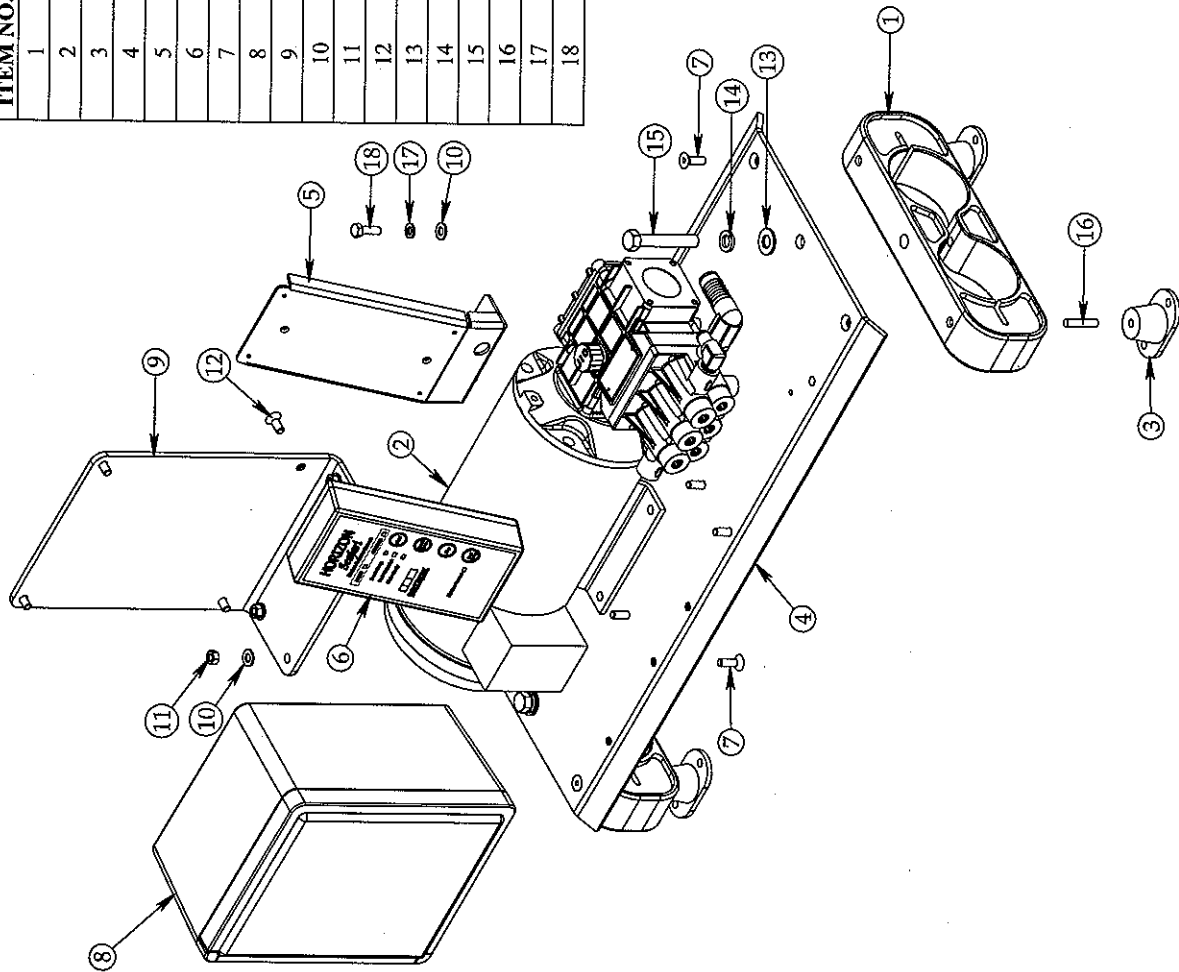
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	2	H31740042104	VESSEL FRAME, WALL MOUNT, HORIZON SEAFARI
2	2	061100066000	WASHER FLAT OS 1/2"SS
3	2	061142167048	BOLT HEX 1/2-13 X 3 SS



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	H31740052101	TOP PLATE HORIZONTAL (SHORT)
2	1	H215621XXXX	PUMP MOTOR ASSEMBLY
3	1	H31740042108	CONNECTION ENCLOSURE BRACKET
4	1	H310312221BQ	ENCLOSURE, CONNECTION, HORIZON SEAFARI
5	4	H33738030135	VIBRATION ISOLATOR RUBBER MOUNT
6	2	H31740042103	VESSEL FRAME, HORIZON SEAFARI
7	1	H31740042105	BRACKET, CONTROLLER, HORIZON SEAFARI
8	1	H31031222171	ENCLOSURE, CONTROLLER, HORIZON SEAFARI
9	4	061161850012	SC ALLEN FLAT 5/16-18 X 3/4 SS
10	7	061161850016	SC ALLEN FLAT 1/4-20 X 1 SS
11	2	061100066000	WASHER FLAT OS 1/2"SS
12	2	061142167048	BOLT HEX 1/2-13 X 3 SS
13	6	061100049000	WASHER FLAT OS 5/16"SS
14	4	061060050000	NUT HEX 5/16-18 W/INSERT SS
15	4	H3061240050024	THREADED ROD 5/16-18 X 1 1/2 SS
16	2	061120049000	WASHER SPLIT LOCK 5/16" SS
17	1	061142150016	BOLT HEX 5/16-18 X 1 SS



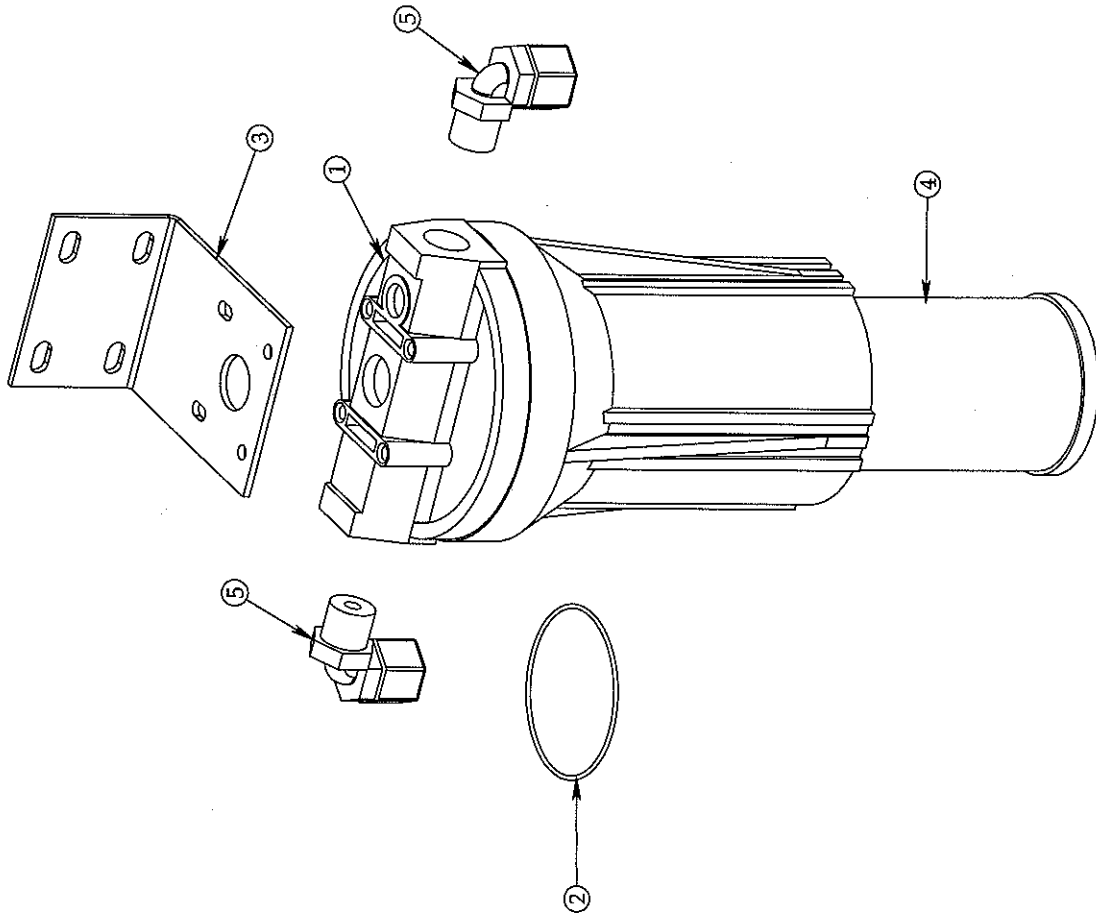
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	2	H31740042103	VESSEL FRAME, HORIZON SEAFARI
2	1	H215621XXXX	PUMP MOTOR ASSEMBLY
3	4	H33738030135	VIBRATION ISOLATOR RUBBER MOUNT
4	1	H31740052102	TOP PLATE HORIZONTAL (LONG), HORIZON SEAFARI
5	1	H31740042105	BRACKET, CONTROLLER, HORIZON SEAFARI
6	1	H31031222171	ENCLOSURE, CONTROLLER, HORIZON SEAFARI
7	7	061161850016	SC ALLEN FLAT 1/4-20 X 1 SS
8	1	H310312221BQ	ENCLOSURE, CONNECTION, HORIZON SEAFARI
9	1	H31740042108	CONNECTION ENCLOSURE BRACKET
10	7	061100049000	WASHER FLAT OS 5/16"SS
11	5	061060050000	NUT HEX 5/16-18 W/INSERT SS
12	4	061161850012	SC ALLEN FLAT 5/16-18 X 3/4 SS
13	2	061100066000	WASHER FLAT OS 1/2"SS
14	2	061120066000	WASHER SPLIT LOCK 1/2" SS
15	2	061142167048	BOLT HEX 1/2-13 X 3 SS
16	4	H3061240050024	THREADED ROD 5/16-18 X 1 1/2 SS
17	2	061120049000	WASHER SPLIT LOCK 5/16" SS
18	2	061142150016	BOLT HEX 5/16-18 X 1 SS



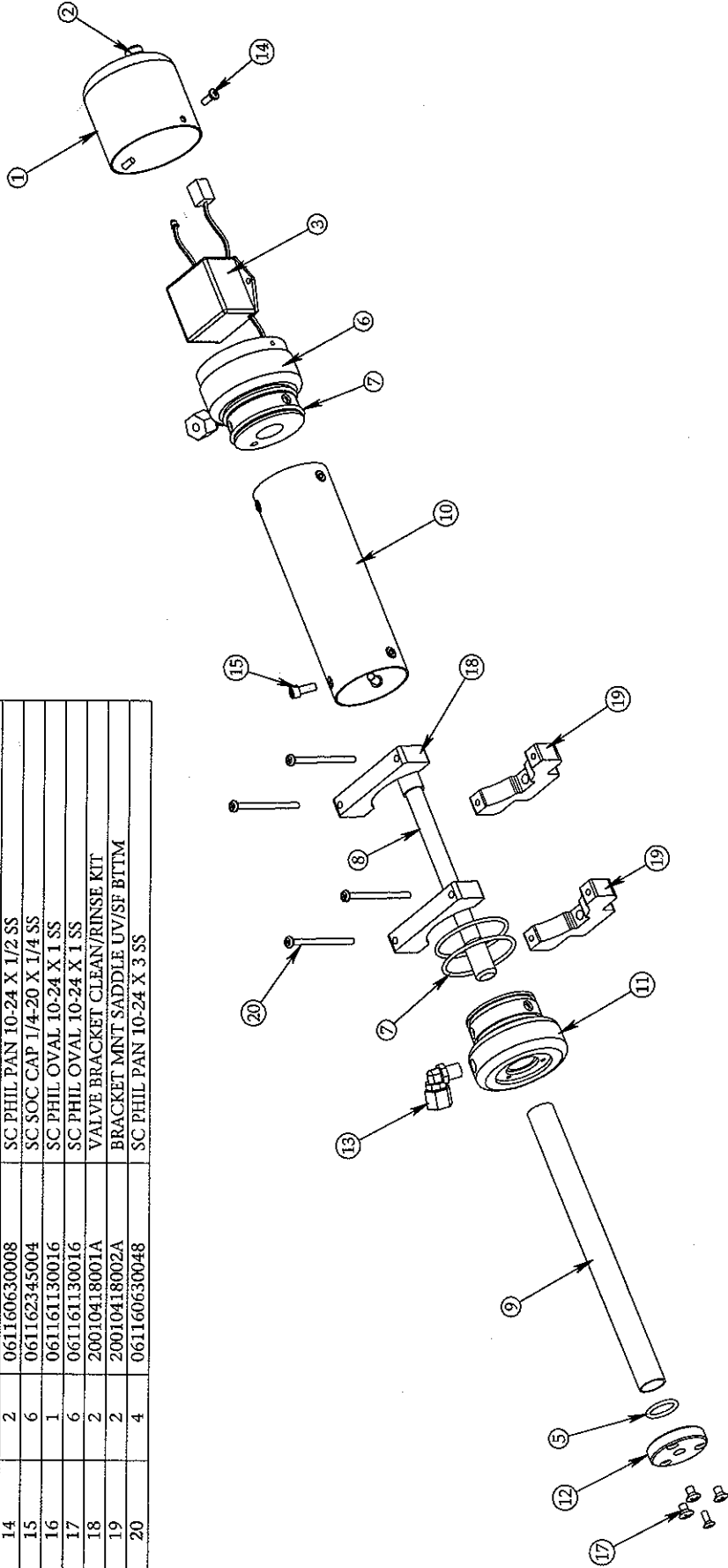


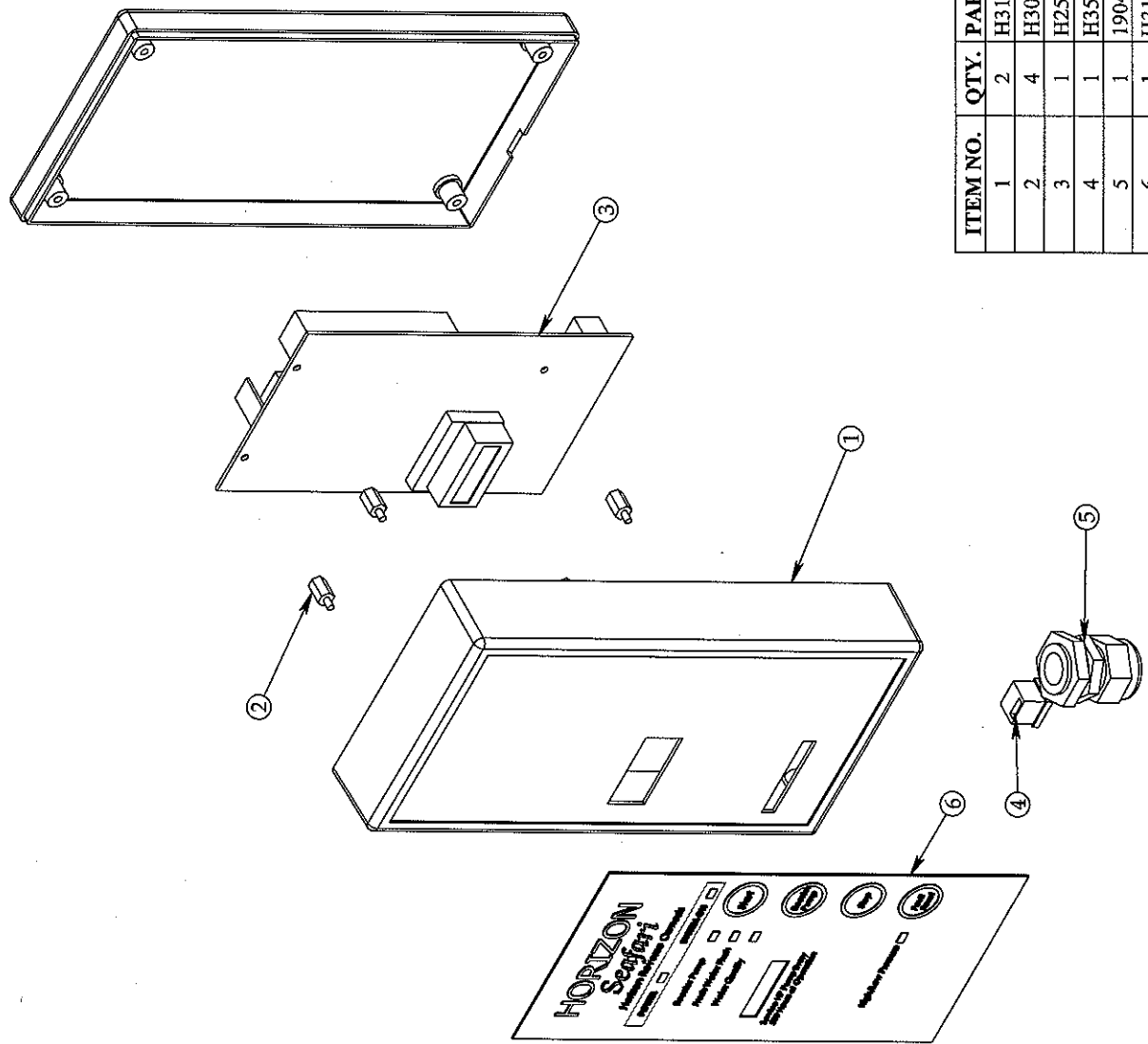


ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	0713020573	FILTER HOUSING/LID 3/8 X 10
2	1	2614010473	O-RING BLUE HOUSING
3	1	20200402100	BRACKET PREFILTER/CHRCL/PLNKTN
4	1	0803004773	ELEMENT CHARCOAL 9.8"
5	2	0204021869	ELB90 3/8 TUBE X 3/8 MPT PLASTIC



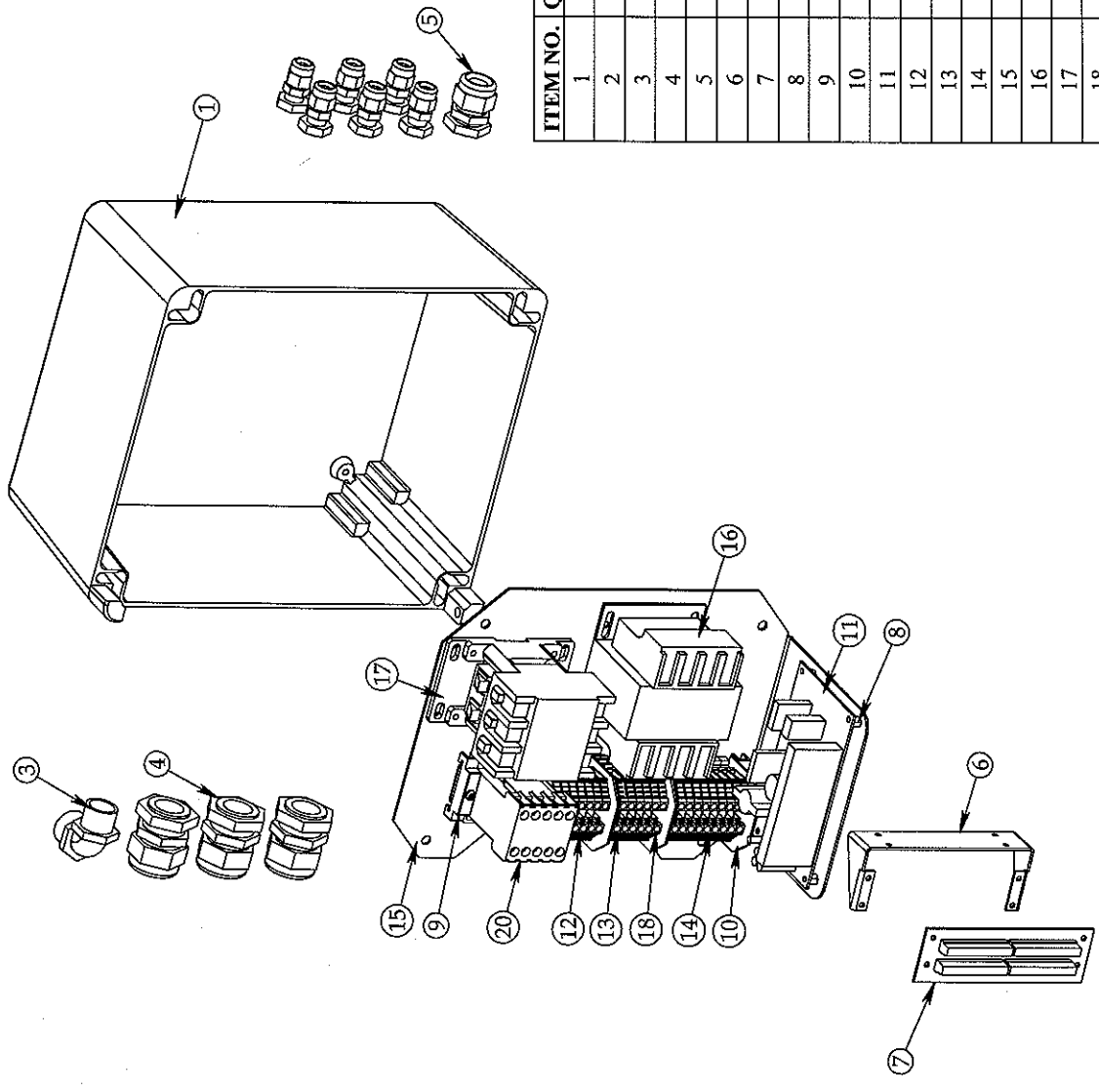
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	4000160100	CAP ELECTRICAL U.V. STL
2	1	1904010643	STRAIN RELIEF 3444 BLK
3	1	4000021400	BALLAST 12VDC-4C SF
4	1	4000100200	BUSHING TOP END U.V. STL
5	2	2614011800	O-RING AIR BLEED VALVE
6	1	2401532200	END PLUG TOP U.V.
7	4	2614010200	O-RING BRINE 2 1/2" #227
8	1	4000010400	LAMP UV SF
9	1	4000040400	QUARTZ SLEEVE UV SF
10	1	2417202200	VESSEL U.V. STERILIZER
11	1	2401522200	END PLUG BTM U.V.
12	1	4000100300	BUSHING BTM END U.V. STL
13	2	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLASTIC
14	2	061160630008	SC PHIL PAN 10-24 X 1 1/2 SS
15	6	061162345004	SC SOC CAP 1/4-20 X 1/4 SS
16	1	061161130016	SC PHIL OVAL 10-24 X 1 SS
17	6	061161130016	SC PHIL OVAL 10-24 X 1 SS
18	2	20010418001A	VALVE BRACKET CLEAN/RINSE KIT
19	2	20010418002A	BRACKET MNT SADDLE UV/SF BTM
20	4	061160630048	SC PHIL PAN 10-24 X 3 SS





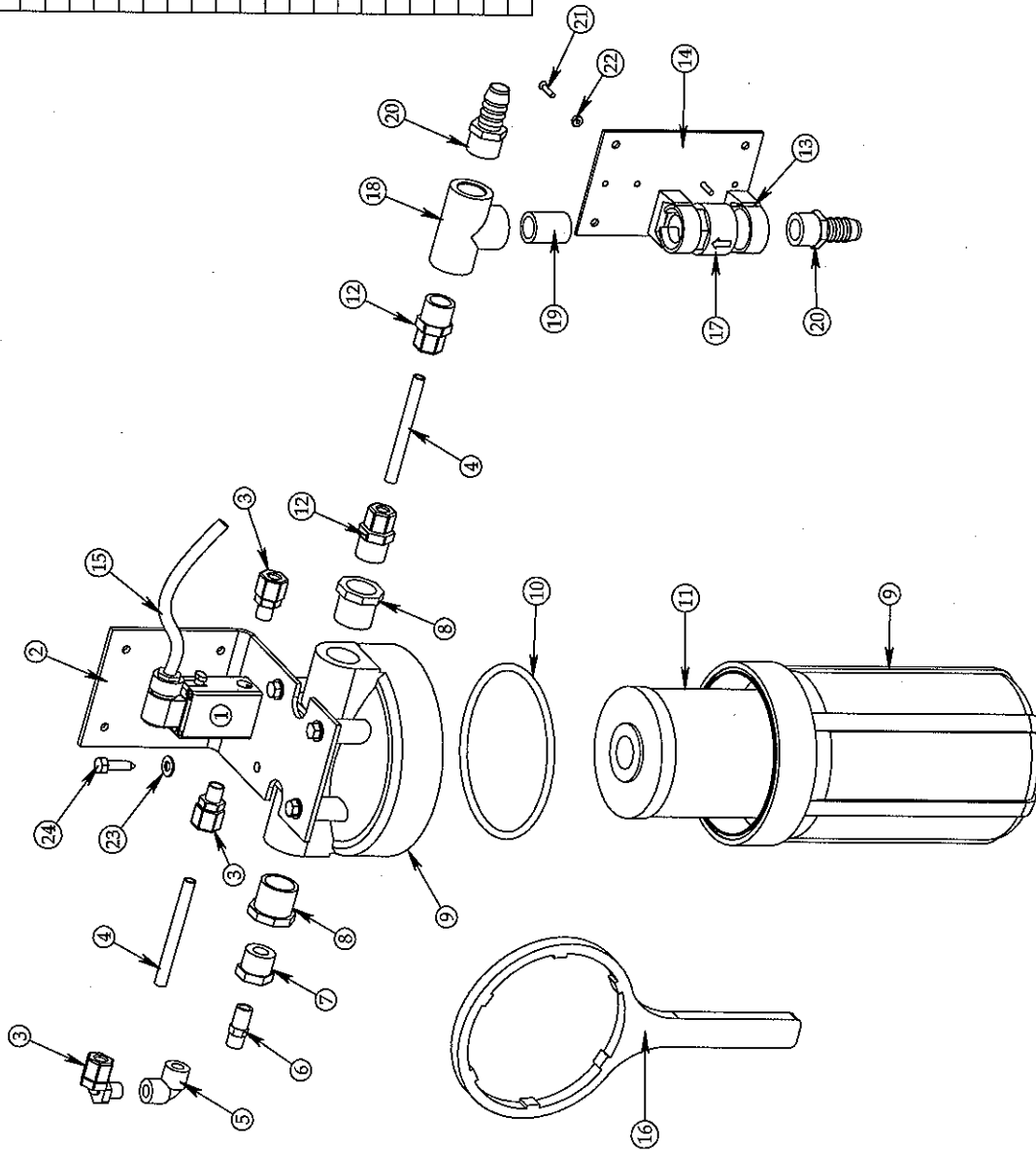
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	2	H31031222171	ENCLOSURE, CONTROLLER, HORIZON SEAFARI
2	4	H3067262712006	STANDOFF 4-40 X 3/8 MAL X FEM
3	1	H2596210004	PCB MAIN, HORIZON SEAFARI
4	1	H35158010911	STRAIN RELIEF 1829
5	1	1904010043	STRAIN RELIEF 3217 1/2" GREY
6	1	H310315601CU	TOUCH PAD MAIN

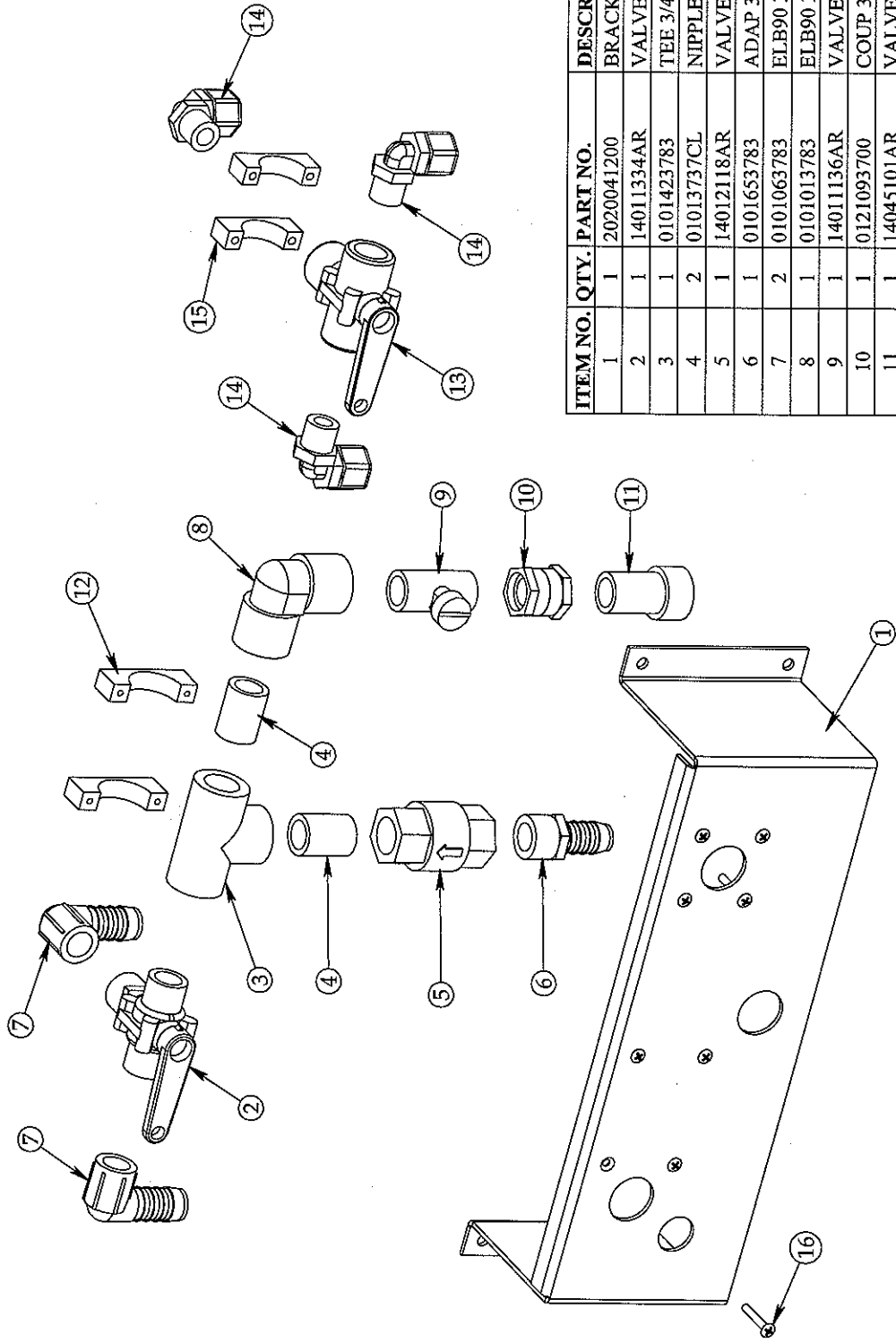
1. H2600210001 IS USED IN SYSTEMS UP TO 240V.  
THIS ASSEMBLY DOES NOT INCLUDE ITEM #16.
2. H2600210002 IS USED IN SYSTEMS 380V AND UP.  
THIS ASSEMBLY IS SHOWN THIS SHEET.



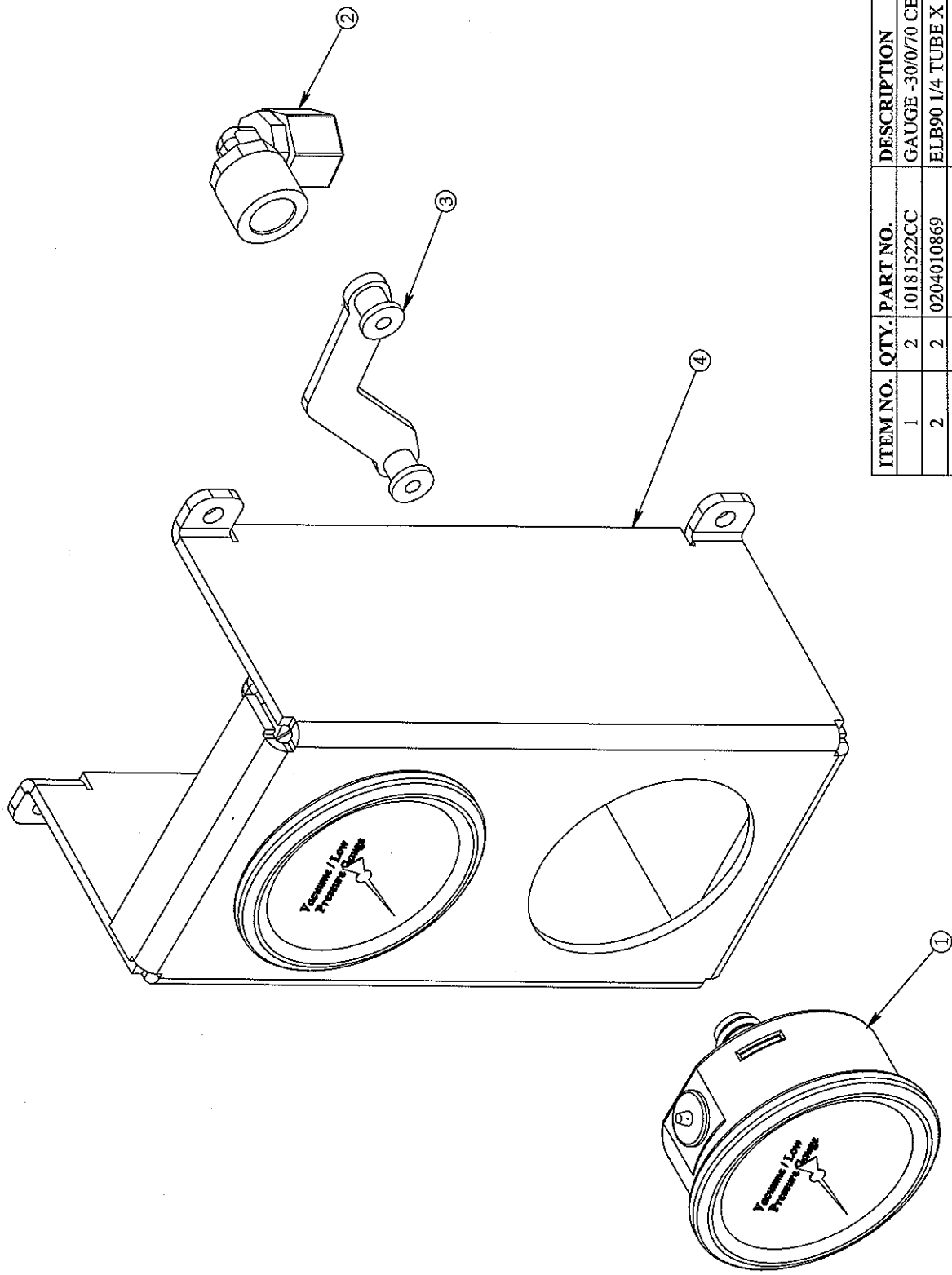
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	H310312221BQ	ENCLOSURE, CONNECTION, HORIZON SEAFARI
2	6	1904010643	STRAIN RELIEF 3444 BLK
3	1	1920043590	STRAIN RELIEF 3/8 LIQITITE 90
4	3	1904010343	STRAIN RELIEF 3223 3/4" GREY
5	1	H35158010077	STRAIN RELIEF 3217
6	1	H31740042127	BRACKET TERMINAL STRIP HORIZON SEAFARI
7	1	H2603210001	TERMINAL STRIP HORIZON SEAFARI
8	4	067272720004	STANDOFF 6-32 X 1/4 MAL X FEM
9	2	3131190347	END ANCHOR
10	3	31311602BY	SEPARATOR DIN
11	1	31314301CW	POWER SUPPLY 12VDC
12	6	31311503BY	DIN TERMINAL (BLUE)
13	7	31311501BY	DIN TERMINAL (BLACK)
14	7	31311502BY	DIN TERMINAL (RED)
15	1	3131231700	CHASSIS PLATE
16	1	3131131100	TRANSFORMER 3 PHASE
17	1	31310603BF	CONTACTOR 30A 12VDC
18	4	31311504BY	DIN TERMINAL (GREEN)
19	1	3131170147	CHANNEL DIN 35 MM RAIL
20	1	31310110BF	CONTACTOR 9A AUX 12VDC

ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	1401095998	VALVE SOLENOID 12VDC AED/CSFE
2	1	2020040001	BRACKET CARBON FILTER HSG FWF
3	3	0204021769	ELB90 3/8 TUBE X 1/4 MPT PLASTIC
4	2	0312123569	TUBE 3/8 BLACK
5	1	0101010883	ELB90 1/4 FPT X 1/4 FPT PVC
6	1	14172105AT	VALVE CHECK 1/4" MPT SS
7	1	0101293483	RB 3/4 MT X 1/4 FT PVC
8	2	0101294283	RB 1 MT X 1/2 FT PVC
9	1	0713020606	FILTER HOUSING BIG BLUE
10	1	2614010500	O-RING BIG BLUE HOUSING
11	1	0803004906	ELEMENT CARBON BRIQUETTE 10"
12	2	0204092069	CONN 3/8 TUBE X 3/4 MPT PLASTIC
13	2	0501164400	PIPE SUPPORT 1"
14	1	2020040002	BRACKET CHECK VALVE FWF
15	1	H2618210002	CABLE ASSEMBLY FWF
16	1	0713020606-3	FILTER LID WRENCH BIG BLUE
17	1	14012118AR	VALVE CHECK 3/4" FPT WITH VHO
18	1	0101423783	TEE 3/4 FT X 3/4 FT X 3/4 FT PVC
19	1	01013737CL	NIPPLE 3/4 NPT X CLOSE PVC
20	2	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC
21	2	061161626012	SC PHIL FLAT 8-32 X 3/4 SS
22	2	061060026000	NUT HEX 8-32 W/INSERT SS
23	4	061100049000	WASHER FLAT OS 5/16" SS
24	4	061172149020	SC HEX "A" 5/16 X 1 1/4 LAG SS



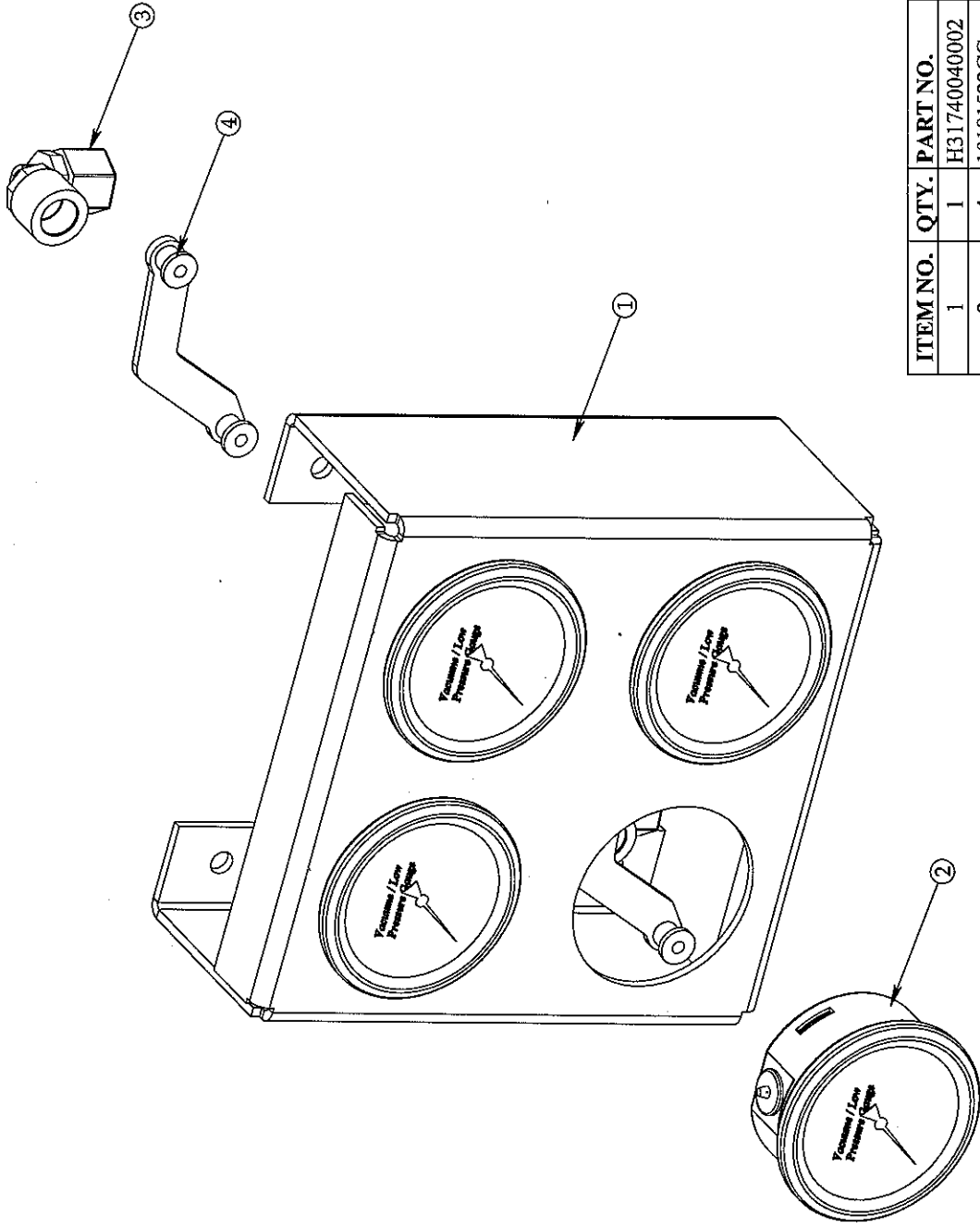


ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2020041200	BRACKET MNT CLEAN RINSE
2	1	14011334AR	VALVE 3-WAY BALL 3/4" MPT
3	1	0101423783	TEE 3/4 FT X 3/4 FT X 3/4 FT PVC
4	2	01013737CL	NIPPLE 3/4 NPT X CLOSE PVC
5	1	14012118AR	VALVE CHECK 3/4" FPT WITH VITO
6	1	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC
7	2	0101063783	ELB90 3/4 FPT X 3/4 BARB PVC
8	1	0101013783	ELB90 3/4 FPT X 3/4 FPT PVC
9	1	14011136AR	VALVE BALL 3/4" MT X 3/4"GHT
10	1	0121093700	COUP 3/4FGHT X 3/4FGHT BRASS
11	1	14045101AR	VALVE PRESS REDUCING BRASS
12	2	1453131700-03	VALVE BRACKET CLEAN/RINSE KIT
13	1	14011336AR	VALVE 3-WAY BALL 1/2" FPT
14	3	0204022569	ELB90 1/2 TUBE X 1/2 MPT PLASTIC
15	2	1453131700-02	VALVE BRACKET 3/4" SL
16	8	061161130020	SC PHIL OVAL 10-24 X 1 1/4 SS



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	2	10181522CC	GAUGE -30/0/70 CBM.NPT
2	2	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
3	2	05180851CC	BRACKET MOUNTING CBM GAUGE
4	1	H31740040003	PANEL TWO GAUGE HORIZON SEAFARI

Page L - 28 H2012210002 LOW PRESSURE GAUGE PANEL, 2 GAUGE, HORIZON SEAFARI



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	H31740040002	PANEL FOUR GAUGE HORIZON SEAFARI
2	4	10181522CC	GAUGE -30/0/70 CBM.NPT
3	4	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLASTIC
4	4	05180851CC	BRACKET MOUNTING CBM GAUGE



**NOTES:**



## **APPENDIX A**

# **Wiring Information & Diagrams**

## ELECTRICAL REQUIREMENTS

The Electric Motors within the Horizon Seafari systems start in series with time delay between each motor starting. First, the Booster Pump starts, then the main High Pressure Pump Electric Motor starts.

For a normal Marine Ship installation, the current surges with the Booster Pump starting, then drop down to Booster Pump Electric Motor running Amperes. At the instant of the High Pressure Pump starting, the current surges up again then drop down to normal system running amperage.

Therefore, the Maximum surge current equals the Booster Pump Running Amperage plus the High Pressure Pump Starting Amperage. The normal running Amperage equals both the Booster Pump Motor and High pressure Pump Motor combined running Amperage.

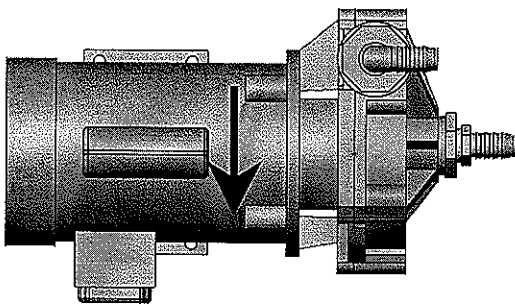
## AC INDUCTION MOTORS

After unpacking, check for damage. Be sure that the shaft rotates freely.

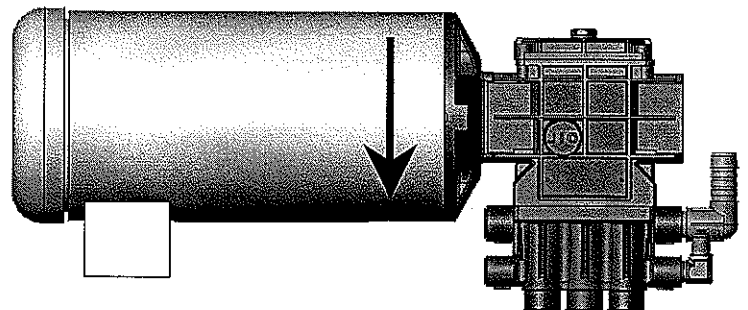
Check line voltage, frequency and phase, ensure that it agrees with system nameplate. Grounding and circuit protection should be done in accordance with National Electrical Code. See connection diagram on nameplate of motor or refer to the diagrams on pages Appendix - 7 - 12.

### POWER SOURCE REQUIREMENTS:

Voltage	HZ (AC)	Min. Voltage	Max. Voltage	Min. HZ	Max. HZ
<b>AC Systems Single Phase</b>					
120 VAC	60 HZ	108 VAC	132 VAC	58 HZ	62 HZ
230 VAC	60 HZ	207 VAC	253 VAC	58 HZ	62 HZ
220 VAC	50 HZ	198 VAC	242 VAC	48 HZ	52 HZ
<b>AC Systems Three Phase</b>					
208 VAC	60 HZ	187 VAC	228 VAC	58 HZ	62 HZ
230 VAC	60 HZ	207 VAC	253 VAC	58 HZ	62 HZ
460 VAC	60 HZ	414 VAC	506 VAC	58 HZ	52 HZ
220 VAC	50 HZ	198 VAC	242 VAC	48 HZ	52 HZ
380 VAC	50 HZ	342 VAC	418 VAC	48 HZ	52 HZ



**BOOSTER PUMP ROTATION**



**HIGH PRESSURE PUMP ROTATION**

**RECOMMENDED CIRCUIT BREAKER:**

**HORIZON SEAFARI SYSTEMS**

Operating Voltage 115 VAC, Single Phase  
Circuit Breaker Size 30 Amperes

Operating Voltage 230 VAC, Single Phase  
Circuit Breaker Size 15 Amperes

Operating Voltage 208 VAC, Three-Phase  
Circuit Breaker Size 10 - 15 Amperes

Operating Voltage 230 VAC, Three Phase  
Circuit Breaker Size 10 Amperes

Operating Voltage 380 VAC, Three Phase  
Circuit Breaker Size 7.5 - 10 Amperes

Operating Voltage 460 VAC, Three Phase  
Circuit Breaker Size 5 - 7.5 Amperes

**RECOMMENDED COPPER WIRE & SIZE FOR  
MAIN POWER FEED LINE**

Operating Voltage 115 VAC, Single Phase  
Minimum Power Line Wire Size 10 AWG

Operating Voltage 230 VAC, Single Phase  
Minimum Power Line Wire Size 12 AWG

Operating Voltage 208 VAC, Three Phase  
Minimum Power Line Wire Size 12 AWG

Operating Voltage 230 VAC, Three Phase  
Minimum Power Line Wire Size 12 AWG

Operating Voltage 380 VAC, Three Phase  
Minimum Power Line Wire Size 12 AWG

Operating Voltage 460 VAC, Three Phase  
Minimum Power Line Wire Size 12 AWG

**MOTOR ROTATION:**

**Single Phase Systems:**

The High Pressure Pump Electric Motor rotation is pre-wired by HRO prior to shipment.

The Booster Pump Motor rotation is controlled by interchanging two specific wires at the Electric Motors wiring box.

**Three Phase Systems**

The High Pressure Pump and Booster Pump Electric Motor rotation is controlled by interchanging any two of the three power lines at the Electric Motors wiring box connections.

**WIRING CONNECTIONS**

Refer to each individual Electrical Motor, which include attached name plate with wiring diagram or separate wiring diagram plate, decal or label.

**NOTE:** Use the following procedure when changing motor voltage as shown on pages Appendix - 7 through Appendix - 12. Wire nuts are supplied when system is shipped and are taped inside controller lid for voltage modifications.

1. Cut crimped motor leads as close to the crimped terminal.
2. Wires which, need to be jumpered (connected) must be stripped with stripped length not exceeding 1/2".
3. When two wires are jumpered, use the supplied blue wire nuts. When three wires are jumpered, use the supplied yellow wire nuts.
4. Do not over-tighten wire nuts.

**Single-Phase System Rotation:**

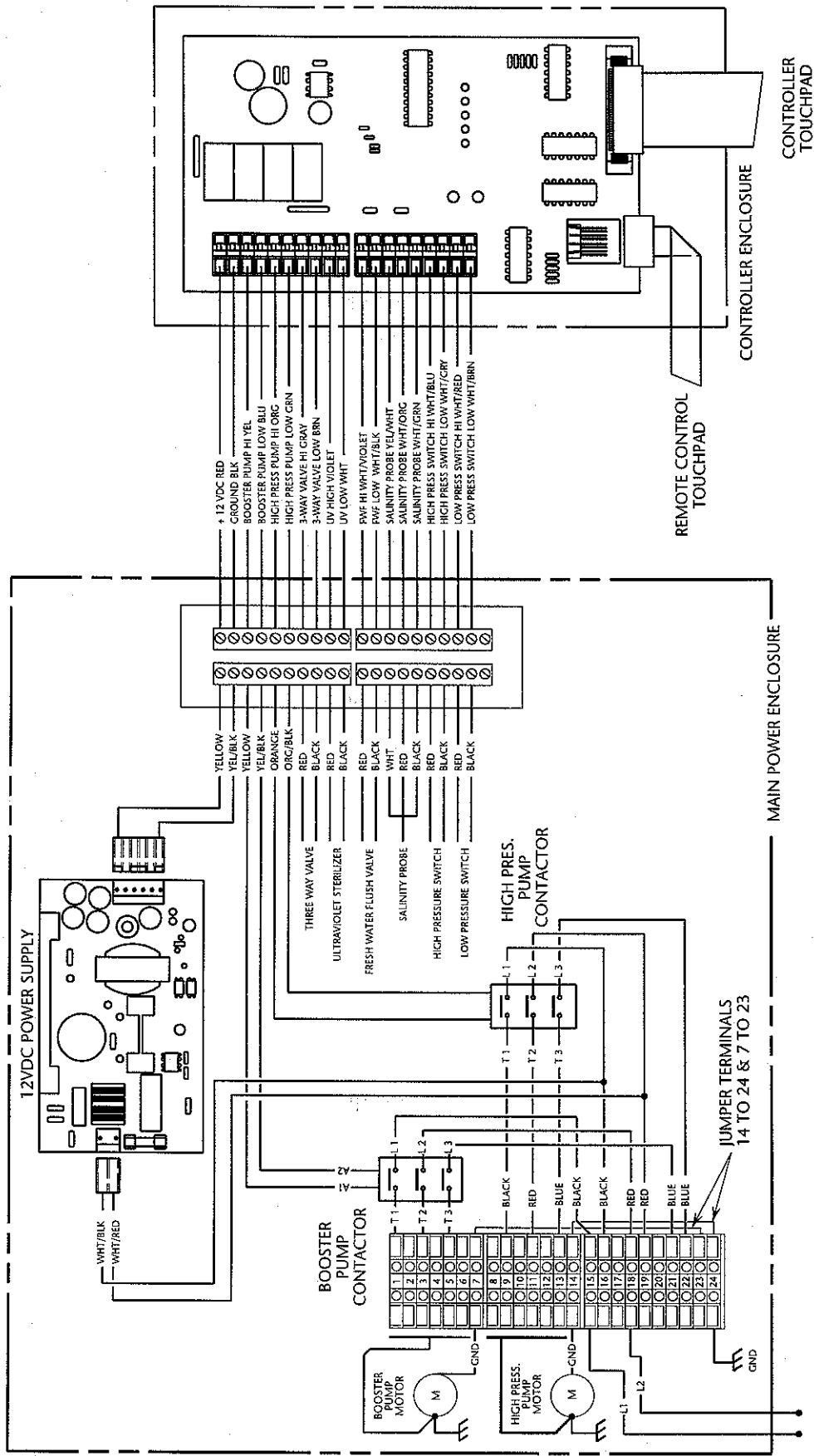
JOG TO CHECK ROTATION BEFORE OPERATING. TO REVERSE ROTATION INTERCHANGE MOTOR LEADS 5 AND 8 LOCATED INSIDE THE REAR COVER. HOWEVER, WIRING CONNECTIONS LISTED ABOVE ARE PROPER FOR THE SEA RECOVERY SYSTEM.

**Three-Phase System Rotation:**

JOG TO CHECK ROTATION BEFORE OPERATING. THREE PHASE MOTORS ONLY - TO REVERSE ROTATION INTERCHANGE ANY TWO POWER LEADS.

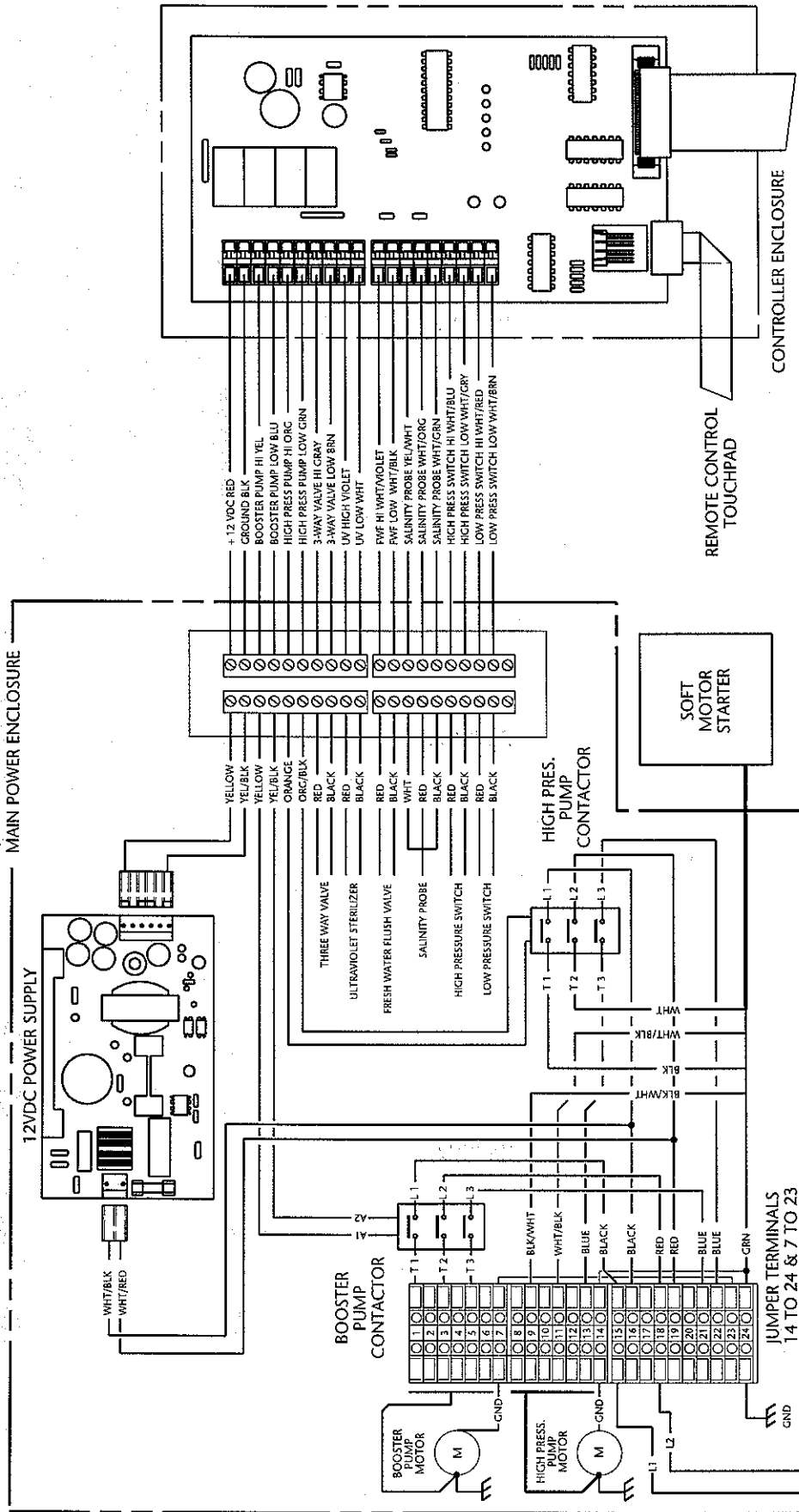
# HORIZON Seafari Electrical Diagram

## 110/220 VAC Single Phase Standard Controller



# HORIZON Seafari Electrical Diagram

110/220 VAC Single Phase with Soft Motor Start



CONTROLLER TOUCHPAD

CONTROLLER ENCLOSURE

REMOTE CONTROL TOUCHPAD

SOFT MOTOR STARTER

### SOFT MOTOR STARTER INSTALLATION INSTRUCTIONS:

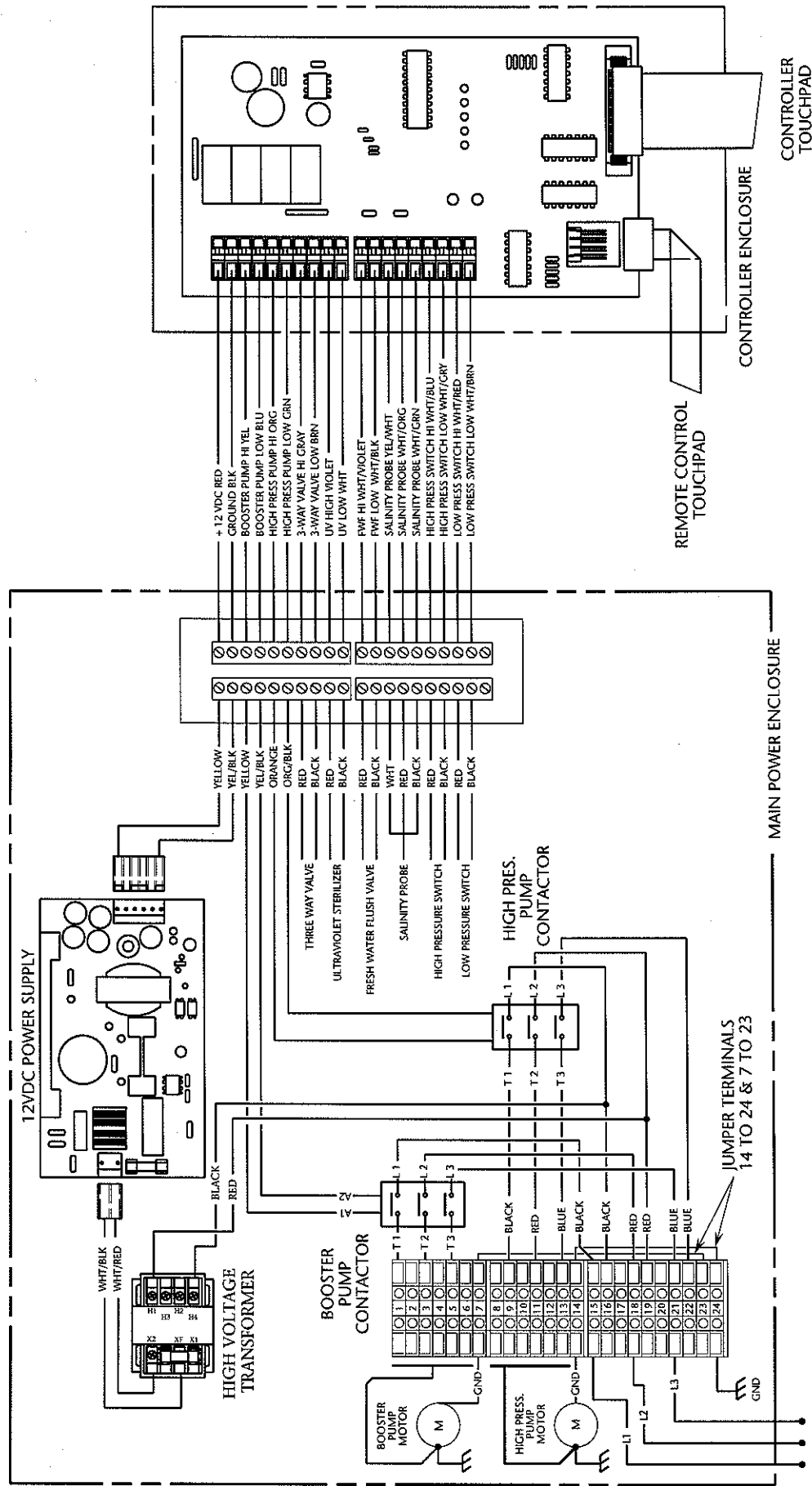
1. INSERT WHITE SOFT MOTOR STARTER CABLE THROUGH THE LARGE GRAY STRAIN RELIEF ON LEFT SIDE OF MAIN POWER ENCLOSURE. (STRAIN RELIEF IS ITEM #4 ON PAGE L-25)
2. REMOVE BLACK WIRE EXTENDING FROM TERMINAL #9 TO TERMINAL T-1 OF THE HIGH PRESS. PUMP CONTACTOR & DISCARD.
3. CONNECT BLACK/WHITE STRIPE WIRE TO TERMINAL #8 OR #9.
4. CONNECT BLACK WIRE OF THE SOFT MOTOR STARTER TO TERMINAL T-1 ON THE HIGH PRESS. PUMP CONTACTOR.
5. REMOVE RED WIRE EXTENDING FROM TERMINAL #11 TO TERMINAL T-2 OF THE HIGH PRESS. PUMP CONTACTOR & DISCARD.
6. CONNECT WHITE/BLACK WIRE TO TERMINAL #10 OR #11.
7. CONNECT WHITE WIRE OF THE SOFT MOTOR STARTER TO TERMINAL T-2 ON THE HIGH PRESS. PUMP CONTACTOR.
8. CONNECT GREEN GROUNDING WIRE OF THE SOFT MOTOR STARTER TO TERMINAL #23 OR #24

INCOMING POWER SINGLE PHASE: CONNECT L1 & L2 TO 15 & 18.



# HORIZON Seafari Electrical Diagram

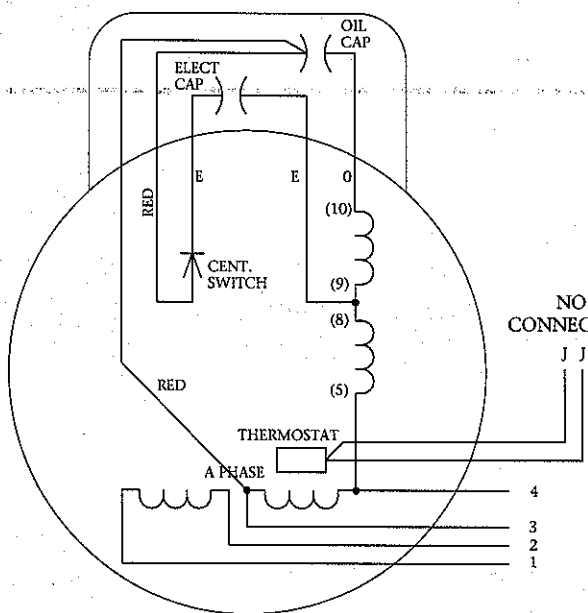
## 380/440 VAC Three Phase Standard Controller





## HORIZON Seafari Self-Contained Booster Pump & High Pressure Pump Single Phase 50/60 HZ

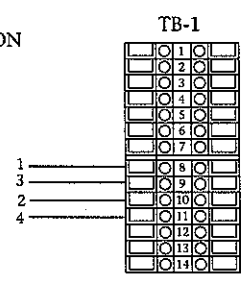
### HIGH PRESSURE PUMP MOTOR WIRING



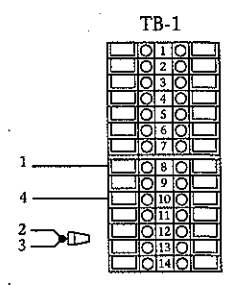
**HIGH PRESSURE PUMP MOTOR**  
 WINDING NUMBER: CD0615A01  
 SPEC NUMBER: 35M821T427G1 2.1 HORSE POWER  
 50/60 Hz SINGLE PHASE,  
 110-115 / 220-230 VAC

AND  
 SPEC NUMBER: 35M940T426G1 2.5 HORSE POWER  
 50/60 Hz, SINGLE PHASE,  
 110-115 / 220-230 VAC

	LINE A	LINE B	JOIN TOGETHER
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/230 VAC	1	4	2, 3

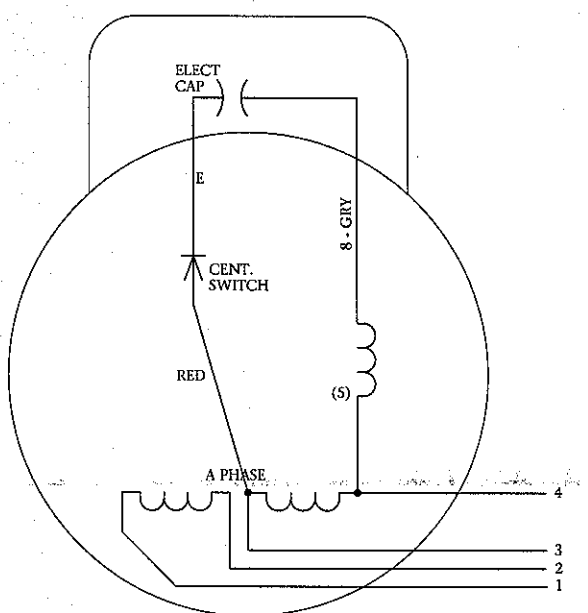


HIGH PRESSURE PUMP  
LOW VOLTAGE  
CONNECTION



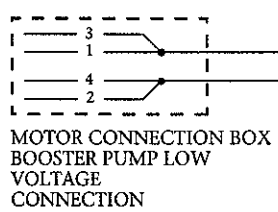
HIGH PRESSURE PUMP  
HIGH VOLTAGE  
CONNECTION

### BOOSTER PUMP MOTOR WIRING

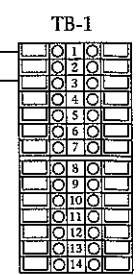


**BOOSTER PUMP MOTOR**  
 WINDING NUMBER: CD0093  
 SPEC NUMBER: 34G757W588 .5 HORSE POWER  
 50/60 Hz SINGLE PHASE,  
 110-115 / 220-230 VAC

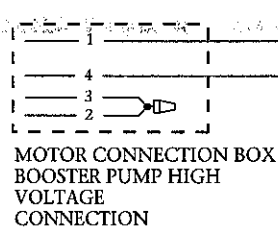
	LINE A	LINE B	JOIN
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/230 VAC	1	4	2, 3



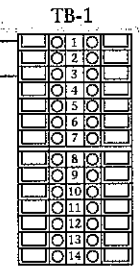
MOTOR CONNECTION BOX  
BOOSTER PUMP LOW  
VOLTAGE  
CONNECTION



BOOSTER PUMP  
LOW VOLTAGE  
CONNECTION



MOTOR CONNECTION BOX  
BOOSTER PUMP HIGH  
VOLTAGE  
CONNECTION

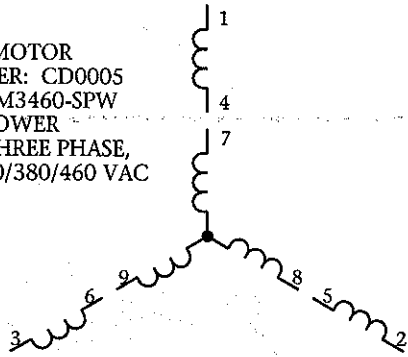


BOOSTER PUMP  
HIGH VOLTAGE  
CONNECTION

## HORIZON Seafari Self-Contained Booster Pump & High Pressure Pump Three-Phase 50 HZ

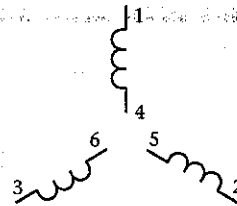
### Booster Pump, Wiring

**BOOSTER PUMP MOTOR**  
WINDING NUMBER: CD0005  
SPEC NUMBER: JM3460-SPW  
5.5 HORSE POWER  
50/60 Hz, THREE PHASE,  
208-230/220/380/460 VAC

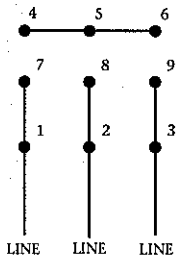


### High Pressure Pump, Wiring

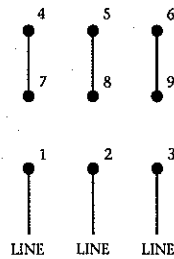
**WINDING NUMBER: CD0022**  
**SPECIFICATIONS:**  
3 HORSE POWER  
50 Hz, THREE PHASE,  
220/380 VAC



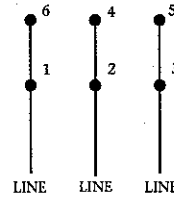
**LOW VOLTAGE  
CONNECTION ( 2Y )  
220 VAC**



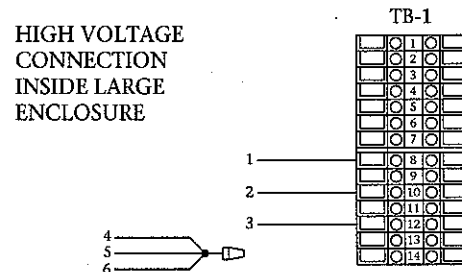
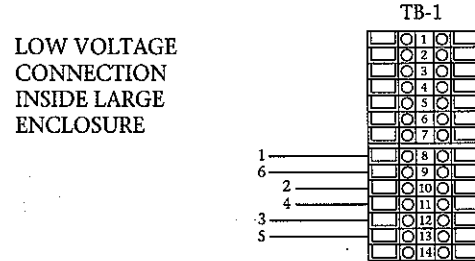
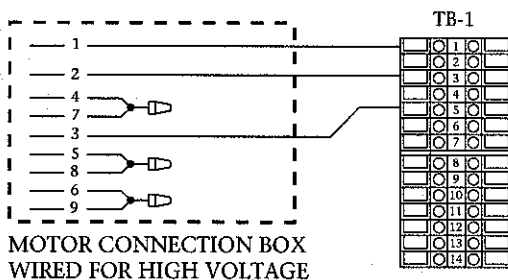
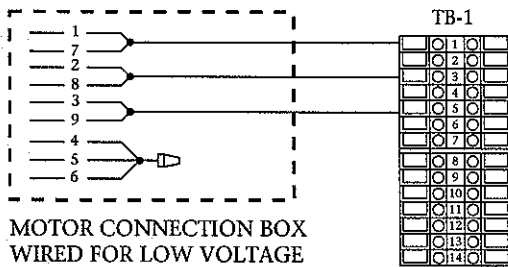
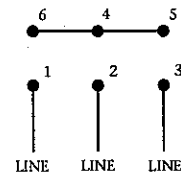
**HIGH VOLTAGE  
CONNECTION ( 1Y )  
380 - 415 VAC**



**LOW VOLTAGE  
CONNECTION  
220 VAC**



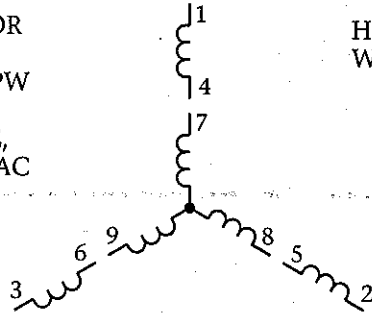
**HIGH VOLTAGE  
CONNECTION  
380 - 415 VAC**



# HORIZON Seafari Self-Contained Booster Pump & High Pressure Pump Three Phase, 60 Hz

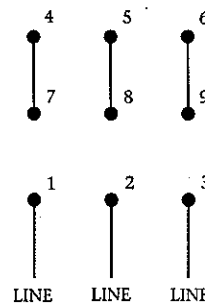
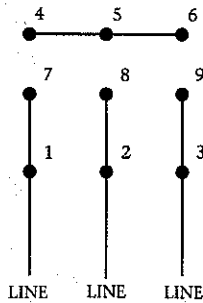
**HIGH PRESSURE PUMP MOTOR**  
WINDING NUMBER: CD0005  
SPEC NUMBER: JM3460-SPW  
.5 HORSE POWER  
50/60 Hz, THREE PHASE,  
208-230/220/380/460 VAC

**HIGH PRESSURE PUMP MOTOR**  
WINDING NUMBER: CD0005  
SPEC NUMBER: 35A012Y334G2  
3 HORSE POWER  
60 Hz, THREE PHASE,  
208 - 230/460 VAC



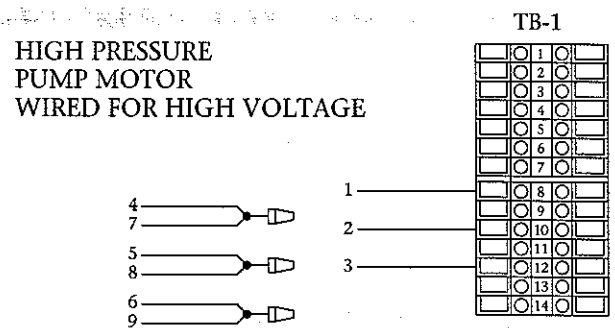
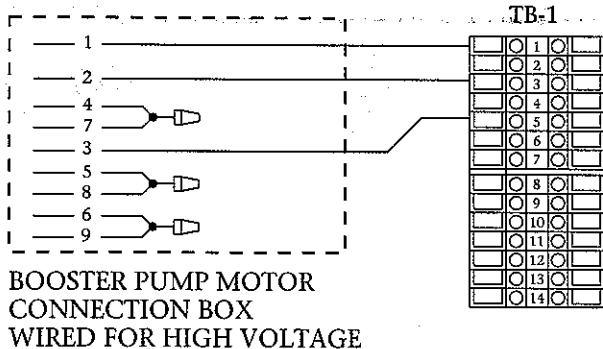
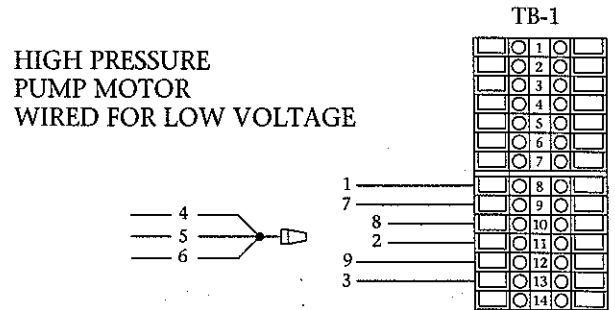
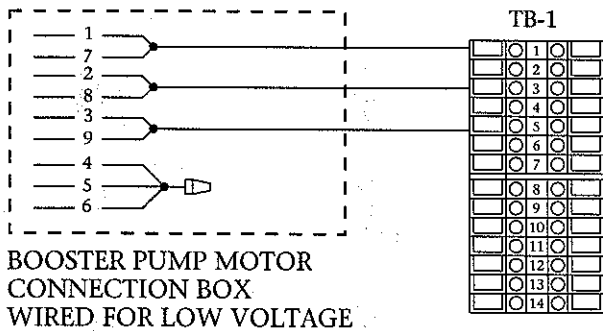
**LOW VOLTAGE CONNECTION ( 2Y )**  
208 - 230 VAC  
THREE PHASE, 60 Hz

**HIGH VOLTAGE CONNECTION ( 1Y )**  
460 VAC  
THREE PHASE, 60 Hz



## BOOSTER PUMP MOTOR WIRING

## HIGH PRESSURE PUMP MOTOR WIRING

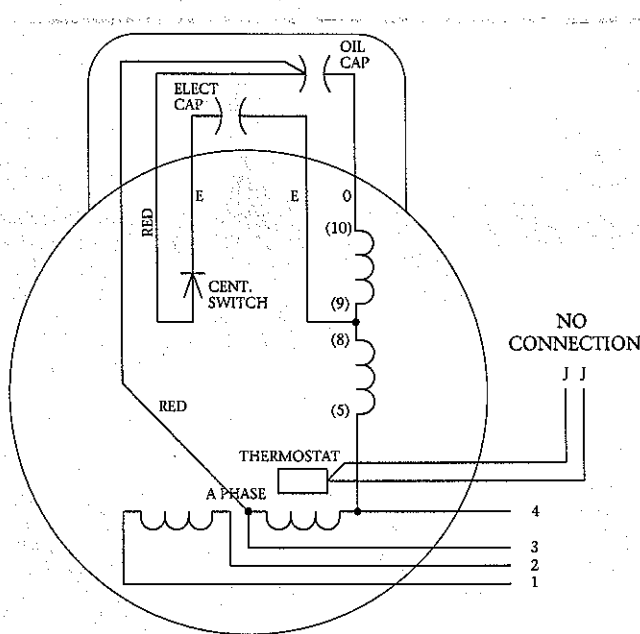


## HORIZON Seafari Modular Booster Pump & High Pressure Pump Single Phase 50/60 HZ

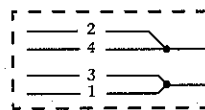
### HIGH PRESSURE PUMP MOTOR WIRING

	LINE A	LINE B	JOIN TOGETHER
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/230 VAC	1	4	2, 3

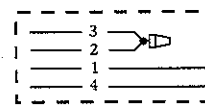
HIGH PRESSURE PUMP MOTOR  
 WINDING NUMBER: CD0615A01  
 SPEC NUMBER: 35M821T427G1 2.1 HORSE POWER  
 50/60 Hz SINGLE PHASE,  
 110-115 / 220-230 VAC  
 AND  
 SPEC NUMBER: 35M940T426G1 2.5 HORSE POWER  
 50/60 Hz, SINGLE PHASE,  
 110-115 / 220-230 VAC



MOTOR CONNECTION BOX  
 HIGH PRESSURE PUMP  
 LOW VOLTAGE CONNECTION

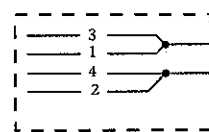
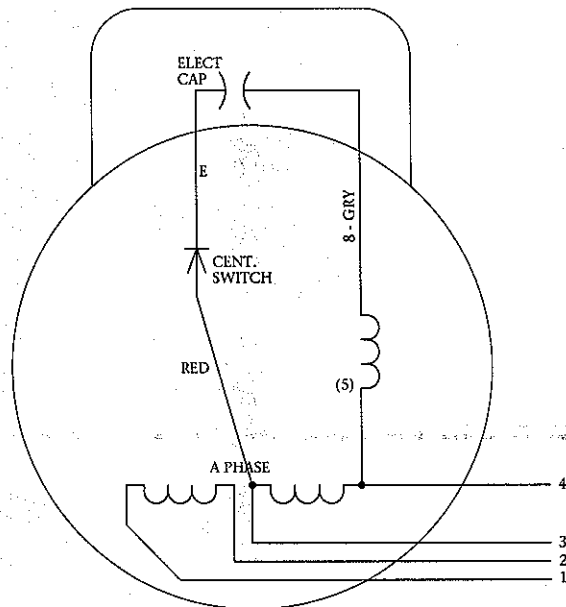


MOTOR CONNECTION BOX  
 HIGH PRESSURE PUMP  
 HIGH VOLTAGE CONNECTION

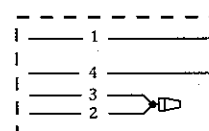


### BOOSTER PUMP MOTOR WIRING

	LINE A	LINE B	JOIN
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--
HIGH VOLTAGE 220/230 VAC	1	4	2, 3



MOTOR CONNECTION BOX  
 BOOSTER PUMP LOW VOLTAGE  
 CONNECTION



MOTOR CONNECTION BOX  
 BOOSTER PUMP HIGH  
 VOLTAGE  
 CONNECTION

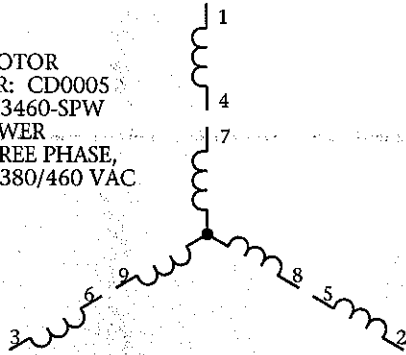
BOOSTER PUMP MOTOR  
 WINDING NUMBER: CD0093  
 SPEC NUMBER: 34G757W588 .5 HORSE POWER  
 50/60 Hz SINGLE PHASE,  
 110-115 / 220-230 VAC

BOOSTER PUMP  
 HIGH VOLTAGE  
 CONNECTION

## HORIZON Seafari Modular Booster Pump and High Pressure Pump Three-Phase, 50 HZ

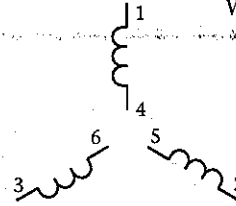
### Booster Pump Wiring

**BOOSTER PUMP MOTOR**  
WINDING NUMBER: CD0005  
SPEC NUMBER: JM3460-SPW  
5.5 HORSE POWER  
50/60 Hz, THREE PHASE,  
208-230/220/380/460 VAC

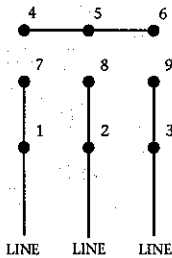


### High Pressure Pump Wiring

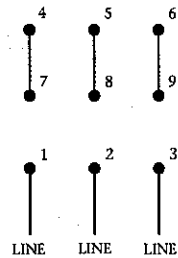
**HIGH PRESSURE PUMP MOTOR**  
WINDING NUMBER: CD0022  
SPECIFICATIONS:  
3 HORSE POWER  
50 Hz, THREE PHASE,  
220/3800 VAC



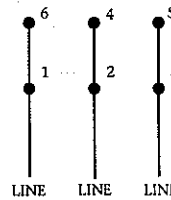
**LOW VOLTAGE CONNECTION ( 2Y )**  
220 VAC



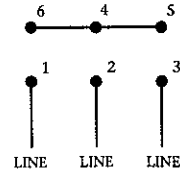
**HIGH VOLTAGE CONNECTION ( 1Y )**  
380 - 415 VAC



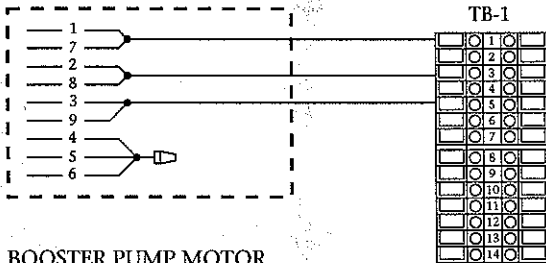
**LOW VOLTAGE CONNECTION**  
220 VAC



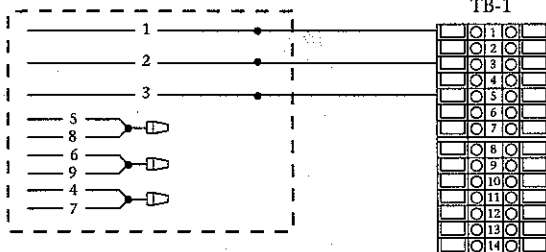
**HIGH VOLTAGE CONNECTION**  
380 - 415 VAC



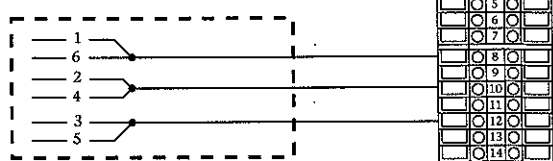
**BOOSTER PUMP MOTOR CONNECTION BOX WIRED FOR LOW VOLTAGE**



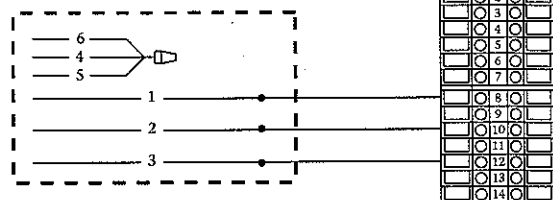
**BOOSTER PUMP MOTOR CONNECTION BOX WIRED FOR HIGH VOLTAGE**



**HIGH PRESSURE PUMP MOTOR CONNECTION BOX WIRED FOR LOW VOLTAGE**



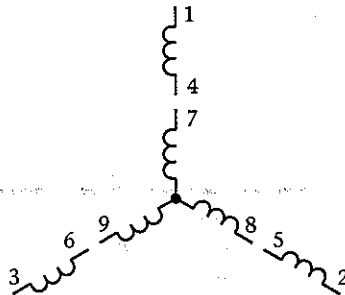
**HIGH PRESSURE PUMP MOTOR CONNECTION BOX WIRED FOR HIGH VOLTAGE**



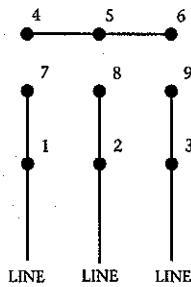
# HORIZON Seafari Modular Booster Pump & High Pressure Pump Three Phase, 60 Hz

**BOOSTER PUMP MOTOR**  
 WINDING NUMBER: CD0005  
 SPEC NUMBER: JM3460-SPW  
 .5 HORSE POWER  
 50/60 Hz, THREE PHASE,  
 208-230/220/380/460 VAC

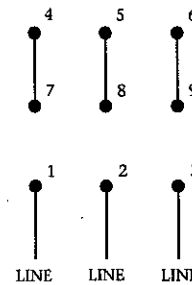
**HIGH PRESSURE PUMP MOTOR**  
 WINDING NUMBER: CD0005  
 SPEC NUMBER: 35A012Y334G2  
 3 HORSE POWER  
 60 Hz, THREE PHASE,  
 208 - 230/460 VAC



**LOW VOLTAGE CONNECTION (2Y)**  
 208 - 230 VAC

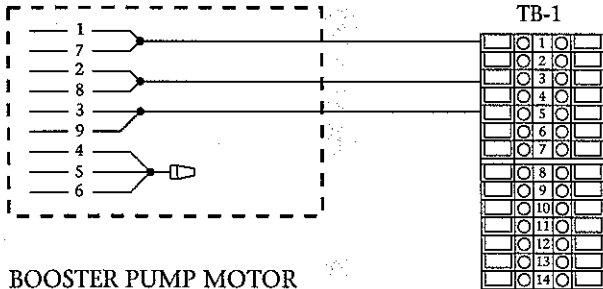


**HIGH VOLTAGE CONNECTION (1Y)**  
 460 VAC

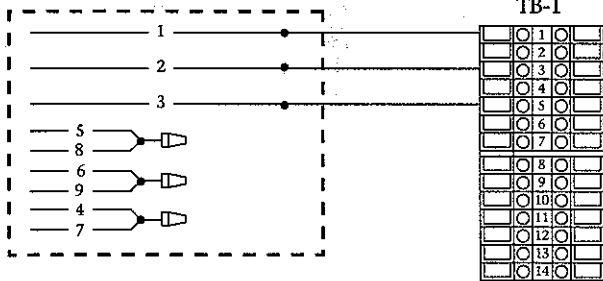


## BOOSTER PUMP MOTOR WIRING

**BOOSTER PUMP MOTOR  
 CONNECTION BOX  
 WIRED FOR LOW VOLTAGE**

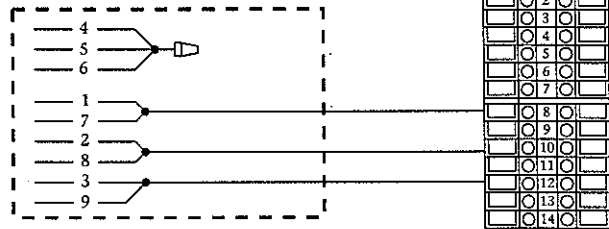


**BOOSTER PUMP MOTOR  
 CONNECTION BOX  
 WIRED FOR HIGH VOLTAGE**

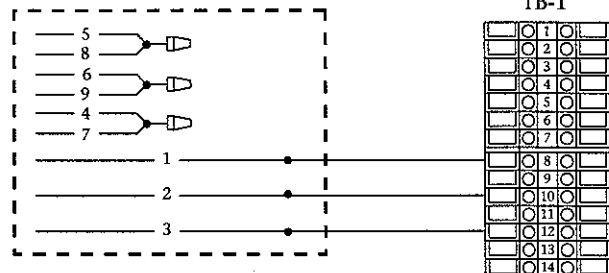


## HIGH PRESSURE PUMP MOTOR WIRING

**HIGH PRESSURE PUMP MOTOR  
 CONNECTION BOX  
 WIRED FOR LOW VOLTAGE**



**HIGH PRESSURE PUMP MOTOR  
 CONNECTION BOX  
 WIRED FOR HIGH VOLTAGE**





Horizon  
Reverse  
Osmosis™

Pioneer of fresh water since 1975

## APPENDIX B

## MICRON / INCH / MESH COMPARISON MEASUREMENTS

MICRON	INCH	INCH (opening)	MESH
1	.00003937	.0070	100
5	.00019685	.0075	90
10	.00039370	.0075	80
15	.00059055	.0078	70
20	.00078740	.011	60
25	.00098425	.013	50
30	.00118110	.018	40
40	.00157480	.026	30
50	.00196850	.041	20
75	.00295275	.085	10
100	.0039370	.177	5
200	.0078740	.937	1

## TEMPERATURES CELSIUS vs FAHRENHEIT

### CONVERSION CHART

°F	°C	°F	°C
0	-32	122	50
32	0	131	55
41	5	140	60
50	10	149	65
59	15	158	70
68	20	167	75
78	25	176	80
86	30	185	85
95	35	194	90
104	40	203	95
113	45	212	100

$$^{\circ}\text{CELSIUS} = 0.556 (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{FAHRENHEIT} = (1.8^{\circ}\text{C}) + 32$$



## HROSystems TEMPERATURE EFFECT COMPARISON CHART

(At 850 psi & 35,000 ppm TDS NaCl feed water conditions)

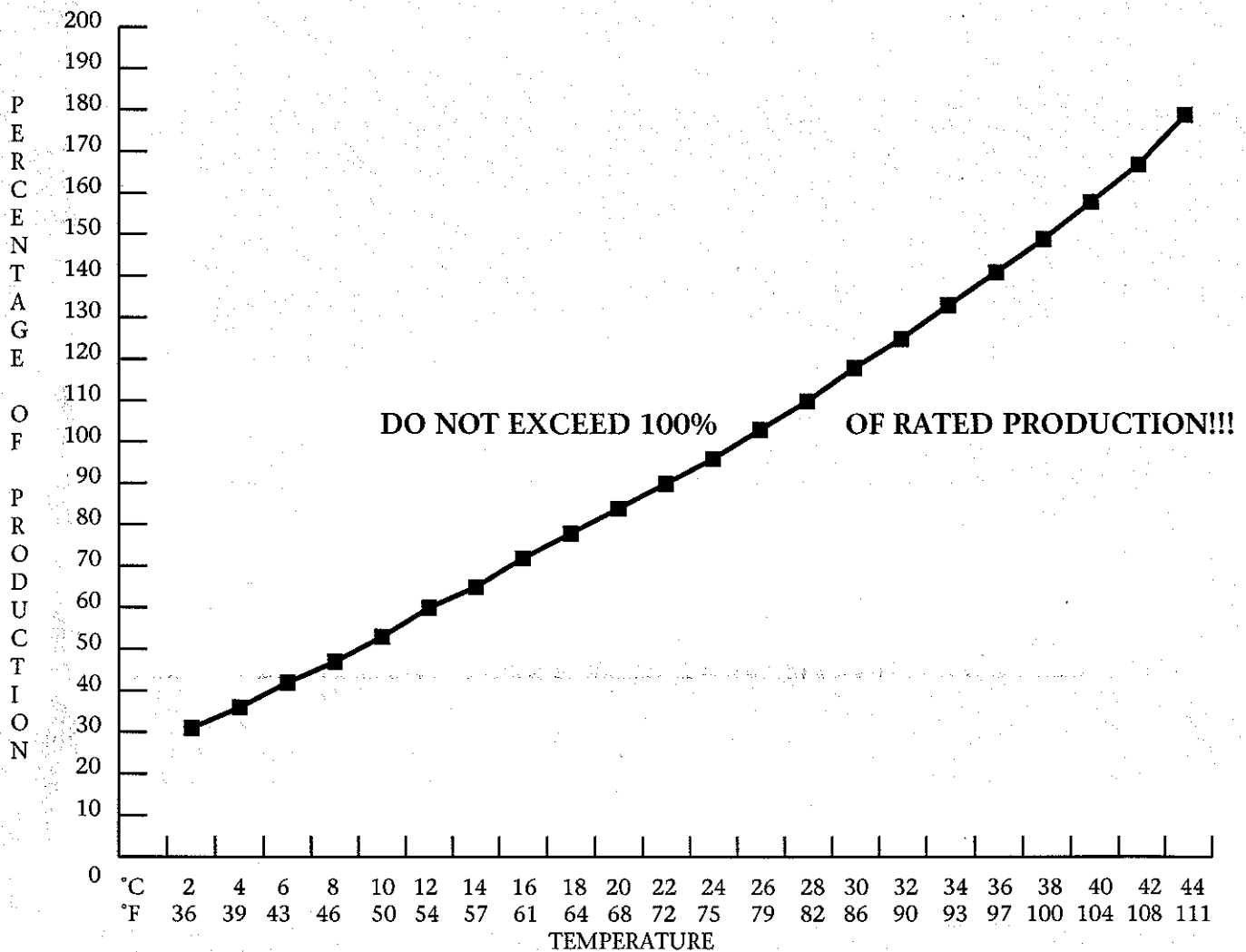
The Temperature Effect Chart on this page illustrates the loss or gain of productivity across the RO membrane.

To determine what normal (in spec.) flow of the RO membrane would be at 77° F / 25° C follow these directions:

- 1) Determine feed source temperature.
- 2) Locate the corresponding temperature on the chart
- 3) Follow the corresponding temperature in a vertical line up to the plotted production line.
- 4) From this temperature point at the production line, move left horizontally to the plotted productivity percent.
- 5) Calculate the system's present productivity in U.S. gallons per day by multiplying the gallon per hour product water flow meter reading by 24.
- 6) Divide the figure reached in step 5 above, present gallon per day productivity, by the plotted productivity percentage from step 4 above. The answer will be equivalent to the membranes present productivity at specification test parameters, 850 psi & 77° F / 25° C.

Example:

- 1) With the system operating at 850 psi.
- 2) Present feed temperature is 61°F or 16° C.
- 3) Plotted productivity is therefore 72% of normal.
- 4) The system is a 420 gallon per day model and it is presently producing 290 gallons per day.
- 5) 290 gallons per day divided by .72 equals 402 gallons per day calculated productivity. The system is rated at 420 gallons per day ±15% (357 to 483 gallons per day). Therefore, the system is within specifications at 302 gallons per day actual productivity at 61° F/16° C, 820 psi and 35,000 ppm feed.



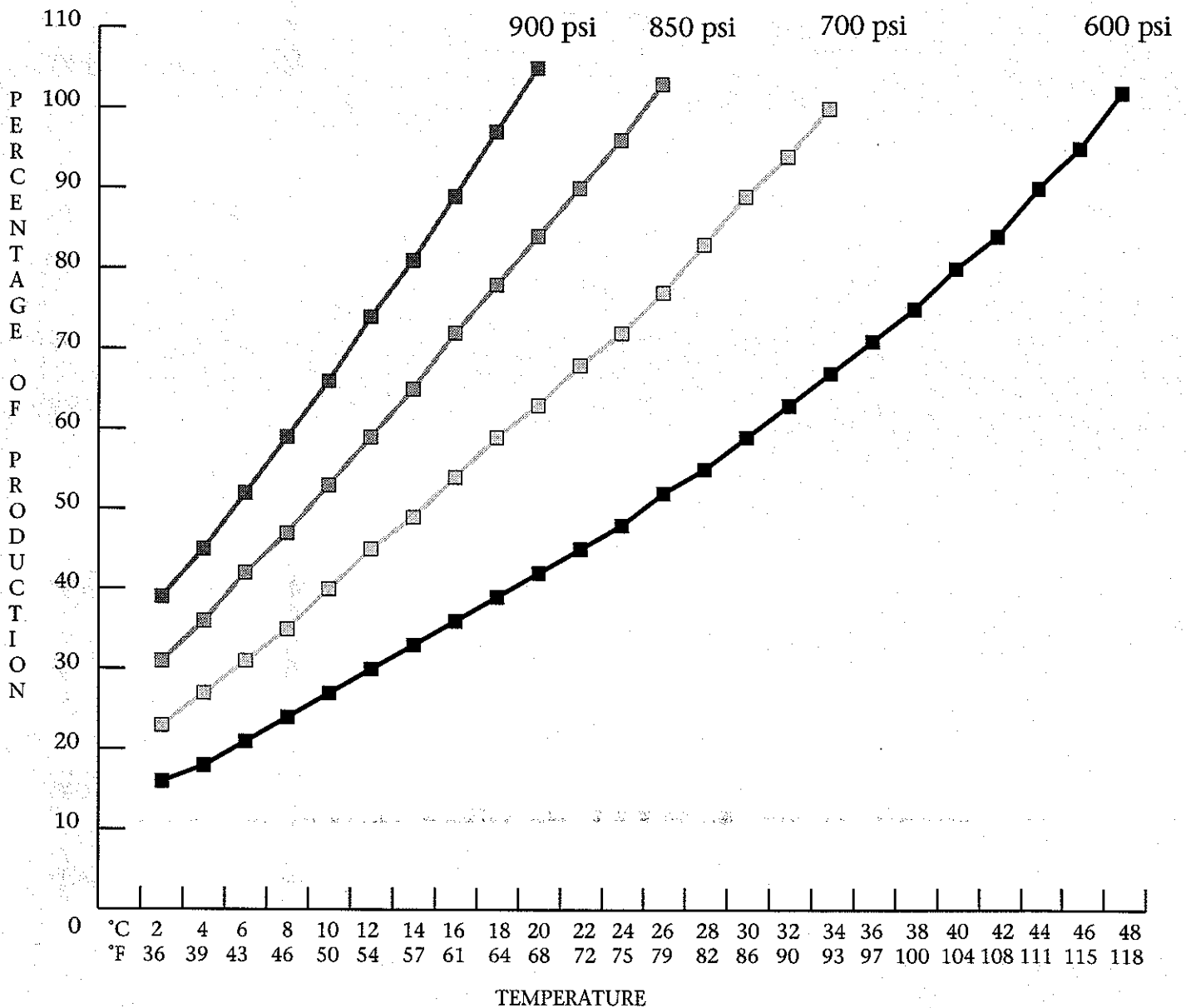
# HROSystems

## SEAWATER TEMPERATURE & PRESSURE EFFECTS CHART

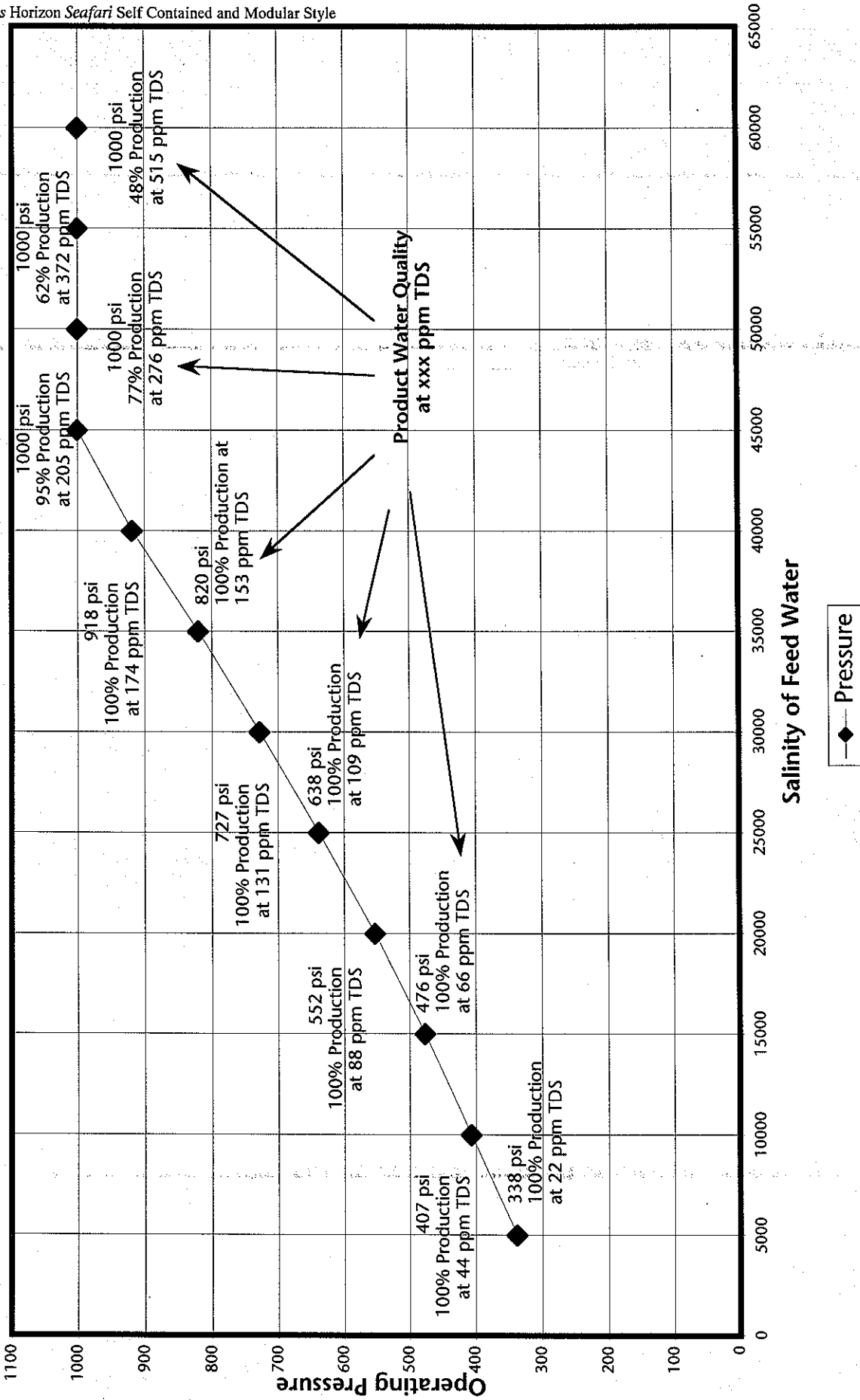
(Do not use this chart for brackish water systems & applications)

As the seawater temperature increases, the Horizon Seafari system pressure must be adjusted so that the system achieves no greater than 100% of rated product water flow. Product water flow greater than 100% of rated product water flow will cause premature fouling of the HRO RO membrane element. This will lead to more frequently required cleaning and void all warranties of the HRO RO membrane element.

**DO NOT EXCEED 100% OF RATED PRODUCTION!!!**



# Salinity Effects Chart



## WATER COMPARISON CHART

### GALLONS / VOLUME / WEIGHT

U.S. GALLON	CUBIC FEET	CUBIC YARD	CUBIC METER	TON SHORT	TON METRIC
1	.13	.005	.004	.004	.004
5	.67	.025	.019	.021	.019
10	1.34	.050	.038	.041	.038
25	3.34	.129	.10	.104	.094
50	6.68	.248	.19	.208	.189
100	13.37	.50	.38	.42	.38
200	26.74	.99	.76	.83	.76
300	40.10	1.49	1.14	1.25	1.13
400	53.47	1.98	1.51	1.67	1.51
500	66.84	2.48	1.89	2.08	1.89
600	80.21	2.97	2.27	2.50	2.27
700	93.58	3.47	2.65	2.92	2.65
800	106.94	3.96	3.03	3.33	3.02
900	120.31	4.46	3.41	3.75	3.40
1,000	133.68	4.95	3.79	4.17	3.78
2,500	334.20	12.38	9.46	10.41	9.45
5,000	668.40	24.76	18.93	20.83	18.89
7,500	1002.60	37.13	28.39	31.24	28.34
10,000	1336.81	49.51	37.85	41.65	37.79
25,000	3342.00	123.80	94.60	104.10	94.50
50,000	6684.00	247.60	189.30	208.30	188.90
75,000	10026.00	371.30	283.90	312.40	283.40
100,000	13368.06	495.11	378.54	416.50	377.85

- 1 U.S. GALLON = 231. CU. INCH
- 1 U.S. GALLON OF WATER = 8.33 LBS.
- 1 SHORT TON = 2000 LBS.
- 1 METRIC TON = 2204.6 LBS.
- 1 CU. INCH OF WATER = 0.0360 LBS.
- 1 CU. FOOT OF WATER = 62.4 LBS.
- 1 IMPERIAL GALLON OF WATER = 10.0 LBS.
- 1 GALLON = 3.7854 LITERS
- 1 CUBIC METER = 1000 LITERS
- 1 CUBIC METER = 264 GALLONS

### PPM CONVERSION CHART

SPECIFIC CONDUCTANCE IN MICROMHOS	SPECIFIC RESISTANCE IN OHMS	DISSOLVED SOLIDS		RESISTANCE*	
		P.P.M.	MHOS	OHMS	P.P.M.
.0385	26,000,000	NONE	250.0	4,000	125
.0556	18,000,000	.02777	256.4	3,900	128
.0625	16,000,000	.03125	263.2	3,800	132
.0714	14,000,000	.03571	270.3	3,700	135
.0833	12,000,000	.04166	277.8	3,600	139
.1	10,000,000	.05	285.7	3,500	143
.125	8,000,000	.0625	294.1	3,400	147
.167	6,000,000	.08333	303.0	3,300	152
.2	5,000,000	.1	312.0	3,200	156
.25	4,000,000	.125	322.5	3,100	161
.5	2,000,000	.25	333.3	3,000	166
1	1,000,000	.5	344.8	2,900	172
2	500,000	1	357.0	2,800	179
4	250,000	2	370.4	2,700	185
6	166,666	3	384.6	2,600	192
8	125,000	4	400.0	2,500	200
10	100,000	5	416.6	2,400	208
12	83,333	6	434.8	2,300	217
14	71,428	7	454.5	2,200	227
16	62,500	8	476.2	2,100	238
18	55,555	9	500.0	2,000	250
20	50,000	10	526.3	1,900	263
22	45,454	11	555.5	1,800	278
24	41,666	12	588.2	1,700	294
26	38,461	13	625.0	1,600	312
28	35,714	14	666.6	1,500	333
30	33,333	15	714.2	1,400	357
40	25,000	20	769.2	1,300	384
50	20,000	25	833.3	1,200	416
60	16,666	30	909.0	1,000	500
70	14,286	35	1,000	1,000	500
80	12,500	40	1,111	900	555
100	10,000	50	1,250	800	625
120	8,333	60	1,428	700	714
140	7,142	70	1,666	600	833
160	6,250	80	2,000	500	1,000
180	5,555	90	2,500	400	1,250
200	5,000	100	3,333	300	1,667
			5,000	200	2,500
			10,000	100	5,000

\*Approximate dissolved solids expressed as Calcium Carbonate (CaCO3)

**PRESSURE**

psi	Kg/cm <sup>2</sup>	"Hg	bar	kPa	atmosphere
1	0.0704	2.036	0.0689	6.895	0.0681
14.22	1	28.96	0.981	98.07	0.968
0.4912	0.0345	1	0.0339	3.386	0.03342
14.504	1.02	29.53	1	100	0.987
0.14504	0.0102	0.295	0.01	1	0.00987
14.7	1.033	29.92	1.013	101.3	1

**PRESSURE**

psi	Kg/cm <sup>2</sup>	"Hg	bar	kPa	atmosphere
1 psi	= 0.0704 Kg/cm <sup>2</sup>	= 2.036 Hg	= 0.0689 bar	= 6.895 kPa	= 0.0681 atm
14.22	= 1	= 28.96	= 0.981	= 98.07	= 0.968
0.4912	= 0.0345	= 1	= 0.0339	= 3.386	= 0.03342
14.504	= 1.02	= 29.53	= 1	= 100	= 0.987
0.14504	= 0.0102	= 0.295	= 0.01	= 1	= 0.00987
14.7	= 1.033	= 29.92	= 1.013	= 101.3	= 1

**METRIC / U.S. CUSTOMARY UNIT EQUIVALENTS**

multiply:	by:	to get or multiply:	by:	to get:
<b>LINEAR</b>				
inch	x 25.4	= millimeters (mm)	x 0.03937	= inch
foot	x 0.3048	= meters (m)	x 3.281	= feet
yard	x 0.9144	= meters (m)	x 1.0936	= yard
mile	x 1.6093	= kilometers (km)	x 0.6214	= mile
inch	x 2.54	= centimeters (cm)	x 0.3937	= inch
<b>VOLUME</b>				
fluid oz	x 29.57	= milliliters (ml)	x 0.03381	= fluid oz
U.S. quart	x 0.94635	= liters(l)	x 1.0567	= quarts
U.S. gallon	x 3.7854	= liters(l)	x 0.2642	= gallons
feet <sup>3</sup>	x 28.317	= liters	x 0.03531	= feet <sup>3</sup>
feet <sup>3</sup>	x 0.02832	= meters <sup>3</sup>	x 35.315	= feet <sup>3</sup>
yard <sup>3</sup>	x 0.7646	= meters <sup>3</sup>	x 1.3080	= yard <sup>3</sup>
<b>MASS</b>				
ounces	x 28.35	= grams(g)	x 0.03527	= ounces
pounds	x 0.4536	= kilograms (kg)	x 2.2046	= pounds
tons (2000lb)	x 907.18	= kilograms (kg)	x 0.001102	= tons
tons (2000lb)	x 0.90718	= metric tons(t)	x 1.1023	= tons

**NOTES:**



Horizon  
Reverse  
Osmosis™

Pioneer of fresh water since 1975

# INDEX



## B

Backpressure Regulator Valve  
Operation F-6, F-7, G-1  
Operation w/Soft Start G-2

Booster Pump  
Button D-6  
Description D-1  
Dimensions E-8  
Exploded Parts View L-3  
Indicator Lamp D-7  
Installation E-13  
Motor Rotation F-6,  
Appendix A-1,  
Appendix A-2  
Seal Replacement K-4  
Maintenance K-4  
Priming E-13  
Wiring Appendix A

Brackish Water *See System, Operation*

## C

Cautions  
Chemicals *See Chemicals, Handling Cautions*  
Installation E-11  
Operating G-1  
Storage *See System, Storage*

Charcoal Filter  
Dimensions E-9  
Element Replacement K-11, K-12  
Exploded Parts Views L-22  
Installation E-16  
Maintenance Timetable K-3  
Troubleshooting I-9

Chemicals  
Handling Cautions E-1, F-1, J-1  
Membrane Cleaning J-6 to J-8  
Storage *See System, Storage, Long Term*

Cleaning *See Chemicals, Membrane Cleaning*

Clean/Rinse Inlet Valve [5] *See Also Clean & Rinse Panel*  
Description D-1  
Installation E-12

Clean/Rinse Outlet Valve [35] *See Also Clean & Rinse Panel*  
Description D-4  
Installation E-17

Clean & Rinse Panel *See Also Clean/Rinse Outlet Valve, Clean/Rinse Inlet Valve*  
Description E-12  
Dimensions E-10  
Exploded Parts View L-27  
Installation (*Installation points shown on individual valves on E-12 & E-17*)

## COMMISSIONING, SECTION F

Controller *See Electrical, Controller*

Control Manifold  
Connections to E-11  
Exploded Parts Views L-21

## D

Distances (between components) E-2, E-3

Dimensions *See System, Dimensions*

Diversion Valve  
Manual Bypass F-5  
Installation E-16  
Troubleshooting I-11, I-12

## E

Electrical

Circuit Breaker Sizing B-4, B-5,  
Appendix A-2

Cable Sizing E-1, Appendix A-2

Controller  
Description D-5  
Exploded Parts View L-24  
Fault Conditions D-7  
Installation E-18  
Operation SECTION G  
Troubleshooting I-10, through  
I-16

Electrical Diagrams Appendix A  
System Appendix A-3 through  
Appendix A-6

Fault Conditions *See Fault Lamps*

Electrical (cont.)

Main Power Enclosure

Descriptions D - 5

Exploded Parts View L - 25

Motors *See Motors*

Power Requirements Appendix A - 1

Remote *See Remote*

Salinity Probe *See Salinity Probe*

Soft Start

Description D - 7

Installation Appendix A - 4

Operation G - 2

Power Reduction With B - 5

Specifications B - 5

Wiring Appendix A - 4

Specifications

Booster Pump Specifications B - 4,  
B - 5

High Pressure Pump Motor B - 4,  
B - 5

System Power B - 4, B - 5

Starting Amps (LRA) B - 4, B - 5

Switches

Troubleshooting I - 15

**F**

Fault Lamps D - 7, F - 7, G - 2

Fittings

Fast & Tite (Black) Description E - 5

Flow Meter

Exploded Parts View L - 21

Maintenance K - 11

Viewing F - 7, I - 4, I - 5

Forms

Daily Operation Log Form H - 2, H - 3

Maintenance Timetable K - 3

New System Initial Readings F - 9,  
F - 11

Freezing, Protection From J - 4, J - 5

Fresh Water Flush (Optional)

Description D - 4, D - 5

Dimensions E - 9

Exploded Parts Views L - 26

Indicator Lamp D - 7

Installation E - 13

Operation H - 1

Timing Adjustment I - 12, I - 13

Fuses

Troubleshooting I - 15

**G**

Gauges

Connection of Low Pressure Gauge on  
System Manifold E - 11

Descriptions D - 3

Four Gauge Panel L - 29

High Pressure Gauge Reading I - 3

Low Pressure Gauges Reading I - 2

Troubleshooting I - 2, I - 3

Two Gauge Panel L - 28

**H**

High Pressure Pump

Description D - 3

Dimensions (Modular) E - 8

Exploded Parts View L - 9 to L - 11

Indicator Lamp D - 7

Installation E - 16, F - 1, F - 5

Motor Rotation F - 6, Appendix A - 1  
Appendix A - 2

Manifold Installation K - 7 to K - 9

Maintenance Timetable K - 3

Packings (Seals) Replacement K - 8

Performance (*Shown in Feed Water Flow  
Section of page B - 2*)

Plunger Installation K - 8, K - 9

Troubleshooting I - 7, K - 7 *See also  
Motors, Troubleshooting, High  
Pressure Pump*

Valve Replacement K - 7

Wiring *See Electrical, Electrical Diagrams,  
High Pressure Pump Motor*

High Pressure Switch

Adjustment K - 11

Assembly Location L - 21

Description D - 3

Maintenance K - 11

Operation F - 7

Troubleshooting I - 8

## I

### INSTALLATION, SECTION E

Cautions E-11

### INTRODUCTION, SECTION C

## L

### Low Pressure Switch

Adjustment K-6  
Maintenance K-6  
Operation F-7  
Troubleshooting I-8

## M

### MAINTENANCE & REPAIR, SECTION K

Maintenance Timetable K-3

### Media Filter

Backwashing F-6, K-5  
Connections E-14  
Dimensions E-10  
Description E-14  
Exploded Parts Views L-5  
Operation (Valve Positioning) K-5

Membrane *See Membrane Vessel Assembly*

### Membrane Vessel Assembly

Adding a Second Membrane K-9, K-10  
Description of C-3, D-3  
Exploded Parts Views L-12 to L-17  
Flow Specifications B-1, B-2, F-7, G-1  
Installation E-16  
Membrane Cleaning Procedure J-6 to J-8  
Membrane Removal & Replacement K-9 to K-11  
Membrane Specifications B-2  
Membrane Storage J-4, J-5  
Maintenance *See Membrane Vessel Assembly, Membrane Cleaning*  
Salinity Effects Appendix B-4  
Temperature Effects Appendix B-2, Appendix B-3  
Troubleshooting I-4, I-5, I-10

## Motors

Rotation F-6, Appendix A-1, Appendix A-2  
Specifications B-4, B-5  
Troubleshooting  
Booster Pump I-10, I-11  
High Pressure Pump I-13  
Wiring  
Booster Pump Appendix A-7 through A-12  
High Pressure Pump Appendix A-7 through A-12

## O

### Oil/Water Separator

Air Bleeding F-7  
Description D-3  
Dimensions E-10  
Element Replacement K-6  
Exploded Parts Views L-8  
Installation E-15  
Maintenance K-6

## P

### P & ID (Piping and Identification Diagrams)

C-1, D-2, E-4, F-2, G-3, G-4, J-2, J-3, K-2

Pickling *See System, Storage, Long Term*

### Plankton Filter

Dimensions E-10  
Description D-1  
Exploded Parts Views L-4  
Installation E-14

### Pre-filters

#### Standard Pre-filters

Connections E-14  
Description D-1  
Dimensions E-8  
Element Replacement K-6  
Element Replacement Interval K-3  
Exploded Parts Views L-6  
Installation E-14, E-16  
Low Pressure Pickup Tee Installation E-16

Pre-filters (cont.)

Commercial Pre-filters

- Air Bleed F-7
- Connections E-15
- Description D-3
- Dimensions E-10
- Element Replacement K-6
- Element Replacement Interval K-3
- Exploded Parts Views L-7
- Installation E-15

Multi-Media Filter *See Media Filter*

Oil/Water Separator *See Oil/Water Separator*

Plankton Filter *See Plankton Filter*

Product Water

- Quality, Quantity/Troubleshooting I-6
- Pressure Effects On Appendix B-3
- Salinity Effects On Appendix B-4
- Specification (Flow) B-1
- Temperature Effects On Appendix B-2, Appendix B-3

Pumps, Booster *See Booster Pump*

Pumps, High Pressure *See High Pressure Pump*

**R**

Remote

- Description D-5
- Illustration E-18
- Installation E-18

Rinse/Clean Inlet Valve *See Clean/Rinse Inlet Valve*

Rinse/Clean Outlet Valve *See Clean/Rinse Outlet Valve*

Rinse/Clean Panel *See Clean/Rinse Panel*

**Q**

Quartz Tube *See Ultra-Violet Sterilizer, Lamp Replacement*

**S**

Salinity Probe

- Calibration I-14
- Description D-4
- Electrical Connection Appendix A-3 to Appendix A-6
- Installation E-18, L-21
- Maintenance K-11
- Troubleshooting I-14

Sea Strainer

- Description D-1
- Dimensions E-9
- Exploded Parts Views
  - Standard L-1
  - Commercial L-2
- Installation E-12
- Maintenance K-4
- Maintenance Interval K-3

Soft Start *See Electrical, Soft Start*

System

- Brackish Water Operation F-7
- Component Identification F-6, F-7
- Dimensions
  - Self-Contained E-6, F-3
  - Modular E-7, F-4
- Flow Diagrams C-1, D-2, E-4, F-2, G-3, G-4, J-2, J-3, K-2
- Operation, **SECTION G**
- Shutdown, **SECTION H**
- Storage E-1, J-1
  - Long Term J-4, J-5
  - Short Term J-4

**SPECIFICATIONS, SECTION B**

## **T**

Tanks, Potable Water E-1

### **Tools**

For Installation E-2

### **Thru-Hull Fitting**

Description D-1

Installation E-2

## **TROUBLESHOOTING, SECTION J**

## **U**

### **Ultraviolet Sterilizer**

Description D-4

Exploded Parts Views L-23

Installation E-17

Lamp Replacement K-12

Maintenance Timetable K-3

Troubleshooting I-9

Unpackaging (System) E-3