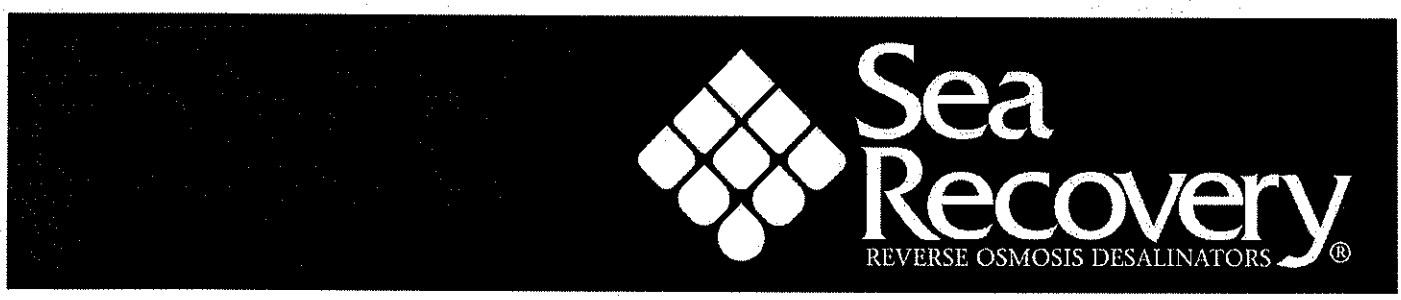
Ultra Whisper
SYSTEM MANUAL



Sea Recovery Corp.
P.O. Box 5288
Carson, California 90745 U.S.A.
Toll Free: 1 (800) 354-2000
Telephone: 1 (310) 637-3400
Facsimile: 1 (310) 637-3430
www.searecovery.com

Revisions: 10/10/02, 12/2/02, 1/15/03, 3/6/03, 6/5/03
B651380001

PREFACE

Thank you for your purchase of a Sea Recovery Ultra Whisper 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.

Sea Recovery Corporation's 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 Ultra Whisper 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, which if detected early are usually easily corrected. However, if left unattended, a problem in one component eventually affects the rest of the system and leads to further repairs.

The manual is divided into chapters that address different subject matter. Each chapter should be reviewed before operating the Reverse Osmosis Desalination System.

REVISION RECORD

REV	PAGE	DESCRIPTION	ECN	DATE
1	All	First issue of manual – internal - not released	n/a	10/10/02
A	All	Electronics and text updates, included new bracket	02-002	12/02/02
B	All	Includes intermediate switches & compact designs	02-018	01/15/03
C	All	Update procedures, charts, figures and graphs	03-017	03/06/03
D	All	Changes to various drawings	n/a	06/05/03

Sea Recovery

SYSTEM IDENTIFICATION INFORMATION

INSTRUCTIONS: Please complete the following information at the time of purchase of the Sea Recovery Ultra Whisper Reverse Osmosis Desalinator. This information will be requested to provide better service by the Service Department whenever contacting Sea Recovery for technical assistance or by the Sales Department whenever ordering parts.

System Information:

Model Number:_____ Serial Number: _____

Operating Voltage:

Direct Current:
___ 12 VDC ___ 24 VDC

Alternating Current:
___ 110/115 VAC ___ 220/230 VAC

Date Purchased:_____

Date Commissioned:_____
(First tested or operated)

Dealer Information:

Dealer's Name:_____

Address:_____

City:_____ State:_____

Country:_____ Postal Code:_____

Dealer's Invoice Number:_____

Sea Recovery

P.O. BOX 5288, CARSON, CALIFORNIA 90745-5288
U.S.A.
TELEPHONE 1-310-637-3400 FACSIMILE 1-310-637-3430

Sea Recovery

WARRANTY REGISTRATION INFORMATION

INSTRUCTIONS: At the time of purchase of the Sea Recovery Ultra Whisper Reverse Osmosis Watermaker, please complete the warranty information listed below. After completing this form, please make a copy and mail it, in the provided envelope, to Sea Recovery Corp. 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 a copy to:

Sea Recovery
P.O. BOX 5288
CARSON, CALIFORNIA 90745-5288 U.S.A.

Sea Recovery Ultra Whisper LIMITED WARRANTY

Sea Recovery warrants that the Sea Recovery Desalination System performs according to specifications for a period of twelve (12) months and specifically listed separate components are warranted by Sea Recovery for up to 5 years from the date of shipment. Sea Recovery's liability under this warranty is limited to repair or replacement of the Ultra Whisper Desalination System at Sea Recovery's discretion. Under no circumstances is Sea Recovery liable for consequential 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.

Warranty Period from date of original shipment from Sea Recovery:

1.	System and accessories:	1 (one) year
2.	Reverse Osmosis High Pressure Vessel:	5 (five) years
3.	Energy Transfer Device:	1 (one) year
4.	Repairs made after the original warranty period has expired:	3 (three) months

Normal reoccurring user maintenance listed below is not covered by this or any Sea Recovery limited warranty.

1. Sea Strainer Element
2. Cartridge Filter Elements
3. Fuses
4. Pump Packing Assemblies
5. Pump Seal Assemblies
6. Pump Valve Assemblies
7. Pump Crankcase Oil
8. Gauge Instrument Calibration
9. Valve Seals and Packings
10. Exterior Corrosion

This or any Sea Recovery limited warranty does not cover installation components not supplied by Sea Recovery.

Improper installation resulting in the Ultra Whisper system or Sea Recovery component failure or decline in performance is not covered by this or any Sea Recovery limited warranty.

The Ultra Whisper Reverse Osmosis Membrane Element is guaranteed to be cleanable for a minimum of one year from 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 Ultra Whisper Membrane Element is not guaranteed against iron fouling (rust), chemical or petroleum products attack, extreme temperatures (over 120° F/under 32° F), drying out, or extreme pressures (over 1000 psig).

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

To obtain warranty service, the defective product or part must be returned to an authorized Sea Recovery Factory Service Center or direct to Sea Recovery. The purchaser must pay any transportation or labor expenses incurred in removing and returning the product to the service center or to Sea Recovery.

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 Sea Recovery, nor does the warranty extend to components on which the serial number has been removed, defaced, or changed.

Sea Recovery 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. Sea Recovery 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 Sea Recovery supplied parts and accessories, including but not limited to, maintenance parts, pre-filter 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.

Sea Recovery

P.O. BOX 5288
CARSON, CALIFORNIA 90745-5288 U.S.A.
TELEPHONE 1-310-637-3400 • FACSIMILE 1-310-637-3430

INTRODUCTION:

This manual contains instructions for the installation, operation, and maintenance of the Sea Recovery Ultra Whisper Series Desalination System. This information is provided to ensure the long life and safe operation of your Ultra Whisper Series System. Please read this manual thoroughly before installation or operation and keep it for future reference. The instructions in this manual are intended for personnel with some general training and experience in the operation and maintenance of fluid handling systems.

SAFETY:

This system is designed to provide safe and reliable service. However, precaution must be taken when dealing with industrial equipment. This system contains electro-mechanical, electronic and high-pressure components that necessitate technical safeguarding. Therefore, operations and maintenance personnel must exercise good judgment and proper safety practices to avoid damage to the equipment, to surrounding areas, and to prevent personal injury.

It must be understood that the information contained in this manual does not relieve operation and maintenance personnel of the responsibility of exercising normal good judgment in the operation and care of this product and its components. Proper installation and maintenance of shutdown devices and over-pressure protection equipment is an essential part of any safety program. In general, all personnel should be guided by all the basic rules of safety associated with high-pressure equipment and processes. Operation under conditions outside of those stated in this manual can result in damage to the equipment and void warranty.

Do not clean systems with any oil-based solutions or cleaning solvents. Oil-based solutions may have adverse reactions with the plastic or metal components used on this reverse osmosis system. A simple rule of thumb is, "If you wouldn't wash your hands with it, don't clean this system with it." Hard water deposits can be removed with a 5% acetic acid solution (Vinegar).

QUALITY AND INSPECTION:

Sea Recovery Corporation's commitment to quality starts with the fabrication and procurement of top quality materials made to reliable tolerances. System components are checked to ensure they meet all dimensional specifications during and after each stage of the manufacturing process.

Each system is tested for production levels, noise levels, power consumption, operating pressures, and feed flow rates. All systems are tested to ensure proper functionality of every component. Every unit is tracked with a serial number and the performance test records are maintained.

> Sea Recovery Corporation will not be liable for any project delay, damage or injury caused by the failure to comply with the procedures in this manual. This product must never be operated at pressures or temperatures outside of those stated in, or used with liquids not approved by Sea Recovery Corporation.

Every system should be inspected immediately upon arrival. Chapter 1 visually illustrates every Ultra Whisper Package. Account for system and all purchased options by using the enclosed packing list. Any irregularities due to shipment should be reported to the carrier. These systems are fastened to a wooden base and packed in foam to protect the system from damage during transportation. The membrane has been rinsed with storing chemical to minimize the possibility of biological growth due to exposure to contaminants during shipment and storage. Use care during unpacking and handling to avoid damage to the equipment.

TABLE OF CONTENTS

1 INTRODUCTION

1.0 INTRODUCTION TO ULTRA WHISPER PACKAGES

1.0 INTRODUCTION TO SYSTEM:

This section introduces the customer to the Ultra Whisper System. Throughout this section graphic illustrations are used to inform the customer of the components within each Ultra Whisper package. This information is provided to ensure that the customer receives and understands all of the components shipped with the Ultra Whisper package. The component names provided in this chapter are used throughout this manual. It is recommended that the user become familiar with the names defined in this chapter.
Section 1.1 educates the customer on component functions.
Section 1.2 demonstrates how the components are connected together to make a system.

STYLES:

The Ultra Whisper Series Systems are available in two styles. The **Modular Style**, is designed to install components of the system in different areas giving the customer maximum flexibility over the installation. The **Compact Style** is designed for a rapid installation and minimal installation effort. The compact style bundles the components into a small unit.

MODELS AND OPTIONS:

The Ultra Whisper Series Systems are available in three models. The models are defined by the quantity of product water the model can produce. The three models available are the **200**, the **400** and the **600**. The model number signifies the number of gallons the system can produce in a 24-hour period. Each of these systems is available in a voltage option to match the customer's craft. The Model 600 Ultra Whisper System is not available in direct current.

SYSTEM DIAGRAMS:

The diagrams in this chapter are used to introduce the customer to the Ultra Whisper System by illustrating the two styles in the three models available. These diagrams pictorially reflect the standard components in each Ultra Whisper package.

DIAGRAM ILLUSTRATIONS:

The different production flows and voltage options require equipment that is slightly different for each model. The electronics, pump and accumulator are sized and tailored for a specific system model. The diagrams physically show the different look of the accumulators and the pumps for each unit. An electrical schematic diagram for each model is available in Chapter 7. The schematic diagram illustrates the electronic components and the electrical connections.

INSPECTION:

Use the diagrams in this chapter to ensure all the components are enclosed in the shipping container. Ensure that all the system components have been shipped free of visual defects. A Bill of Material for every sub-assembly and each component part numbers has been provided in The Explode Views Section, Chapter 9.

SYSTEM DEFINITIONS:

Each system is defined using pictorial definitions on the following pages. These definitions are used throughout the manual. The customer should refer back to these diagrams to eliminate any system confusions.

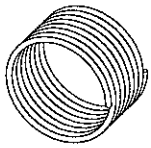
SPECIFICATION:

System specifications such as voltages, currents, wire sizes, dimensions, flows and pressures are listed in Chapter 10.

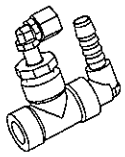
SECTION CONTENT:

STAINLESS HOSE CLAMPS

3/4 NPT INLET ELBOW ASSEMBLY



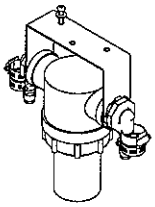
5/8" BRAIDED HOSE



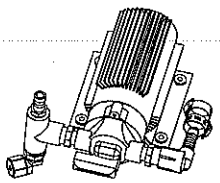
REJECT WATER ASSEMBLY

1/4" BLACK TUBE

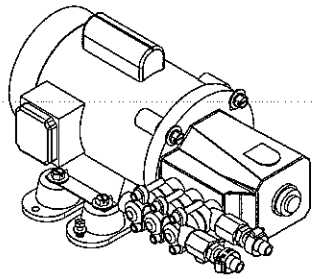
1/4 TUBE CONNECTOR



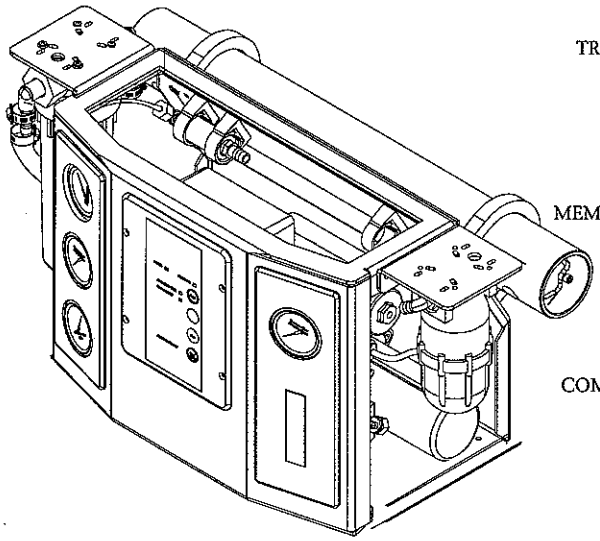
SEA STRAINER



DIAPHRAGM PUMP
Model 200 DC only



TRIPLEXER / PLUNGER PUMP



MEMBRANE VESSEL ASSEMBLY

COMPACT FRAME ASSEMBLY

COMPACT SYSTEM

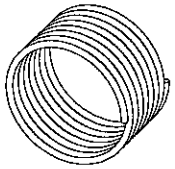
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

COMPONENTS:

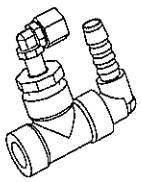
Each Compact System includes all of the components shown above (only one pump per system). The fitting assemblies may be interchanged to suit the installation. The Elbow Assembly is used on the Sea Cock Valve provided by the installer to route and minimize a protruding hose that may cause accidental activity. The Reject Water Assembly is used to combine and dump the reject product water and the reject brine water through the Thru Hull Fitting provided by the installer. The 1/4" connector is used to connect the potable product water to the product tank.

STAINLESS HOSE CLAMPS

3/4 NPT INLET ELBOW ASSEMBLY



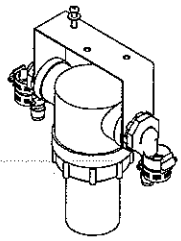
5/8" BRAIDED HOSE



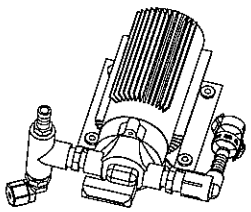
REJECT WATER ASSEMBLY

1/4" BLACK TUBE

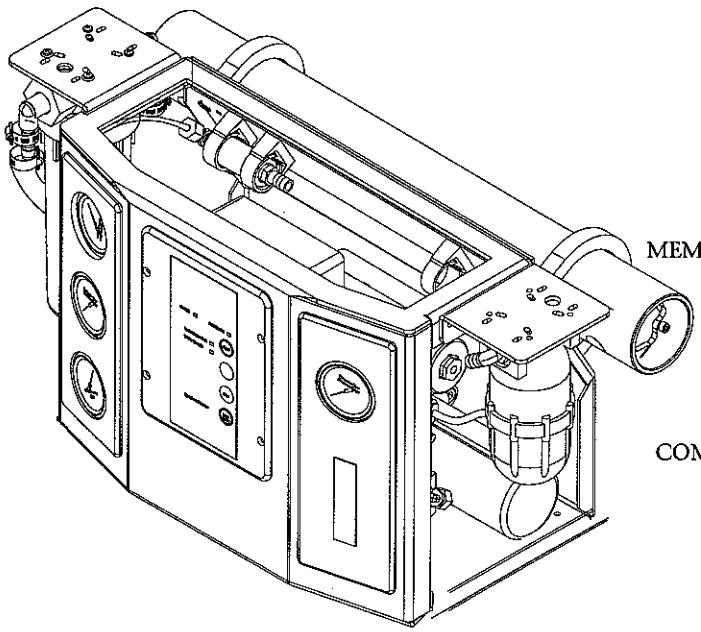
1/4 TUBE CONNECTOR



SEA STRAINER



DIAPHRAGM PUMP



MEMBRANE VESSEL ASSEMBLY

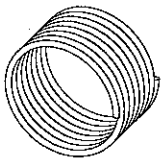
COMPACT FRAME ASSEMBLY

COMPACT 200 DC MODEL

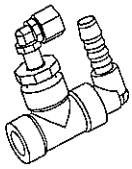
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

STAINLESS HOSE CLAMPS

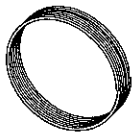
3/4 NPT INLET ELBOW ASSEMBLY



5/8" BRAIDED HOSE

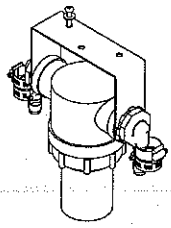


REJECT WATER ASSEMBLY



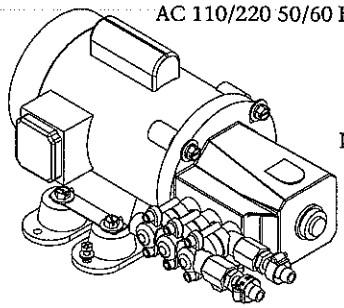
1/4" BLACK TUBE

1/4 TUBE CONNECTOR

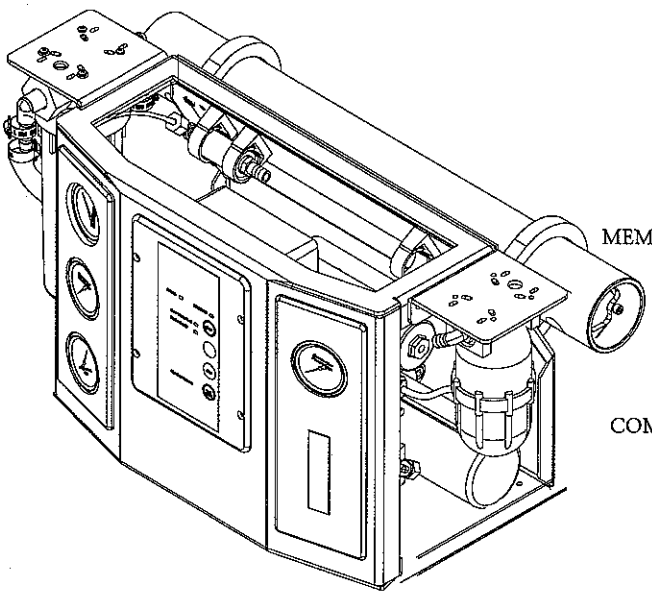


SEA STRAINER

AC 110/220 50/60 Hz MOTOR



PLUNGER PUMP



MEMBRANE VESSEL ASSEMBLY

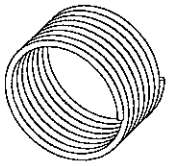
COMPACT FRAME ASSEMBLY

COMPACT 200 AC MODEL

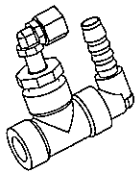
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

STAINLESS HOSE CLAMPS

3/4 NPT INLET ELBOW ASSEMBLY



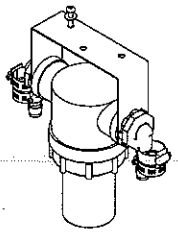
5/8" BRAIDED HOSE



REJECT WATER ASSEMBLY

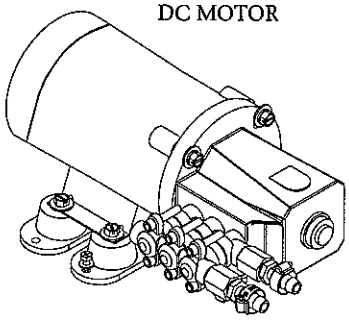
1/4" BLACK TUBE

1/4 TUBE CONNECTOR

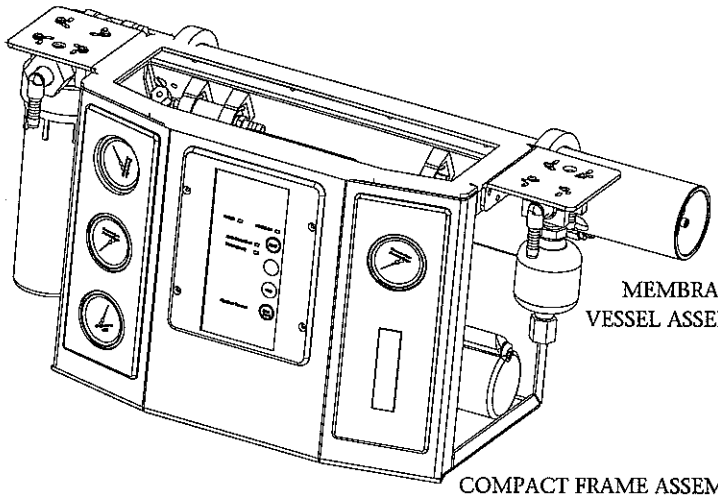


SEA STRAINER

DC MOTOR



PLUNGER PUMP



MEMBRANE
VESSEL ASSEMBLY

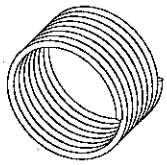
COMPACT FRAME ASSEMBLY

COMPACT 400 DC MODEL

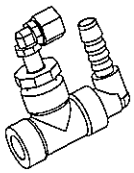
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

STAINLESS HOSE CLAMPS

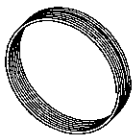
3/4 NPT INLET ELBOW ASSEMBLY



5/8" BRAIDED HOSE

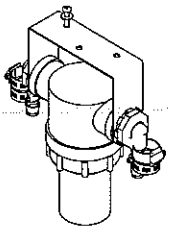


REJECT WATER ASSEMBLY



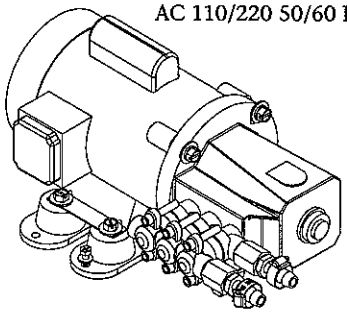
1/4" BLACK TUBE

1/4 TUBE CONNECTOR

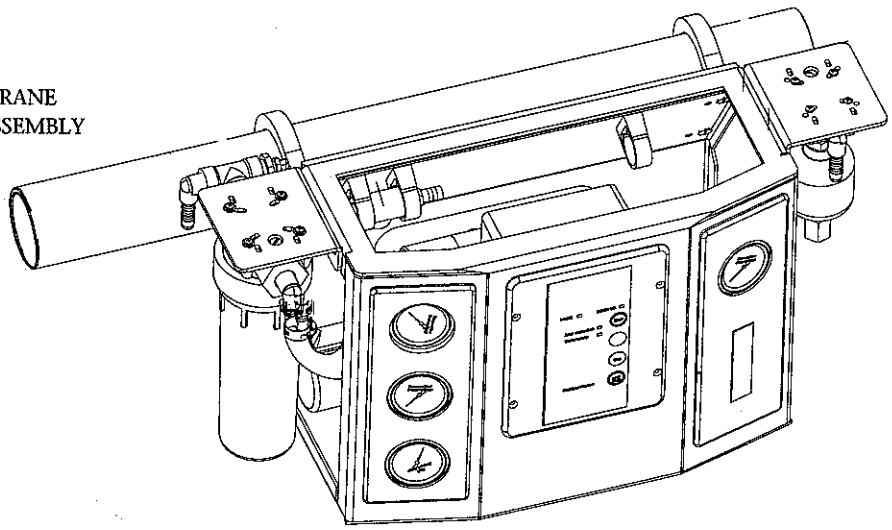


SEA STRAINER

AC 110/220 50/60 Hz MOTOR



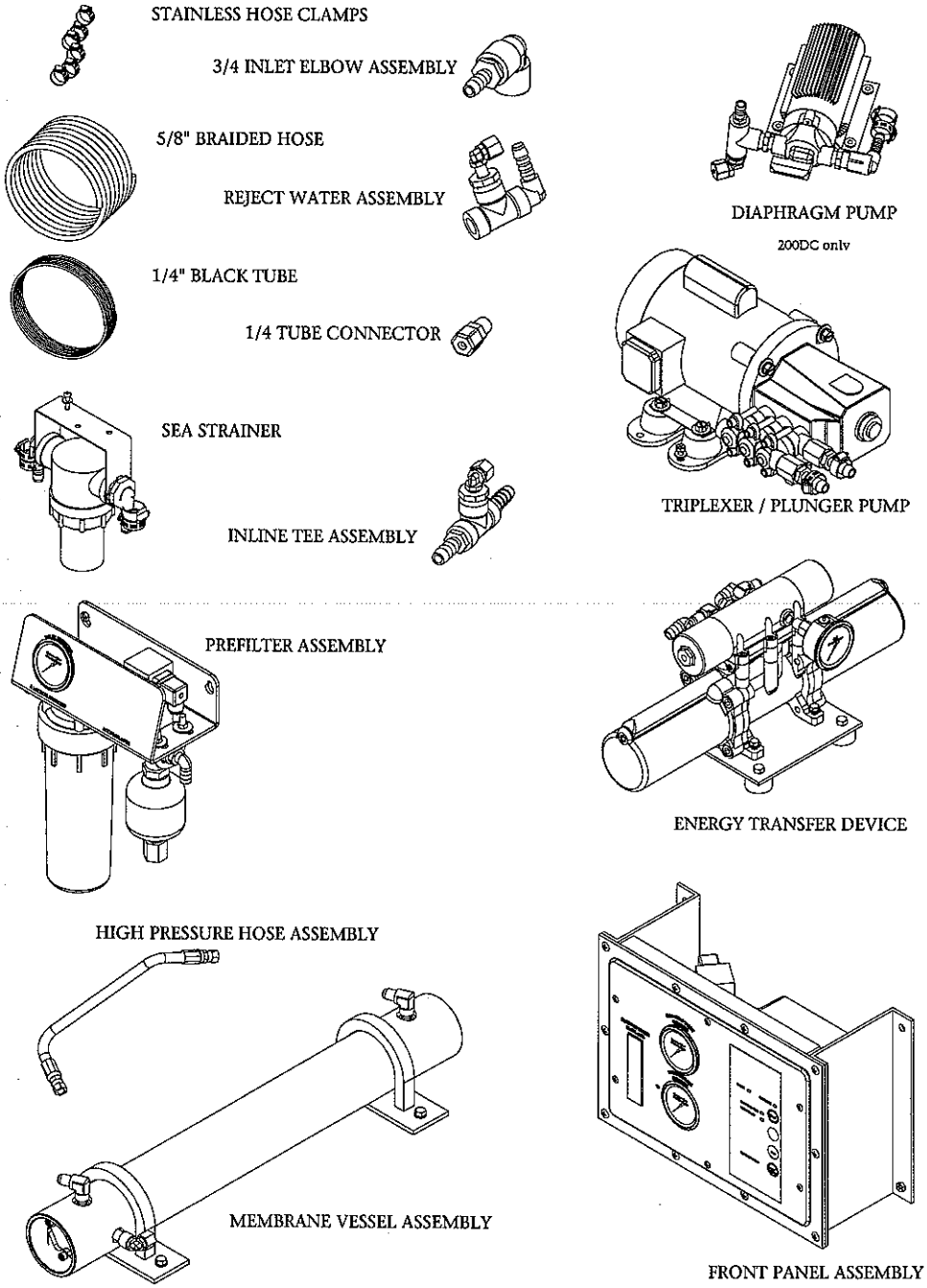
MEMBRANE
VESSEL ASSEMBLY



COMPACT FRAME ASSEMBLY

COMPACT 600 & 400 AC MODELS

PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10



MODULAR SYSTEM

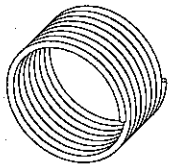
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

COMPONENTS:

Each Modular System includes all of the components shown above (only one pump per system). The fitting assemblies may be interchanged to suit the installation. The Inline Tee Assembly is used by the Pre-filter inlet & outlet pressure gauges located on the panel. The Elbow Assembly is used on the Sea Cock Valve provided by the installer to route and minimize a protruding hose that may cause accidental activity. The Reject Water Assembly is used to combine and dump the reject product water and the reject brine water through the Thru Hull fitting provided by the installer. The 1/4" connector is used to connect the potable product water to the product tank.

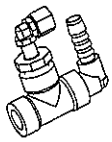
STAINLESS HOSE CLAMPS

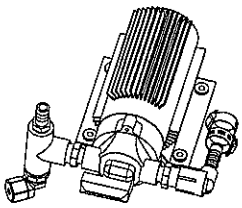
3/4 INLET ELBOW ASSEMBLY



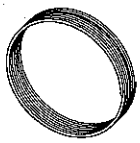
5/8" BRAIDED HOSE

REJECT WATER ASSEMBLY



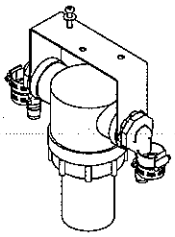


DIAPHRAGM PUMP



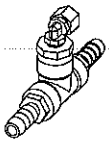
1/4" BLACK TUBE

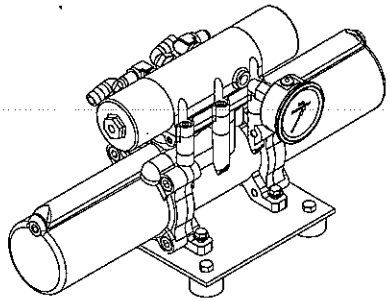
1/4 TUBE CONNECTOR



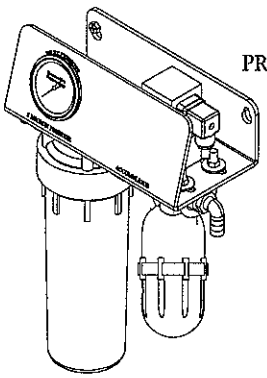
SEA STRAINER

INLINE TEE ASSEMBLY



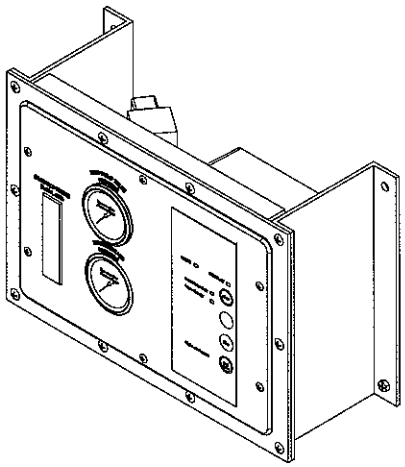


ENERGY TRANSFER DEVICE

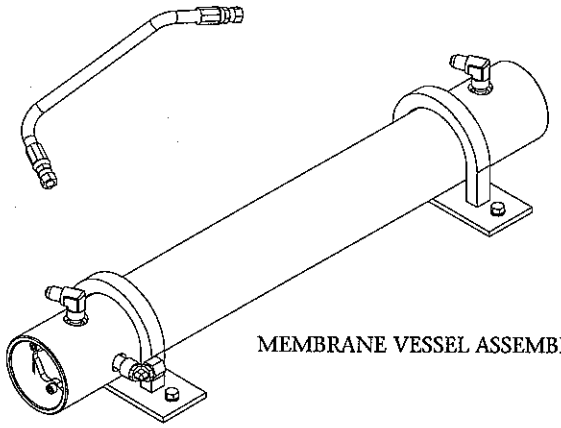


PREFILTER ASSEMBLY

HIGH PRESSURE HOSE ASSEMBLY



FRONT PANEL ASSEMBLY



MEMBRANE VESSEL ASSEMBLY

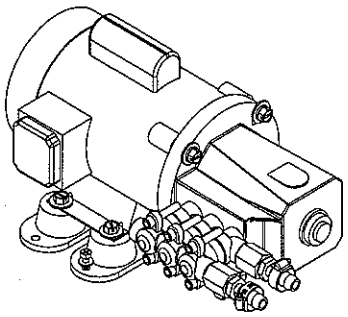
MODULAR 200 DC MODEL

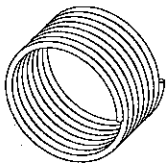
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

STAINLESS HOSE CLAMPS

3/4 INLET ELBOW ASSEMBLY

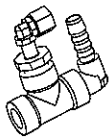
AC 110/220 50/60 Hz MOTOR





5/8" BRAIDED HOSE

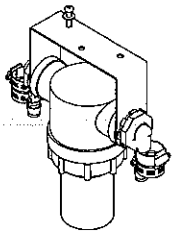
REJECT WATER ASSEMBLY



1/4" BLACK TUBE

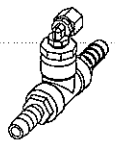
1/4 TUBE CONNECTOR

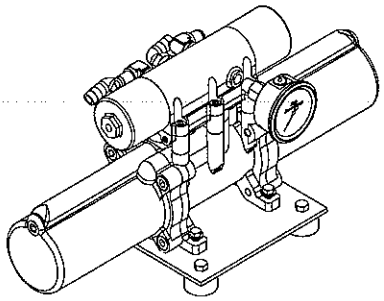
PLUNGER PUMP



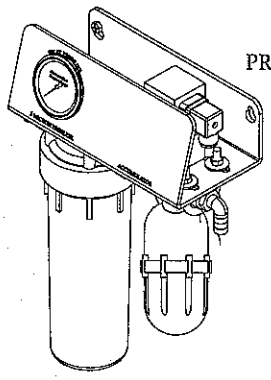
SEA STRAINER

INLINE TEE ASSEMBLY

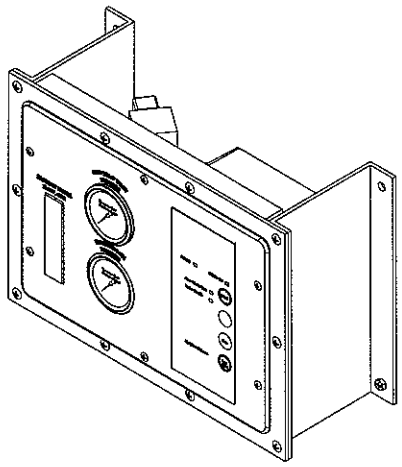




ENERGY TRANSFER DEVICE

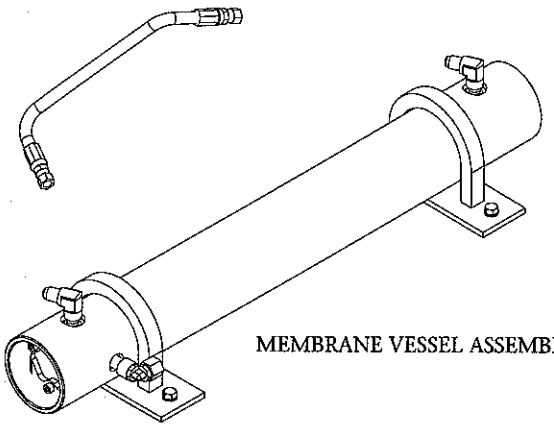


PREFILTER ASSEMBLY



FRONT PANEL ASSEMBLY

HIGH PRESSURE HOSE ASSEMBLY



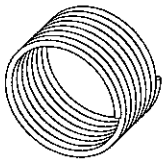
MEMBRANE VESSEL ASSEMBLY

MODULAR 200 AC MODEL

PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

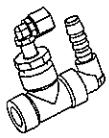
STAINLESS HOSE CLAMPS

3/4 INLET ELBOW ASSEMBLY

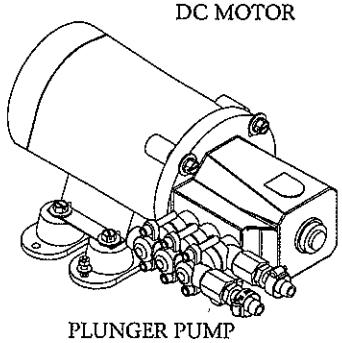


5/8" BRAIDED HOSE

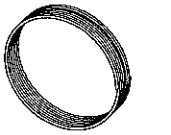
REJECT WATER ASSEMBLY



DC MOTOR

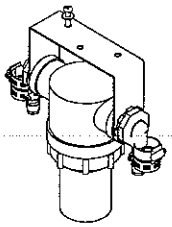


PLUNGER PUMP



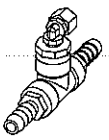
1/4" BLACK TUBE

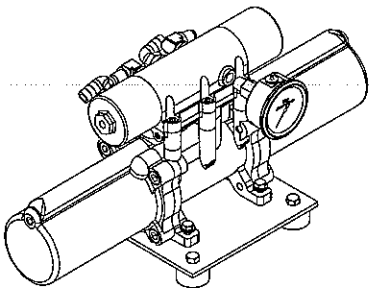
1/4 TUBE CONNECTOR



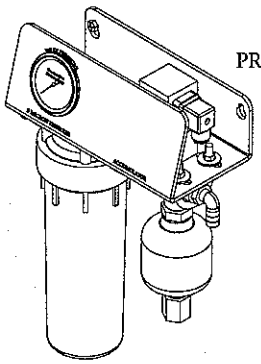
SEA STRAINER

INLINE TEE ASSEMBLY



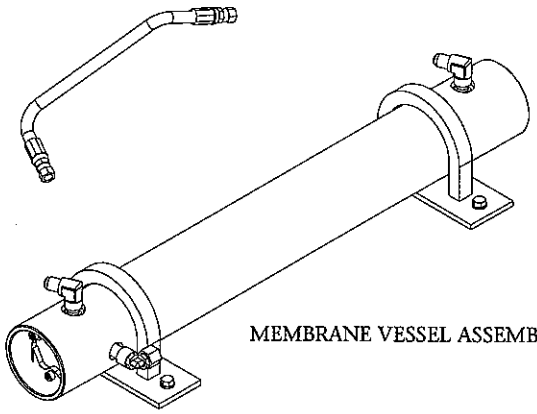


ENERGY TRANSFER DEVICE

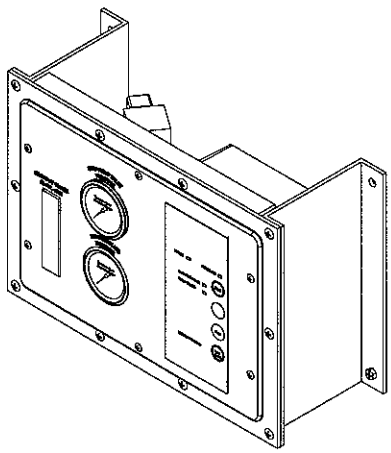


PREFILTER ASSEMBLY

HIGH PRESSURE HOSE ASSEMBLY



MEMBRANE VESSEL ASSEMBLY



FRONT PANEL ASSEMBLY

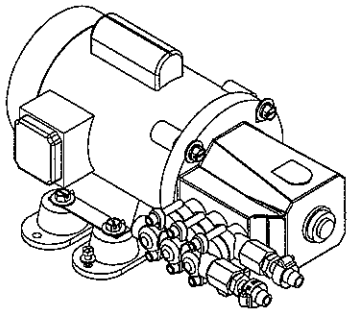
MODULAR 400 DC MODEL

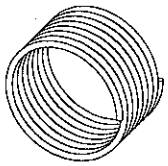
PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

STAINLESS HOSE CLAMPS

3/4 INLET ELBOW ASSEMBLY

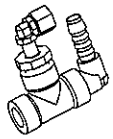
AC 110/220 50/60 Hz MOTOR

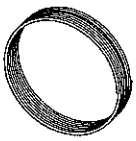




5/8" BRAIDED HOSE

REJECT WATER ASSEMBLY

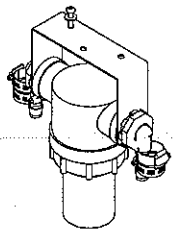




1/4" BLACK TUBE

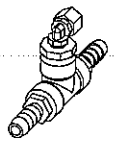
1/4 TUBE CONNECTOR

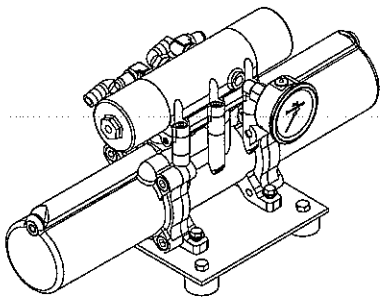
PLUNGER PUMP



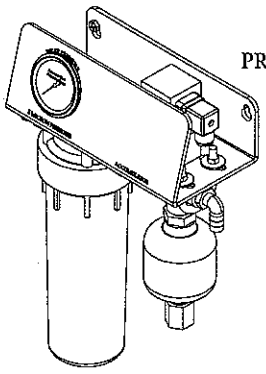
SEA STRAINER

INLINE TEE ASSEMBLY

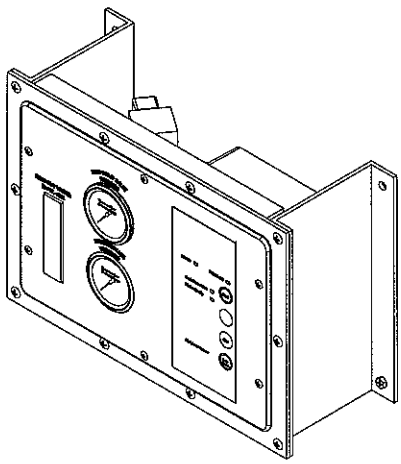




ENERGY TRANSFER DEVICE

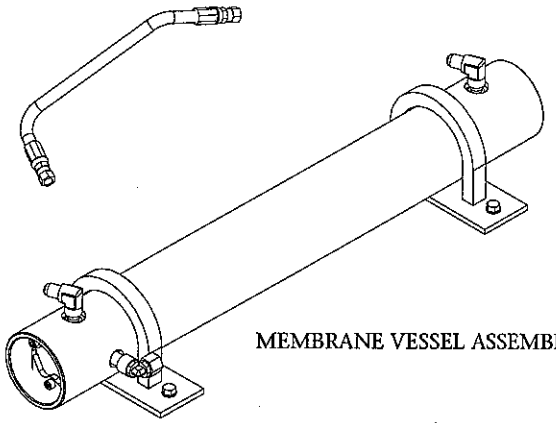


PREFILTER ASSEMBLY



FRONT PANEL ASSEMBLY

HIGH PRESSURE HOSE ASSEMBLY



MEMBRANE VESSEL ASSEMBLY

MODULAR 400 & 600 AC MODELS

PART NUMBERS IN CHAPTER 9 AND DIMENSIONS IN CHAPTER 10

1.1 INTRODUCTION TO ULTRA WHISPER COMPONENTS

1.1 COMPONENT FUNCTIONS:

This section informs the customer of every Ultra Whisper component option, and the function of every system component. The component definition in this chapter must be understood before continuing through this manual. The manual beyond this section assumes that the customer has read and understood the system component definitions. If needed, a glossary of seawater industry terms is available in Chapter 11.

COMPONENT DESCRIPTIONS:

All components supplied by Sea Recovery, both standard and optional, are described in this section along with items required or desired by the installer. The location, operation, and purpose of each major component is briefly explained in this section. The descriptions in this section are listed according to the ID numbers. This ID number defines each component with a system-definition. This ID number is used throughout this manual to locate the component in the System Piping and Interconnect Diagram in Chapter 1.2. Throughout this manual, a number in brackets follows system components

i.e., Sea Strainer [3]

which refers to the component's location in the System Piping and Interconnect Diagram illustration and the ID number used in the definitions on the following pages.

COMPONENT SUBDIVISION:

The Ultra Whisper System is broken down into seven subdivisions described below.

** Denotes items supplied by installer
*** Denotes optional equipment

PREFILTRATION:
This subdivision of the system filters the feed water before pressurizing and moving into the membrane element. The feed water is filtered to remove suspended solids larger than 5 Microns in size (5/1,000,000 of a meter). The pre-filtration protects the Membrane Element from becoming encrusted, clogged, or choked with a foreign substance.

PRESSURIZATION:
This subdivision of the system ensures the proper pressure is applied across the Membrane Element to produce the required product water within a safe operating condition. A minimum pressure must be applied across a membrane to ensure product flow and acceptable salinity for every feed water condition.

PRODUCT WATER:
This subdivision of the system gives a visual indication of quantity, and quality of the product water. The product flow meter comes with a scale that indicates the amount of potable water being produced. The Touch Pad comes with a red light that indicates non-potable water and a green light that indicates potable water.

POST FILTRATION*:**
This subdivision of the system is the final step in Product Water quality control. The Post Filtration is designed to limit unpleasant odor, taste, and biological matter, which may have passed through the Reverse Osmosis Membrane Element.

FRESH WATER FLUSH SUBSYSTEM*:**
This subdivision of the system is designed to rinse the membrane element and the feed water passageway of the system replacing corrosive seawater in the system with fresh product water. It consists of a solenoid valve, which controls or opens the flow of water from the boat's pressurized fresh water system; a Carbon Briquette, which removes any chlorine added to the boat's fresh water storage tank; and a Check Valve Assembly, which isolates the Fresh Water Flush from the seawater inlet of the system.

ELECTRONIC CONTROLLER SUBSYSTEM:
This subdivision of the system monitors water quality, directs Product Water flow, and protects the system from damage by utilizing the High-Pressure Switch, Low-Pressure Switch and Salinity Probe as well as customer input front the Touch Pad and Remote Control. All of these inputs are analyzed by the electronic subsystem to properly control the 3-Way Product Diversion Valve, Fresh Water Flush Solenoid Valve, Motor, and U.V. Sterilizer.

BRINE DISCHARGE SUBSYSTEM:
This subdivision of the system carries the Brine Discharge exiting from the Reverse Osmosis Membrane Element. The Membrane element has one input and two outputs. Pressurized feed water enters the membrane element and product water and high-pressure brine exit the membrane element. Brine-water is always discharged. If the product water does not meet quality standards it is diverted to discharge.

A. PREFILTRATION SUBSYSTEM:
This section of the system filters and delivers the feed water into the System. The water is filtered to remove suspended solids larger than 5 Microns in size. The pre-filtration protects the Membrane Element.

1. **Inlet Thru Hull Fitting with Forward Facing Scoop** ** is the point at which the feed water 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 Ultra Whisper System.

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 Feed Pump.

4. **Feed Pump** supplies a positive pressure through the Pre-filters, into the Energy Transfer Device. The Ultra Whisper utilizes a feed pump that flows from 1.5 to 3.5 gallons per minute at 80-175 psig. The resulting pressure at the Energy Transfer Device depends on the feed water condition and final configuration.

5. **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 provides lower system maintenance costs.

6. **Pre-Filter Inlet Gauge** is mounted on the System Panel and monitors the pressure from the Feed Pump entering the Pre-filter. This Gauge is used along with the Pre-Filter Outlet Gauge to determine the condition of the Pre-Filter Element.

7. **Pre-Filter** This filter removes suspended solids larger than 5 Microns in size to protect the Reverse Osmosis Membrane from fouling.

8. **Pre-Filter Outlet Gauge** is mounted on the System Panel and monitors the outlet pressure of the Pre-Filter. This Gauge is used along with the Pre-Filter Inlet Gauge to determine the condition of the Pre-Filter Element.

9. **Low Pressure and Vacuum Gauge** displays the Inlet Pressure to the Feed Pump. The gauge assists the operator in troubleshooting problems with the Sea Strainer and Feed Pump.

10. **Low Pressure Switch** is a safety devise used to alert the controller when a plugged sea strainer or other condition causes an abnormally low-pressure situation.

11. **Accumulator** dampens pressure pulses that may occur between the Feed Pump and the Hydraulic Energy Transfer Device.

B. PRESSURIZATION SUBSYSTEM:
Proper pressure and proper flow across the Membrane Element are two basic requirements of Reverse Osmosis.

12. **Energy Transfer Device** utilizes pressurized Brine Water from the membrane to aid in the pressurization of the Feed Water.

13. **High Pressure Gauge** is a stainless steel gauge, used to monitor the high-pressure developed by the Energy Transfer Device into the Membrane Vessel Assembly.

14. **High Pressure Switch** is a safety device that alerts the controller if a pressure in the system exceeds a safe level.

15. **High Pressure Hose,** *Energy Transfer Device Outlet/ MVA Inlet,* transfers pressurized Feed Water from the Energy Transfer Device to the inlet of the Reverse Osmosis Membrane Element.

16. **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 Seawater Feed becomes fresh Product Water. The remainder carries the rejected salt ions out of the R.O. The Vessel protects the R.O. Membrane.

17. **High Pressure Hose,** *MVA Outlet/ Energy Transfer Device Inlet,* transfers pressurized Brine Water from the Membrane Vessel Assembly to the Energy Transfer Device.

C. PRODUCT WATER SUBSYSTEM:
This section of the System gives a visual indication of the clarity, quantity, and quality of the product water. Post Filtration 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.

18. **Temperature Compensated Salinity Probe** electronically determines whether the salinity content of the Product Water is acceptable. This Salinity Probe is temperature compensated and provides an accurate measurement of the Product Water quality.

19. **Flow Meter, Product Water** This flow-through meter measures the rate of Product Water flow from the R.O. Membrane Element in gallons per hour before entering the Product Water Post Filtration Components.

20. **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 remains in the normally open position. The "fail safe" normally open position diverts the un-potable Product Water to the Hull Discharge Fitting.

21. **Charcoal Filter** *** is designed to remove unpleasant odors and taste from the Product Water.

22. **Ultra Violet Sterilizer***** Sterilizes 99.9% of any virus, bacteria and other microorganisms which may be present in the product water. The U.V. Sterilizer is highly recommended if the Product Water Storage Tank is not otherwise treated by means such as chlorination.

23. **Potable Water Storage Tank**** may be any container suitable for storing Potable Water, i.e. existing water storage tank.

D. FRESH WATER FLUSH SUBSYSTEM***:
The Fresh Water Flush system is designed to clean the system and replace corrosive seawater in the system with fresh product water. It consists of a solenoid valve, which controls the flow of water from the boat's pressurized fresh water system; a Carbon Briquette, which removes any chlorine added to the boat's fresh water storage tank; and a Check Valve Assembly, which isolates the Fresh Water Flush from the seawater inlet of the system.

24. **Fresh Water Flush Carbon Briquette and Solenoid Valve***** are the main component of the Fresh Water Flush System. The Solenoid Valve controls the flow of fresh water through the system. The Carbon Briquette removes particulate matter and chlorine from the fresh water to prevent damage to the R.O. Membrane Element.

25. **Fresh Water Flush Check Valve Assembly** *** This check valve assembly isolates the Fresh Water Flush system, forcing fresh water through the system and out the Discharge Fitting while preventing water from escaping through the Inlet Hull Fitting [1].

E. ELECTRONIC SUBSYSTEM:
This subsystem monitors water quality, directs Product Water flow, and protects the system from damage by utilizing the Pressure Switches, Salinity Probe, Touch Pad and Remote to control the 3-Way Product Diversion Valve, fresh water flush solenoid valve, Motor, and U.V. Sterilizer. This is the central electrical connection point of the system.

26. **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. This enclosure houses the electronic components and the electrical connections of the system. It also ensures only potable Product Water passes into the Product Water Storage Tank.

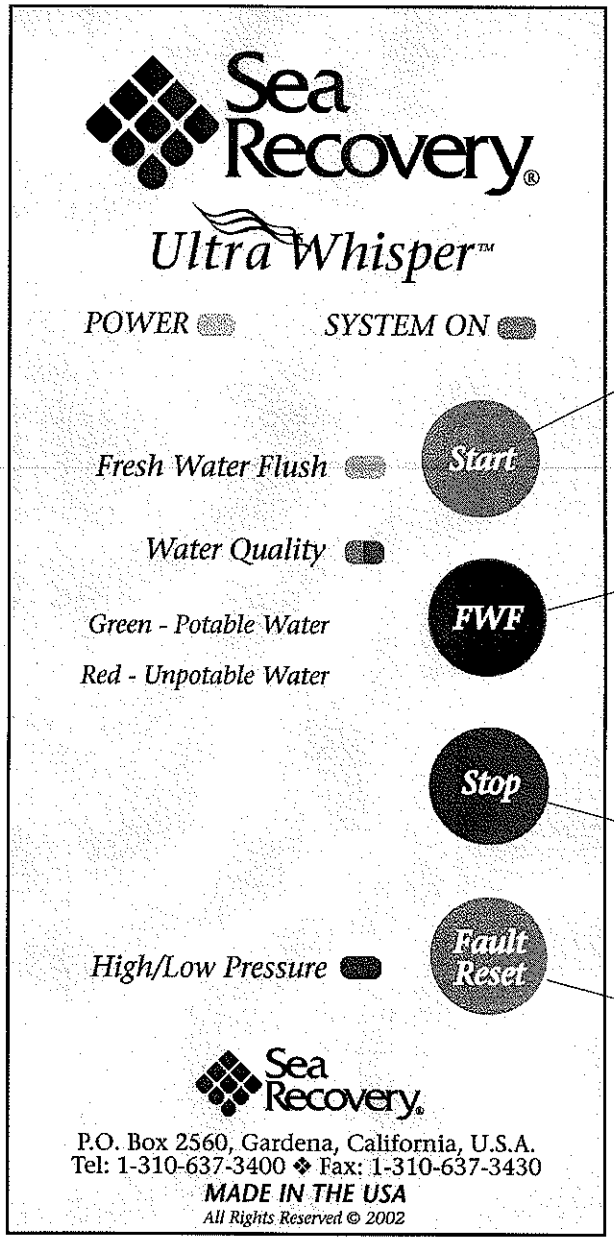
27. **Remote Control** *** allows for remote monitoring and controlling of the system.

F. BRINE DISCHARGE SUBSYSTEM:
This section of the system carries the Brine Discharge exiting from the R.O. Membrane Element.

28. **Thru Hull Discharge Fitting** ** should be installed above water level for discharge of the Brine Reject Water from the system.

TOUCH PAD CONTROL DESCRIPTIONS:

SYSTEM BUTTONS:
The Touch Pad contains all of the system control buttons. The system buttons are identified and described below.



START: This button initiates the start cycle.

FRESH WATER FLUSH***: This button controls the Fresh Water Flush [24]. When pressed, the fresh water flush runs in auto mode (see Chapter 4), until the "Stop" button is pressed.

STOP: This button stops the system functions when pressed. Each time the system is stopped, the Fresh Water Flush Mode is initiated. The Fresh Water Flush Mode is aborted by pressing the Stop button a second time.

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

INDICATOR LAMPS:
Above and to the left of the buttons 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.

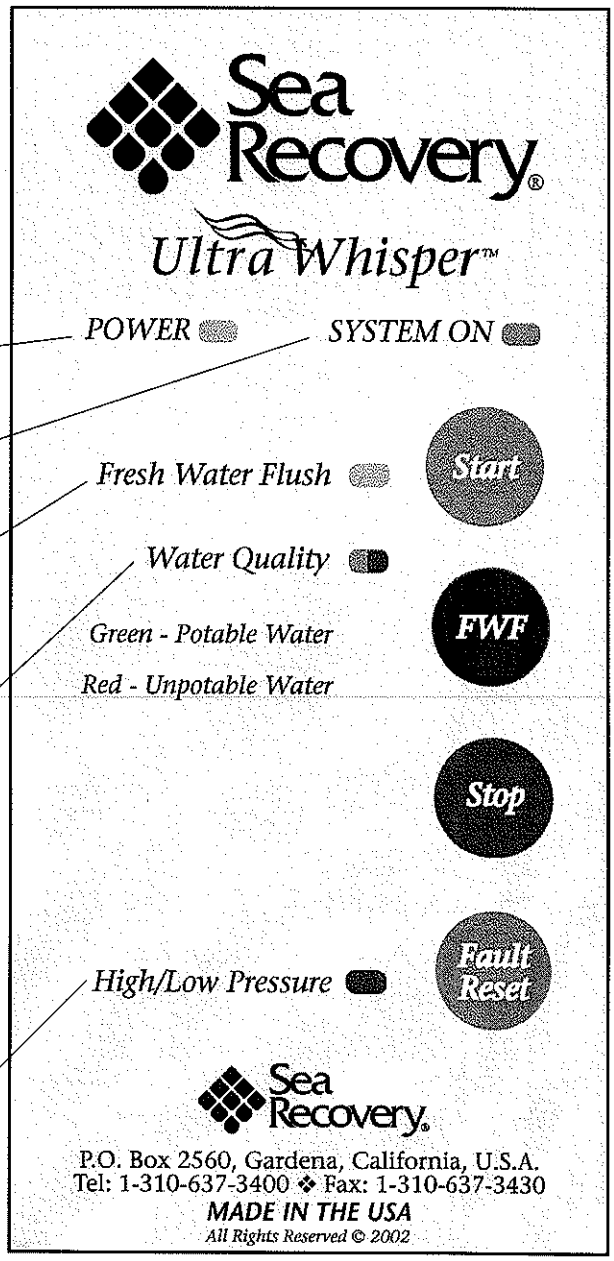
Power: This indicator is lit when power is supplied to the controller. This indicates that the main power source connection to the system has been switched on.

System On: This lamp illuminates when the System is operating.

Fresh Water Flush:*** This indicator illuminates solidly during the Fresh Water Flush cycle. When the Fresh Water Flush is on stand-by between rinse cycles, 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 [10] senses an irregular low-pressure condition, this lamp blinks for twenty seconds. If the condition is not corrected, the system shuts down. If the high-pressure switch [14] senses a pressure greater than a safe level for longer than 2 seconds, the system shuts down and the High/Low pressure fault lamp illuminates.



1.2 INTRODUCTION TO ULTRA WHISPER SYSTEM DIAGRAMS

1.2 INTRODUCTION TO DIAGRAMS:

This section informs the customer of every Ultra Whisper component option and how the component is connected with respect to all of the other system components. This is accomplished by using a System Piping and Interconnect Diagram (P&ID) with additional illustrative diagrams. The P&ID is used through out this manual to assist the customer with component connections as well as illustrating the different system operations. Refer to the previous chapter for a description of the component's function within the system subdivision. If needed, a glossary of seawater industry terms is available in Chapter 11.

COMPONENT ILLUSTRATIONS:

All components supplied by Sea Recovery, both standard and optional, are illustrated within the enclosed Piping and Interconnect Diagrams. The installer should refer to these diagrams to ensure proper installation. The ID numbers used in the enclosed diagrams are listed and defined in the previous section. This ID number is used to locate the component in the System Piping and Interconnect Diagram. Throughout this manual, the number in brackets will refer to the ID number.

i.e., Sea Strainer [3]

The ID number is used to locate components in the System Piping and Interconnect Diagram illustration (P&ID).

SYSTEM OPERATION OPTIONS

The Ultra Whisper System has two operational modes described below.

NORMAL SYSTEM OPERATION:
In this mode, the system regulates itself to produce potable water in the designed model specific flow rate. The specifications for each model are listed in Chapter 10. The Ultra Whisper system is very easy to operate. The "Start" button initiates the system to produce potable water. The "Stop" button ends the water production.

FRESH WATER FLUSH OPERATION*:**
In this mode, the system cleanses itself by using the boat's fresh water tank. Seawater is a corrosive solution that should be rinsed from the system after every use. This system extends the life of the membrane element by preventing the membrane from becoming encrusted, clogged, or choked with a foreign substance.

PIPING AND INTERCONNECT DIAGRAMS:

The Piping and Interconnect Diagrams only represent the general component and how that component is connected to the system. The P&ID may have components that may not look exactly like the part received. The thing that matters is that the component function is the same. Component functions are explained in the previous section and are indicated on the P&ID by a number in brackets.

The Piping and Interconnect Diagrams use different line types to symbolize the following:

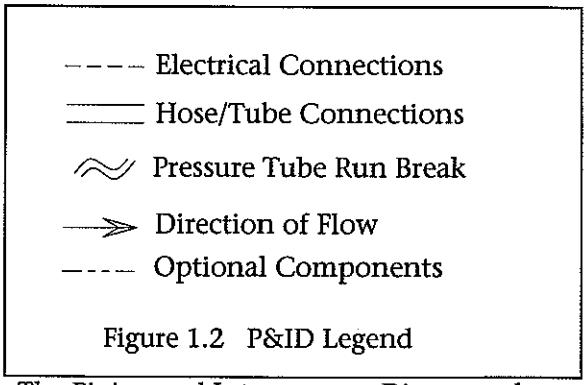


Figure 1.2 P&ID Legend

The Piping and Interconnect Diagrams do not represent the exact location or the exact dimensions of a component; the diagrams only illustrate how each component is connected within the system.

Throughout this Manual, Numbers in [brackets] refer to the I.D. numbers illustrated on the P&ID below.

ULTRA WHISPER REVERSE OSMOSIS DESALINATION SYSTEM

Diagram illustrates the feed pump used on Models 600AC, 400AC/DC, 200AC

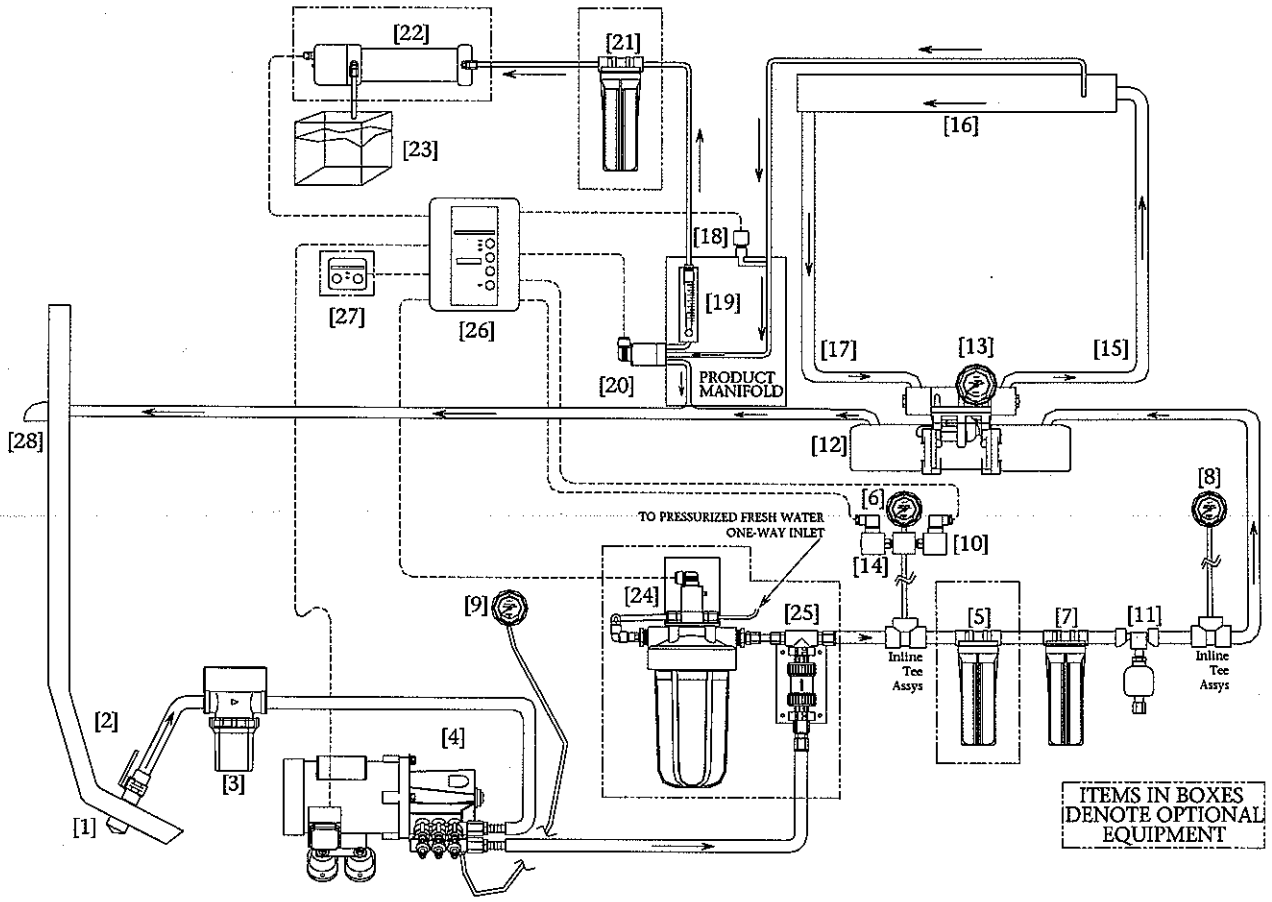


Figure 1.2.1 Piping and Interconnect Diagram illustrating every component option

DISCUSSION:
As illustrated in the first section of this chapter, the system components are slightly different for every Style and Model of the Ultra Whisper System. The Piping and Interconnect Diagrams are the same for every model. However, two Piping and Interconnect Diagrams are illustrated to allow the customer to follow a diagram with components that look like the components shipped with the Ultra Whisper system package.

MODEL DIFFERENCES:

MODEL 200:
There are few differences in the Ultra Whisper models. The 200 Series models operate at a lower feed pressure than the 400 and 600 models. This lower pressure allows the use of a non-corrosive high-strength plastic accumulator. The 200 series models also use an Energy Transfer Device with a set 9% recovery. The recovery means that 9% of the feed water that enters the system is processed into product water. The 200 series DC system models utilize a low power diaphragm pump to minimize the amount of power consumption for a set volume of potable water produced. The 200 series AC system model utilizes a powerful plunger stainless steel pump for reliability.

MODEL 400 & MODEL 600:
The 400 and 600 series models use an Energy Transfer Device with a set 12% recovery. The 12% recovery means that 12% of the feed water that enters the system is processed into product water. The higher recovery results in higher feed pressures into the ETD. This pressure requires a stronger stainless accumulator. Each model comes with a properly sized membrane assembly.

ULTRA WHISPER REVERSE OSMOSIS DESALINATION SYSTEM

Diagram illustrates the feed pump used on the 200DC Model & the accumulator used on all 200 Models

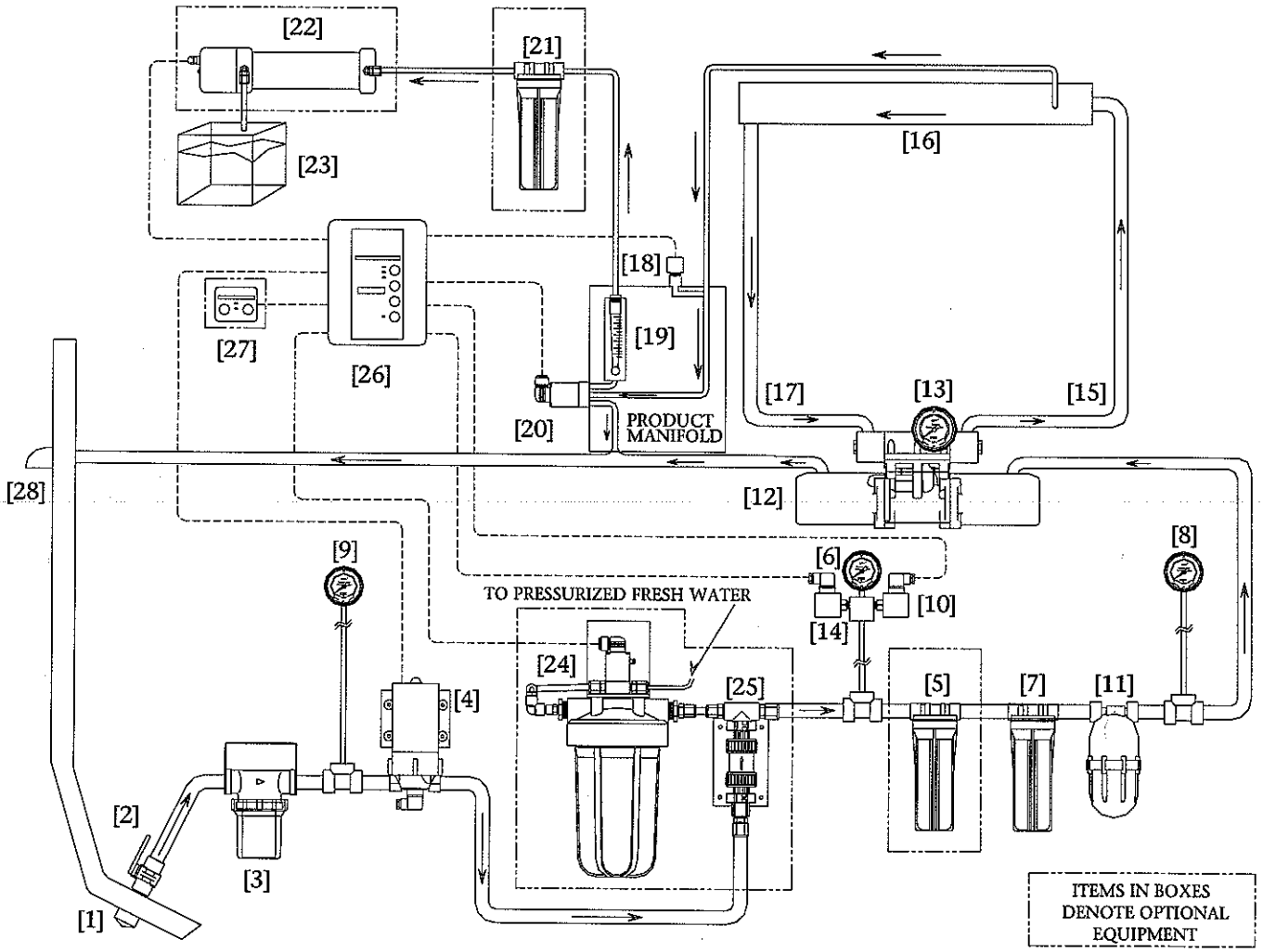
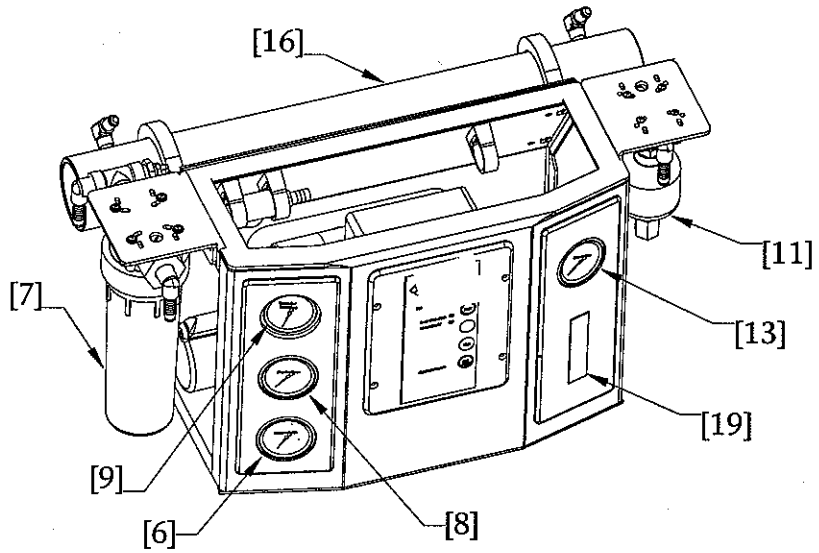


Figure 1.2.2 Piping and Interconnect Diagram illustrating every component option

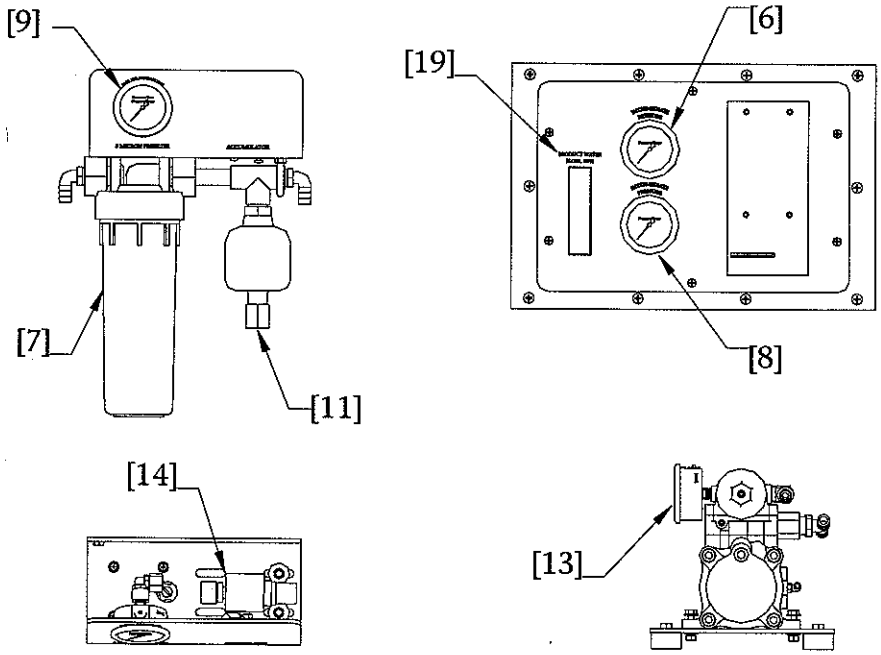
STYLE DIFFERENCES:
The Ultra Whisper Systems come in two Styles, the Modular Style and the Compact Style.

MODULAR STYLE:
The Modular Style contains more individual component assemblies as illustrated in Chapter 1.1. These individual assemblies allow for flexibility during installation. This flexibility also involves more connections for the installer. Figure 1.2.4 should be used with the two Piping and Interconnect Diagrams shown above for a better understanding of the Ultra Whisper Modular system. Refer to Chapter 2 for proper installation instructions of the system components.

COMPACT STYLE:
The Compact Style contains many component assemblies within the compact frame. This limits the installation to a few connections; having most of the plumbing and electrical connections completed at the factory. This minimizes the time to install a Compact Style System. Figure 1.2.5 should be used with the two Piping and Interconnect Diagrams shown above for a better understanding of the Ultra Whisper Compact system. Refer to Chapter 2 for proper installation of the system components.



COMPACT STYLE



MODULAR STLYE

Figure 1.2.3 Illustrates the two styles with common components in different physical locations.

The diagram above, Figure 1.2.3, is used to eliminate the confusion between the P&ID and the two Ultra Whisper Styles. The common components shown are the same but they are configured differently in the two styles. The P&ID is a simple illustration of the connections and components within a system.

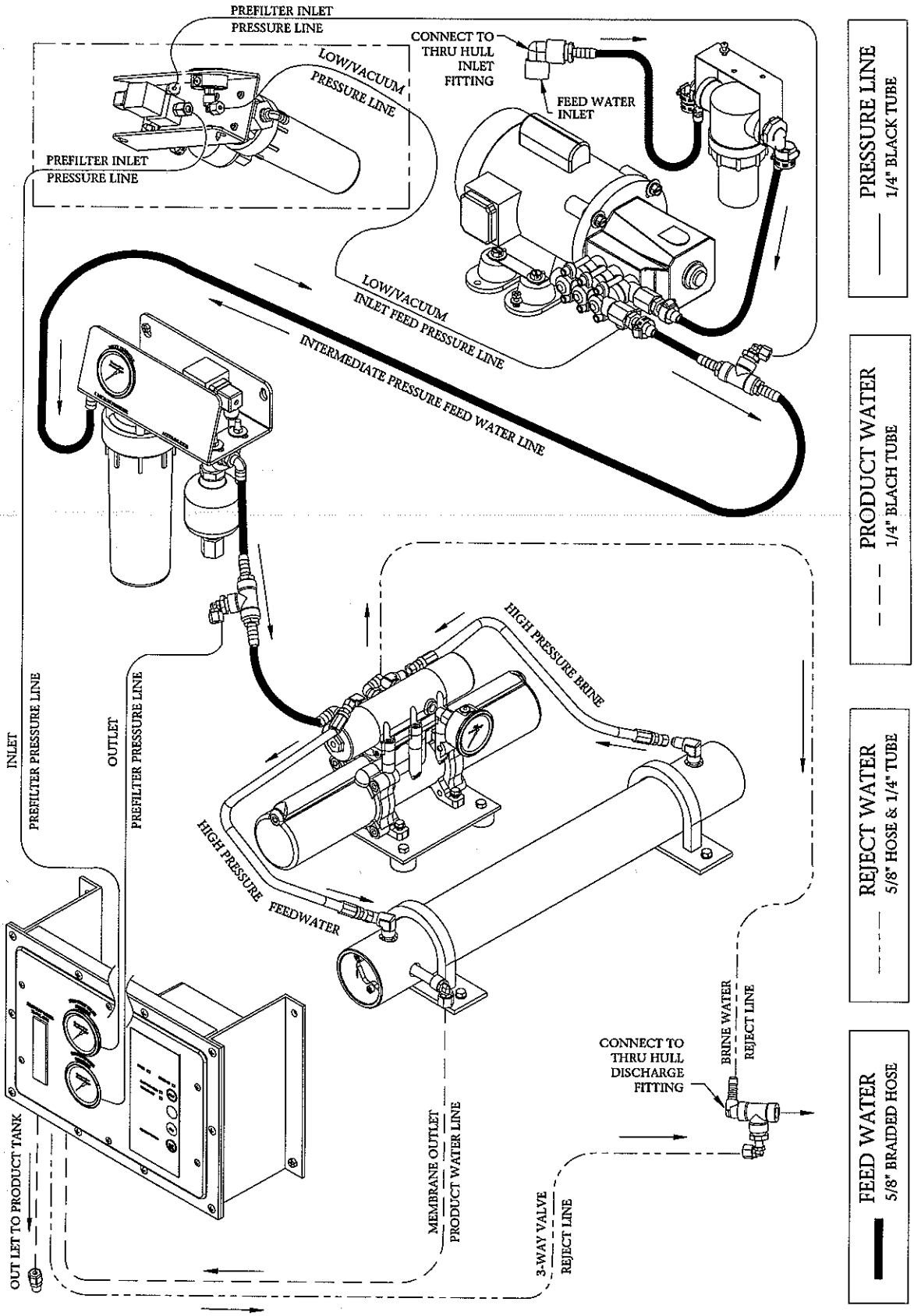


Figure 1.2.4 Modular Style - Piping Diagram illustrating only standard components with no options

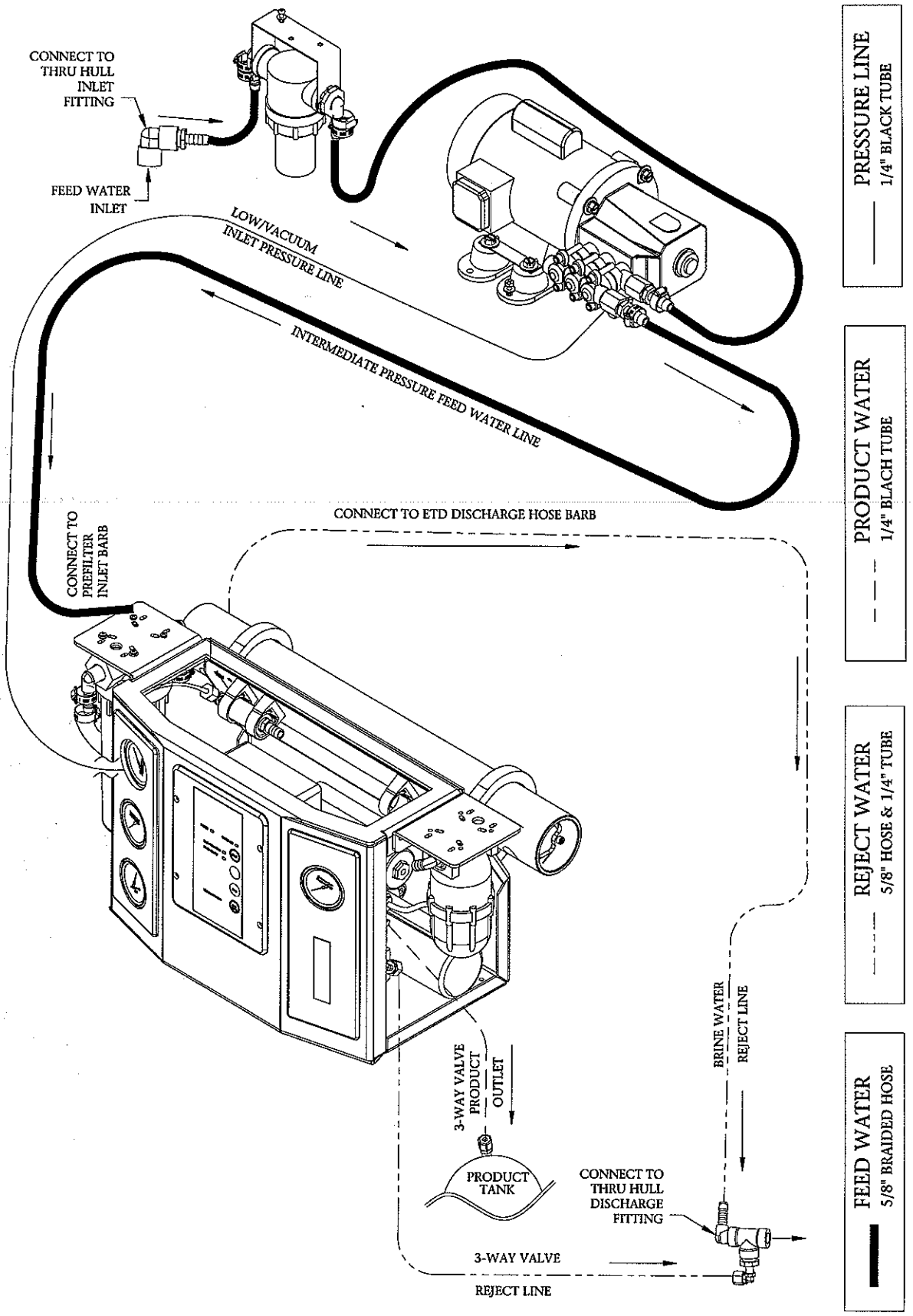


Figure 1.2.5 Compact Style - Piping Diagram illustrating only standard components with no options

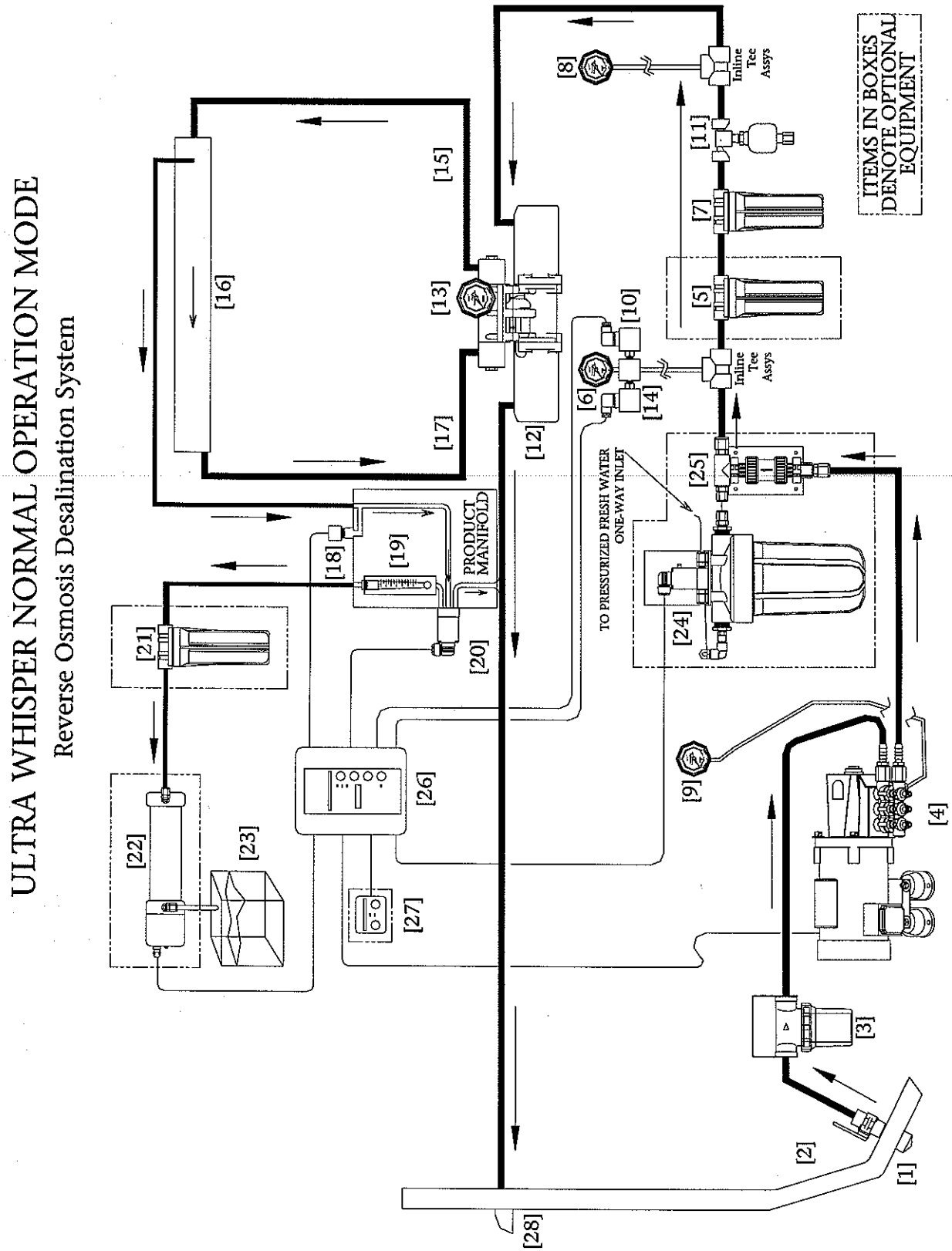


Figure 1.2.6 Illustrates the flows within the system when the system is in normal operating mode.

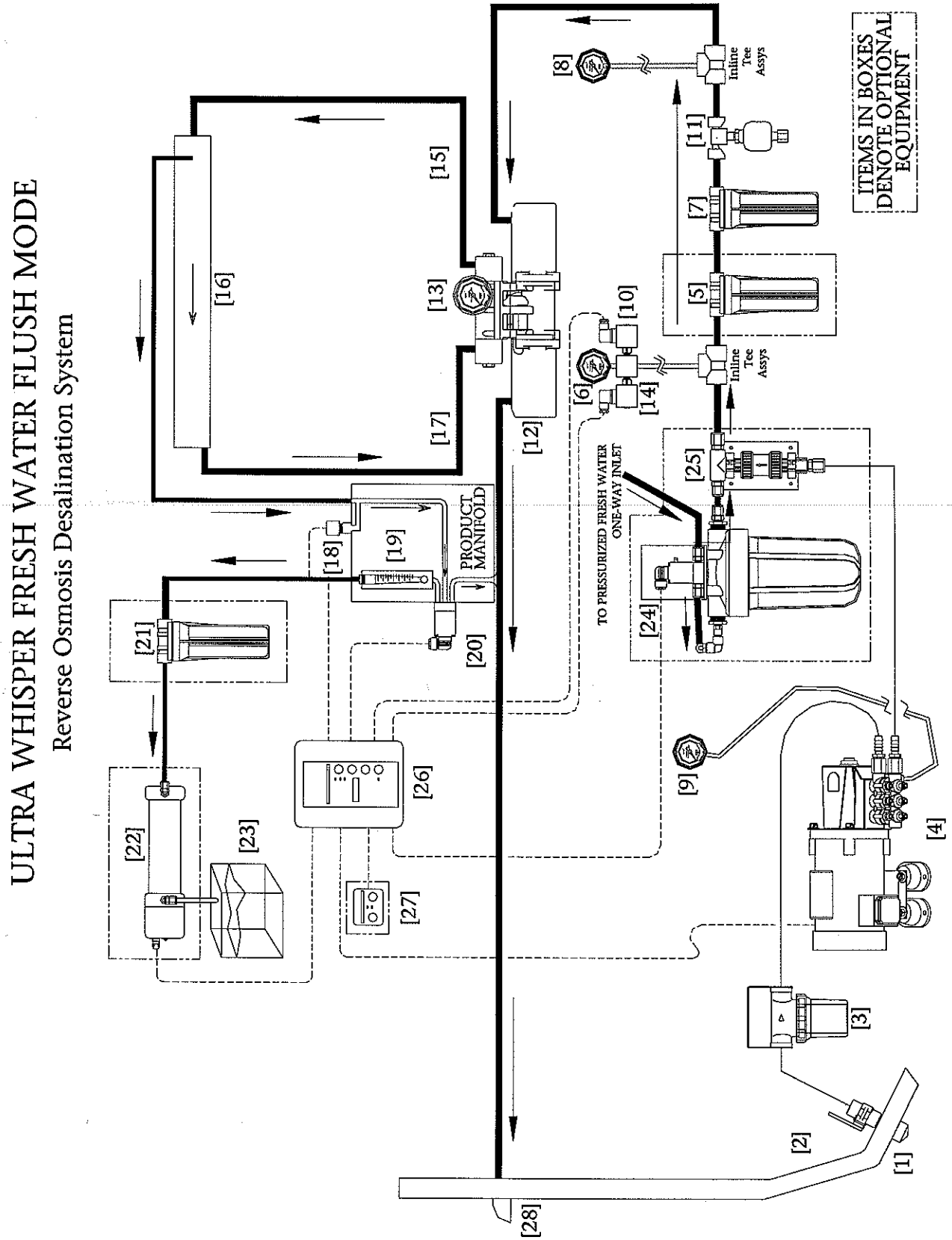


Figure 1.2.7 Illustrates the flows within the system when operating in Fresh Water Flush (FWF) mode.

2 INSTALLATION & COMMISSIONING

2.0 INSTALLATION PREPARATIONS

INTRODUCTION:

This Chapter contains instructions for the installation of the Sea Recovery Ultra Whisper Series Desalination System. This information is provided to ensure a safe installation. Please read this Chapter thoroughly before the installation of any components. The instructions in this chapter are intended for personnel with general training and experience in the operation of fluid handling systems.

A. STORAGE PRIOR TO UNCRATING:

1. Adhere to crate markings:

   DO NOT store in direct sunlight;
   DO NOT store above 120° F / 49° C;
   DO NOT freeze; STORE ONLY on base with ARROWS UP;
   DO NOT store longer than 3 months without additional storage chemical.

2. Refer to Chapter 4 of this manual for further cautions of the Reverse Osmosis Membrane Element.

B. UNCRATING:

DO NOT DISCARD ANY PACKAGING UNTIL YOU HAVE FOUND AND IDENTIFIED ALL PARTS! Remove the Ultra Whisper System from the shipping carton. Some of the components are loose or separately packaged in the shipping container.

C. COMPONENTS SUPPLIED BY OWNER:

Letters in "( )" correspond to the System Packing List. *5/8" Flexible Hose is used for all 1/2" Hose Barb Fittings*

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

   Hull Fitting requires a minimum 3/4" inside diameter with a 3/4" MNPT connection for fitting (SPL-4c). A forward facing scoop type is recommended and these fittings must be installed below water level and never be able to draw air.
   The Quarter turn Ball Valve requires a minimum 3/4" ID thru hole with a 3/4" FNPT connection for the supplied fitting (SPL-4d).

2. **Brine Discharge Thru Hull Fitting** [28]

   Requires a minimum 1/2" thru hole with a 1/2" MNPT connection (SLP-4i) and **must** be located above water level.

3. **Potable Water Storage Tank** [23]

   The installation fitting must have at least a 1/4" thru hole with 1/4" FNPT for the connection fitting (SPL-4e). The fitting must terminate above the maximum water level and no valves should be installed in this line.

4. **Properly sized Power Cable**

   (See Circuit Protection in Chapter 10 or a qualified electrician for wire sizing.)

5. **An electrical power source**

   (See Electrical Specifications on page 7.1)

System Packing List (SPL):

1. **SYSTEM**
2. **FEED PUMP**
3. **ANY OPTIONAL ACCESSORIES**
4. **INSTALLATION KIT**
   a. 30 Feet of 5/8 " Hose
   b. 50 Feet of ¼ " OD Tubing Black
   c. 1 – ¾ " Elbow 90 FNPT PVC
   d. 1 – ¾ " Connector MNPT X ½ " Barb
   e. 1 – ¼ " Elbow 90 Tube X ¼ " MNPT
   f. 1 – ¼ " Connector Tube X ¼ " MNPT
   g. 1 – Reducer Bushing ½ " MNPT X ¼ " FNPT
   h. 1 – ½ " Elbow 90 MPT X ½" Barb
   i. 1 – ½ " Tee FNPT PVC
   j. 4 – ¾" Hose Clamps
   k. OWNER'S MANUAL

MODULAR SYSTEM ONLY ADD
l. 2 – Inline Tee Assembly
m. 8 – ¾" Hose Clamps

Bill of Material is supplied on Page 9.23

Figure 2.1 A general system-packing list

D. TOOLS REQUIRED FOR INSTALLATION:

Not all installations are typical, therefore, it is recommended to have a full set of Mechanic and Electrician tools available. A separate DS Meter, available from Sea Recovery, and a volt/ohm meter (VOM) are beneficial and useful tools for system installation and commissioning. Drill bits are needed to pre-drill holes before installing brackets or fastening equipment. The following Lag screws are supplied with the Ultra Whisper System:
For a 1/4" Lag Screw use a 3/16 Drill bit
For a #10 Lag Screw use a 1/8 Drill bit

E. SPECIAL CONSIDERATIONS:

1. **Length of Connection Lines:**

   All connection lines should be as short as possible. The connection lines must be as straight as possible with minimum number of fittings and pressure losses.

2. **Placement and routing of the Feed Water Line:**

   Always plumb the hose/line so that all air may naturally bleed upward and not get trapped in the feed water line. Restrain the hose to prevent possible entanglement or damage. Using more feed line than necessary causes pressure losses that decrease system efficiency.

3. **System Feed Inlet:**

   The feed inlet must be in constant contact with the feed water and provide an uninterrupted supply of air free feed water. The Inlet Thru Hull Fitting must be dedicated only to the Ultra Whisper System. DO NOT use one Thru Hull Fitting for several auxiliary systems.

4. **Access for Maintenance:**

   Give careful consideration to the access of 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-filter [7] and into the inlet of the Energy Transfer Device [12]:**

   5/8" Braided Hose is supplied for the plumbing of the feed water line from the Inlet Sea Cock Valve through to the Inlet of the Energy Transfer Device. Caution must be exercised in extending the length of the feed water line. Pressure loss from the excess hose results in lower system power efficiency. Be sure to install all of the supplied items that belong between the Sea Cock Valve [2] and the ETD [12].

2. **Brine Dump Tubing to the Reject/Outlet Hull Fitting [28]:**

   5/8" Braided Hose is supplied to connect the ETD outlet to the overboard Outlet Hull Fitting. Quarter inch O.D. tubing is supplied to dump bad product water from the Product Manifold to the Outlet Hull Fitting. A Tee with connections is supplied to unite these two reject lines at the Outlet Hull Fitting. Ensure that hoses cannot obstruct reject flow. Back-pressure in these lines can result in high system pressure or backflow through the 3-way product valve.

3. **Product water tubing from the Product Water outlet connection to the Product Water Storage Tank [23] Inlet:**

   1/4" OD tubing is supplied for this purpose. The Carbon Filter [21] and the UV Sterilizer [22] are optional items that are installed in this line before the Storage Tank.

G. FEED PUMP PREPARATION:

The diaphragm pumps do not need oil or any preparation.

Remove the shipping tape on the Plunger Feed Pump Oil Fill Cap. *This prevents oil from leaking during shipping.*

Ensure that the feed pump oil level is higher than the center of the feed pump sight glass. *The pump oil must be filled with Sea Recovery supplied pump oil.*

H. FEED WATER PRECAUTIONS:

Precautions must be taken to protect the membrane element from contaminants. The list below identifies the chemicals that must be avoided.

Hydrogen peroxide	Chloramines
Chloramines-T	Iodine
N-chlorioisocyanurates	Chlorine
Chlorine dioxide	Hypochlorite
Phenolic disinfectants	Petroleum products
Bromine	Bromide

Or any chemical, not approved in writing by Sea Recovery.

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

Do not connect any water line to the Ultra Whisper System that may contain any of the above listed chemicals.

Example: *Do not connect the inlet of the Ultra Whisper to the ship's 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 Reverse Osmosis Membrane Element.*

A Fresh Water Flush system uses filtration to remove chlorine and bromine from the ship's potable water system.

2.1 INSTALLATION INSTRUCTIONS

SYSTEM INSTALLATION:

Follow these instructions exactly to prevent system failure and possible 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.

INSTALLATION PRECAUTIONS:

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

2. The Inlet Connection [1], Sea Strainer [3], and Feed Pump [4] should all be installed below water level.

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

4. The Ultra Whisper MUST have a dedicated Feed Line that does not feed any other auxiliary systems.

5. DO NOT mount the Ultra Whisper in areas exposed to heat in excess of 120° F / 39° C.

6. Mount the ETD [12] horizontally to allow air in the feed line to naturally flow up.

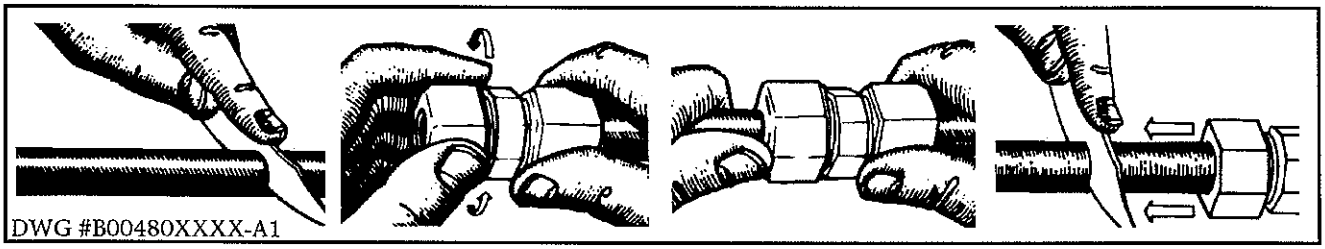
7. Avoid skin and eye contact with the membrane packaging solution. In case of skin contact, rinse the skin thoroughly with water. In case of eye contact, flush repeatedly with water and notify a physician immediately.

INSTALLATION INSTRUCTION OPTIONS:

Detailed installation instructions begin on the next page. Illustrated installation instructions are available in section 3 of this chapter.

NOTE: The following steps illustrate the installation of the Ultra Whisper. The illustrations show the system installed in the port-aft section of a vessel as an example. It is understood that this may not always be possible, and there are a variety of places the system may be mounted. The components in the illustrations are spaced farther apart than they may be in a vessel application to illustrate tube connections between components.

TUBE FITTING CONNECTIONS



TUBING ASSEMBLY

1. Cut tube end square and clean
2. Loosen nut on fitting three turns.
3. 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.

TUBE MUST HAVE AT LEAST 1" OF STRAIGHT TUBE FROM CONNECTION BEFORE ANY BENDS.

STEP 1 MAJOR COMPONENT MOUNTING

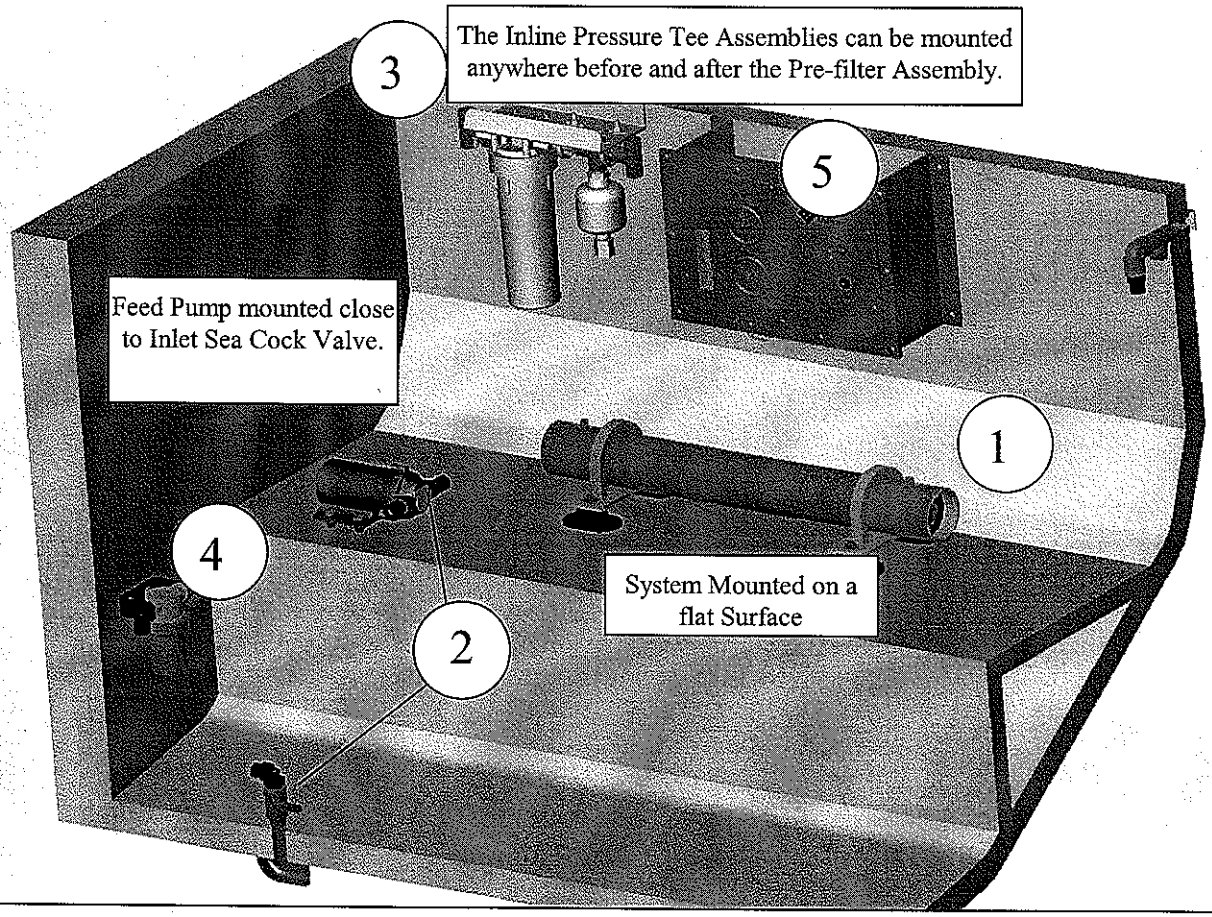
Compact Systems- Skip steps labeled *Modular Only*

1. (*Modular Only*) The Pressure Vessel Assembly (page 9.9) [16] is mounted to a flat surface using the supplied 1/4" x 1" Type "A" lag screws. The Pressure Vessel Assembly must be at least 1 vessel length from a bulkhead to allow access for membrane installation. *The modular flexible high-pressure hoses that connect the Membrane Vessel Assembly to the Energy Transfer Device are 6ft. long. See page 2.13 for installation instructions.*

2. Mount the Feed Pump (page 9.3 or 9.4) to a flat surface using the supplied 1/4" x 1 1/4" Type "A" lag screws. The Feed Pump [4] is mounted horizontally and in an accessible location to allow access for maintenance. *The inlet hoses must be easily accessible so that they can be relocated during storage or cleaning operations.* Mount the Feed Pump close to the [1] Inlet Thru Hull/ Sea Cock Valve [2] and the Sea Strainer [3].

3. (*Modular Only*) Mount the Pre-filter Assembly (page 9.6) [7][11] and optional Plankton-filter (page 9.5) [5] to a bulkhead using the supplied 1/4" x 1" Type "A" lag screws. The Low Pressure Gauge [9] and the high-pressure switch [14] are located on the Pre-filter Assembly. Inline Pressure Tee Assemblies are installed before and after the Pre-filter Assembly, for plumbing instructions see page 2.20.

4. Mount the Sea Strainer (page 9.2) [3] to a clearly visible and accessible bulkhead near the Sea Cock Valve [2] and the Feed Pump [4] using the supplied 1/4" x 1" Type "A" lag screws.



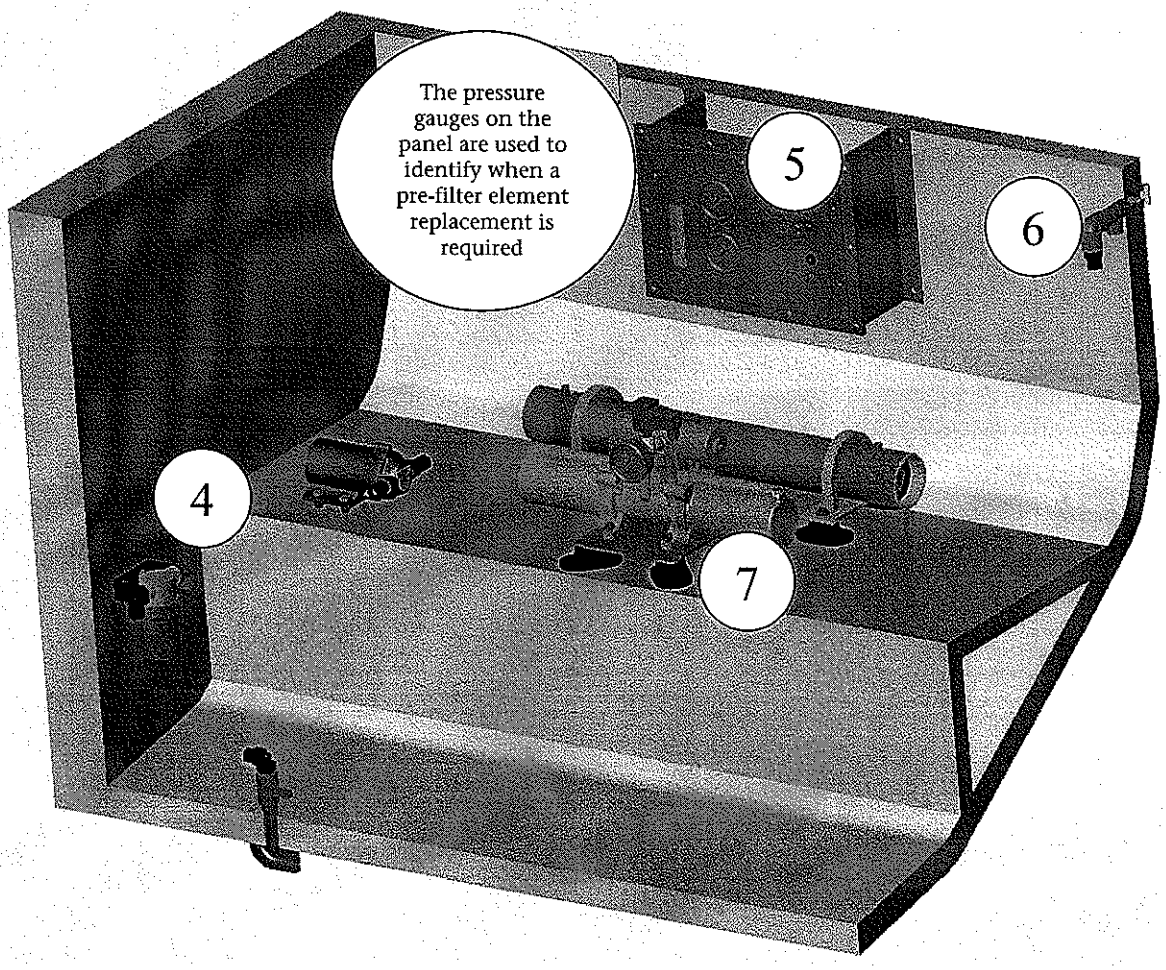
On Compact System steps 1, 3, and 5 are pre-assembled and located within the compact frame. See page 2.10

5. The Front Control Panel Assembly [26] should be located to allow quick access. Mount the Front Control Panel Assembly (page 9.12) to a bulkhead using the supplied 1/4"x 1" Type "A" lag screws. *The Product Manifold [18-20], Inlet [6], and Outlet [8] Gauges have 1/4" tubing entering/exiting below the Front Control Panel. 50 feet of tubing is supplied in the installation kit, for plumbing instructions see page 2.11.*

6. The brine discharge exits through the Hull Discharge Fitting [28] that must be installed above the water line. The reject water assembly is supplied in the installation kit to allow the brine discharge from the Energy Transfer Device [12] and the 3-Way Diversion Valve [20] to exit through the Hull Discharge Fitting.

7. (*Modular Only*) Mount the Energy Transfer Device (page 9.7) [12] to a flat surface using the supplied 1/4" x 2" Type "A" screws and rubber mounts. The Energy Transfer Device is mounted horizontally and in an accessible location to allow access for maintenance. *The inlet hoses must be accessible so that they can be relocated during storage or cleaning operations.* Mount the Energy Transfer Device close to the Pressure Vessel Assembly [16]. Check that the supplied high-pressure hoses can readily be assembled before mounting.

These instructions are also illustrated at the end of the Chapter 2.2. The Modular and the Compact are illustrated as two separate sections.



STEP 2 OPTIONAL COMPONENT MOUNTING

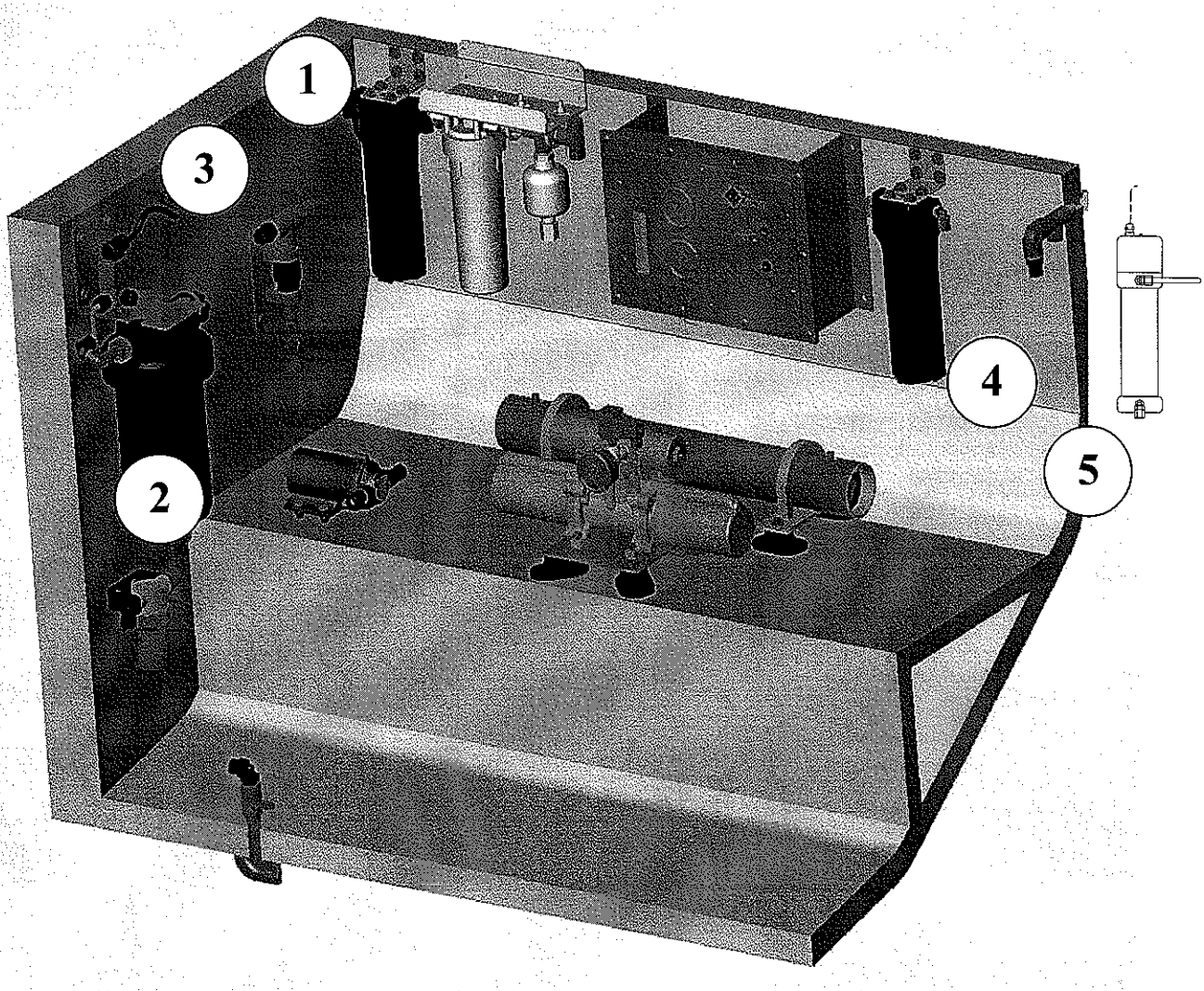
1. If installed, the Plankton Filter (page 9.20) [5] should be mounted inline between the Feed Pump [4] or Fresh Water Flush [25] and the Pre-filter Assembly [7][11].

2. Mount the Fresh Water Flush Filter Canister (page 9.16) [24] to a Vertical Bulkhead. Allow at least four inches of clearance below for element replacement.

3. Mount the Fresh Water Flush Check Valve Assembly (page 9.16) [25] *vertically* in close proximity to the Feed Pump [4] and Fresh Water Flush Filter Canister [24] as shown in below.

4. If installed, Mount the Charcoal Filter (page 9.14) [21] to a bulkhead using the supplied #10 x 1" Type "A" screws. Mount the UV Sterilizer (page 9.15) [22] to a bulkhead directly after the Charcoal Filter.

5. The UV should be mounted vertically with the electrical fitting on the top. The UV should be plumbed with the inlet on the bottom and the outlet on top.



STEP 3 ELECTRICAL CONNECTIONS

1. Remove the Front Cover from the system controller to access the Main Terminal Strip and Printed Circuit Board.

2. Connect main power as shown in Chapter 7, using cable recommendations. The main power cable is inserted through one of the large Strain Reliefs on the bottom of the controller enclosure (pages 9.17-9.19). For AC Systems only, the boat's 12 VDC power source is also inserted through the small Strain Relief indicated by an "X" on the diagram below.

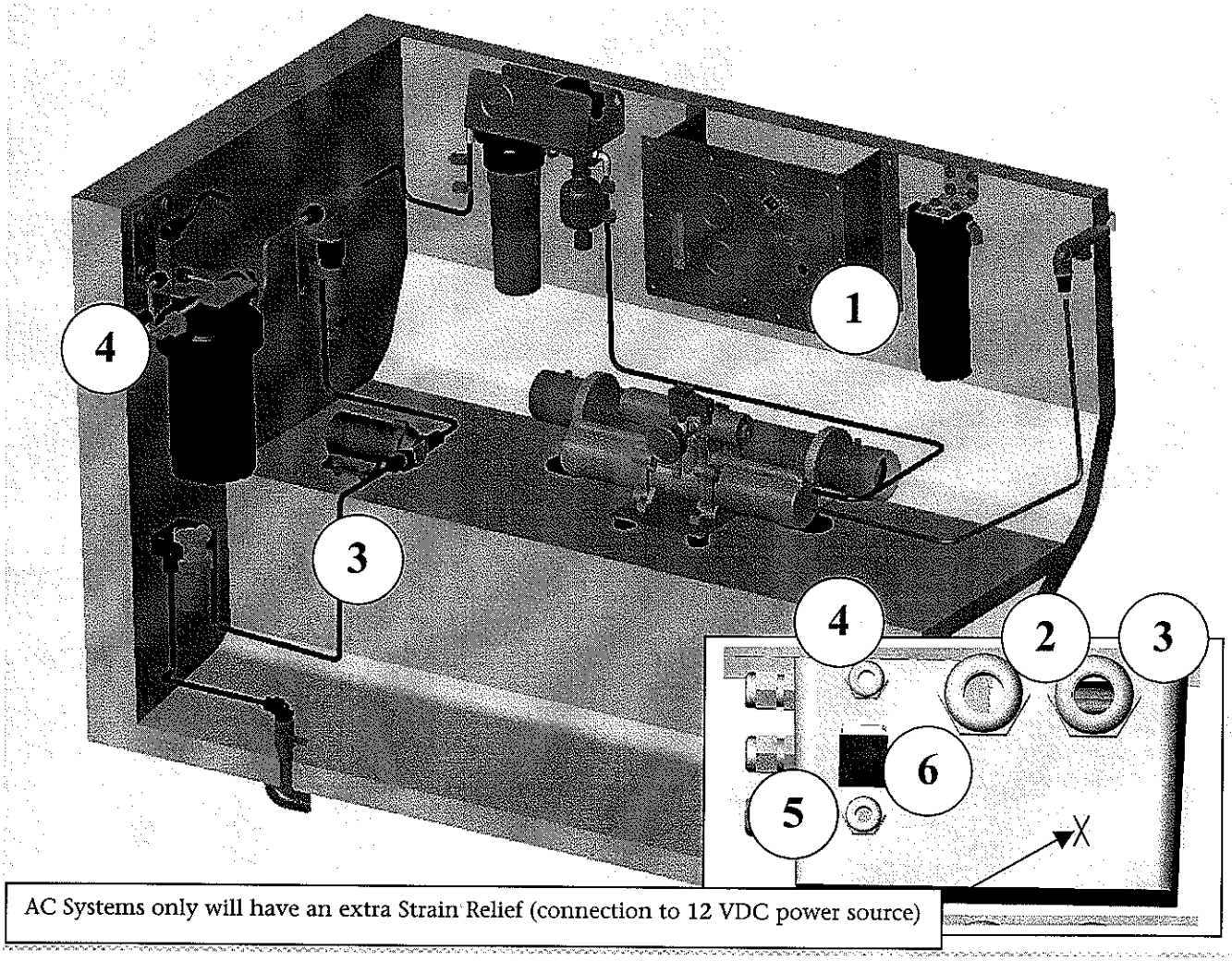
3. Connect the Feed Pump [4] motor power through the other large Strain Relief on the bottom of the controller enclosure to terminals as indicated in Chapter 7. *Note: check electrical code for wire size on longer runs.*

CONNECT ANY OPTIONAL ACCESSORIES (Refer to Chapter 7, page 2.9 and page 6.6)

4. Connect the Fresh Water Flush Solenoid Valve [24] using the supplied Orange Cable. Loosen a small Strain Relief on the bottom of the Controller Enclosure and insert the Orange cable. Connect to the Printed Circuit Board.

5. Connect UV Sterilizer (illustrated on page 9.15) [22] using supplied purple cable. Loosen the other small Strain Relief on the bottom of the Controller Enclosure and insert the Purple cable. Connect to the Printed Circuit Board.

6. Remote Control: Insert thru the square cutout located on the bottom surface of the Controller Enclosure. Close supplied Square Relief around the flat cable and snap together. Connect to modular plug on Printed Circuit Board.



AC Systems only will have an extra Strain Relief (connection to 12 VDC power source)

The Strain Reliefs on the side of the Controller Enclosure are for the Low Pressure Switch [10](black), High Pressure Switch [14](gray), Diversion Valve [20](blue) and the Salinity Probe [18](white).

* *Refers to pre-wired on Compact system only.*

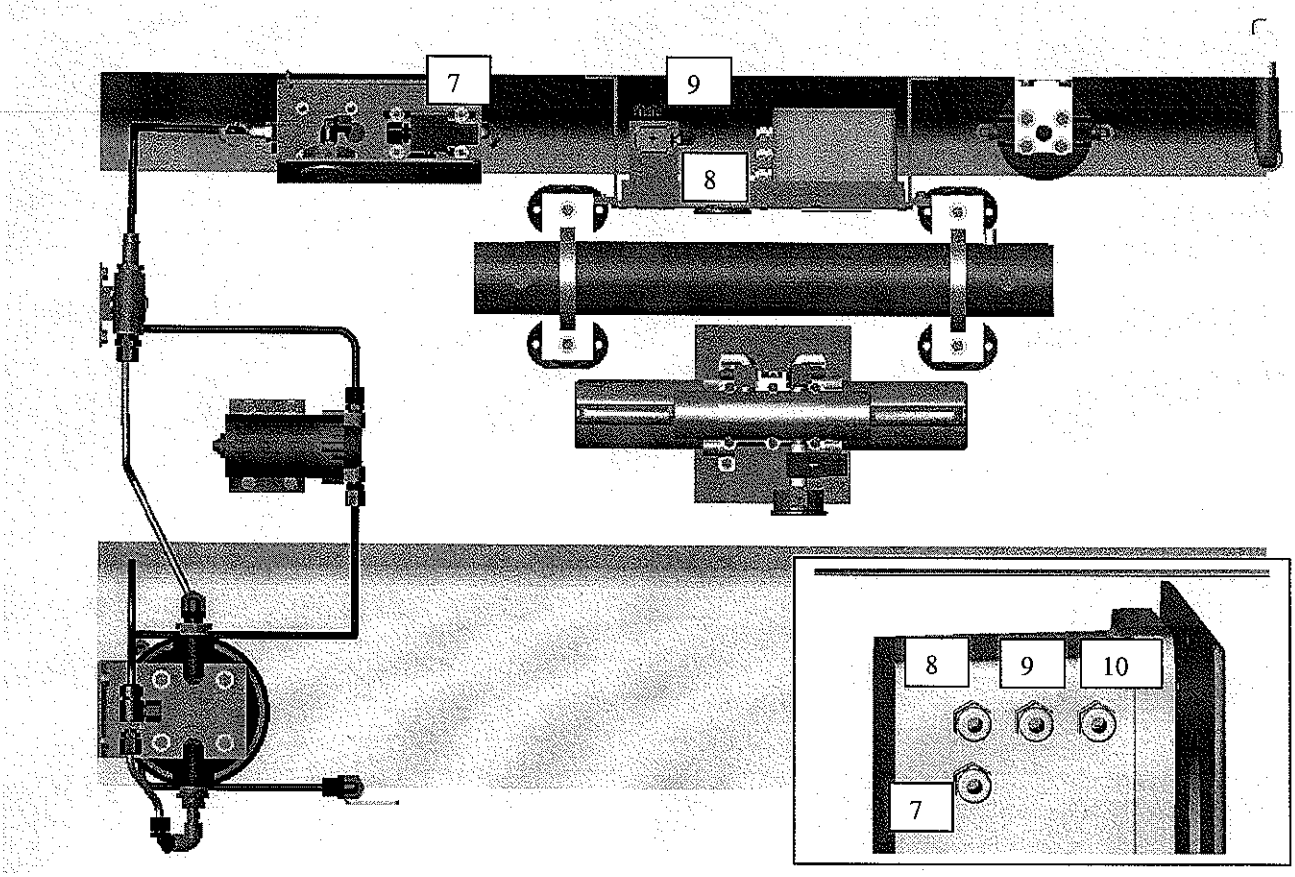
** *Refers to pre-wired on Modular & Compact systems*

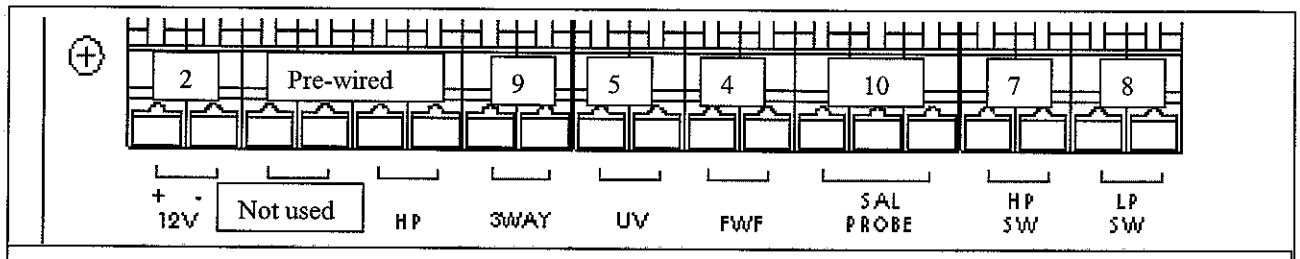
7. *Connect High-Pressure Switch [14] on the Pre-filter assembly [7][11] using supplied gray cable. Loosen a small Strain Relief on the side of the Controller Enclosure and insert. Connect to the Printed Circuit Board.

8. **Connect Low-Pressure Switch [10] in the Front Panel using supplied black cable (if not pre-assembled). Loosen a small Strain Relief on the side of the Controller Enclosure and insert. Connect to the Printed Circuit Board.

9. **Connect 3-Way Diversion Valve [20] on the Control Manifold (page 2.14) using supplied blue cable. Loosen a small Strain Relief on the side of the Controller Enclosure and insert. Connect to the Printed Circuit Board.

10. **Connect Salinity Probe [18] on the Control Manifold (page 2.14) using supplied white cable. Loosen a small Strain Relief on the side of the Controller Enclosure and insert. Connect to the Printed Circuit Board





This figure illustrates the Printed Circuit Board and the number-callouts referred to in the written steps above.

COMPACT QUICK-GUIDE MODEL FOR INSTALLATION

Please read previous sections before using this Compact Quick Guide, unless installer is experienced with system.

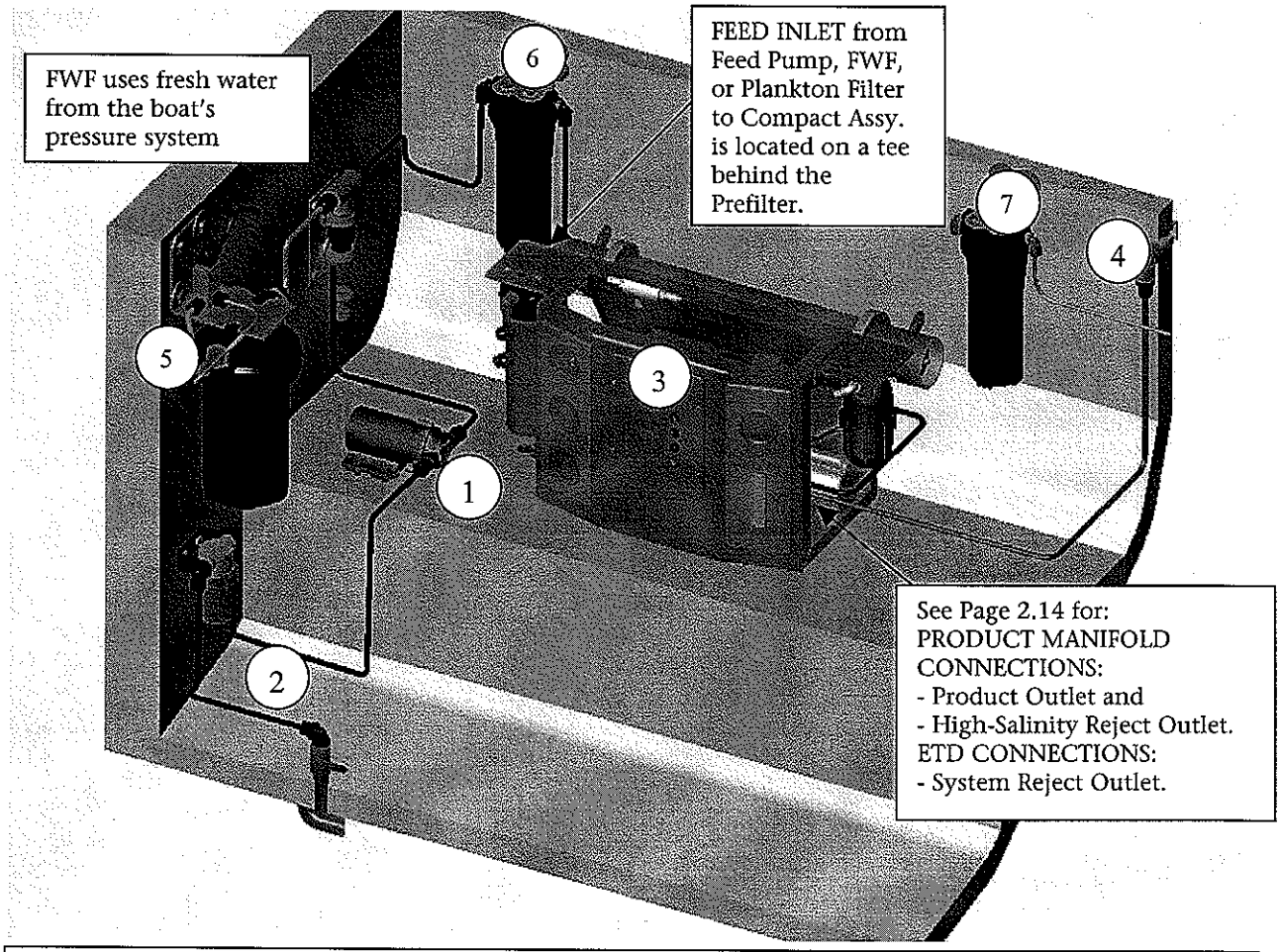
1. Mount the Feed Pump [4] to a flat surface using the supplied 1/4" x 1 1/4" Type "A" lag screws. The Feed Pump is mounted horizontally and in an accessible location to allow access for maintenance. Mount the Feed Pump close to the [1] Inlet Thru Hull/ Sea Cock Valve [2] and the Sea Strainer [3].

2. Mount the Sea Strainer [3] to a clearly visible bulkhead near the Sea Cock Valve [2] and the Feed Pump [4] using the supplied 1/4" x 1" Type "A" lag screws.

3. The Compact Model Assembly should be located to allow quick access. Mount the Frame Assembly (page 9.13) to a flat surface using the supplied 1/4"x 1" Type "A" lag screws. Use the supplied rubber spacers between the frame and mounting surface to dampen any vibrations.

4. The brine discharge exits through the Thru Hull Discharge Fitting [28] that must be installed above the water line. The reject water assembly is supplied in the installation kit to allow the brine discharge water from the Energy Transfer Device [12] and the 3-Way Diversion Valve [20] to exit through the Hull Discharge Fitting.

5. Optional: Fresh Water Flush [24].
6. Optional: Plankton Filter [5].
7. Optional: Carbon Filter [21].



Please read through all of Chapter 2 before attempting to install the Compact System.

STEP 4 PLUMBING CONNECTIONS

Throughout this Manual, Numbers in [brackets] refer to the ID numbers illustrated on the Piping & Installation Diagram

Ensure all 5/8" hose connections use two hose clamps rotated 180 degrees with the screw heads facing the same direction (*this ensures a good seal*). Hose Barb fittings should not have a line of flash from the mold sections. If flash exists, remove the flash and sand down with fine sandpaper. Refer to page 2.4 for proper tube fitting instructions.

5/8" Flexible Hose is used for all 1/2" Hose Barb Fittings

1. Use the 3/4" Inlet Elbow Assembly for the Inlet Thru Hull Fitting [28] and the Sea Cock Valve [2].

2. Use the supplied 5/8" hose to connect the Inlet Sea Cock Valve [2] to the Sea Strainer [3] and from the Sea Strainer to the Feed Pump Inlet [4].

3. Use the 5/8" hose to connect the Feed Pump Outlet [4] to the Pre-Filter Inlet [7]. Install an Inline-Tee Assembly (supplied in the installation kit) anywhere between these two components but after the optional Fresh Water Flush [24], if a Fresh Water Flush is installed, this hose first connects to the Fresh Water Flush Check Valve Assembly [25] as shown in the P&ID. *This inline-tee is pre-assembled behind the pre-filter on the Compact systems.*

4. (*Modular only*) Use the supplied 5/8" hose to connect the Pre-filter Assembly Outlet/Accumulator [11] to the Energy Transfer Device inlet (page2.13) [12]. Install the other Inline-Tee assembly anywhere between these two components.

5. Use the supplied 1/4" tubing to connect the Product Water Outlet [19] on the top of the Product Water Manifold to the Charcoal Filter Inlet [21] or Product Tank inlet [23]. *See page 2.14 for location of Product Water Outlet fitting on the top of the Product Manifold.*

6. *If installed,* connect the Charcoal Filter Outlet [21] to the Product Water Tank [23] using the supplied 1/4" tubing. Use the supplied 1/4" tube connector in the Installation Kit to connect to the Product Water Tank.

7. Connect the Reject Water Assembly to the Discharge Thru Hull Fitting. Use the 1/4" tubing to connect the reject tube fitting from the side of the Product Water Manifold (page2.14) to the 1/4" tube elbow on Reject Water Assembly.
   Use the 5/8" hose to connect the brine discharge from the ETD [12] outlet to the 1/2" hose barb elbow on the Reject Water Assembly.

8. *If Installed,* Connect the Boat's Fresh Water System to the Fresh Water Flush Solenoid Valve [24]. Connect the supplied 3/8" tube to the 3/8" Tube Adapter on the FWF Solenoid Valve then to the boat's fresh water system.

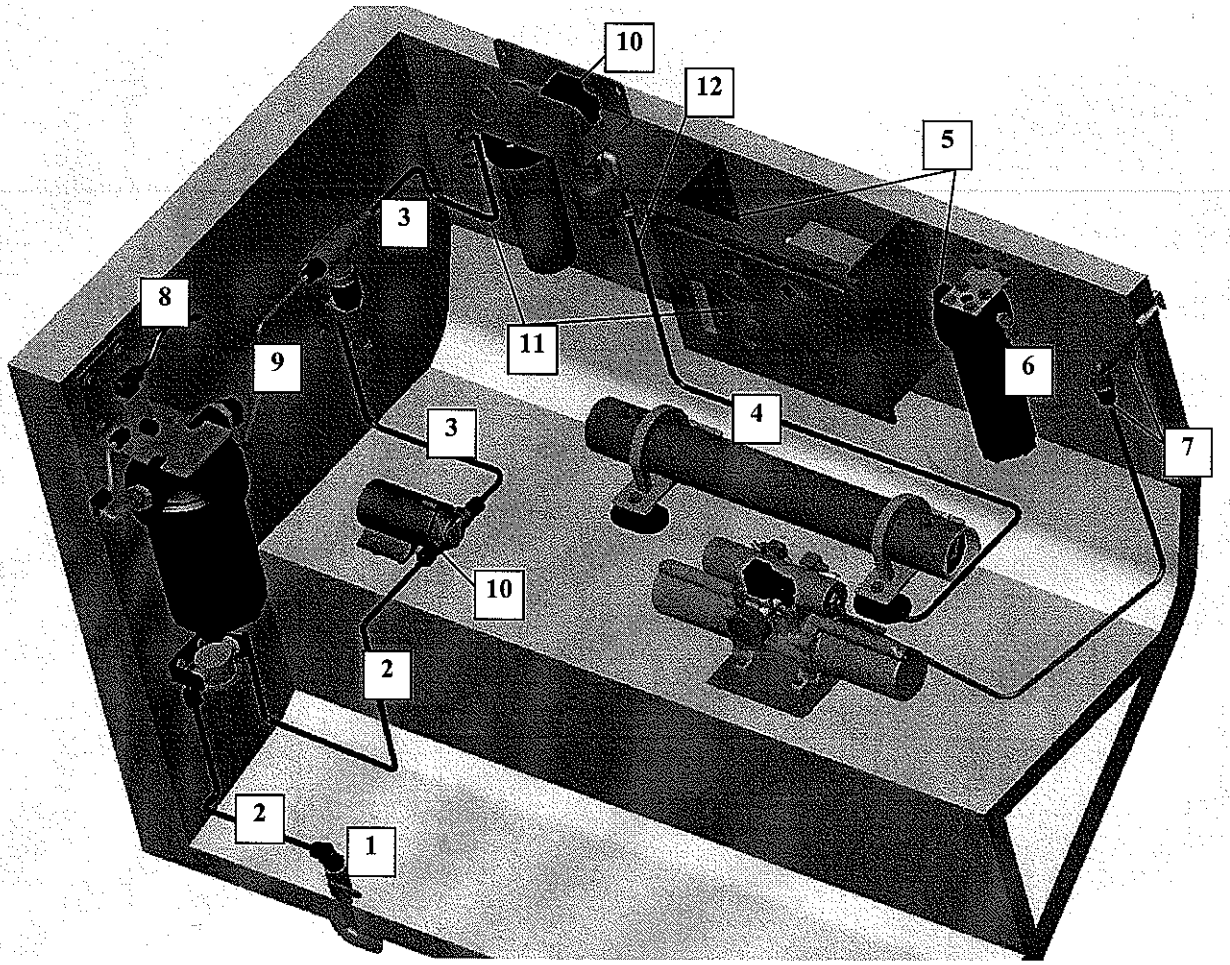
9. *If Installed,* Connect the Fresh Water Flush Canister [24] to the Fresh Water Flush Check Valve [25] as shown in the P&ID. Use 5/8" hose and hose clamps supplied in the Fresh Water Flush Installation Kit.

10. Use the supplied 1/4" tubing to connect the Inlet Feed Pump 1/4" tube connector [4] to the 1/4" tube fitting behind the Vacuum/Low Pressure Gauge [9]. (Modular: located on the Pre-filter Assembly, Compact: located on the Gauge Panel.

Inlet [6] and Outlet [8] Inline Tee Assemblies, 1/2" Barb x 1/4" Tube x 1/2" Barb, are not shown in diagram below but the proper locations are illustrated by an item number and a description. Refer to the P&ID or Chapter 2.2 for clarity.

11. (*Modular only*) (Inline Tee from Step 3 above) Connect one of the supplied Inline Tee Assemblies between the Pre-filter Assembly [7] and the Fresh Water Check Valve Assembly [25] using the supplied hose clamps. Connect the Pre-filter Inlet Intermediate Pressure Gauge [6] on the Front Panel Assembly, using 1/4" tubing, to the 1/4" tube fitting on the Inline Tee Assembly. The Modular installation must pass through the pressure switch [14] manifold assembly on the Pre-filter Assembly [7][11] before connecting to the Inline Tee Assembly (Page 2.20).

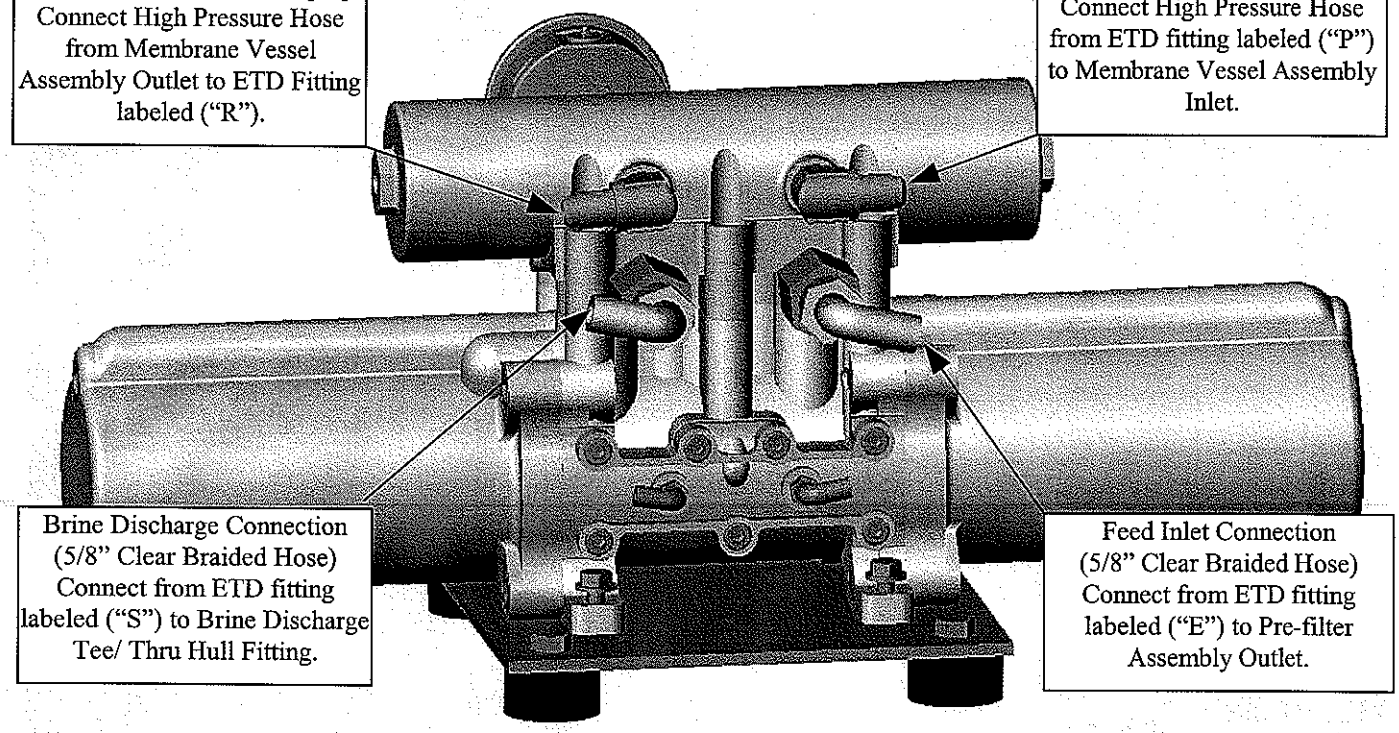
12. (Modular *Only*) Connect the other Inline Tee Assembly between the Pre-filter Assembly [11] and the Energy Transfer Device [12] Inlet. Connect the 1/4" tube fitting behind the Pre-filter Outlet Intermediate Pressure Gauge [8] using 1/4" tubing to the 1/4" fitting on the Inline Tee Assembly. *Note: "Inlet" and "Outlet" refer to the position in reference to the Pre-filter Assembly. For the Compact system, this step is pre-assembled at the factory.*



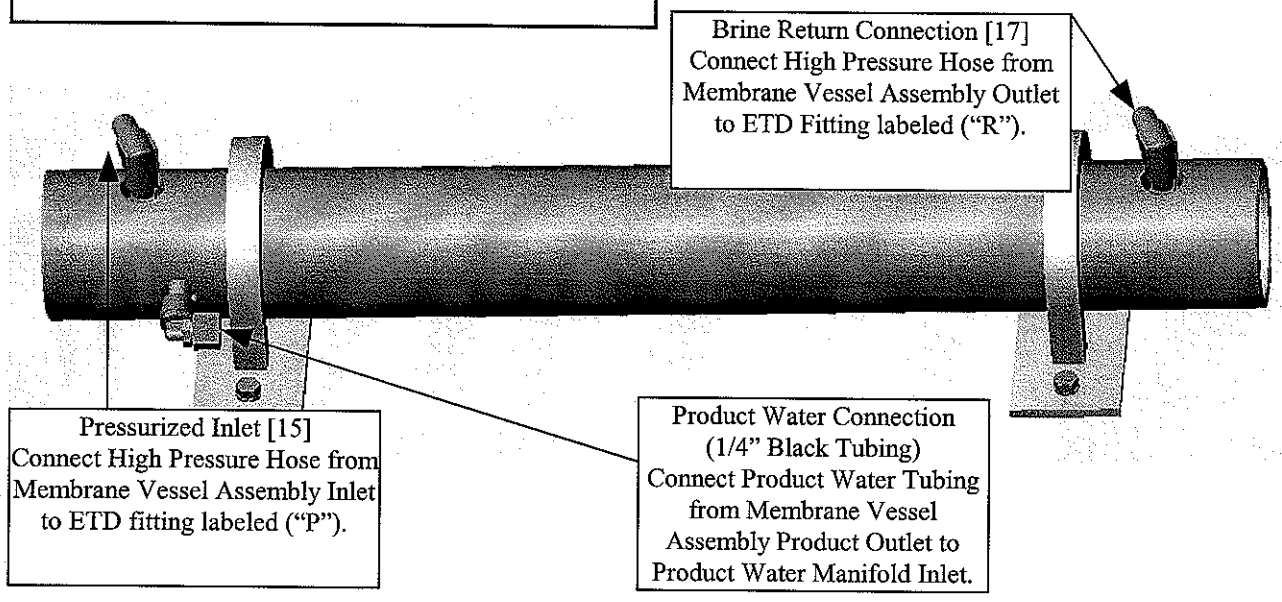
See Page 2.13 for Membrane Pressure Vessel Assembly [16] Connections to Energy Transfer Device [12].

The Front Panel Assembly must be accessible in order to read the gauges and access the Touch Pad. The Membrane Assembly must be mounted in such a way to allow enough space on each side for membrane replacement.

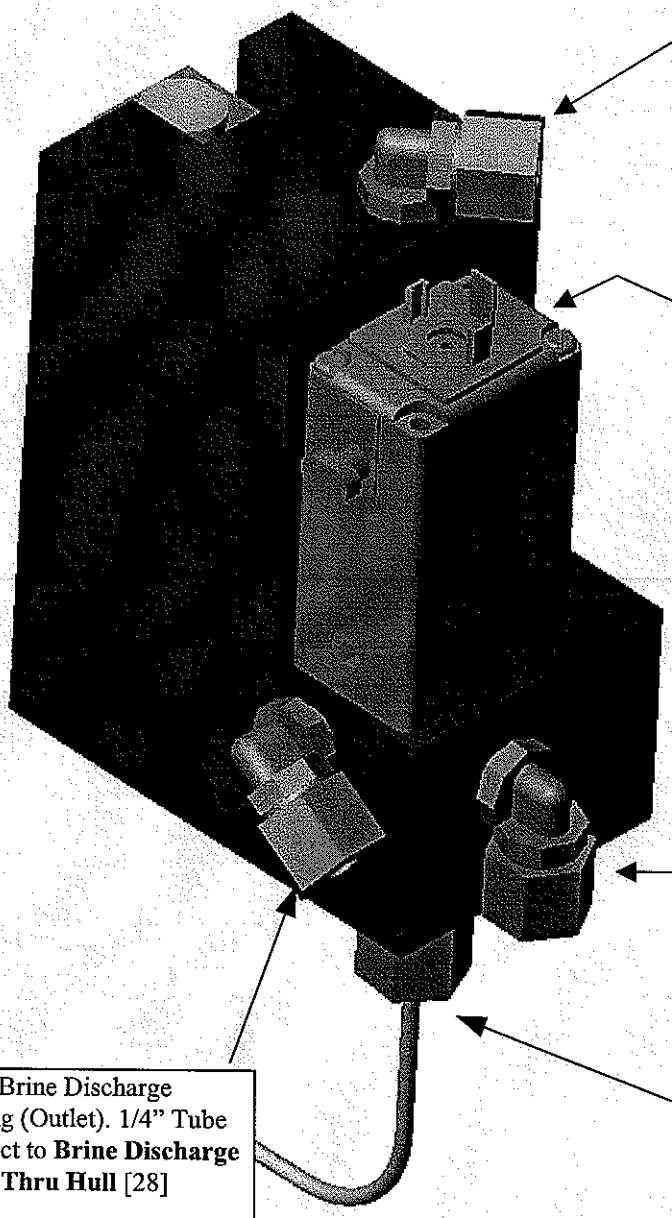
ENERGY TRANSFER DEVICE CONNECTIONS



MEMBRANE VESSEL ASSEMBLY CONNECTIONS



CONTROL MANIFOLD CONNECTIONS



Product Outlet Fitting. (1/4" Tube) Connect to either **Charcoal Filter** [21] or directly to **Product Storage Tank** [23]

Electrical connection for **3-Way Diversion Valve** [20] to **Controller** [26]

Product Inlet Fitting. (1/4" Tube) From Membrane Product Water Outlet [16]

Brine Discharge Fitting (Outlet). 1/4" Tube Connect to **Brine Discharge Thru Hull** [28]

Electrical connection for **Salinity Probe** [18] to **Controller** [26]

2.2 INSTALLATION BY GRAPHIC ILLUSTRATIONS

Chapter 2.2

INTRODUCTION:

This section assists the customer with a step-by-step graphic instruction of the Ultra Whisper components installation. This section illustrates the plumbing and electrical connections on the Modular and Compact styles. The definitions in Chapter 1 should be clearly understood before continuing though this section.

PREPARATIONS:

Every consideration in section 2.1 should be understood before installing the Ultra Whisper system. This section can be used simultaneously with section 2.1.

All 5/8" braided hose connections require two 3/4" hose clamps rotated 180 degrees.

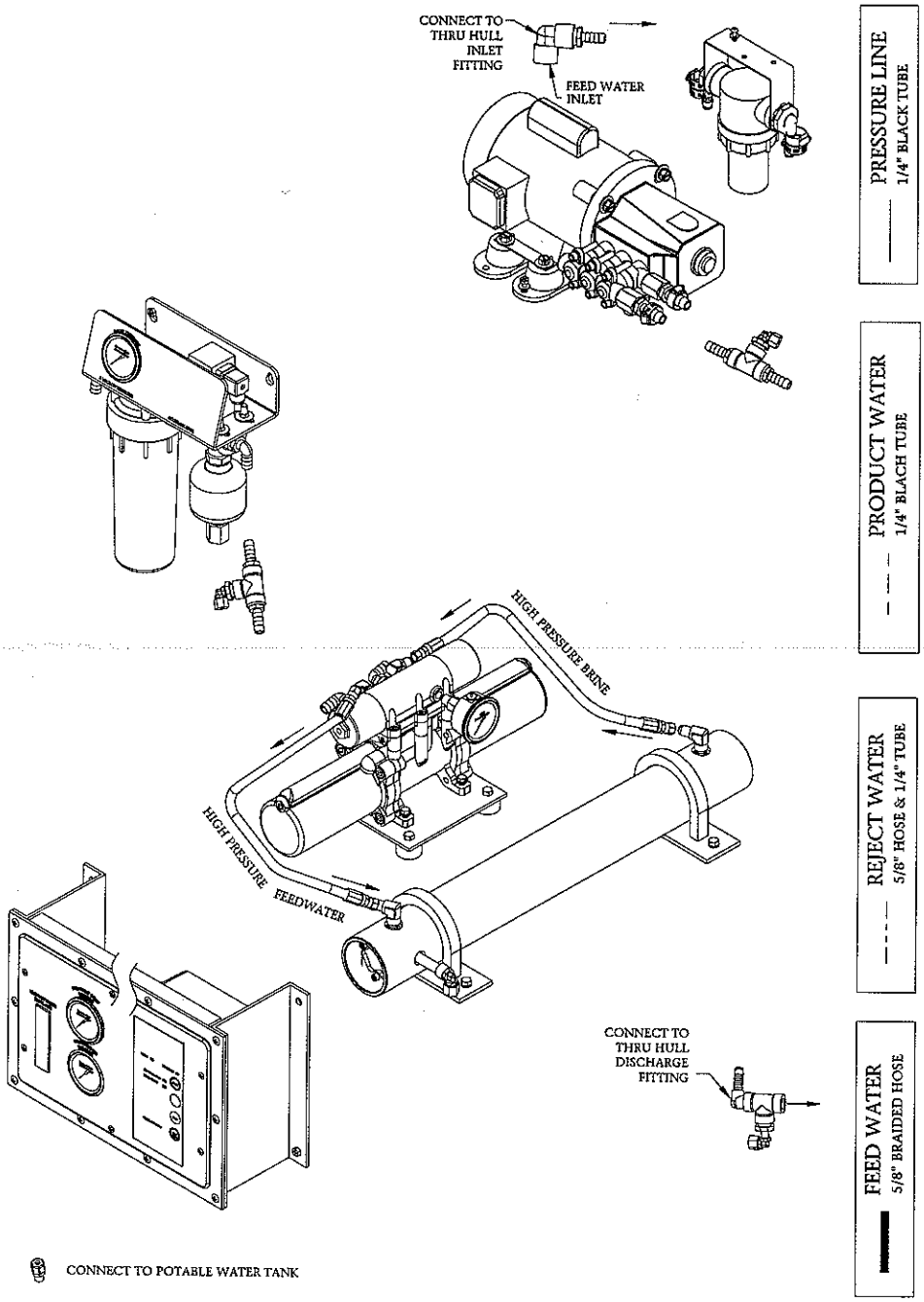
All 1/4" tube connections should be installed per instructions in section 2.1.

USING THIS SECTION:

The instructions in this section are intended for personnel with general training and experience in the operation and maintenance of fluid handling systems or have experience with the Ultra Whisper System.

The instructions in this section assume that the installer has read all of Chapter 1 and Chapter 2 of this manual. This section is a graphic illustration of Chapter 2.1. The components have been arranged to better illustrate the flow path of the system. When installing system components always check the arrows on the component; the component arrows must follow the system flow path. Refer to Chapter 2.1, if instructions beyond this section are needed.

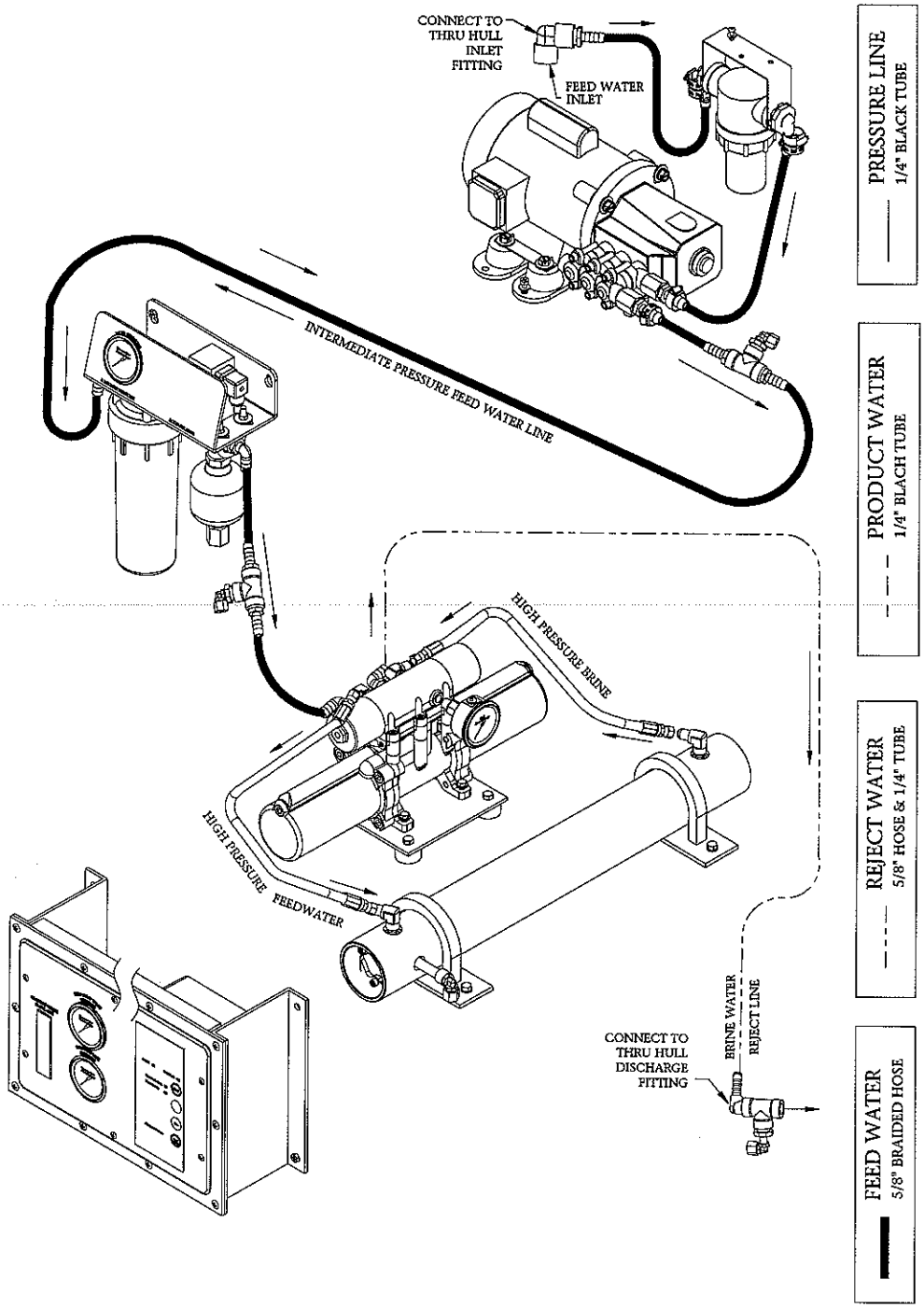
SECTION CONTENTS:



Connect the 3/4" Elbow to the Inlet Thru Hull Fitting or the Sea Cock Valve. The installer should use common sense when installing the Inlet Thru Hull Fitting, the Sea Cock Valve and the Inlet Elbow assembly.

Install the Sea Strainer, Pre-filter Assembly, and Front Panel Assembly to a bulkhead. The installer should know where the hose and tube lines are going to be placed before securing these components.

The Feed Pump, Energy Transfer Device, and Membrane Vessel Assembly should be mounted to a flat surface with enough surrounding area to allow for maintenance. The Feed Pump and Energy Transfer Device must be mounted horizontally. The installer should check the length of the high-pressure hose before securing the Energy Transfer Device and Membrane Vessel Assembly.



FEED WATER 5/8" HOSE LINE

Use the 5/8" braided hose to Connect the 1/2" hose barb on the 3/4" Inlet Elbow Assembly to the Sea Strainer Inlet. Always use two 3/4" hose clamps when assembling the 5/8" braided hose. Connect the Outlet of the Sea Strainer to the Feed Pump Inlet. Connect the Feed Pump Outlet to the Inline Tee Assembly then to the Pre-filter Inlet. Connect the Accumulator Outlet to the other Inline Tee Assembly then to the Inlet of the ETD labeled "E".

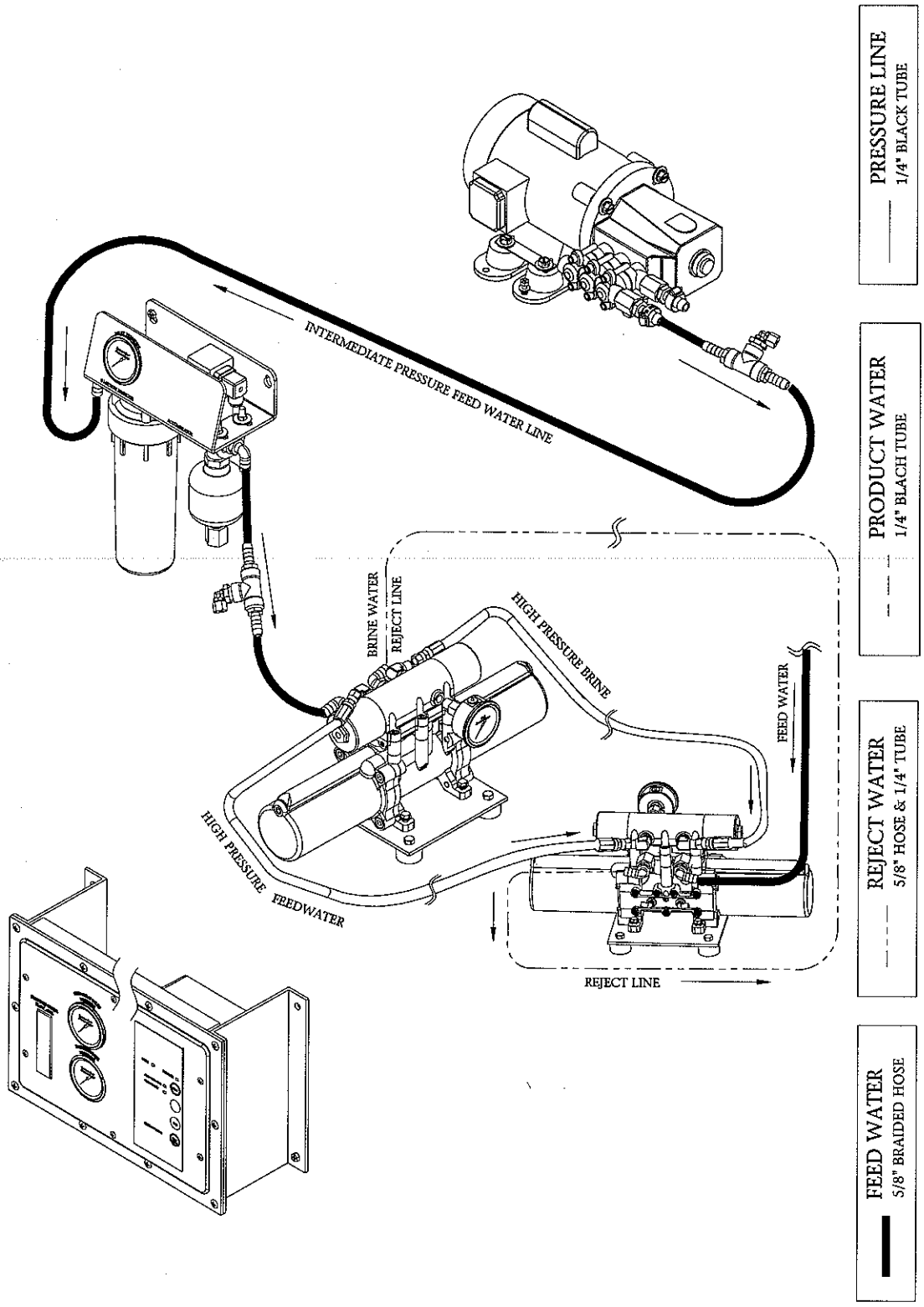


Figure 2.2.3 Illustration of the 5/8" braided hose connections to the Energy Transfer Device.

REJECT WATER 5/8" HOSE LINE

Use the 5/8" braided hose to Connect the 1/2" hose barb on the ETD Outlet labeled "S" to the 1/2" hose barb on the Reject Water Assembly. The Reject Water Assembly should be connected to the Thru Hull Discharge Fitting.

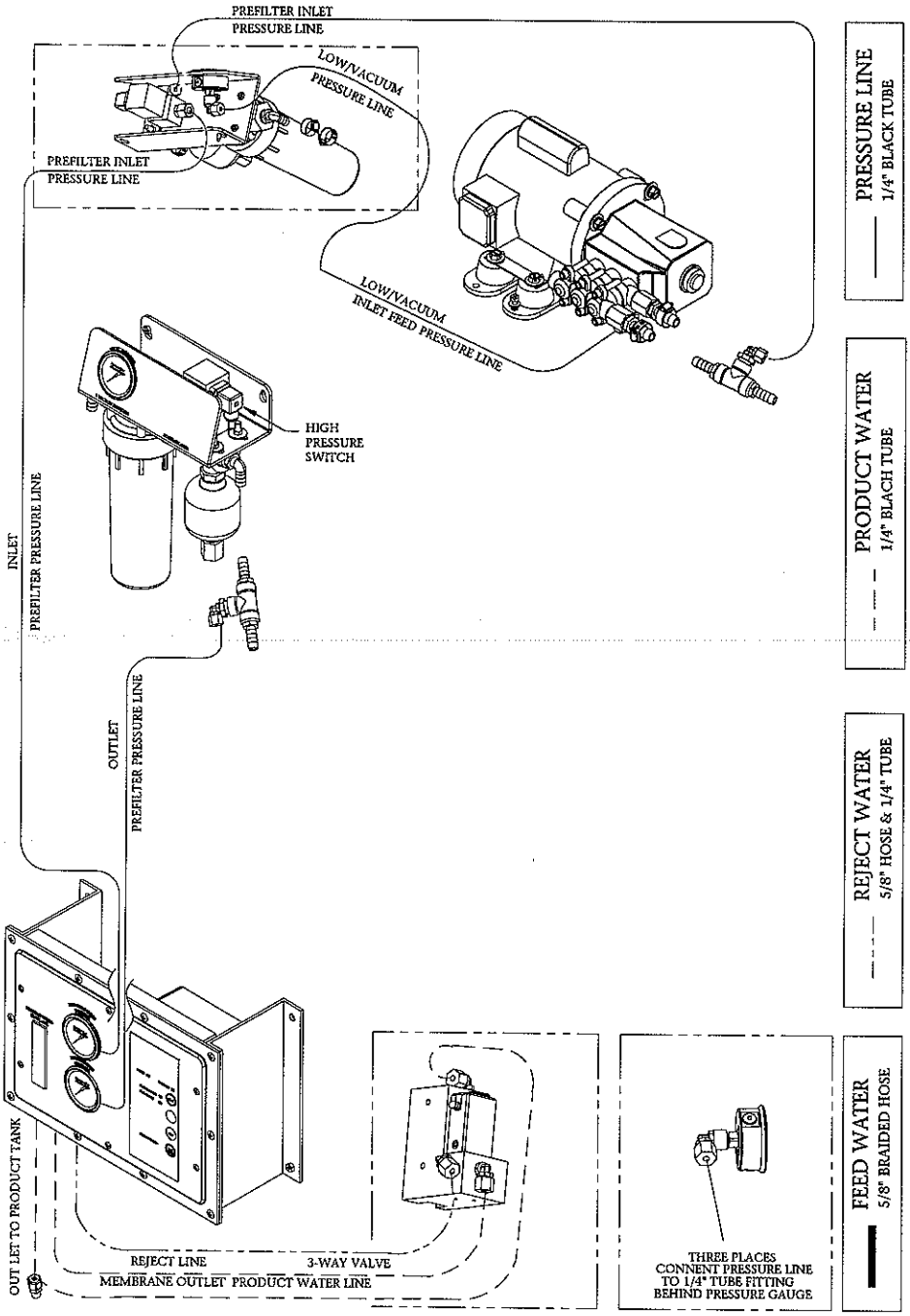


Figure 2.2.4 Illustration of the 1/4" black tube connections on a Modular System.

PRESSURE LINES - 1/4" BLACK TUBE

Use the 1/4" black tube to connect the tube connection on the Feed Pump to the Vacuum Gauge on the Pre-filter Assembly.
Use the 1/4" black tube to connect the tube connection on the first Inline Tee Assembly to the tube connection on the high-pressure switch manifold on the Pre-filter Assembly then use the other tube connection to connect to the Inlet Pre-filter Pressure Gauge on the Front Panel Assembly.
Use the 1/4" black tube to connect the tube connection on the second Inline Tee Assembly to the tube connection behind the Outlet Pre-filter Pressure Gauge on the Front Panel Assembly.

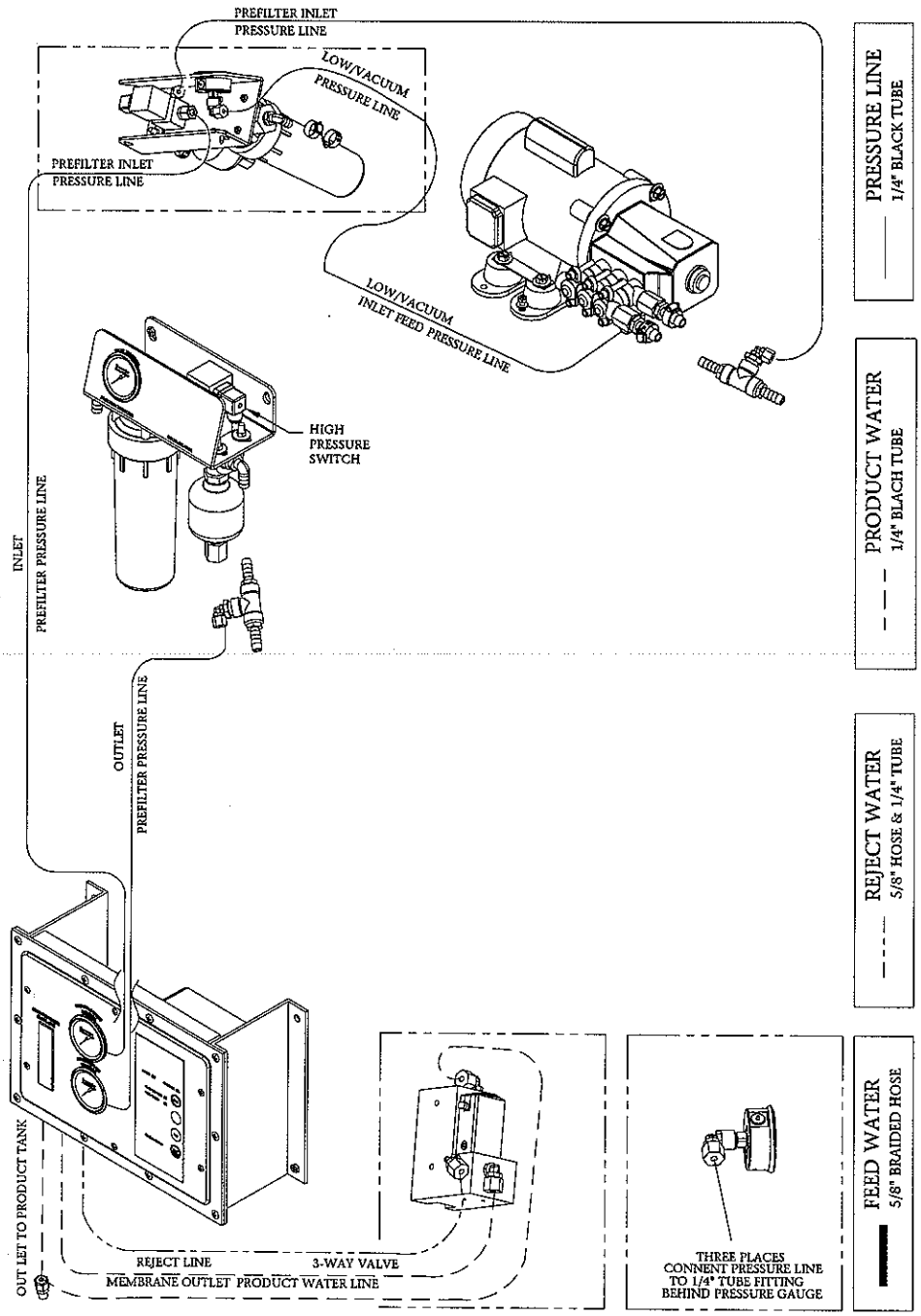


Figure 2.2.5 Illustration of the 1/4" black tube connections to sub-assemblies on a Modular System.

PRODUCT LINES - 1/4" BLACK TUBE

Use the 1/4" black tube to connect the tube connection on the back of the Product Manifold to the tube connection on the Membrane Vessel Assembly.
Use the 1/4" black tube to connect the tube connection on top of the Product Manifold to the tube connection on the Boat's Product Tank.

REJECT LINES - 1/4" BLACK TUBE

Use the 1/4" black tube to connect the tube connection on the side of the Product Manifold to the tube connection on the Reject Water Assembly.

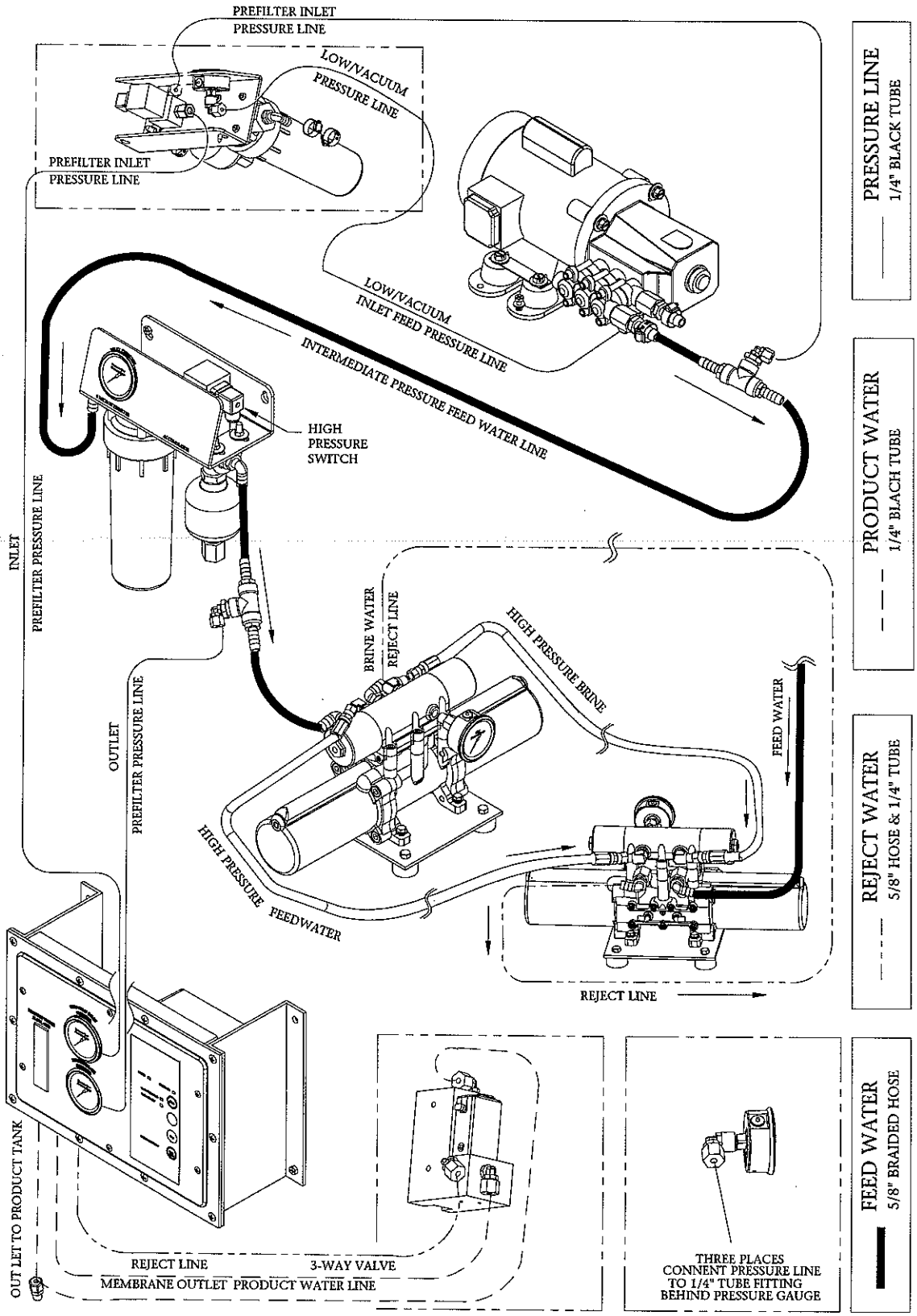


Figure 2.2.6 Use the flow arrows on this figure and to double-check the Modular installation.

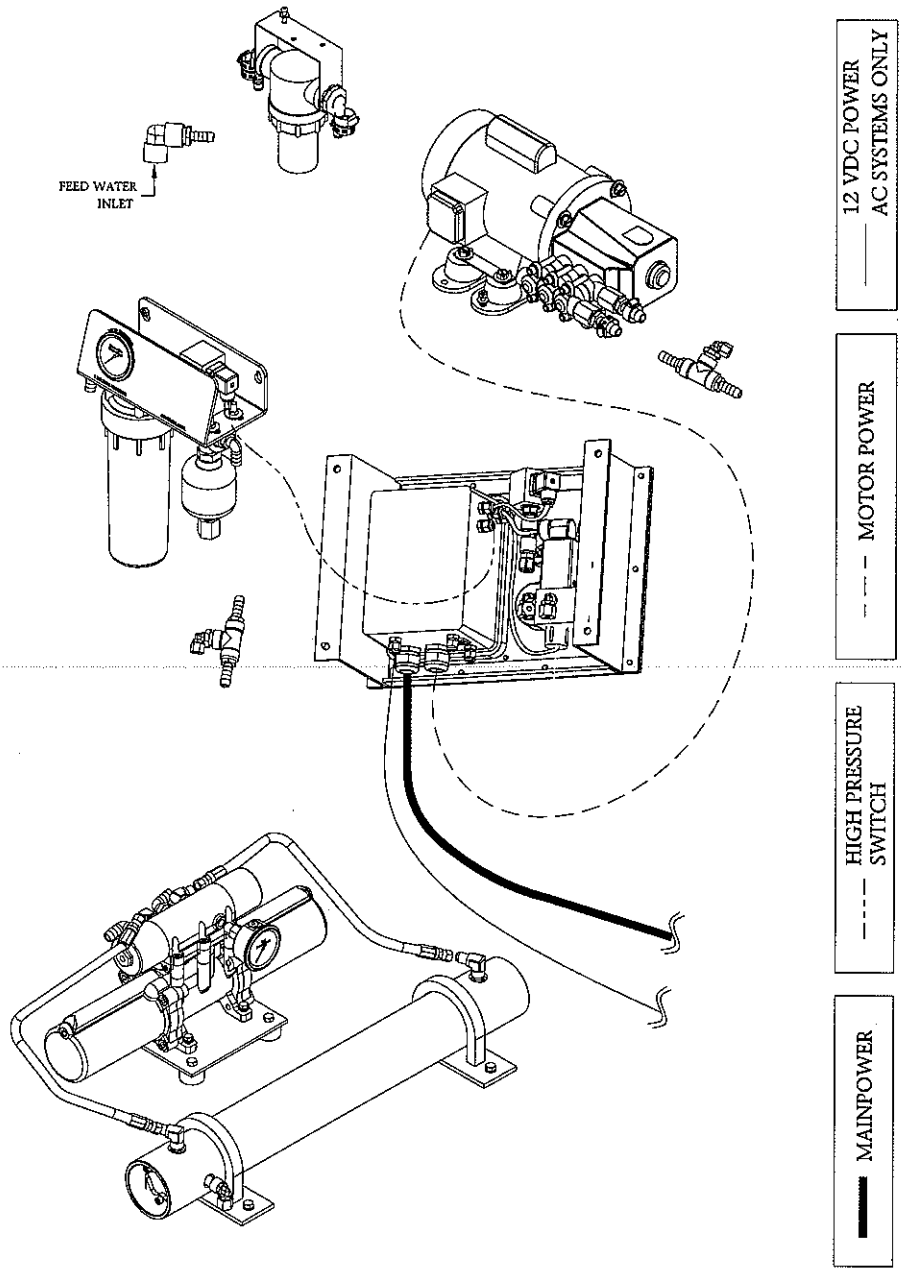


Figure 2.2.7 Illustration of the Modular electrical connections

Connect **main power** to the assigned terminal block in Chapter 7. The main power cable is inserted through a large Strain Relief on the bottom of the controller enclosure.

Connect the **Feed Pump** motor power through the other large Strain Relief on the bottom of the controller enclosure to the assigned terminal blocks as indicated in Chapter 7.

Connect **high-pressure switch** cable to Printed Circuit Board. The high-pressure switch cable is inserted through the lower small Strain Relief on the side of the controller enclosure

AC Systems only- Connect the boat's 12 VDC power source through the small Strain Relief under the controller enclosure and to the fuse terminals below the terminal block assembly

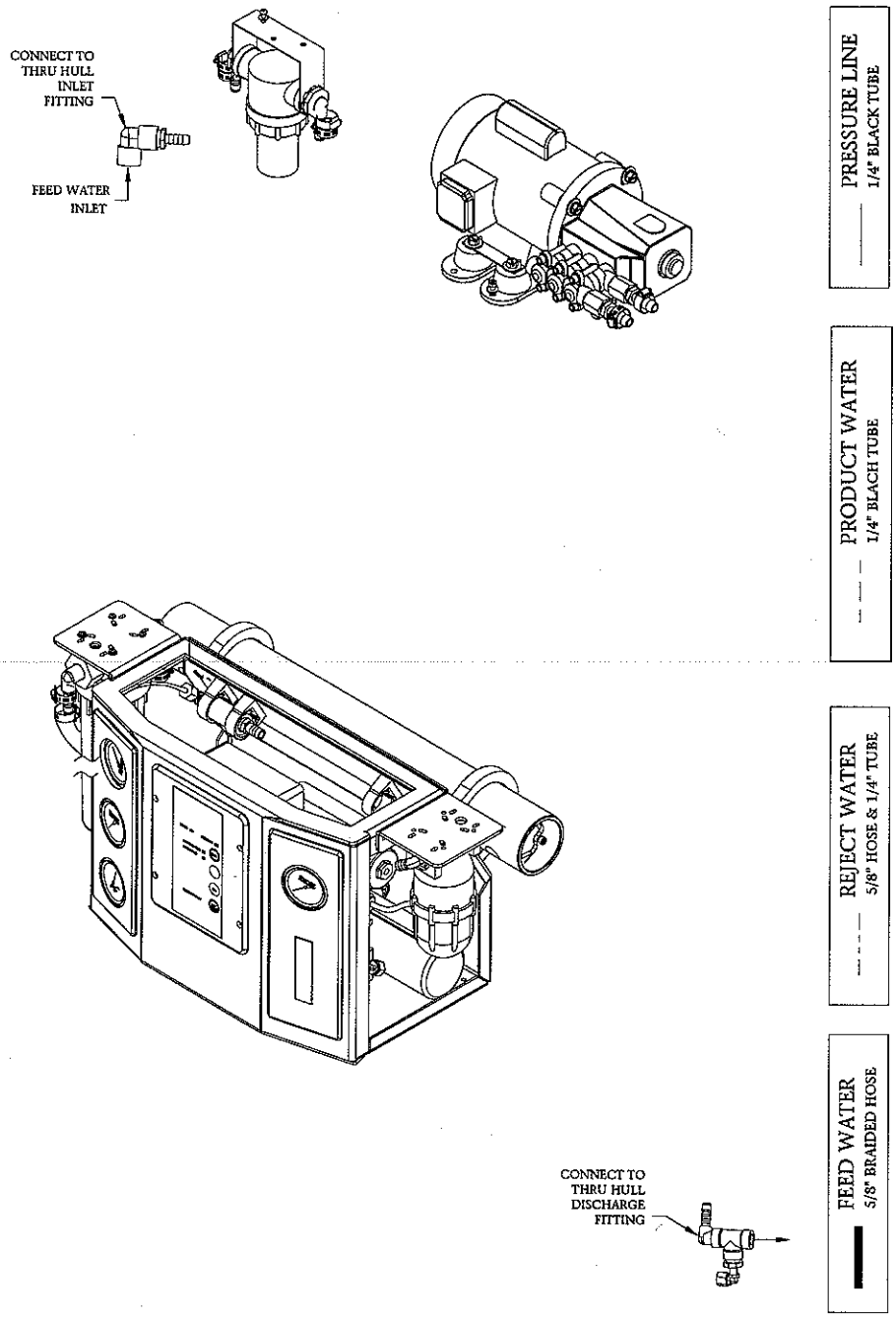


Figure 2.2.8 Illustration of the standard Compact Components required for installation.

Connect the 3/4" Elbow to the Inlet Hull Fitting or the Sea Cock Valve. The installer should use common sense when installing the Inlet Hull Fitting, the Sea Cock Valve and the Inlet Elbow assembly.

Install the Sea Strainer to a bulkhead. The installer should know where the hose and tube lines are placed before securing this component in place.

The Feed Pump and the Compact Frame Assembly should be mounted to a flat surface with enough surrounding area to allow for maintenance. The Compact Frame Assembly comes with rubber washers that are used a vibration insulators. The Feed Pump must be mounted horizontally. Before securing the Compact Frame Assembly, the installer should check that a membrane element could be installed without obstruction.

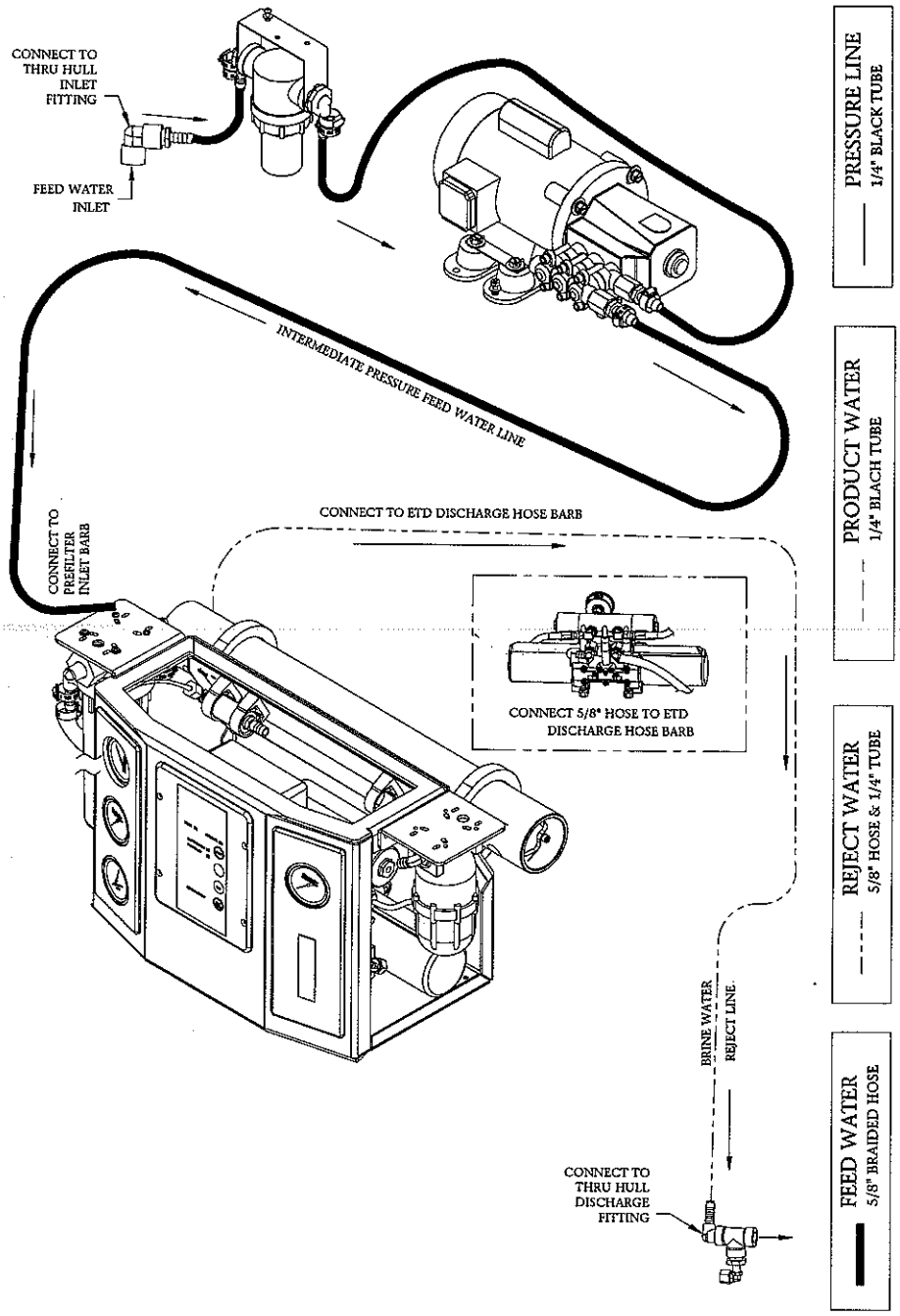


Figure 2.2.9 Illustration of the 5/8" braided hose connections on a Compact System.

FEED WATER 5/8" HOSE LINE
Use the 5/8" braided hose to Connect the 1/2" hose barb on the 3/4" Inlet Elbow Assembly to the Sea Strainer Inlet. Always use two 3/4" hose clamps when assembling the 5/8" braided hose. Connect the Outlet of the Sea Strainer to the Feed Pump then to the Pre-filter Inlet Tee on the Compact Frame Assembly.

REJECT WATER 5/8" HOSE LINE
Use the 5/8" braided hose to Connect the 1/2" hose barb on the ETD Outlet labeled "S" to the 1/2" hose barb on the Reject Water Assembly. The Reject Water Assembly should be connected to the Thru Hull Discharge Fitting.

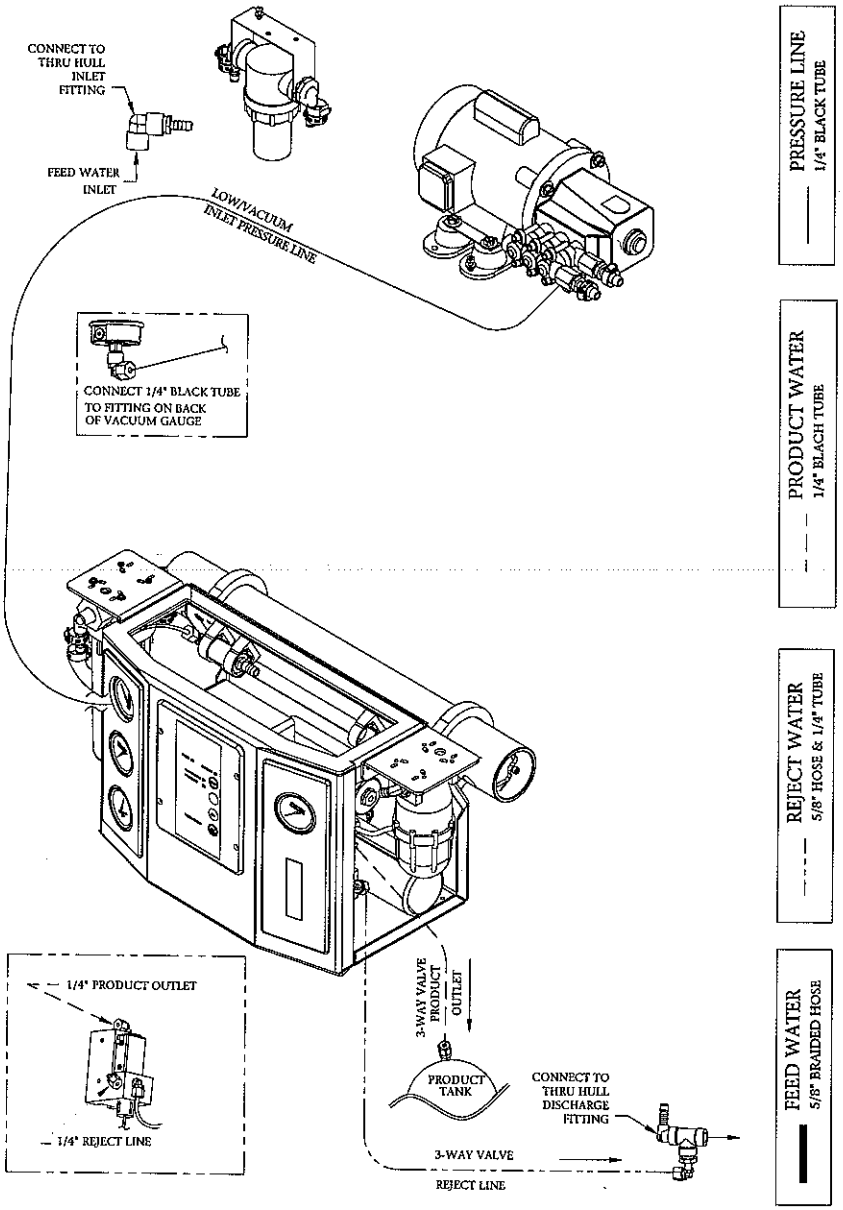


Figure 2.2.10 Illustration of the 1/4" black tube connections.

PRESSURE LINE - 1/4" BLACK TUBE
Use the 1/4" black tube to connect the tube connection on the Feed Pump to the tube connection behind the Vacuum Gauge on the Compact Frame Assembly.

PRODUCT LINE - 1/4" BLACK TUBE
Use the 1/4" black tube to connect the tube connection on top of the Product Manifold to the tube connection on the Boat's Product Tank.

REJECT LINE - 1/4" BLACK TUBE
Use the 1/4" black tube to connect the tube connection on the side of the Product Manifold to the tube connection on the Reject Water Assembly.

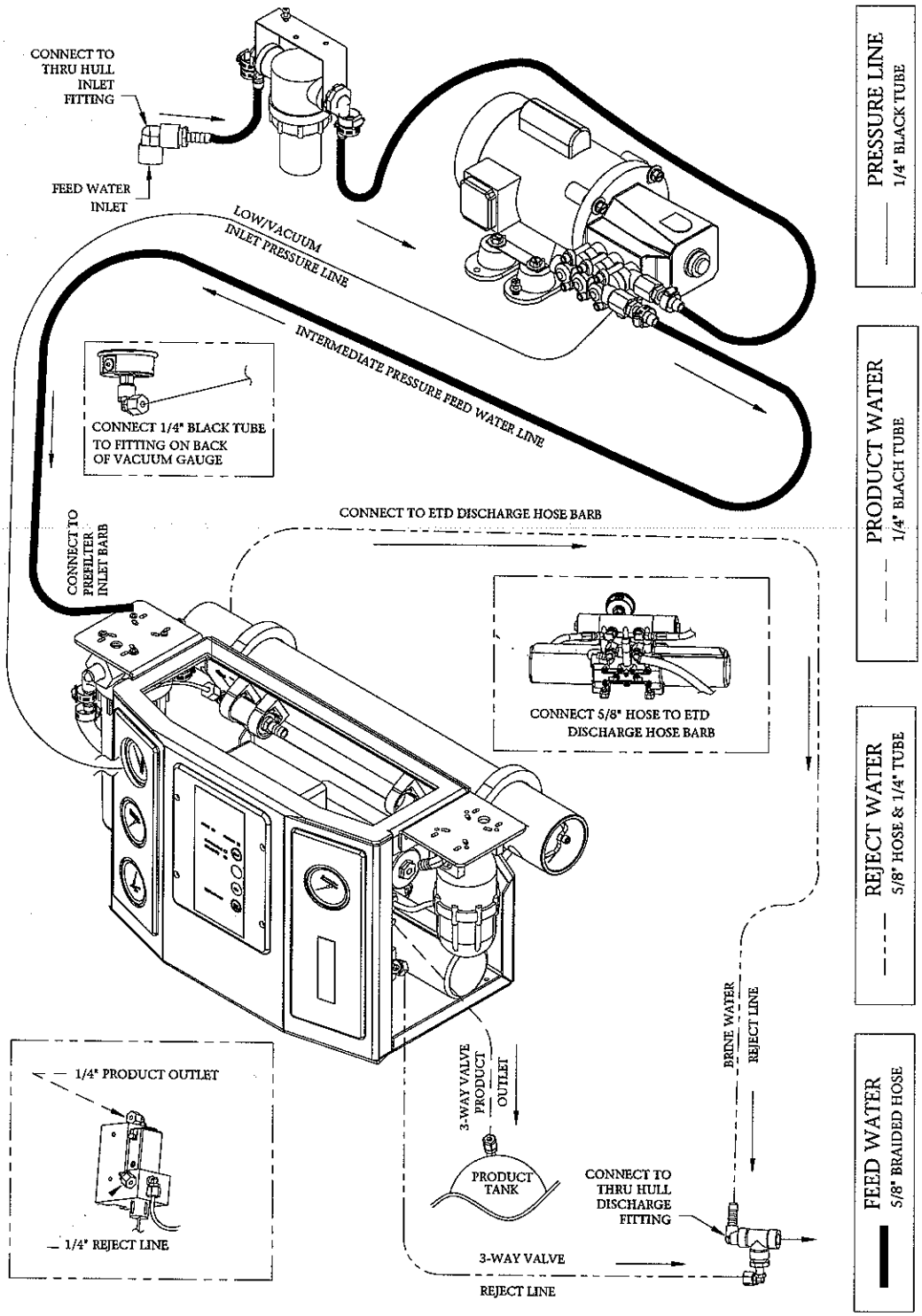


Figure 2.2.11 Use the flow arrows on this figure and to check the Ultra Whisper Compact installation.

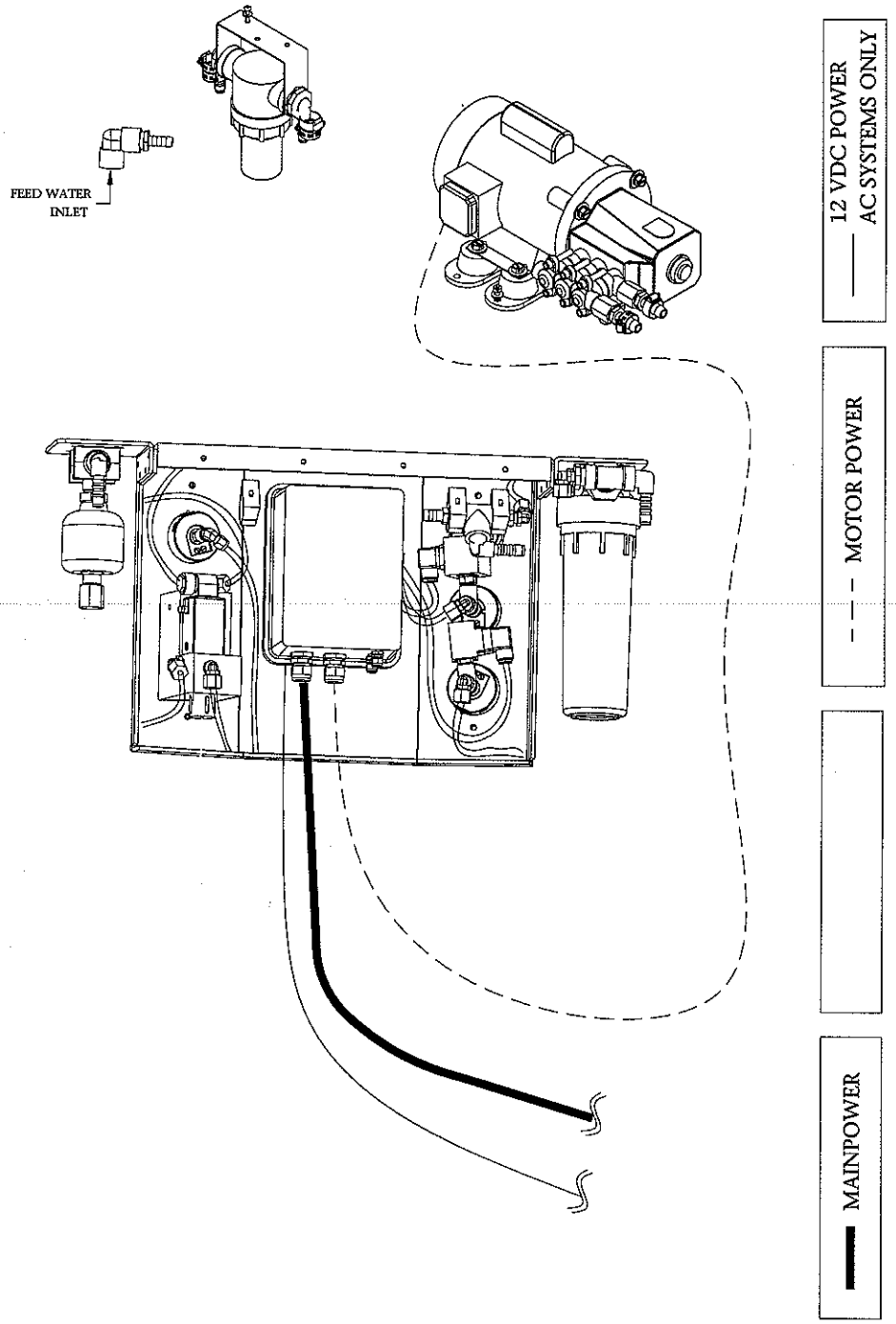


Figure 2.2.12 Illustration of the Compact electrical connections

Connect **main power** to the assigned terminal block in Chapter 7. The main power cable is inserted through a large Strain Relief on the bottom of the controller enclosure.

Connect the **Feed Pump** motor power through the other large Strain Relief on the bottom of the controller enclosure to assigned terminal blocks as indicated in Chapter 7.

AC Systems only- Connect the boat's 12 VDC power source through the small Strain Relief under the controller enclosure and to the fuse terminals below the terminal block assembly.

2.3 COMMISSIONING INITIAL START-UP

INITIAL START-UP PROCEDURE.

This section contains commissioning instructions that must be followed for the initial start-up of this system. For procedures on every day use, refer to Chapter 3 - Operation.

Failure to comply with instructions may lead to component damage and system failure. Read this section and other appropriate sections of this manual in order to gain familiarity with the requirements of this system and the functions of each component within the system.

SYSTEM RESPONSE:

If the system senses any abnormal pressures the system will shut itself off and the high/low pressure fault lamp blinks.

HIGH/LOW PRESSURE FAULT LAMP:

LOW PRESSURE FAULT:
When the inlet pressure to the feed pump creates an abnormal vacuum or the pump cannot develop a pressure more than 25 psig due to a flow problem, the "High/Low Pressure" lamp blinks. If the condition is not corrected, the system shuts down after 20 seconds. The Low Pressure switch monitors this condition, caused by a closed Inlet Sea Cock Valve or restriction in the inlet line or a break in the feed line.

HIGH PRESSURE FAULT:
The High Pressure Switch stops the system if the pressure limit is exceeded for more than 2 seconds. Each model has a different set point before the high-pressure switch sends a signal to stop the system. The table below lists the feed pump intermediate-pressure and the corresponding system high-pressure that must be reached for each model before the system experiences a high-pressure fault.

Table 2.3 Lists the Intermediate Pressure and High Pressure values that result is a High Pressure Fault.

SYSTEM MODEL	INTERMEDIATE PRESSURE	HIGH PRESSURE
200 COMPACT/MODULAR	125	950
400 COMPACT/MODULAR	190	1000
600 COMPACT/MODULAR	220	1020

START-UP PROCEDURE OF A NEW ULTRA WHISPER.

1. Ensure that all temporary Plugs and shipping Caps have been removed prior to commissioning. Failure to remove these caps could cause damage to the system.

2. If not already installed, install the Reverse Osmosis Membrane, Refer to page 6.11 for Installation Instructions.

3. Check the level of the oil in the Feed Pump crankcase. Ensure that the oil level is higher than the center of the sight glass. (Diaphragm pumps do not use oil)

   Use only SRC supplied Pump Oil, as it is special hydraulic oil, which contains rust and wear inhibitors essential to the feed pump crankcase section.

4. Check each tube/hose connection to the System. Ensure that the installer has properly connected and properly routed each tube/hose. Improper routing and any blockage in any line causes damage to the system. ***Do not rely on the installer's word, check it yourself.***

5. Make sure that the Electrical Power Source to the System is switched "OFF".

6. Open the Controller Enclosure Front Panel. Check all connections for proper wiring and attachment. Refer to the wiring diagrams in Chapter 7.

7. Close the Controller Enclosure Front Panel.

8. Ensure that the manual By-Pass Lever on the Diversion Valve [20] is positioned outward (away from the coil body).

9. Open any auxiliary Valve within the incoming Feed Line; Outgoing Brine Discharge Line; and Outgoing Product Water Line. Walk the flow path to be certain that the incoming feed water is not abnormally restricted. Walk the flow path of the two reject lines and the product line to be certain that they are not abnormally restricted.

   CAUTION: ***Any auxiliary Valve in these lines damage the system components if left closed during starting and operation.***

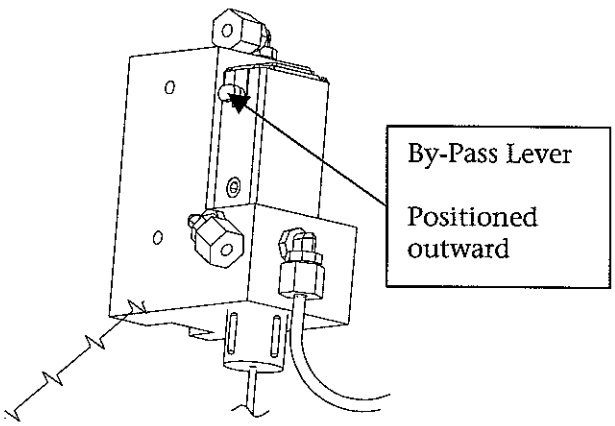
10. Switch the Electrical Power Source to the Salinity Controller "ON".

11. **FEED PUMP ELECTRIC MOTOR ROTATIONAL CHECK ON TRIPLEX PLUNGER PUMPS:** Ask an assistant to view the fan section of the Electric Motors. Press the "Start" button on the Touch Pad, and then immediately press the "Stop" button twice. Ensure that the Feed Pump Electric Motor turned in the clock-wise direction looking at the fan. If the motor turned in the wrong direction, refer to the diagram on the motor electric box cover. (Diaphragm pumps are not rotation sensitive)

12. To start the system, press the "Start" button. *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. After a fault has been confirmed (refer to Chapter 5 for Troubleshooting), press the Fault Reset button on the Touch Pad and restart the system.*

13. The system pressurizes itself once the "Start" button has been initiated. It may take 1-2 minutes for the system to reach full operation pressure. *(Like a hand pump, the ETD [12] builds pressure with every stoke)*

14. If any abnormality develops, STOP the System and correct the problem. *See Chapter 5 for troubleshooting.*



15. The system may not produce "potable" water for up to 30 minutes. The salinity of the Product Water diminishes gradually, until the Product Water reaches, 1000 parts per million-total dissolved solids, the factory setting. After reaching the factory setting, the product water is directed to the "potable" (good water) position and water flows through the flow meter. This allows product water to pass into the Post Filtration components, and on to the Ship's Storage Tank [23]. *At the same time, the Water Quality LED on the Touch Pad changes from red to green.* ***The first gallon of product water may contain storing chemicals. Divert this water into the reject or a bucket.***

16. Check for:

    a. A constant feed water flow.
    b. A consistent system pressure. The system pressure will fluctuate but the fluctuation will be consistent.
    c. Leaks in the system.
    d. Unusual noises or other occurrences.

At this time, the person commissioning the Ultra Whisper System should fill out the INITIAL SYSTEM READINGS form on Page 2.32.

Retain the form on page 2.32 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 Ultra Whisper System.

The person or company who performed the commissioning of the Ultra Whisper System should retain a copy of the form on page 2.32. This information is valuable to the servicing technicians in providing support to the owner and future operators of the Ultra Whisper System.

Sea Recovery *Ultra Whisper* NEW SYSTEM INITIAL READINGS

Record the following information prior to 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 Sea Recovery Service Technician, when requesting assistance from Sea Recovery.

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 (Circle AC or DC): _____ Volts AC DC

Feed Water Temperature: _____ ° Fahrenheit or _____ ° Centigrade

PRESSURE GAUGE READINGS:

Feed Inlet Pressure Gauge Reading: _____ min psi _____ max psi

High Pressure Gauge reading: _____ min psi _____ max psi

WATER FLOW METER READINGS:

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: _____

_____

_____

_____

3 OPERATION

SYSTEM OPERATION

This system does not use a regulating-valve. The system automatically adjusts the product flow. No manual/physical adjustments are required.

The "Start" button is used to produce potable water and the "Stop" button is use to stop the system. "It is that simple."

If a Fresh Water Flush option is purchased, the system flushes/cleans itself every seven days.

CAUTION: In temperatures below 32° F/ 0° C, the fresh water will freeze and damage the components filled with fresh water. See Chapter 4 for freezing temperature procedures.

PRODUCTION:

The fresh water production of the Sea Recovery Ultra Whisper is relatively constant, regardless of feed water temperature, salinity, or the condition of the membrane. The technology utilized in this system forces the system to create a set amount of water. Pressure becomes the system variable without a control knob because the production must stay constant. See Chapter 8 and Chapter 10 for a better understanding of these pressure variations.

The Ultra Whisper feed water flows are listed below:

1.5GPM for the 200 model
2.5GPM for the 400 model,
3.5GPM for the 600 model.

The product flow is directly related to the feed water flow. The 200 model product water flow is 9 percent of the feed water flow and the 400 and the 600 product flow is 12 percent of the feed water flow. On DC systems the feed flow will decrease slightly with the increase in the feed pressure do to the nature of a direct current motor.

PRESSURE CHANGES:

The system pressure varies depending upon the temperature, the condition of the feed water and the condition of the membrane. Every unit is designed around feed water temperature of 77° F/ 25° C, and a salinity of 35,000 PPM-TDS (parts per million-total dissolved solids). At this temperature and salinity, the system will run at the standard system pressure listed in Chapter 10. If the salinity is increased or the temperature is decreased the system pressure will rise. Inversely, decreased salinity or increased temperature will cause the system pressure to decline. It is possible for both of these variables to rise and maintain the same system pressure.
Monitor the pressure, temperature and salinity in the system to determine the condition of the membrane and the pre-filter as well as system components.

OPERATION CAUTIONS:

1. Open all valves on the piping or hoses leading to and from the system
2. Check the Oil level in the Feed Pump (Diaphragm pumps do not need oil).
3. Check for any abnormalities such as leaks, damaged hoses or wires, etc.

EFFECTS OF TEMPERATURE ON THE MEMBRANE:

COLDER WATER:

At feed water temperatures 76° F and lower, the system must operate at a higher system pressure to produce the same amount of fresh water. As water temperature drops, the individual H_2O molecules are less active and need a higher pressure to drive them through the membrane. Another result of lower temperature feed water is that the product water produced has a lower salt content. ***Do not operate with feed water below 33°F / 1°C.***

WARMER WATER:

At feed water temperatures 78° F and above, the system operates at a lower system pressure to produce the same amount of product water. As water temperature rises, the individual H_2O molecules are more active and do not need as high a pressure to drive them through the membrane. Higher temperatures also allow more salts to pass into the product water line. ***Do not operate with feed water that exceeds 91°F / 33°C.***

HIGH/LOW FAULT LAMP EXPLANATION:

A. **Low Pressure Fault:** If the inlet pressure to the Feed Pump declines causing a vacuum or the pressure after the Feed Pump drops below 25 psig, the "High/Low Pressure" lamp blinks. If the condition is not corrected, the system shuts- down after 20 seconds. The Low Pressure Switch senses the conditions caused by:

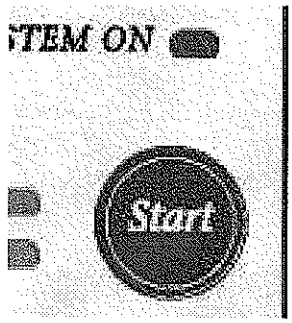
   1. a closed Inlet Sea Cock Valve
   2. a restriction in the inlet line
   3. a ruptured line/ fractured equipment

   High Pressure Fault: If the intermediate pressure line after the Feed Pump or the system pressure line after the ETD exceed a safety limit for 2 seconds, the system stops. The High Pressure switch senses abnormally high pressures within the system.

After a fault condition has been corrected, press "Fault Reset" and repeat the startup procedure.

STARTUP PROCEDURE

1. Open the Inlet Sea Cock Valve [2] fully.
2. Switch "on" the electrical power to the system at the circuit breaker. *The "POWER" lamp on the system Touch Pad should illuminate.*
3. **Press the "Start" button.** This *initiates the automatic start sequence. The automatic start sequence begins with the feed pump starting immediately, which in turn causes the energy transfer device to move and pressurize with each stroke or cycle*
4. If any abnormality develops, stop the system and correct the problem.
5. Check for unusual noises or other occurrences.



A complete illustration of Touch Pad is illustrated on page 1.5

SHUTDOWN PROCEDURE

1. **Observe and compare the performance of the system to the previously recorded normal operating specifications on Page 2.32.** The Daily Log on page 3.4 should be used prior to every shutdown. *This allows the operator to monitor performance and spot deviations or deficiencies when they occur.*

2. **Press the "Stop" button on the system controller.** If installed, the Fresh Water Flush cycle is initiated when the "Stop" button is pressed. The Fresh Water Flush has a 30-minute delay in order to allow the system to depressurize before flushing with 5-9 gallons of fresh water (the rinse cycle). The Fresh Water Flush lasts for 10 minutes but is adjustable from 6 to 13 minutes. After the ten minutes, the fresh water flush stops, but it remains in Fresh Water Flush mode. In this mode, the fresh water flush repeats the ten-minute rinse every 7 days. *This protects the membrane from biological growth and prevents it from drying out.* ***To continue the 7-day cycle, skip steps 4 - 6.***

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

4. **Press the "Stop" switch a second time to exit Fresh Water Flush Mode.**

5. **Turn off the electrical power source (circuit breaker) to the system.** This eliminates the chance of inadvertently starting the system. A posted notice called, "Lockout Tags or Tag Outs" must be used on the system circuit breaker when performing maintenance to the system. This tag indicates the current use of that breaker. **Warning-** if the power source is off then the fresh water flush will not cycle every seven days.

6. **Refer to Chapter 4 for proper Storage procedures.** This section describes the proper storage of the system for various time intervals.

This system does not use a regulating-valve. The system automatically adjusts the product flow. No manual/physical adjustments are required.

The "Start" button is used to produce potable water and the "Stop" button is use to stop the system. "It is that simple."

If a Fresh Water Flush unit is purchased, the system will flush itself every seven days. See Chapter 6 for system maintenance. See Chapter 4 for storage and additional cleaning information.

DAILY LOG READING

This Log helps the customer with system maintenance by recording the system performance after every shutdown and using this data for reference to determine abnormalities.

The customer uses the Daily Log to compare data. The results, inform the customer when to clean the membrane element, replace the pre-filter, replace the pump valves, replace the diaphragm pump head and to determine if the system is experiencing any abnormal conditions.

Chapter 6 is dedicated to assisting the user with system maintenance and repair procedures.

Units to be used (please circle one): psi/gpm bar/m^3/hr

Date	Total Days	FW Temp	LP gauge Pressure	PF Inlet Pressure	PF Outlet Pressure	HP Pressure	Product Flow	*FW Salinity	*Product Salinity

Notes:

LP = low pressure
HP = high pressure
PF = Pre-filter
FW = Feed Water

psi= pounds per square inch
gpm = gallons per minute
m^3 = cubic meters
hrs = hours

PF pressure difference>10psi = Replace Pre-Filter
HP gauge (calibrate) 10% increase = membrane
Diaphragm: PW decrease of10% = replace head
Plunger: Pulsations on LP gauge = replace valves

Salinity = concentration of total dissolved solids in parts per million

* A DS meter is strongly recommended and available from Sea Recovery.

4 STORAGE & CLEANING

4.0 SYSTEM STORAGE, CLEANING, and WINTERIZING

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

1. TEMPERATURE:
   Freezing temperatures cause extensive mechanical damage to the system components and irreversible damage to the Reverse Osmosis Membrane Element.

   FREEZING TEMPERATURE NOTE: The expansion of water as it freezes will damage components in the system. If the system is exposed to freezing temperatures special procedures must be followed. These procedures prevent damage to the membrane, membrane vessel assembly, Energy Transfer Device, and all components containing water. Should the system be subjected to freezing temperatures, use the **Freezing Temperature Procedure** described within this chapter.

   Never store the Reverse Osmosis Membrane Element in direct sunlight or expose the Sea Recovery Reverse Osmosis Membrane to storage temperatures above 120° F / 50° C or below 32° F / 0° C. High temperatures cause significant membrane production loss that results in an increase in operating pressure and places undue stress on the membrane. This damage is irreversible.

2. DRYING OUT:
   Never allow the R.O. Membrane Element to dry out, as it will cause significant membrane production loss that results in an increase in system pressure and places undue stress on the membrane. This membrane damage may be irreversible. The R.O. membrane element must remain wet at all times.

3. BIOLOGICAL FOULING:
   Protect the R.O. Membrane Element from biological fouling. Biological fouling results from improperly flushed and/or stored membranes and causes significant losses in membrane performance. Biological slimes that build up on the surface of the membrane cause an increase in system pressure. Cleaning may restore normal system pressure.

4. CHEMICAL FOULING:
   Never expose the R.O. Membrane Element to chemicals other than those supplied by Sea Recovery. 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 and is not covered by warranty.

5. STORAGE:
   The dark and moist interior of a membrane element is an excellent breeding ground for microorganisms. Simply operating the system does not protect the R.O. Membrane Element from increased system pressure due to biological fouling. During short-term shutdowns, the system must be rinsed as explained in the following pages. During long-term shutdowns the system must be rinsed and chemically treated as explained later in this chapter.

6. NEW SYSTEM STORAGE:
   Do not install the membrane and store the system for longer than 1 week prior to actual use. If storage of the new system is longer than 1 week prior to initial use the system must be rinsed with fresh water and stored with fresh storage solution every 3 to 6 months, otherwise biological fouling and or drying out damages the R.O. Membrane Element.

4.1 SHORT-TERM SHUTDOWN FRESH WATER RINSE PROCEDURE:

Freezing Temperature Note: *If the system is exposed to freezing temperatures special procedures must be followed. These procedures prevent damage to the system. Should the system be subjected to freezing temperatures, use the* ***Freezing Temperature Procedure*** *explained in this chapter on pages 4.3 and 4.4.*

A short-term shutdown is defined as a period of time in which the system is not used for one to fourteen days. An effective short-term protection for the system and R.O. Membrane Element is a Fresh Water Rinse of the entire system with fresh water (non-chlorinated product water from the system). This prolongs the system life by minimizing electrolysis and retarding biological growth.

The following procedures displace the corrosive feed water with fresh water and allow a short-term shutdown for up to two weeks. Five gallons (19 liters) of fresh product or potable water is required for the fresh water rinse.

The Fresh Water Rinse may be accomplished by utilizing the optional Automatic Fresh Water Flush Assembly or manually. Both methods are explained below.

A. AUTOMATIC FRESH WATER FLUSH ASSEMBLY INSTALLED:

Note: With the Automatic Fresh Water Flush Assembly Installed there is no need to disconnect any tubes or hoses from the system.

1. Press the "Stop" button on the system controller. The Fresh Water Flush cycle is initiated when the "Stop" button is pressed. The Fresh Water Flush has a 30-minute delay in order to allow the system to de-pressurize before rinsing with clean water. The Fresh Water Flush lasts for 10 minutes. After the ten minutes, the fresh water flush stops, but it remains in Fresh Water Flush mode. In this mode, the fresh water flush repeats the ten-minute rinse every 7 days.

2. The Fresh Water Flush system is timed and repeats every seventh day unless the "Stop" button is pressed twice, or the power supply is interrupted.

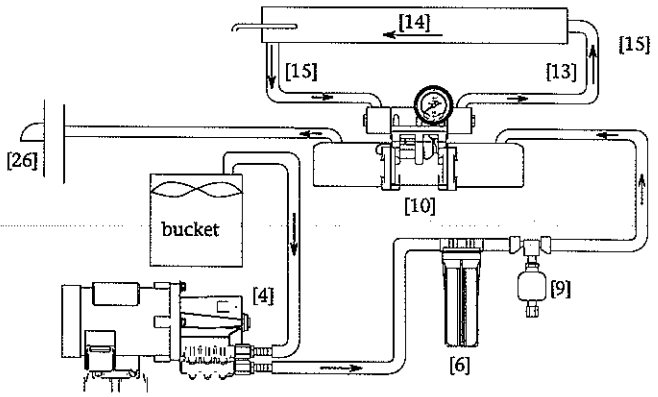
B. MANUAL FRESH WATER RINSE PROCEDURE:

1. Close the Inlet Sea Cock Valve [2].

2. Fill a 5-gallon plastic bucket with fresh, non-chlorinated water.

3. Disconnect the system inlet line from the outlet of the Sea Cock or Sea Strainer if used [4] and place the inlet line in the plastic bucket filled with the clean fresh water.

Figure 4.2.1 Illustration of the system's inlet line placed into a bucket.



4. Press the "Start" button. The fresh water rinses the system and discharges to waste through the Thru Hull Fitting.

5. Just prior to depleting the rinse water from the tank, stop the system.

6. Reconnect the Feed Pump inlet line. 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 while the system is not in use. This procedure limits biological growth on the R.O. Membrane Element and prevents corrosion in metallic components.

By installing optional Rinse/Clean valves on the inlet and brine discharge of the system the above procedure may be accomplished by repositioning the Inlet Rinse/Clean valve rather than disconnecting the inlet line.

4.2 FREEZING TEMPERATURE PROCEDURE:

This procedure describes how to protect an Ultra Whisper system from freezing temperatures during winter storage.

CAUTION: The product water channel, or substrate, beneath the membrane surface within the R.O. Membrane Element contains product water. This product water within the R.O. Membrane Element will expand and damage the R.O. Membrane Element if subjected to freezing temperatures. For this reason, the Membrane Vessel Assembly must be removed from the system and stored in a location not subject to freezing temperatures. Prior to removal, or prior to storage, the R.O. Membrane Element must be rinsed with fresh water then rinsed with R.O. Membrane Element Storage Solution to prevent biological growth during the storage period. (Many Sea Recovery Dealers offer winter storage of the Membrane Vessel Assemblies as a service)

During the Freezing Temperature Procedure, a solution of fresh water and food-grade glycerin (Food Grade Propylene Glycol) is pumped through the system's plumbing and Energy Transfer Device. The lowest expected winter temperature determines the percentage of glycerin and water that is required to prevent freezing. Refer to the Winterizing Solution of Water and Food Grade Glycerin (Propylene Glycol) Mixture Chart Figure 4.3.1 at the bottom of this page.

The Freezing Temperature Procedure requires the following items:

1. Plastic Bucket (2 _ -gallon size or larger).
2. Sea Recovery CLEANING AND STORAGE KIT UW (P/N B591380001).
3. Food-grade glycerin.
4. 5 gallons of fresh water.

NOTE: The CLEANING AND STORAGE KIT UW is designed specifically for storage of the Energy Transfer Device on the Ultra Whisper System. It allows a small portion of water to flow out of the center tube before returning to the Brine side of the ETD. This prevents excessive pressure build up and damage to system components. The blue hose with swivel fittings attached, which was included in the CLEANING AND STORAGE KIT UW is not necessary for the Freezing Temperature Procedure. It is used for Membrane Cleaning and Storage only.

Follow the below procedure to Winterize the Ultra Whisper System.

SETUP (SEE FIGURE 4.4.1).

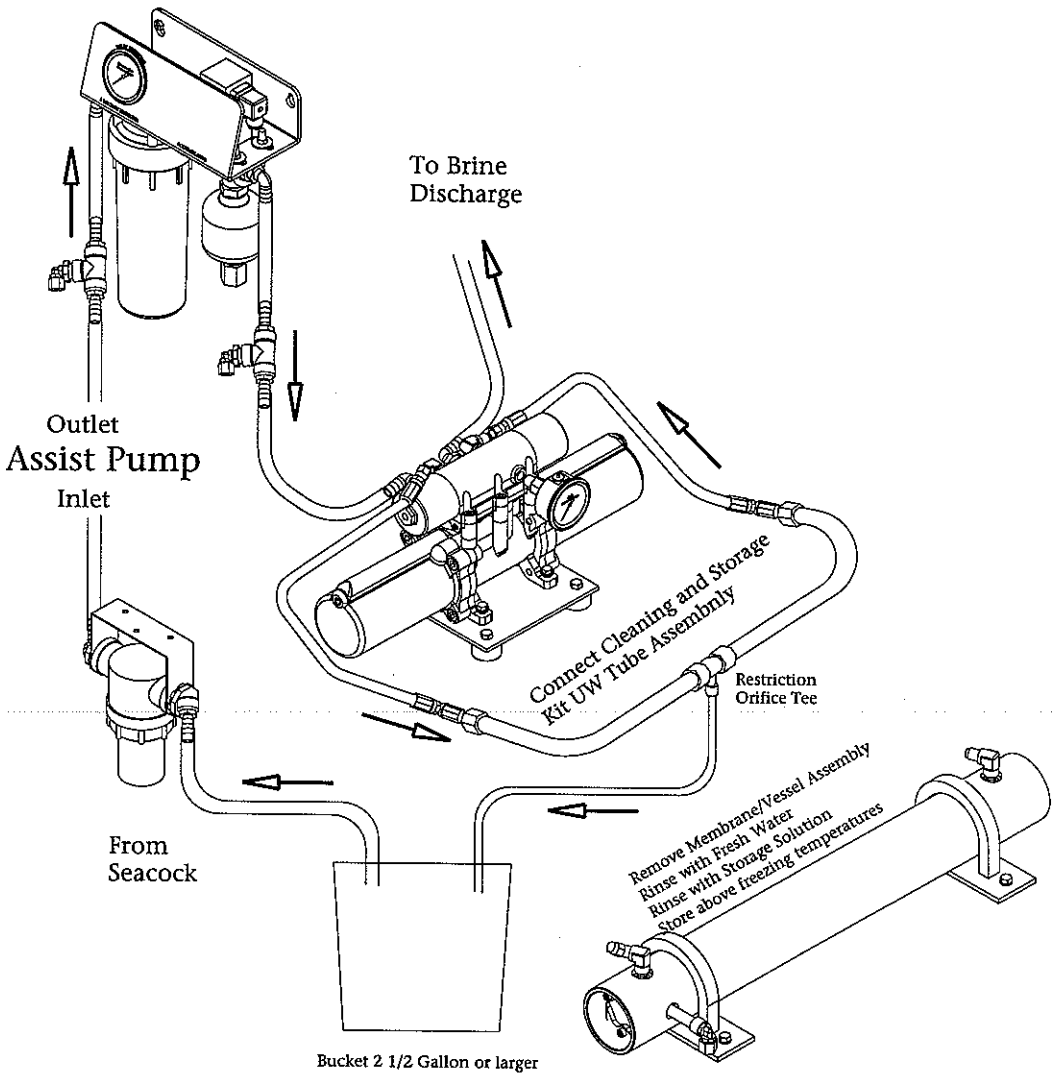
1. Close the Inlet Sea Cock Valve.
2. Remove the Membrane and place into Winter Storage.
3. Remove the Feed Pump inlet hose from its connection at the Inlet Sea Cock Valve. Place the end of this hose in the plastic bucket.
4. Connect the Membrane Vessel Assembly Inlet Hose to one of the flare connections on the CLEANING AND STORAGE KIT UW Tube Assembly.
5. Connect the Membrane Vessel Assembly Outlet Hose to the other flare connection on the CLEANING & STORAGE KIT UW.

Figure 4.4.1 Winterizing the System

Winterizing Solution of Water and Food Grade Glycerin (Propylene Glycol) Mixture Chart

Lowest Temperature Fahrenheit	Lowest Temperature Celsius	Percentage Solution	Fresh Water Required gallons	Propylene Glycol Required gallons	Fresh Water Required liters	Propylene Glycol Required liters
32	0	10%	2 1/4	1/4	8.52	0.95
28	-2	15%	2 1/8	3/8	8.04	1.42
24	-4	20%	2	1/2	7.57	1.89
19	-7	25%	1 7/8	5/8	7.10	2.37
14	-10	30%	1 3/4	3/4	6.62	2.84
8	-13	35%	1 5/8	7/8	6.15	3.31
-1	-18	40%	1 1/2	1	5.68	3.79
-10	-23	45%	1 3/8	1 1/8	5.20	4.26
-21	-29	50%	1 1/4	1 1/4	4.73	4.73

Figure 4.3.1



6. Place the center bleed hose of the CLEANING AND STORAGE KIT UW Tube Assembly into the plastic bucket (This hose needs to be restrained).

FRESH WATER RINSE.

7. Fill the plastic bucket with fresh water.

8. Operate the system until all of the water in the bucket is used. (The center tube on the CLEANING AND STORAGE KIT UW will return a portion of the fresh water into the plastic bucket)

WINTERIZATION SOLUTION.

9. Fill the bucket with the appropriate amount of fresh water according to Figure 4.3.1

10. Add the appropriate amount of food-grade glycerin. See Figure 4.3.1

11. Operate the system until all of the water in the plastic bucket is used.

12. Replace the Feed Pump Inlet hose onto the Inlet Sea Cock Valve.

SPRING START UP NOTE: After the system has been stored for the winter, a Fresh Water Rinse must be performed using the STORAGE AND CLEANING KIT UW PRIOR TO REINSTALLING THE MEMBRANE VESSEL ASSEMBLY. This prevents Glycerin Solution from entering the Membrane Vessel Assembly. The Glycerin Solution has a high Osmotic Pressure and if not evacuated, the solution would cause the system pressure to exceed 1000 psi (6895 kPa) and cause damage to system components.

After the Glycerin Solution is removed, the Membrane Vessel Assembly may be reinstalled, the CLEANING AND STORAGE KIT UW removed, and the system lines returned to their original position.

4.3 LONG TERM SHUTDOWN:

FREEZING TEMPERATURE NOTE:
If the system is exposed to freezing temperatures special procedures must be followed. These procedures prevent damage to the Membrane, Membrane Vessel Assembly, and the Energy Transfer Device. Should the system be subjected to freezing temperatures, use the ***Freezing Temperature Procedure*** *on pages 4.3 and 4.4.*

A Long Term or Prolonged Shutdown is a period in which the Ultra Whisper system is not used for longer than three months. For this shut down interval, the following procedures are required:

1. Rinsing system with fresh water (FWF)

2. Circulation of System and Membrane Element Storage Chemical (SRC SC). This chemical inhibits bacterial growth while maintaining the high flux and salt rejection of the R.O. Membrane Element. This procedure requires 5 gallons/19 liters of potable water.

THE LONG TERM SHUTDOWN PROCEDURE:

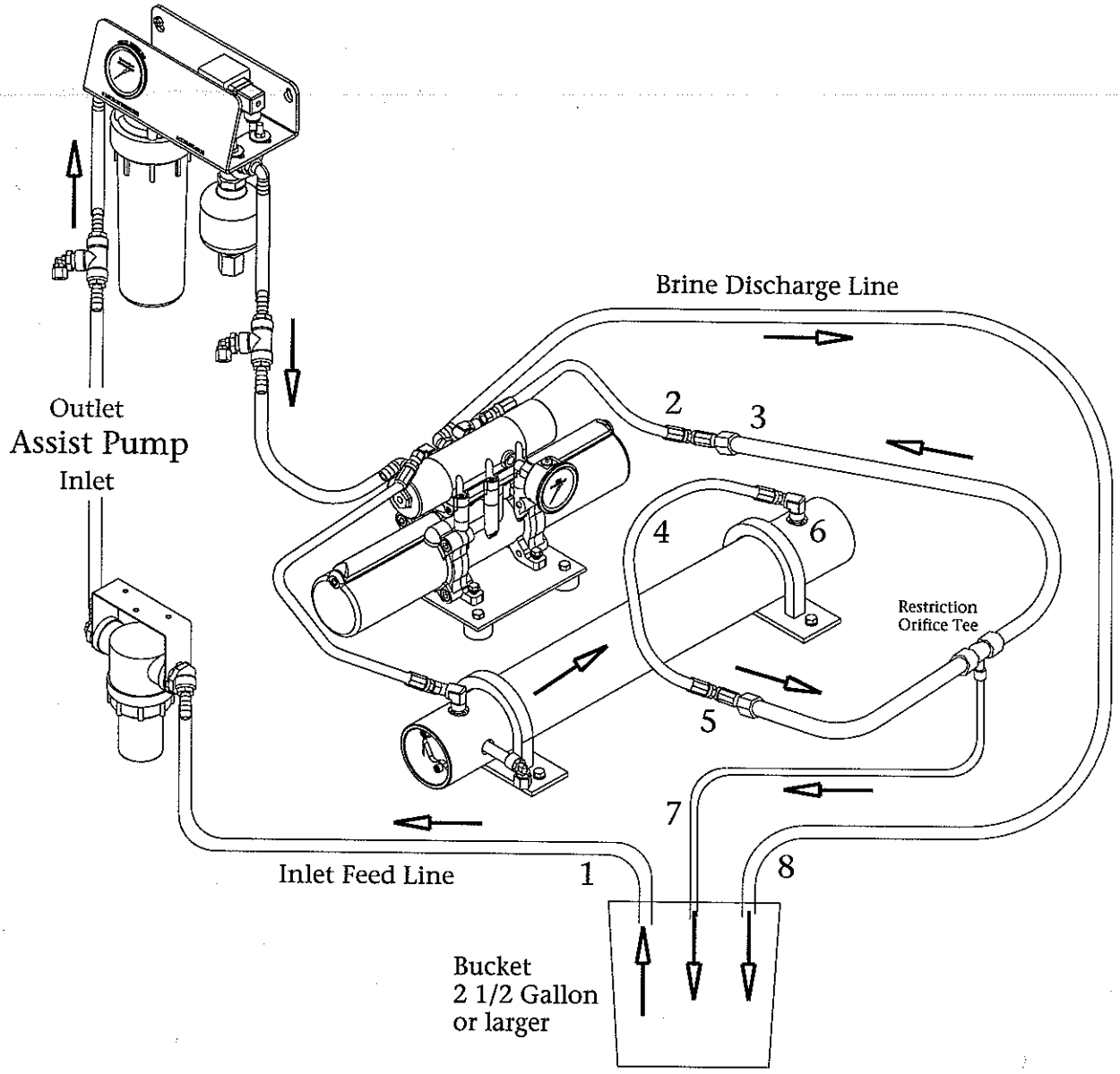
A. SETUP (REFER TO FIGURE 4.2.1)

1. Replace the Pre-filtration Cartridge with a new Pre-filtration Element.

2. Perform a Manual Fresh Water Rinse Procedure (Section 4.1 B).

B. SETUP (REFER TO FIGURE 4.5.1)

Figure 4.5.1 Closed Loop Configuration



1. Detach the Inlet Feed Line from the Sea Cock Valve [1]. Place the detached end of this hose into the bucket.

2. Remove the High Pressure Hose, MVA Outlet/Energy Transfer Device Inlet [2] from the outlet side male flare fitting on the Membrane Vessel Assembly. Attach this hose to the male flare end of the CLEANING AND STORAGE KIT UW [3].

3. The CLEANING AND STORAGE KIT UW is supplied with a blue hose [4] with female flare swivel fittings at each end. Attach one end of this hose to the remaining male flare on the CLEANING AND STORAGE KIT UW [5].

4. Attach the other female end of the blue hose in the CLEANING AND STORAGE KIT UW to the Membrane Vessel Assembly outlet side male flare fitting [6].

5. Place the center bleed hose of the CLEANING AND STORAGE KIT UW into the plastic bucket [7]. (This hose needs to be restrained)

6. Detach the Brine Discharge hose from the Brine Discharge Through Hull and place it in the plastic bucket for Closed Loop Circulation [8].

C. MEMBRANE STORAGE PROCEDURE

7. Fill the 2 1/2 gallon plastic bucket with product water. Add 1 1/2 ounces (1/16 bottle) of SRC SC Storage Chemical to the water in the plastic bucket. DO NOT ADD ANY OTHER CHEMICAL.

   a. Mix and thoroughly dissolve the solution in the plastic bucket.

   b. The maximum ratio for the Storage Chemical (SC) is one bottle per 40 gallons of product water.

8. Operate the system by pressing the "Start" Button. The Storage Chemical Solution flows from the plastic bucket, through the System, and back into the plastic bucket in a Closed Loop circulating configuration. Some of the cleaning chemical is bled off in the center tube. This is normal.

9. After approximately 10 minutes of circulation, stop the system (Press stop button twice to abort Fresh Water Flush Cycle).

10. Empty the 2 1/2 -gallon plastic bucket by reconnecting the Brine Discharge line to the Brine Discharge Thru-Hull fitting [28].

11. After connecting the Brine Discharge hose to the overboard Thru-Hull Fitting, push "Start". This discharges the Storage Chemical Mixture through the Brine Discharge Thru Hull Fitting.

12. Stop the system just before depleting the Storage Chemical Solution from the plastic bucket used. (Press the STOP button twice to abort the Fresh Water Flush Cycle)

13. Reconnect the Inlet Feed Line to the Inlet Sea Cock Valve connection. Leave the Sea Cock Valve in the Closed position.

14. Disconnect the Cleaning and Storage Kit UW Tube Assembly.

15. Reconnect the High Pressure Hose [2] to the R.O. Membrane Vessel flare Outlet fitting [6].

4.4 REVERSE OSMOSIS MEMBRANE ELEMENT CLEANING:

Do not arbitrarily clean a new system. If a new system experiences high system pressure, then it should first be operated for up to 24 hours continuously to clear the R.O. Membrane Element and wet the product water channel. If a new system still experiences abnormally high pressure or abnormally high salinity after 24 hours of continual operation then contact the factory.

WHEN TO CLEAN MEMBRANE ELEMENT:
The membrane element requires cleaning periodically. Biological growth and salt accumulation eventually make replacement necessary. The frequency of required cleaning depends on the amount of system pressure increase or pressure gauge difference from initial readings recorded on the New System Initial Readings on page 2.32 and the Daily Log Readings recorded on page 3.4. In order to properly assess performance changes, it is important to maintain daily log readings for comparison.

PERFORMANCE COMPARISON:
During performance comparisons, Feed Water Temperature, Feed Water Salinity, and System Pressure must be taken into consideration and compensated using the information in Chapter 8. After compensations, a 10% increase in the system pressure reading indicates that the R.O. Membrane Element requires cleaning.

PERFORMANCE VALIDATION:

- If the system pressure is dramatically higher than when the system was last used, the Membrane Element may be dried out and/or fouling may have occurred.

- If the system has not been used for several months and the high-pressure gauge pressure reading has increased dramatically since the last time the system was used, try operating the system with non chlorinated fresh water for the feed water for one hour to saturate the Product Water Channel in the Membrane Element.

- If the system pressure has fluctuated dramatically from one day to the next in water with the same temperature and salinity, chemical attack may be the cause. Sewage chemicals or petroleum products cause irreparable damage to the Membrane Element and are not cleanable.

CLEANING CHEMICAL CAUTIONS AND INFORMATION:

The Sea Recovery cleaning compounds are designed to clean moderate fouling from the R.O. Membrane Element. The chemical solution must circulate through the system to allow proper cleansing. If the R.O. Membrane Element is excessively fouled and this chemical cleaning is not successful, the R.O. Membrane Element may be returned to Sea Recovery or to one of Sea Recovery's many Service Dealers for Professional chemical cleaning.

1. SRC MCC-1, Membrane 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 Element becomes unusable and uncleanable even with no actual system use. This fouling is minimized with fresh water rinsing whenever the system is not in use.

2. SRC MCC-2, Membrane 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 a slow process, which takes place during 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.

3. SRC MCC-3, Membrane Cleaning Compound "# 3" is used for iron fouling. It is not included in the Sea Recovery MCC kit. If the Sea Recovery R.O. Membrane Element is fouled with rust from iron piping then SRC MCC-3 may be used for effective removal of light or moderate rust fouling. Heavily rust fouled RO Membranes may not be recoverable as rust not only fouls the Membrane Element but also damages the membrane surface.

MEMBRANE CLEANING INSTRUCTIONS:

To perform the Membrane Cleaning Procedure, you will need:

1. 7 1/2 gallons (28 liters) of non-chlorinated fresh water.

2. Plastic bucket 2 1/2 -gallon size or larger.

3. Sea Recovery CLEANING AND STORAGE KIT UW (SRC P/N B591380001)

4. The appropriate Membrane Cleaning Chemical.

A. SETUP (REFER TO FIGURE 4.2.1)

1. Replace the Pre-filtration Cartridge with a new Pre-filtration Element.

2. Perform a Manual Fresh Water Rinse Procedure (Section 4.1 B).

B. SETUP (REFER TO FIGURE 4.5.1 Closed Loop Configuration)

1. Detach the Inlet Feed Line from the Sea Cock Valve [1]. Place the detached end of this hose into the bucket.

2. Remove the High Pressure Hose, MVA Outlet/Energy Transfer Device Inlet [2] from the outlet side male flare fitting on the Membrane Vessel Assembly. Attach this hose to the male flare end of the CLEANING AND STORAGE KIT UW [3].

3. The CLEANING AND STORAGE KIT UW is supplied with a blue hose [4] with female flare swivel fittings at each end. Attach one end of this hose to the remaining male flare on the CLEANING AND STORAGE KIT UW [5].

4. Attach the other female end of the blue hose in the CLEANING AND STORAGE KIT UW to the Membrane Vessel Assembly outlet side male flare fitting [6].

5. Place the center bleed hose of the CLEANING AND STORAGE KIT UW into the plastic bucket [7]. (This hose needs to be restrained)

6. Detach the Brine Discharge hose from the Brine Discharge Through Hull and place it in the plastic bucket for Closed Loop Circulation [8].

C. CLEANING CHEMICAL RECIRCULATION:

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.

7. Fill a 2 1/2 -gallon plastic bucket with fresh non-chlorinated water. Add to the water 3 ounces (1/8 bottle) of the appropriate Membrane Cleaning Chemical (SRC MCC-1, MCC-2, or MCC-3). DO NOT ADD MORE THAN ONE CHEMICAL.

   a. Mix and thoroughly dissolve the solution in the plastic bucket.

   b. The ratio for the Membrane Cleaning Chemical (MCC) is one bottle per 20 gallons of product water

8. Operate the system by pressing the "Start" Button. The Cleaning Chemical Solution flows from the plastic bucket, through the System, and back into the plastic bucket in a Closed Loop circulating configuration. Some of the cleaning chemical is bled off in the center tube. This is normal.

NOTE: FOR BEST RESULTS, USE WATER BETWEEN 90°-110° F/ 32°-43° C. DO NOT EXCEED 120° F/ 49° C.

9. After approximately 60 minutes of circulation, stop the system (Press stop button twice to abort Fresh Water Flush Cycle).

NOTE: FOR BEST CLEANING RESULTS, ALLOW THE CLEANING SOLUTION TO SIT IN SYSTEM FOR 4 – 12 HOURS. THIS WILL ALLOW IT TO SOAK, DISLODGE, AND DISSOLVE FOULING.

10. After soaking, empty the 2 1/2 -gallon plastic bucket by reconnecting the Brine Discharge line to the Brine Discharge Thru-Hull fitting [28].

11. After connecting the Brine Discharge hose to the overboard Thru-Hull Fitting, push "Start". This discharges the Storage Chemical Mixture through the Brine Discharge Thru Hull Fitting.

12. Stop the system just before depleting the Storage Chemical Solution from the plastic bucket used. (Press the STOP button twice to abort the Fresh Water Flush Cycle)

D. RINSE WATER RECIRCULATION CYCLE:

13. Detach the Brine Discharge line from the Brine Discharge Thru-Hull fitting [28] and place it in the plastic bucket for the Rinse Water Circulation Cycle.

14. Fill the plastic bucket with 2 1/2 gallons of non chlorinated fresh water.

15. Press the "Start" button to begin circulating the Rinse Water from the plastic bucket, through the System, and back into the plastic bucket.

16. After about 20 minutes stop the system by pressing the "Stop" button (Press the stop button twice to abort the Fresh Water Flush Cycle).

17. Reconnect the Brine Discharge line to the Brine Discharge Thru-Hull fitting [28].

18. After the Brine Discharge line connection is secure, press the "Start" button to empty the solution from the plastic bucket and out the Brine Discharge Thru Hull Fitting [28].

19. Just prior to depleting the rinse water from the plastic bucket, stop the system (Press the stop button twice to abort the Fresh Water Flush Cycle).

ADDITIONAL CLEANING:

20. If further Membrane cleaning with a different chemical is required, prepare the solution in Step 10 and repeat steps 7 through 19.

RESTORE SYSTEM CONFIGURATION:

If cleaning is completed and the Ultra Whisper System is to be restored to normal operating condition.

21. Reconnect the Inlet Feed Line to the Inlet Sea Cock Valve connection. Leave the Sea Cock Valve in the Closed position.

22. Disconnect the Cleaning and Storage Kit UW Tube Assembly.

23. Reconnect the High Pressure Hose [2] to the R.O. Membrane Vessel flare Outlet fitting [6].

24. Recheck all connections for tightness.

5 TROUBLESHOOTING

5. TROUBLESHOOTING

This section deals with possible occurrences with the Sea Recovery Ultra Whisper System. Some occurrences may have many different causes. For each symptom, one or more causes are given. In turn, each cause has one or more corresponding tests to help identify whether the cause of the occurrence is the correct one. When the test(s) has confirmed the source of the problem, the appropriate remedy is given to correct it.

There may be more than one cause of a problem. In the following guide, when there is more than one cause of a problem, the causes are listed starting with the least serious. The tests given are designed to determine whether or not the cause of the problem is the correct one. When diagnosing the causes of a problem in this case, eliminate the listed causes one by one until the correct cause is found. Then the appropriate remedy is performed. Diagnosing and correcting the various occurrences in this manner makes troubleshooting easier and less time consuming.

USE CAUTION WHEN TROUBLESHOOTING. DO NOT PERFORM MAINTENANCE UNLESS:

1. The System Feed Water Sea Cock Valve [2] is closed.
2. The system main electrical disconnect switch is switched "**OFF**", **LOCKED**, and **TAGGED**.
3. Chapter 9, "EXPLODED PARTS VIEWS" of this MANUAL.

Symptom	Possible Causes	Test	Remedy
1. The System Shut Down By Itself & High/Low Pressure Lamp is Lit.	1. Low Pressure Fault.	1. Reset Fault 2. Start System and observe Low Pressure Gauge. 3. If the Feed Pump Inlet Gauge reads negative pressure and the High/Low Pressure Lamp blinks, after 20 seconds if the condition is not corrected, the System shuts off. This is due to a Low Pressure Fault. 4. Intermediate gauges are below operating pressures.	1. Make sure Sea Cock Valve is Open. 2. Clean Sea Strainer. 3. Ensure there are no kinks or blockages in Feed Line. 4. Make sure feed pump is below water level. 5. Ensure there are no air Suctions/ Leaks in Feed Line. 6. Ensure no leaks exist.
	2. High Pressure Fault	1. Check to see if there are any blockages or Closed Valves in Brine Discharge Line. 2. Check to see if there are any blockages or Closed Valves in Product Line. 3. Check the Inlet Pressure Gauge: Model 200 <125psi Model 400/600 < 215psi	1. Observe pressure at which system shuts off. If the switch setting has drifted from its original setting refer to page 6.4. 2. Replace Filters. 3. Feed Water High Salinity or Temperature below 50° F/ 10°C.
2. The System Shut Down By Itself & High/Low Pressure Lamp is NOT Lit.	Electrical System	1. Check Voltage at system 12 DC Systems shut down when the voltage falls below 11 VDC. 24 VDC Systems shut down when the voltage falls below 22 VDC. AC systems may experience a voltage spike or cycle fluctuation causing the circuit breaker to trip. 2. Is Circuit Breaker tripped or is it rated too low for the system.	1. Check Electrical Source 2. Check for Loose electrical connections. 3. Reset Circuit Breaker. 4. Check size of circuit breaker.
3. Feed Pump Inlet Pressure Gauge reading low but system remains running.	Low Pressure Gauge or Low-Pressure Switch orifice is clogged with debris.	Inspect Pressure Gauge and LP switch orifice at the pressure inlet port on the rear or bottom of the gauge or switch.	Clean Orifice of corrosion & debris. Replace Gauge if necessary.

Symptom	Possible Causes	Test	Remedy
4. The System has not Shut Down but system pressure is far below normal conditions, and the ETD is properly cycling.	1. The Energy Transfer Device may have worn valve seals.	Ensure the Feed Pump can build the pressure needed. If the feed pump is fine and the High-Pressure side will not develop the required pressure.	The two Valve Seals need to be sanded down as explained in Chapter 6.7 or the Valve Seals need replacement
	2. The membrane is torn or the membrane product tube is cracked and the system is in low salinity waters.	The product pressure and the salinity are higher that normal.	Replace membrane
5. The System pressurizes past 1000 psi and does not automatically shut down.	1. High Pressure Switch has drifted from factory setting.	If the system shuts down out of the switches range, it is in need of calibration.	Field calibration is not recommend and should only be performed by an Authorized Dealer. In case of emergency section 6.2 #7.
	2. High Pressure Gauge may be clogged & is not displaying the actual system pressure.	Inspect Pressure Gauge orifice at the pressure inlet port on the rear of the gauge.	Clean Gauge orifice with a small #6 drill. Be careful not to damage the gauge.
6. The System is running at 850 psi or above.	1. System is running in Feed Water greater than 35,000 ppm.	Check salinity of Feed Water. *Higher salinity Feed Water Requires higher Pressure to make rated flow.*	Refer to Salinity Effects chart to identify expected pressure for Higher Salinity Feed Waters.
	2. System Feed Water is at lower temperature.	Check Temperature of Feed Water. If feed water is below 76° F / 24° C, pressure should be expected to be higher.	Refer to "Temperature Effects" chart on page 8.2 to find expected pressure adjustment.
	3. RO Membrane.	Membrane just installed recently.	Run System at pressure for at least 30 minutes. Re-evaluate performance after 30 minutes.
	4a. RO Membrane Element is fouled.	Investigate whether the RO membrane element been stored improperly, without proper flushing and/or storage solution or if it has slowly degraded.	Membrane is biologically fouled and cleaning may restore performance. See section 4 for cleaning instructions.
	4b. Membrane is fouled.	Membrane was operated in water where oil or chemicals were present.	Membrane needs to be cleaned or replaced.
	4c. Membrane is fouled.	RO membrane is dried out.	Membrane needs to be replaced.
	4d. Membrane is fouled.	RO membrane was exposed to temperatures in excess of 140° F / 60° C.	Membrane needs to be replaced.
	4e. Membrane is fouled.	RO membrane was exposed to pressures in excess of 1000 psig and is compacted.	Membrane needs to be replaced.
7. The Feed Pump does not operate.	Various	See page 5.8 (this section) for step by step testing.	See page 5.8 for remedies.
8. The Diversion Valve does not operate.	Various	See page 5.8 (this section) for testing.	See page 5.8 for remedies.

Symptom	Possible Causes	Test	Remedy
9. System operating at elevated pressure in normal seawater.	1. Restriction in the Product outlet line/hose.	Ensure there are no blockages in product hoses or lines.	Straighten lines and hoses leading from the product outlet. Open all valves on product line completely.
	2. Error in calculating Salinity or Temperature Effects.	Higher Feed Water salinity requires an increase in pressure to produce the recommended product water. Lower Feed Water temperature requires an increase in pressure.	Refer again to "Salinity Effects" and "Temperature Effects" charts.
	3. Fouled Membrane	Membrane has been: 1. Stored improperly for extended period of time 2. Been operated in contaminated waters containing oil or other chemicals. 3. Been exposed to temperatures in excess of 140° F / 60° C. 4. Been pressurized past 1000 psi and become compacted. 5. Allowed to dry out.	1. In tests 1 and 2, Membrane Cleaning is performed. This may not be completely effective in all situations. 2. In tests 3 through 5, RO Membrane element must be replaced.
10. System operating at low pressure creating unpotable water.	1. Product Water O-ring on one or more of End Plug is damaged.	1. Water Quality Lamp is Red. 2. Salinity of Product water is extremely high.	Replace damaged O-rings or seals. *Use care during re-assembly.*
	2. Cracked RO Membrane Element.	1. Water Quality Lamp is Red. 2. Salinity of Product water is extremely high.	Membrane needs to be replaced.
11. The Water Quality Indicator remains Red (Un-potable water) for Extended Period.	1. Salinity Probe	Salinity Probe has debris on the probe causing the system to read poor water quality.	Clean the Salinity Probe with a toothbrush.
	2. Salinity Monitor out of calibration.	Test the actual Salinity of the product water with a portable TDS meter. *The system switches from "potable" water to un-potable water at 1000 TDS.*	If the Salinity Monitor is found to need calibration, refer to page 6.4 for instructions.
	3. Product O-rings	Check to see if Product Water O-rings are damaged. *These are the O-rings that separate the brine from the product in the Membrane Vessel Assembly.*	Replace O-rings if they are damaged.

Symptom	Possible Causes	Test	Remedy
13. The Water Quality Indicator remains Red (Un-potable water) for Extended Period. ***(Continued)***	4. Membrane has a broken Product Tube.	The system not only produces bad water, but also produces rated amount of water at a lower than normal Pressure.	Replace RO Membrane element. *Refer to section 6.4 for instructions.*
	5. Membrane is fouled, or has been attacked by chemicals.	The system produces the appropriate amount of product water, but the product water remains of poor quality.	Membrane is fouled and cleaning may restore performance. If not, membrane should be replaced. *Refer to section 4 for Membrane Cleaning and section 6 for Membrane Replacement.*
14. The Water Quality Indicator is Green (Potable water lamp) but the water has a definite salt taste.	1. Blockage or pressure in excess of 55 psi is present in the Brine discharge line.	A blocked brine discharge line causes brine water to mix with product at the Diversion Valve. Flow through the flowmeter will be normal.	Ensure that the Brine discharge line is free from kinks and that any valves installed in the brine discharge line are fully open.
	2. Salinity Probe	Salinity Probe has debris on the probe causing the system to read good water quality.	Clean the Salinity Probe with a toothbrush.
15. Product Water is leaking from the Product Tubing when the Green (Potable water lamp) comes on.	1. Blockage or pressure in excess of 55 psi is present in the product outlet line from the system.	Is water flowing from the product outlet line in the ship fresh water storage tank?	Ensure that the Product line is free from kinks and that any valves installed in the product line are fully open.
	2. Clogged Charcoal Filter	Leaks occur forward of this filter, but not downstream.	Change the appropriate Charcoal element.
16. There is a Sulfurous smell (rotten eggs) in the product tank.	1. Dirty Pre-Filtration Element.	Dirty Pre-Filtration Elements allow biological matter to grow in a very amiable environment. When this biological matter decomposes sulfur gas is released as a byproduct.	Replace Pre-Filter element and/or Clean Plankton Element if installed.
	2. Charcoal Filter	Charcoal filter has not been replaced in the recommended time interval.	Change Charcoal element.
	3. Product Tank	Product tank is dirty or has biological growth in it.	Clean and Chlorinate Product tank.
17. The UV sterilizer is flickering or does not light. ***(Do not look directly at the UV lamp)***	1. UV lamp.	UV lamp has not been changed in the recommended period of time.	Replace the UV lamp.
	2. Voltage.	The UV ballast is sensitive to voltage changes.	Ensure that the voltage supplied to the UV sterilizer is within 11 VDC to 14 VDC.

FEED PUMP TROUBLESHOOTING *(See also Electrical Troubleshooting if Pump Fails to Operate)*

Symptom	Possible Causes	Test	Remedy
18.The Feed Pump flow drops below normal as pressure is applied.	1. Faulty Seals	1. Leaking from Feed Pump Manifold 2. More than 2000 hrs. on Seals	Replace Feed Pump Seals
	2. Worn Feed Pump valves, valve seats, valve springs and/or valve seat "O" rings are allowing internal by-passing.	1. Pump is noisier than usual 2. Excessive vibration in Intermediate Pressure Gauge and/or Hoses. Valves accumulated more than 2000 hrs.	Replace Feed Pump Valve Assemblies
	3. Improper Voltage (DC systems)	Check Voltage at system	Check Electrical Source
	4. Improper Cycles (AC systems)	Check Cycles at system	Check Electrical Source
19. Feed Pump becomes erratic as pressure is applied.	1. Worn Feed Pump valves, valve seats, valve springs and or valve seat "O" rings are allowing internal by-passing.	1. Pump is noisier than usual 2. Excessive vibration in Intermediate Pressure Gauge and/or Hoses. 3. More than 2000 hrs. on Valves.	Replace Feed Pump Valve Assemblies
	2. Foreign Material Interfering with Valve Operation.	1. Pump is noisier than usual 2. Vibration in High Pressure Gauge and or Hoses. 3. Less than 2000 hrs. on Valves.	Remove manifold & Inspect Feed Pump Valve Assemblies
20. Feed Pump flow is normal and pump is not noisier than normal but the pressure becomes erratic as the system pressurizes.	1. The pressure in the accumulator is set too high or too low for system set-up.	1. Intermediate gauges fluctuate more than 60 psi. 2. Check Accumulator pressure. 3. ETD device noisier than usual	Recharge accumulator See Chapter 6.7. Model 200: 40-50 psi Model 400: 70-95 psi Model 600: 95-125 psi
	2. Damaged accumulator bladder	1. Accumulator leaks water. 2. Excessive vibration in Intermediate Pressure Gauge and or Hoses 3. Gauges fluctuate more than 60 psi.	Remove accumulator & Inspect rubber bladder. Replace Accumulator if needed
21. Feed Pump Leaks Oil	Drain Plug Oil Seal	Inspect bottom of pump Inspect seals closest to pump body	Tighten Pump Drain Plug or Replace Plug O-ring Replace oil seals
22. Feed Pump leaks water between manifold and Drive End.	1. Worn Inlet Packings.	Pump operated dry or at a vacuum	Replace Inlet Packings/ LP seals
	2. Worn Seals.	Seals have not been replaced in 2000 or more hours	Replace Seals

ELECTRICAL TROUBLESHOOTING

Symptom	Possible Causes	Test	Remedy
23. The "Start " button is pressed, but the system does not attempt to start.	1. System is in Fresh Water Flush Mode.	Fresh Water Flush Lamp is Blinking.	Press "Stop" to exit Fresh Water Flush Mode. Press 'Start" to operate the system.
	2. System has a Fault.	High/Low Pressure lamp is lit.	Press Fault Reset on controller. Press 'Start" to operate the system.
	3. No power to the system	The Power LED on the Touch Pad is not illuminated.	Reset the system circuit breaker.
	4. Microprocessor has locked up.	None.	Turn power off at the circuit breaker for a minimum of 20 seconds to reset the microprocessor.
	5. Blown Fuse in controller.	Check the fuse in the controller.	Replace fuse if blown.
	6. Improper wiring.	Ensure that system is wired correctly and/or there are no loose wires.	Check the system wiring. *Refer to Chapter 7 for wiring diagrams.*
	7. Inadequate power source to the system	AC & DC Systems: Ensure that the voltage does not drop below the industry standard of 15%. If the voltage drops below this standard during the system startup, the system will not start.	Provide adequate power to the system. *Refer to Chapter 7 for power requirements.*
	8. Defective Start Switch on Touch Pad.	Test using a copper wire to complete the circuit.	Replace Touch Pad.
24. The "Stop" button is pressed, but the system does not stop.	1. Microprocessor has locked up.	None.	Turn power off at the circuit breaker for a minimum of 20 seconds to reset the microprocessor.
	2. Defective Stop Switch on Touch Pad.	Test using a copper wire to complete the circuit.	Replace Touch Pad.
	3. Water damage to printed circuit board.	Inspect Printed Circuit board for presence of water.	If board had water spilled on it, it is possible to use a blow drier to dry the water causing the short. If this does not solve the problem, replace the printed circuit board.
25. Fuse in the controller blows at startup.	1. Power source	There is either low voltage or high voltage into the system.	Provide adequate power to the system. *Refer to Chapter 7 for power requirements.*
	2. Defective Component that relies on the fuse for power.	Check the 3-Way Diversion Valve, Printed Circuit board, Fresh Water Flush, UV Sterilizer (if installed), and the Touch Pad.	Repair or replace Defective Component.

FEED PUMP TROUBLESHOOTING:

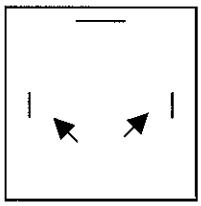
If the Feed Pump [4] fails to operate, follow these steps to isolate the problem.

1. Make sure the system is receiving proper power and the "POWER" LED is on.
2. Press "Start" button to activate the motor. Do not press any other button.
3. Measure the Voltage between terminals 1 and 2 on the Main Terminal Strip in the controller.
4. If the Voltage measured in Step 3, matches the system voltage, then problems may be in the motor wiring or in the motor itself.
5. If a low or no voltage condition is present in Step 3, check for proper operation of the Feed Pump Contactor. To deactivate the Contactor, press the "Stop" button twice. To activate the Contactor again press the "Start" button.
6. If the Contactor is mechanically operating, but a no voltage condition is present at the motor terminal refer to Step 3, then the Contactor may be at fault.
7. If the Contactor does not operate mechanically, measure DC voltage between A1 and A2 terminals. It should read 12 VDC when activated.
8. If the Contactor gets 12 VDC, but is inoperative, the Contactor coil may be open. Replace the Contactor.
9. If 12VDC is not present when the Feed Pump is activated, trace orange and orange/black wires to the main circuit board and measure the DC voltage at the terminals. It should read 12 VDC when activated.
10. Confirm the Feed Pump LED (on circuit board) is on when the Feed Pump is activated. Whenever this LED is on, HP terminals on the circuit board have 12 VDC. If it is not the case, replace the controller circuit board.

DIVERSION VALVE TROUBLESHOOTING:

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

1. Disassemble Controller Enclosure by removing 4 screws. This exposes the main controller circuit board.
2. Disconnect 3 wires from "SAL PROBE" terminals temporarily after noting wire connections. (Main Printed Circuit "PC" Board) 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. If this is not observed, then go to Salinity Level Calibration procedure on page 6.4.
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.
6. If the valve is silent, measure the continuity of its solenoid coil as shown below.



Measure the resistance between pins 1 & 2. It is approx. 12 to 15 Ω.

7. If the resistance value is abnormal (shorted or open), then replace the Valve.
8. If resistance value is OK, then measure the DC voltage at the connector, pins between 1 & 2. This should be 12 VDC.
9. If the voltage is 0 on the step above, measure DC voltage on the terminals marked as "3WAY" on the Control Circuit board. If there is 12 VDC present, then check the connecting cable between the Valve and Circuit board.
10. 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.

6 MAINTENANCE & REPAIR

6.0 MAINTENANCE & REPAIR

WEEKLY QUICK CHECK:
The following steps ensure that potential problems are resolved preventing major repairs. The numbers in [brackets] refer to the ID numbers illustrated on the P&ID in Chapter 1.2

INSPECTION:
Inspect all fasteners for tightness including brackets, screws, nuts, and bolts. Pay special attention to the Feed Pump and Electric Motor [4] since they are subject to increased vibration. Make sure Sea Strainer [3], Pre-filter[7] & Plankton Filter [5], if installed, are clean and do not restrict flow.

OIL:
Check the level of the crankcase oil. The minimum oil level is the center of the sight glass, located at the right side of the system. The maximum oil level is the top of the sight glass. (If applicable)

Use only SRC Feed Pump oil. **DO NOT USE MOTOR OR OTHER HYDRAULIC OIL.**

Check for fluid leaks; either oil from the Feed Pump or water from anywhere in the system.

HOSE:
Check all tubing and high-pressure hoses for wear and friction against abrasive surfaces. *The hoses should not contact heated or abrasive surfaces.*

WIPE DOWN:
Clean any salt water or salt deposits from the system with a moistened rag. Do not clean with Oil-Solutions.

DO NOT PERFORM MAINTENANCE UNLESS:

1. The System Feed Water Sea Cock Valve [2] is closed.
2. The system's main electrical disconnect switch is switched **"OFF", "LOCKED",** and **"TAGGED."**
3. Chapter 9, EXPLODED PARTS VIEWS.

6.1 OPERATOR MAINTENANCE INTERVALS

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 Ultra Whisper 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 Sea Recovery 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
Sea Strainer	Inspect & Clean Screen & Housing	weekly
Plankton Filter	Inspect & clean	weekly
Pre-filter	Replace element	Differential is >10 psi
Flow Meter	Clean inside of the clear tube	As required when dirty
Feed Pump	Change oil Replace Seal Kit Replace Valve Kit	6 months 2 Years 2 Years
Feed Pump 200-DC Pump Motor 200-DC	Replace Pump Head/Diaphragm Replace Motor	250 - 500 hours 2000- 3000 hours
R. O. Membrane	Clean Element	When system pressure has increased by 10% (at normal Temp. & Salinity)
Salinity Probe	Clean Probes	Annually
Charcoal Filter	Inspect/ Replace Element	3 months
U.V. Sterilizer	Replace lamp & Clean quartz sleeve	2 years
Fresh Water Flush Charcoal Briquette	Inspect/ Replace Carbon Element	3 months
Energy Transfer Device	Replace Seals and Valves Reface/Replace ETD Valves	2000- 5000 hours System Pressure <500psi

Other _____

Other _____

6.2 SMALL ITEM 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 Ultra Whisper System to shut off.

2. **Inlet Sea Cock Valve [2]:** The seals and connections of the Inlet Sea Cock Valve must be tight and properly sealed. Clean the valve cavity of debris or replace the seal and seat, or the entire valve, as required. Make sure the handle moves freely.

3. **Sea Strainer [3]:** Keep the mesh screen free and clear of debris. When the mesh screen is clogged, it results in a low-pressure condition causing system shut off. To clean the Sea Strainer:

    a. Remove the bowl by turning it counter-clockwise.
    b. Remove the Mesh Screen from the bowl.
    c. Remove the flat sealing gasket from the bowl and take care to not damage it.
    d. Wipe the sealing gasket with a damp cloth. Lubricate it sparingly with O-Ring lubricant or liquid soap.
    e. Place the seal back onto the bowl. Seat the mesh screen back into the bowl.
    f. Screw the lid on clockwise. *Hand-tighten only enough to seal water in and air out.*

4. **Plankton Filter [5]** Element Cleaning: Identical procedure for Pre-filter and Charcoal Elements

    a. Unscrew the blue or clear bowl counter clockwise.
    b. Remove the Plankton Filter Element from the bowl.
    c. Remove the O-Ring from the top of the bowl and take care to not damage it.
    d. Clean the mesh screen filter element with a bristle brush and water spray.
    e. Wipe the O-Ring with a damp cloth.
    f. Lubricate it sparingly with O-Ring lubricant or liquid soap.
    g. Place the O-Ring back onto the bowl.
    h. Insert the cleaned, or a new, plankton filter element into the bowl.
    i. Screw the bowl on clockwise.

5. **Pre-filter [7] Element Replacement:** The pre-filter element must be replaced when plugged to the extent that the Pre-filter Outlet Pressure Gauge at the control panel reads more than 10 PSI below the Pre-filter Inlet Pressure Gauge. The *Pre-filter element replacement procedure is identical to the plankton filter, see Paragraph #4 for replacement steps.*

6. **Low/Vacuum Pressure Gauge [9]:** If the pressure gauge fails to register, the orifice may be corroded with debris. Use a thin wire or 1/16 drill bit to dislodge any debris trapped within the pressure port orifice.

7. **Low Pressure Switch [10]:** The Low Pressure Switch contains one N.O. (Normally Open) contact. As the Feed Pump builds pressure on the Pre-filtration Section, the Low Pressure Switch closes at 24 psi (+/- 2 psi). When pressure decreases below 24 psi (+/- 2 psi) on the intermediate pressure line for a continuous 20 seconds, the Low Pressure Switch opens and shuts the system off. The switch automatically resets itself if the pressure increases above 34 PSI before the 20-second limit. Adjustment of the Low Pressure Switch is not recommended.

    If in field adjustment is absolutely necessary:

    a. Stop the Ultra Whisper System.
    b. Remove the cap located in the center top of the pressure switch to expose the calibration screw.
    c. Adjust the calibration screw, maximum 1/8th turn (45 degrees) at a time, clockwise to increase and counter-clockwise to decrease the set point.
    d. Restart the system and check the setting by slowly closing the Inlet Sea Cock Valve while observing the Intermediate Pressure Gauge at the point of shut down.
    e. Repeat as necessary to calibrate the switch.

8. **High Pressure Gauge [13]:** If the pressure gauge fails to register, the orifice may be corroded with debris. Use a thin wire or #6 drill bit to dislodge debris trapped in the orifice.

9. **High Pressure Switch [14]:** The High Pressure Switch keeps the system in operation when the high pressure is within a safe level. When the feed pump intermediate pressure (feed pump outlet/pre-filter inlet pressure) reaches 125 psig (±5 psi) on the 200 model, 190 psig (±5 psi) on the 400 model or 220 psig (±5 psi) on the 600 model, the High Pressure Switch shuts the System off. Field adjustment of the High Pressure Switch is not recommended. If in field adjustment is absolutely necessary:

   a. Stop the Ultra Whisper system.
   b. Remove the cap located in the center top of the pressure switch to expose the calibration screw.
   c. Adjust the calibration screw, maximum 1/8th turn (45 degrees) at a time, clockwise to increase and counter clockwise to decrease the set point.
   d. Restart the system and check the setting by limiting the flow after the switch while observing the Intermediate Pressure Gauge at the point of shut down.
   e. Repeat as necessary to calibrate the switch.

8. **Flow Meter [19]:** 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.

9. **Salinity Probe [18]:** The salinity probe requires cleaning once a year. To clean the probe:

   a. Remove wires, noting the color code position.
   b. Unscrew the probe from the control manifold.
   c. Using a soft bristle brush, scrub the probes to remove any built up debris.
   d. Clean the Salinity Probe threads and replace all old Teflon tape before reinstalling hand tight only.
   e. Replace wires.

Salinity Probe Calibration:

   a. Disconnect the system from power source.
   b. Temporarily disable the Feed Pump by removing power cords at the main terminal strip in the Controller, after noting the original connections.
   c. Remove the Salinity Probe from its mounting manifold, and wipe electrodes clean with a clean soft cloth.
   d. Restore the power to the system and press the "Start" switch. Wait for approximately 10 seconds.
   e. If the Salinity Probe is exposed in the air and it is dry, the "Water Quality" LED should turn green.
   f. If the LED does not turn on green, disconnect the probe cable from the circuit board terminals. If the LED comes on green, inspect the Salinity Probe thoroughly and replace it if necessary.
   g. Dip the Salinity Probe electrodes well into the test solution of 1,000 PPM, available from Sea Recovery.
   h. Turn the "SALINITY SET" control on the main circuit board to fully clockwise position, then very slowly turn back counter clockwise until the LED turns 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.
   i. This completes the calibration of the Salinity Level.
   j. Disconnect the system from power source and revert disconnected wires to original terminals, and assemble enclosures.

12. **Charcoal Filter [21]:** 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.

13. **Ultraviolet Sterilizer [22]:** The UV Sterilizer lamp emits a high 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:

    a. Remove the top lid. *The ballast should remain in the lid.*
    b. Remove the lamp and the lamp plug from the quartz sleeve.
    c. 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:

    a. Remove the top cap (cap, ballast, and lamp).
    b. Remove the three Phillips-head screws on the top end bushing.
    c. Remove the top bushing and the top O-Ring and place in a safe place.
    d. 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 with it.*
    e. Remove the bottom O-Ring and clean it with a damp cloth.
    f. 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 Ultraviolet 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.

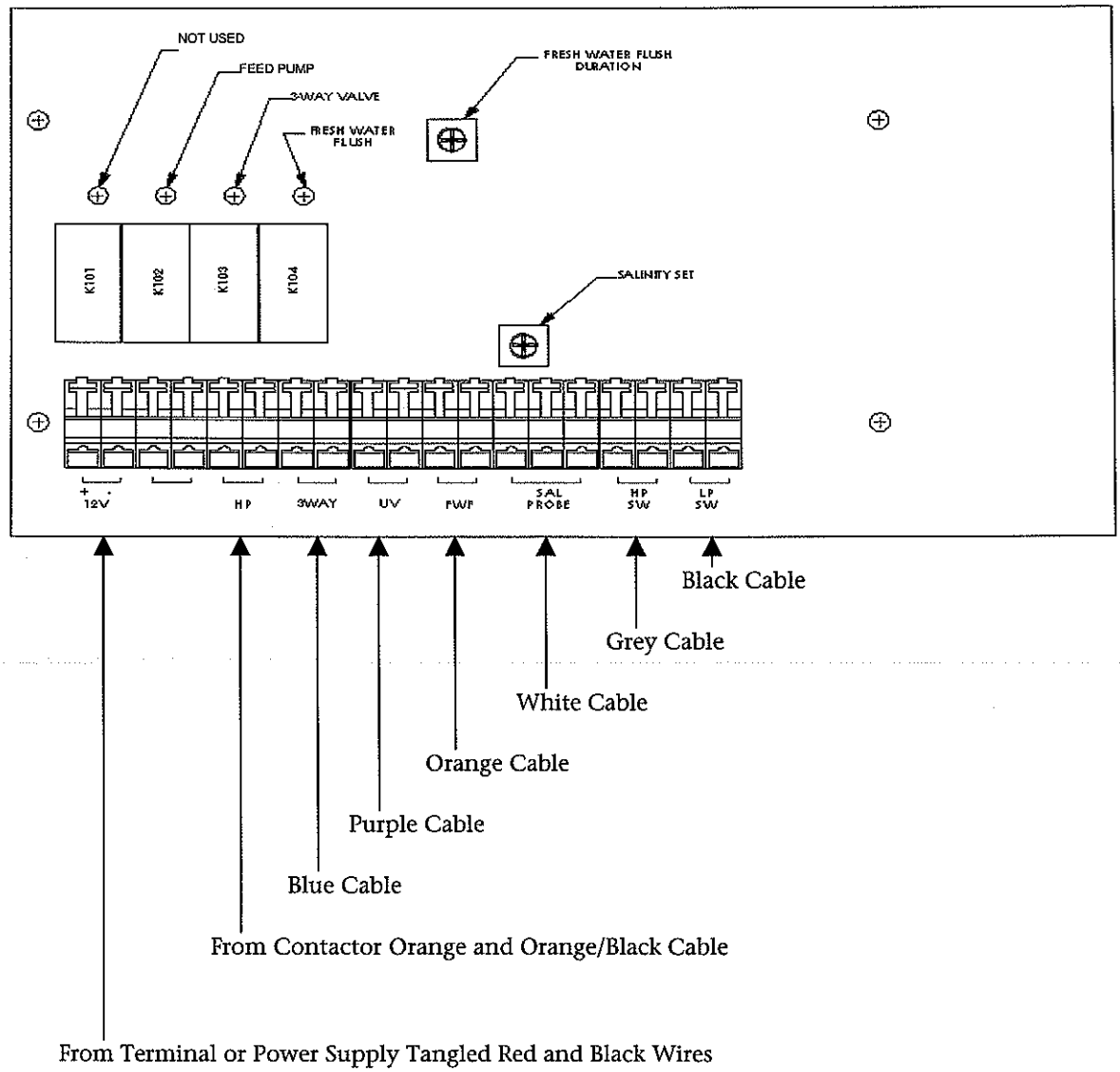
14. **Fresh Water Flush [24 & 25]** The Carbon Briquette in the Fresh Water Flush should be replaced every 3 months in order to avoid water with 0.10 PPM of chlorine or greater that foul the membrane.

    Fresh Water Flush Adjustment:

    a. Disassemble the Controller Enclosure and open it by removing 4 screws.
    b. Press the "Start" switch, then the "Stop" switch.
    c. Note that the "Fresh Water Flush" LED is either on or flashing.
    d. Adjust "FRESH WATER FLUSH DURATION" control on the main circuit board (shown on page 6.6) to obtain a desired length of operation time. Full counter-clockwise position is approximately 9 minutes and full clockwise position results to approximately 14 minutes.
    e. To time the duration, cycle the power, then repeat the Step b above.

    This completes the adjustment.

    f. Reassemble the Controller Enclosure.



Each Color Coded Cable has a set of red and black wires inside that connect to a corresponding terminal. If additional equipment is purchased, ensure that the wire colors match this diagram. Refer to Chapter 7 before ant action is done on the circuit board illustrated above.

Figure 6.2.1 Illustrates the Printed Circuit Board located inside the Electrical Enclosure and the cable color code.

15. **Controller [26]:** The salinity controller does not require any routine maintenance. However, if any optional equipment has been purchased, the color-coded wires must agree with the diagram shown in Figure 6.2.1.

6.3 FEED PUMP MAINTENANCE & REPAIR

NOTE: THIS SECTION APPLIES TO SYSTEMS WITH A TRIPLEX PUMP ONLY. REFER TO CHAPTER 1 FOR PUMP AND SYSTEM DEFINITIONS.

FAILURE SIGNS AND POSSIBLE CAUSES

1. Pulsations at the Feed Gauge are caused by (check low pressure gauge for pulsations):

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

2. Water Leak between the Feed Pump Manifold and Rear Section caused by:

   - Worn Seals or Seals damaged due to running dry.

3. Flow drops dramatically when attempting to pressurize and there is no flow at the Product Flow Meter. This is caused by:

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

FEED PUMP SERVICING

a. Disassembly of the Discharge Valve Assemblies:

Tools required: 3/8" Drive Ratchet; 6 mm Hex Socket; O-Ring Pick; Two slotted screwdrivers, Torque Wrench; Needle Noise Pliers.

1. Only one valve kit is required to repair all of the valves in one pump. The Valve Kit includes new valve O-Rings, valve seats, valves, and springs.

2. Disconnect all plumbing.

3. Remove the six socket head screws from the manifold. Remove the outer screws first, then the inner screws.

4. Using a soft mallet, tap the back side of the Discharge Manifold from alternate sides to maintain alignment and avoid damage to the plungers

5. Grasp the Discharge Manifold from the underside and gradually lift manifold while you pull away from the Crankcase.

6. The Adapter/Spacers may stay with either the Discharge or Inlet Manifold. By inserting two opposing screwdrivers between Spacer and manifold, you can easily pry them out of the Discharge Manifold. If they stay in the Inlet Manifold, gently work them up and down as you pull away from the Inlet Manifold.

7. The Valve Assemblies are in the Discharge Manifold ports and will fall out when manifold is turned over. A complete valve assembly includes: Retainer, Spring, Valve and Seat.

b. Disassembly of the Seal Assembly:

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

1. Remove the Inlet Valve Assembly from the exposed plunger rod ends, including Cotter pin, Nut, Washer, Spring, Spacer and Inlet Valve.

2. Grasp the Inlet Manifold from the front and underside and pull to remove from Plunger Rods.

3. Carefully examine backside of Low Pressure Seal before removing from manifold as it will be damaged during removal. If worn, insert screwdriver into I.D. of seal and pry out. Exercise caution to avoid damage to the Inlet Manifold.

4. Press ceramic Plunger with thumb or soft tool from backside of Inlet Manifold. (The High Pressure Seal may stay with the plungers or remain in the Inlet Manifold. If on the plungers, slide off by hand. If in the

manifold, use a reverse pliers to remove.)

5. Remove Seal Retainers from Crankcase by grasping tab with pliers and pulling out.

6. Examine Crankcase Oil Seal to determine if Crankcase servicing is needed.

7. Examine Ceramic Plunger, Low Pressure Seals, V-Packings for scoring, cracks and wear and replace.

c. Reassembly of Seal Assembly:

1. Examine Seal Retainers and replace if worn or damaged. Install on Plunger Rod and press into Crankcase **with tab out.**

2. Place Inlet Manifold on work surface with **Crankcase Side up.**

3. Lubricate new Low Pressure Seals and press into position with **garter spring down.** Be certain the seal is seated squarely on the shoulder on the inlet manifold chamber.

4. Place the inlet Manifold on work surface with **Crankcase side down** (Larger ID ports up).

5. Carefully examine the Plungers for scoring or cracks and replace if worn.

6. Lubricate Ceramic Plungers and new High Pressure Seals. Press the plunger into the seal and position seal in middle of plunger.

NOTE: Place the deeper recessed end of the plunger into the seal from the metal back side.

7. Insert the Plungers into the manifold ports. Press into position using the **larger I.D. end of Discharge Valve Spacer.** Examine the O-Ring and Back-up-ring under the Sleeve for cuts or wear and replace. Examine the Barrier Slinger for wear and replace as needed. Install the Barrier Slinger with the concave side facing away from the Crankcase. Lubricate the Plunger Rod O-Ring to avoid cutting during installation. Install the Back-up-ring first then the O-Ring into the groove on the Plunger Rod. Install the Sleeve with the tapered end facing out. Gently press towards the Plunger Rod shoulder until flush with the Barrier Slinger.

8. Carefully install Inlet Manifold over Plunger Rod ends and slowly press into Crankcase.

9. Examine Inlet Valve and replace if worn. **Inlet valves cannot be reversed if worn.** The SS Inlet Valves may be lapped if not badly worn. Install the SS Inlet Valves with **square edges towards the plungers** (round edges towards the discharge). Install the Nylon Inlet Valve with **ridged side towards the discharge.**

10. Examine Spacers for wear and replace as needed. Install Spacer on each Plunger Rod with **smaller O.D. towards inlet valve.**

11. Examine Springs for damage or fatigue and replace as needed. Place on Plunger Rods.

12. Install Washers next with **concave side towards Inlet Manifold.**

13. Install Nuts and torque to 55 in. lbs./ 4.6 ft. lbs./ 6.2 Newton meters.

14. **Always install new Cotter pins** and turn ends to secure in position.

d. Reassembly of the Discharge Valve Assembly:

1. Examine Adapter Spacer O-Rings and replace if worn. Lubricate and install O-Rings and Back-up-Rings on **both front and rear of the Adapter Spacer.**

2. Examine the Valve Retainers for scale build up or wear and install into each Discharge Manifold port with tab down into the manifold chamber.

3. Replace worn or damaged Springs and place into Retainers.

4. Examine Valve and Seats for pitting, grooves, or wear and replace as needed.

5. Place Valves over springs with **concave side down.**

6. Place Valve Seats on Valves with **concave side down.**

7. Lubricate O.D. of Adapter/Spacer and insert smaller I.D. into Discharge Manifold ports. Snap into position. Exercise caution not to cut or pinch O-Rings.

8. Carefully guide Discharge Manifold with Spacers over Plunger Rod ends and press into Inlet Manifold.

9. Replace Socket Head Screws and torque to 115 in. lbs./ 9.4 ft. lbs./ 13 Newton meters.

10. If oil was not changed, be sure oil is at the proper level on the sight gauge.

Torque sequence for tightening the manifold:

3	1	5
X	X	X
X	X	X
6	2	4

6.4 REMOVAL OF THE REVERSE OSMOSIS MEMBRANE ELEMENT

RECOMMENDATIONS:

The Ultra Whisper Membrane Element is accessible with the Vessel still attached to the frame or bracket.

Replace all O-Rings within the High Pressure Vessel Assembly each time the Reverse Osmosis Membrane Element is removed or replaced. Ensure these O-Rings are on hand prior to repair.

Membranes are only installed and removed from the Inlet (LEFT) side of the High Pressure Vessel.

REMOVAL PROCEDURE:

Tools Required:

5/16" Allen wrench
Regular pliers
Needle-Nose Pliers

1. 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.
2. Push inward on the End Plug and remove the three-piece segment ring.
3. Remove the Port Retainer.
4. Remove the Feed Port.
5. Insert all three of the Socket Head Cap Screws back into the End Plug. These screws are used as a handle to remove the End Plug.
6. Grasp one or more of the Socket Head Cap Screws with a pair of pliers and pull slowly outward to remove the End Plug. There is some resistance due to the two Brine O-Rings exerting friction against the Vessel wall. *With the End Plug removed from the High Pressure Vessel, the Reverse Osmosis Membrane Element is visible.*
7. 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.*
8. Remove the 2 Brine O-Rings and Product Water O-Rings from all End Plugs removed from the High Pressure Vessel.
9. Clean the end plugs with a cloth and sparingly lubricate new Brine O-Rings and new Product Water O-Rings with O-Ring lubricant. Place them onto the End Plug.
10. With your fingers grasp the Product Water Tube and pull outward. If resistance is met, cup the open end of the High Pressure Vessel with one hand and shake downward to dislodge the R.O. Membrane Element. Run a rag through the High Pressure Vessel to remove any biological film or debris from the High Pressure Vessel.

CAUTION: At each end of the Reverse Osmosis Membrane Element is a Product Water Tube approximately ¾" 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 the Product Water Tube. Do not drop the R.O. Membrane onto a hard surface as the Product Water Tube may be damaged.

6.5 INSTALLATION/REPLACEMENT OF THE REVERSE OSMOSIS MEMBRANE ELEMENT

A new Sea Recovery Reverse Osmosis Membrane Element comes complete with a "U" cup Brine Seal at one end of the Membrane Element. **This Brine Seal must be installed at the inlet end of the High Pressure Vessel.**

1. 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.

2. 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.

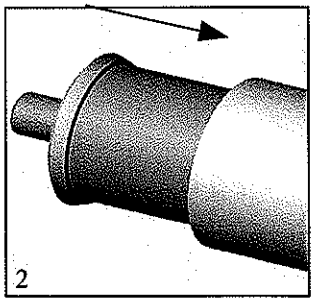
3. Insert the End Plug with new attached O-Rings into the High Pressure Vessel while aligning the High Pressure Port and Product Water Port to the respective holes in the High Pressure Vessel. Continue pushing inward on the End Plug until it's exposed end travels just past the Segment Ring Groove in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

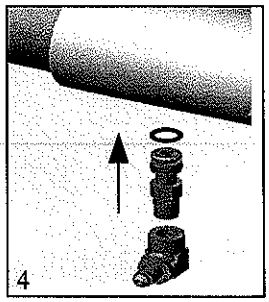
4. Insert the High Pressure Port Fitting with attached O-Rings into the High Pressure Port.

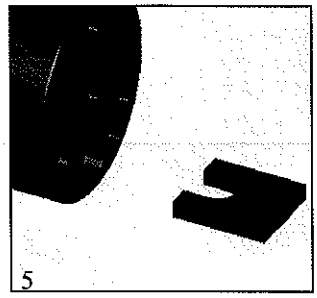
5. Replace the Port Retainer.

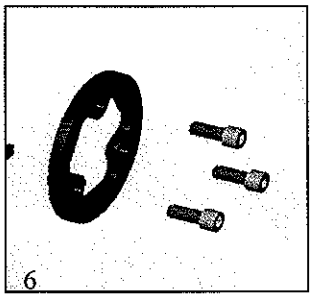
6. Insert the three-piece Segment Ring Set into the Segment Ring Groove of the High Pressure Vessel. Align the Segment Ring Set with the tapped holes in the End Plug for insertion of the three Socket Head Cap Screws. Attach the three Socket Head Cap Screws and tighten.

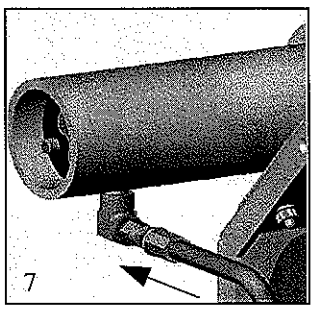
7. Connect the High Pressure Hose to the inlet end fitting of the MVA. Do not over tighten the female swivel nut.


2


4


5


6


7

6.6 RECHARGING ACCUMULATOR BLADDERS

Sea Recovery recommends that only experienced personnel charge accumulators. Accumulators are shipped pre-charged with nitrogen gas (pressurized).

Prior to charging the accumulator with nitrogen, it is advisable to pour some water with hand soap into the accumulator port and tilt the accumulator to allow the water to completely wet the inside diameter of the accumulator shell. This provides the initial lubrication between the bladder and the shell.

NITROGEN PRECHARGE PRESSURE

The nitrogen pre-charge pressure is 65% of the working pressure on bladder units. As this nitrogen pre-charge percentage increases, more volume is displaced from the accumulator. However, it should not be increased above 90%. If this percentage is exceeded, the bladder life is reduced. Bladder damage can occur if the nitrogen pre-charge pressure falls below 35% of the maximum working pressure.

Accumulator	Pre-charge Pressure
Model 200	40 psig +/- 5%
Model 200	85 psig +/- 10%
Model 200	110 psig +/- 10%

AN ACCUMULATOR PRE CHARGE VALVE ASSEMBLY KIT IS REQUIRED FOR CHARGING.

The following step-by-step procedure should be used to charge the accumulator:

1. Make certain the bleeder valve is closed.

2. Turn the core opening handle of the 3-way gas charging valve clockwise to depress the stem in the gas valve body.

3. Open the valve in the top of the nitrogen bottle very slightly to allow a small flow of nitrogen into the accumulator. It is highly recommended that a regulator be used on the top of the nitrogen bottle. In this case, you would then open the regulator slightly to allow a small flow of nitrogen into the accumulator.

NOTE: If the nitrogen is allowed to flow too rapidly into the accumulator, the bladder can be DAMAGED.
Watch the pressure gauge on the top of the pre-charge valve assembly. Allow this to stabilize between 15 to 20 psig for the 200 Model, 70 psig and 90 psig for models 400 and 600. At this point, the bladder is fully expanded and you may now proceed to bring the nitrogen charge up to your requirement.

4. Once you have reached your required pre-charge pressure, allow the system to stabilize for 5 to 10 minutes. Usually the gas pressure drops slightly due to molecular movement of the gas. If the gas pressure does drop slightly, add enough gas to bring the system up to your desired pre-charge.

5. The diaphragm plastic diaphragm accumulators only require a gas charge pressure of 45% of system pressure. The bladder stainless accumulators require a minimum gas charge pressure of 65% of system pressure.

6. When the gas charging procedure is completed, turn the core opening handle counter clockwise to allow the gas valve in the accumulator top to seat. Next, close the valve on the top of the nitrogen bottle. Bleed the pressure in the charging hose by opening the bleeder valve on the gas charging 3-way valve.

7. Remove the 3-way gas-charging valve from the top of the accumulator. It is always a good practice to check for leakage after the charging procedures have been completed.

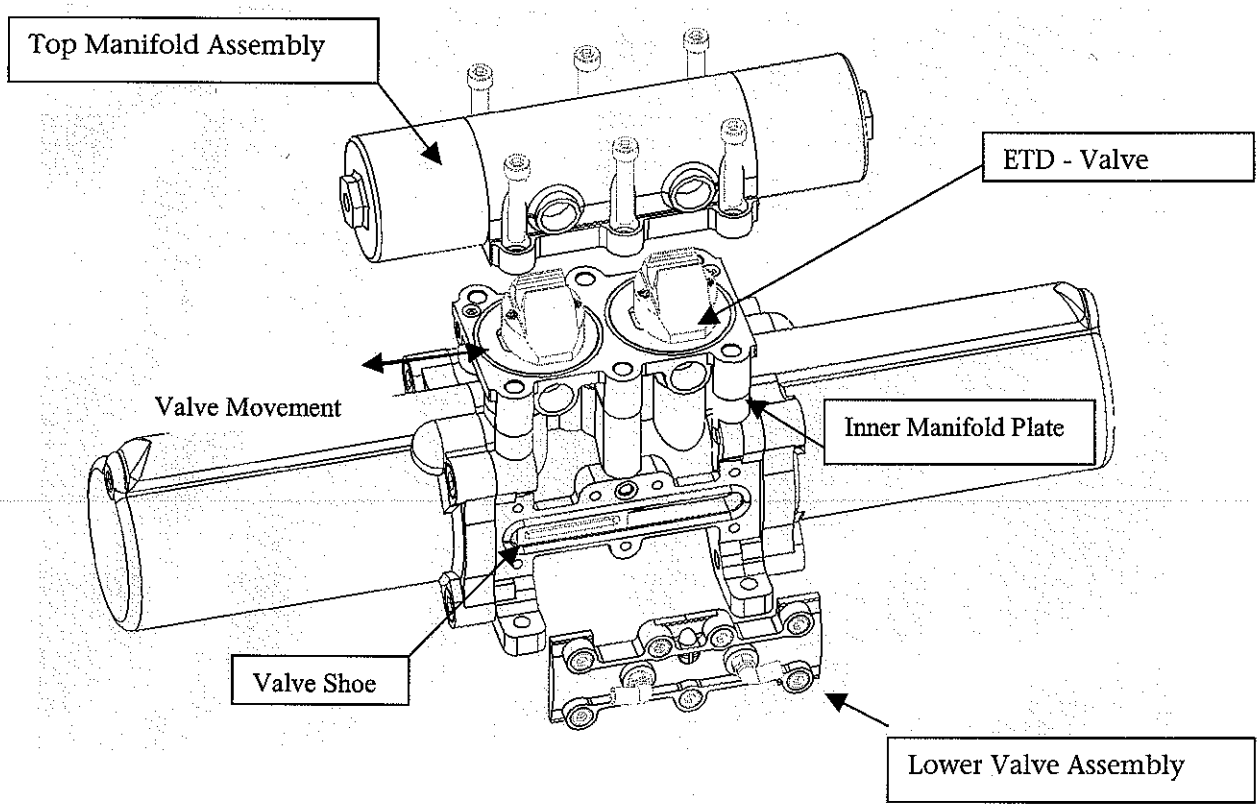
8. Replace the gas valve guard and other components that you removed prior to the charging procedure.

9. **DO NOT** leave the 3-way charging valve attached to the accumulator. The 3-way valve is not intended to be a permanent leak proof connection. The gas valve guard helps serve this purpose.

10. **NEVER** start the hydraulic pump before charging the accumulator. The pump pressure tends to force the bladder up into the charging valve and can damage the bladder.

6.7 REPAIRING THE ETD VALVES

START-UP CHECK:
Every time the System is "Started" the pressure gauges should be checked. If the feed pump is flowing but the ETD is not building pressure the following procedure should be followed:



1. Press "Start" and watch the High-Pressure Gauge increase in pressure with each stoke of the ETD piston. If the ETD does not build pressure above 400 psig, proceed to step 3.

2. In a few minutes the system should begin to make good product water that flows through the flow meter. If this water flows then proceed to Chapter 5, the ETD valves are not the problem. If the ETD does not build pressure and water does not flow through the flow meter, follow the procedure below.

3. The ETD Valves seal on a flat surface and move axially over the manifold passages. The system pressure slightly deforms the plastic Valves and the oblong-hole openings on the manifold remove microns of material from the Valve face like a cheese-grader. A Channel may form on the valve face. This Channel prevents the valve from sealing by allow a connection between the high and low pressure chambers. If the system is running this Channel is closed because the high-pressure deforms the Valve. In a time period between 1000 to 3000 hours depending on the pressure, the Valves may lose the ability to seal.

4. New seals may be purchased and quickly replaced by calling Sea Recovery or the Valves can be refaced and reused.

5. The Valves are refaced using sandpaper between 200-400 grit and a flat surface. This process works as well as new seals.

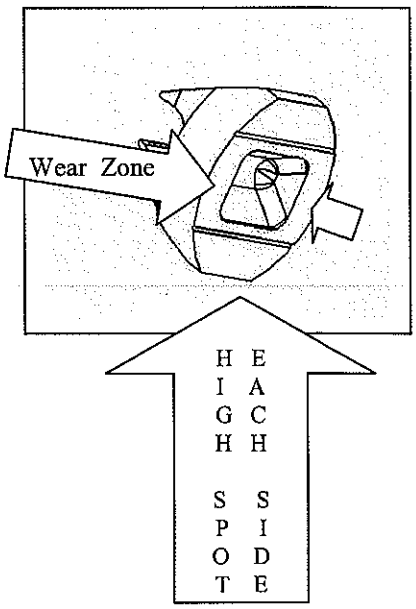
6. Care should be taken not to damage the O-ring when dismantling the ETD as shown above.

Tools and Supplies required:
Sandpaper 400-600 grit – Inner Manifold Plate face
Sandpaper 200-400 grit – Valve face
6mm Allen Wrench – Manifold Top
5mm Allen Wrench – Manifold Lower

REFACING VALVE PROCEDURE:

1. **Remove Top Manifold Assembly:** Use a 6mm Allen Wrench to unscrew the 6 socket hex head screws. Carefully lift the Top Manifold Assembly and place the Top Manifold Assembly on stable surface exposing the valve face. Use a screwdriver to pry each Valve from the Top Manifold Assembly shaft or pull hard and the valve will come loose. Ensure pressed-in springs behind the valve are not missing.

2. **Inspect Valve:** Inspect the face of the valve. Wear should be evident on the middle of the face parallel to the two linier pressure grooves or on each side of the pocket. This surface must have a flatness less than .003". Place the sandpaper on a flat surface on rub the Valve face using a figure "8" motion for 30 seconds. Look at the Valve face. The "Wear Zone" is the area that the sandpaper did not touch.



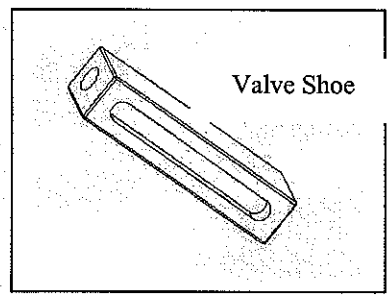
3. **Repairing Seal:** This face is not completely flat due to the rubbing off of material by the oblong holes on the Inner Manifold Plate face. Place the 200 grit sandpaper on a flat surface and wear down the face evenly by rubbing the Valve face on the sandpaper using a figure "8" motion. Keep inspecting the Valve face until the face is worn evenly and flat. The two linear pressure grooves are very important and should be clear of any material.

4. **Repair Inner Manifold Plate face:** The manifold face may have wear scratches. Use the 600 grit sandpaper to remove the scratches and leave a flat smooth surface. Rub face using a figure '8' motion.

5. Repeat step 1-4 for the other Valve.

6. **Assembly of Valve:** To reassemble the Top Manifold Assembly, simply push the Valve until the Valve "bottoms-out" on the rod. Pull slightly to ensure that the Valve is in place.

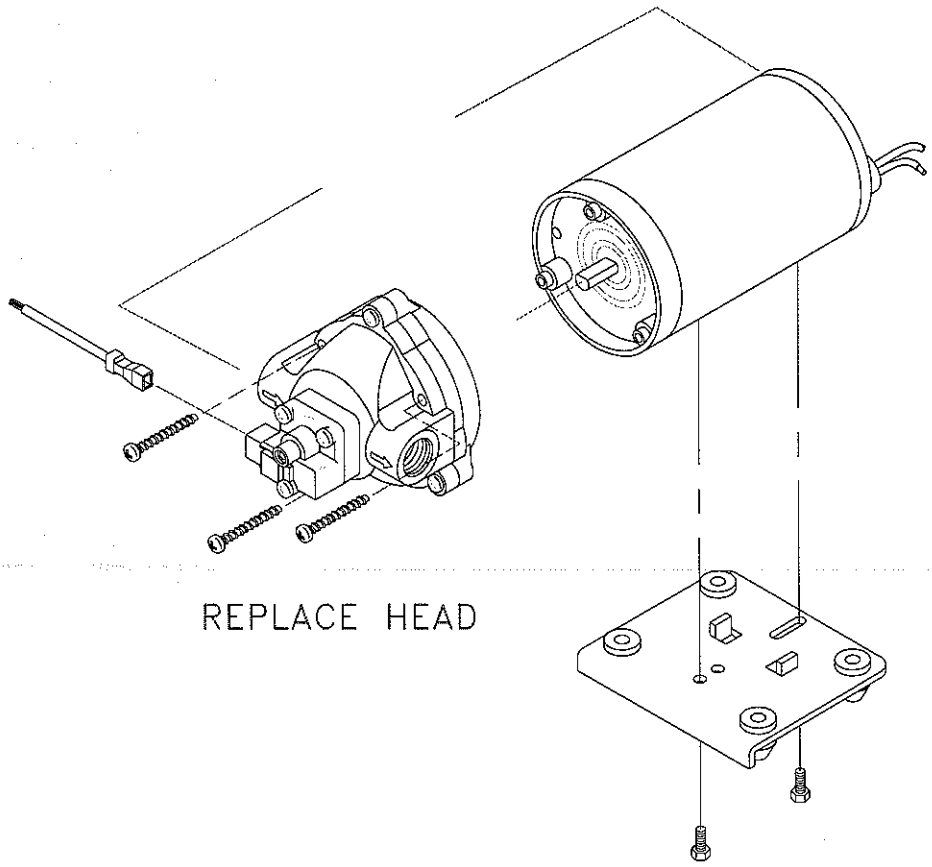
7. **Assembly of Top Manifold Assembly:** To reassemble, make sure that the O-rings are in good condition and they are located in their prospective grooves. Keeping the faces aligned and parallel to the bolt holes, assemble the unit.



The Lower Valve Assembly should be removed and cleaned. Use a small wire to remove any debris that might be logged in the hole directly above the Valve Shoe. This Face keeps itself flat but should also be inspected for flatness. If the Valve Shoe wears to the point that it no longer protrudes from the ETD when removing the Lower Manifold Face Plate then replacement is required.

Tighten the screws and test the unit by starting the system. This should fix the problem.
If the system pressure is not restored, the faces were not flat enough. If this is not the problem, refer to Troubleshooting in Chapter 5.

6.8 PUMP REPLACEMENT FOR 200 DC MODELS



DISASSEMBLY OF PUMP HEAD:

TOOLS REQUIRED: Philips Screwdriver.

1. Remove electrical wire by pulling wire away from pump head.
2. Remove the Inlet and Outlet fittings and hoses.
3. Unscrew the three Philip screws with a Philips Screwdriver.
4. Grasp the pump head and pull, it will come out easily.

REASSEMBLY OF PUMP HEAD:

5. Place the new pump head on the motor. Insert the shaft of the motor on the bearing on the pump head.
6. Align the bolt-holes from the pump head to the standoffs on the motor and jiggle into place.
7. Screw in the three Philip screws with a Philips screwdriver (10 foot-pounds of torque).
8. Install electrical wire into pump head receptacle.
9. Install the Inlet and Outlet fittings and hoses.

7 SYSTEM ELECTRICAL

7. SYSTEM ELECTRICAL

ELECTRICAL CONTROLLER PANEL INSIDE VIEWS: The Identification numbers [#] on the panels below and the following descriptions correspond to each other but do not correspond to the identification numbers used in the System P&ID's. Ensure a watertight seal around the entire Controller Enclosure Assembly.

1. **Contactor, Feed Pump Motor Starter** is used on all AC Ultra Whisper Systems. It is rated for a maximum of 1 horsepower and 250VAC.

2. **Printed Circuit Board** receives inputs from the system's monitoring devices. The system's Touch Pad, Salinity Probe, High Pressure Switch, Low Pressure Switch, and Remote connect to this PCB. The board requires a 12 VDC/ 2 Amp maximum current power source. The PCB is located behind the Ultra Whisper Touch Pad and would cover the components if it where shown. See electrical diagrams below.

3. **Voltage Converter/Power Supply** receives the system input voltage from 24 VDC/ 1 Amp maximum and outputs 12 VDC/ 2 Amps used by the PCB board to power the 3-Way Diversion Valve, Ultraviolet Sterilizer, and Fresh Water Flush Solenoid Valve. ***12VDC systems do not use this component.***

4. **Feed Pump Relay** with 12 VDC coil and 1PDT action to turn on the feed pump.

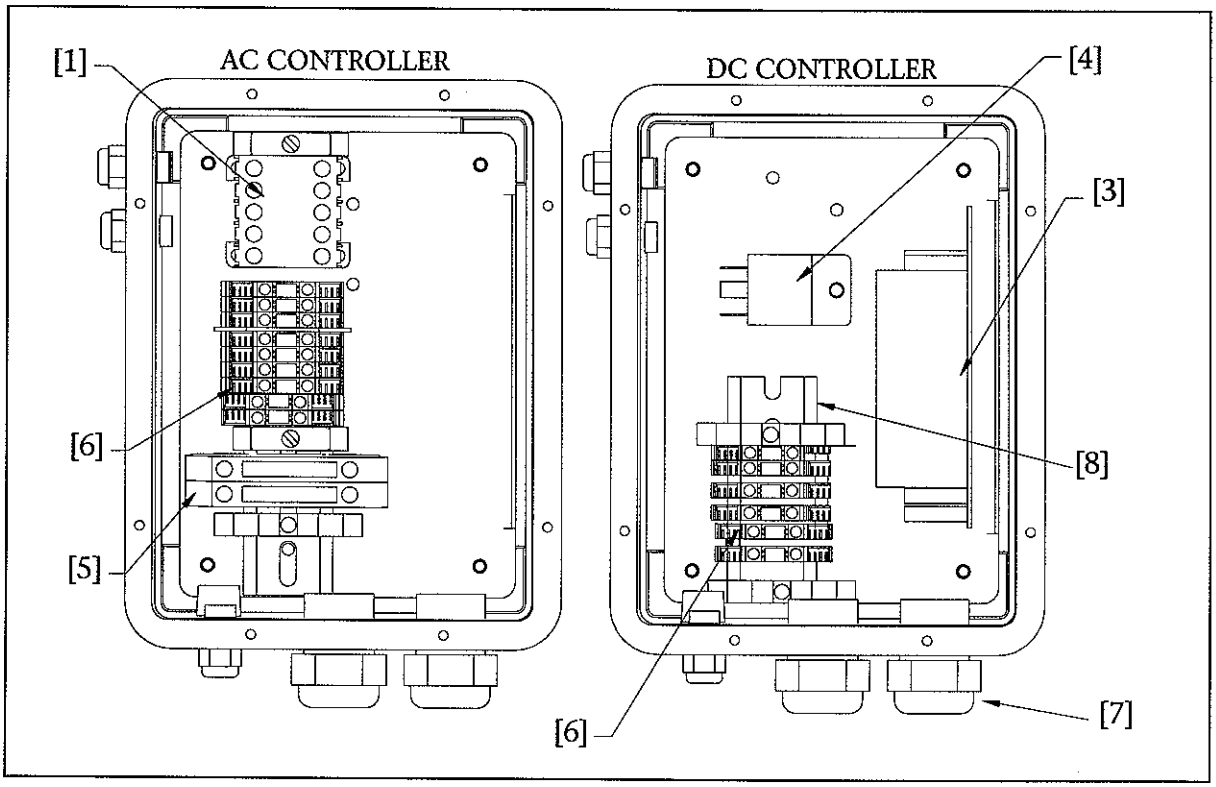
5. **Fuse Block** protects the PCB from abnormal currents. This fuse is used only on the AC systems and the 12VDC power source comes from the boat's power source. The fuse is rated for 2.0 Amps.

6. **Input Power Terminal Blocks** is the main connection for incoming power to the system. See electrical schematic for jumpers and connections.

7. **Strain Reliefs** allow wires to enter the enclosure and prevent fluid from entering the enclosure.

8. **Channel DIN 35 mm Rail** is used to hold electrical components in place.

Electrical Component are first mounted to an anodized aluminum chassis then fastened into electrical enclosure.



ELECTRICAL REQUIREMENTS

The Ultra Whisper System power requirements are limited to two sources: the Feed Pump with the Power Source requirements listed on the chart below and the Printed Circuit Board that supplies the power to all additional components and uses 12 VDC with 2 Amps maximum current. *The AC Ultra Whisper Systems use the boat's 12 VDC power source that directly connects through the electrical enclosure and into the fuse assembly before connecting to the PCB.*

Special measures must be taken to ensure safety. This system contains electrical components that can result in personal injury or material damage. Please review the contents of the entire manual before proceeding to install or operate the Ultra Whisper Reverse Osmosis System.

FEED PUMP POWER SOURCE REQUIREMENTS:

Check line voltage and frequency to ensure that it agrees with motor nameplate. Grounding and circuit protection should be done in accordance with National Electrical Code. See connection diagram on nameplate of motor. Refer to the wire diagrams in this section to ensure proper system connections.

TABLE 7.1 LISTS THE VOLTAGE REQUIREMENTS FOR MOTORS AND PRINTED

DC Systems

Voltage	HZ (AC)	Min. Voltage	Max. Voltage	Min. HZ	Max. HZ
12 VDC	NA	11 VDC	15 VDC	NA	NA
24 VDC	NA	22 VDC	30 VDC	NA	NA

AC Systems

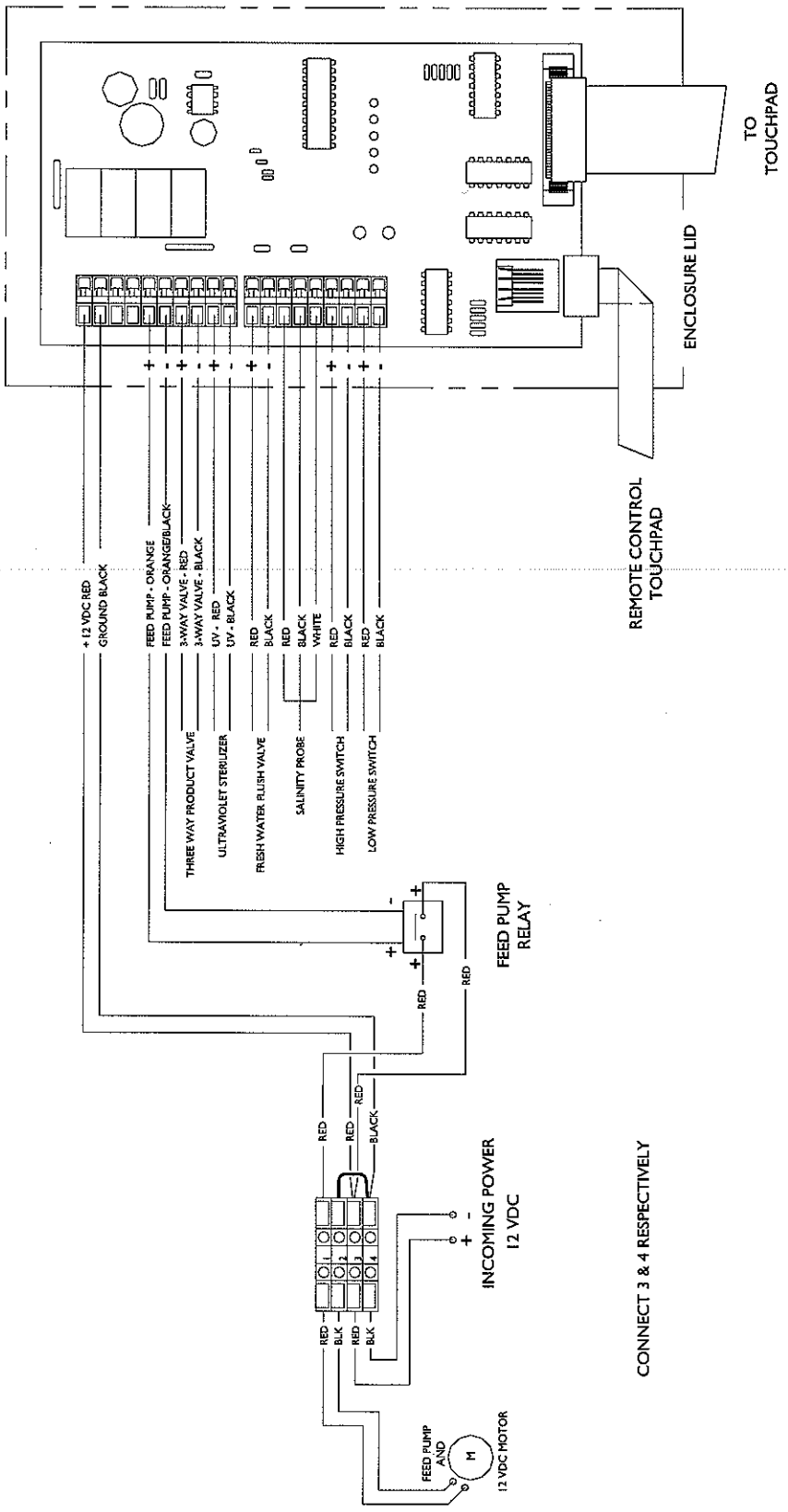
Voltage	HZ (AC)	Min. Voltage	Max. Voltage	Min. HZ	Max. HZ
115 VAC	60 HZ	108 VAC	132 VAC	58 HZ	62 HZ
230 VAC	60 HZ	207 VAC	253 VAC	58 HZ	62 HZ

AC SYSTEMS ALSO REQUIRE A 12 VDC (10.5 V to 16.5V, 2 Amps max) POWER SOURCE.

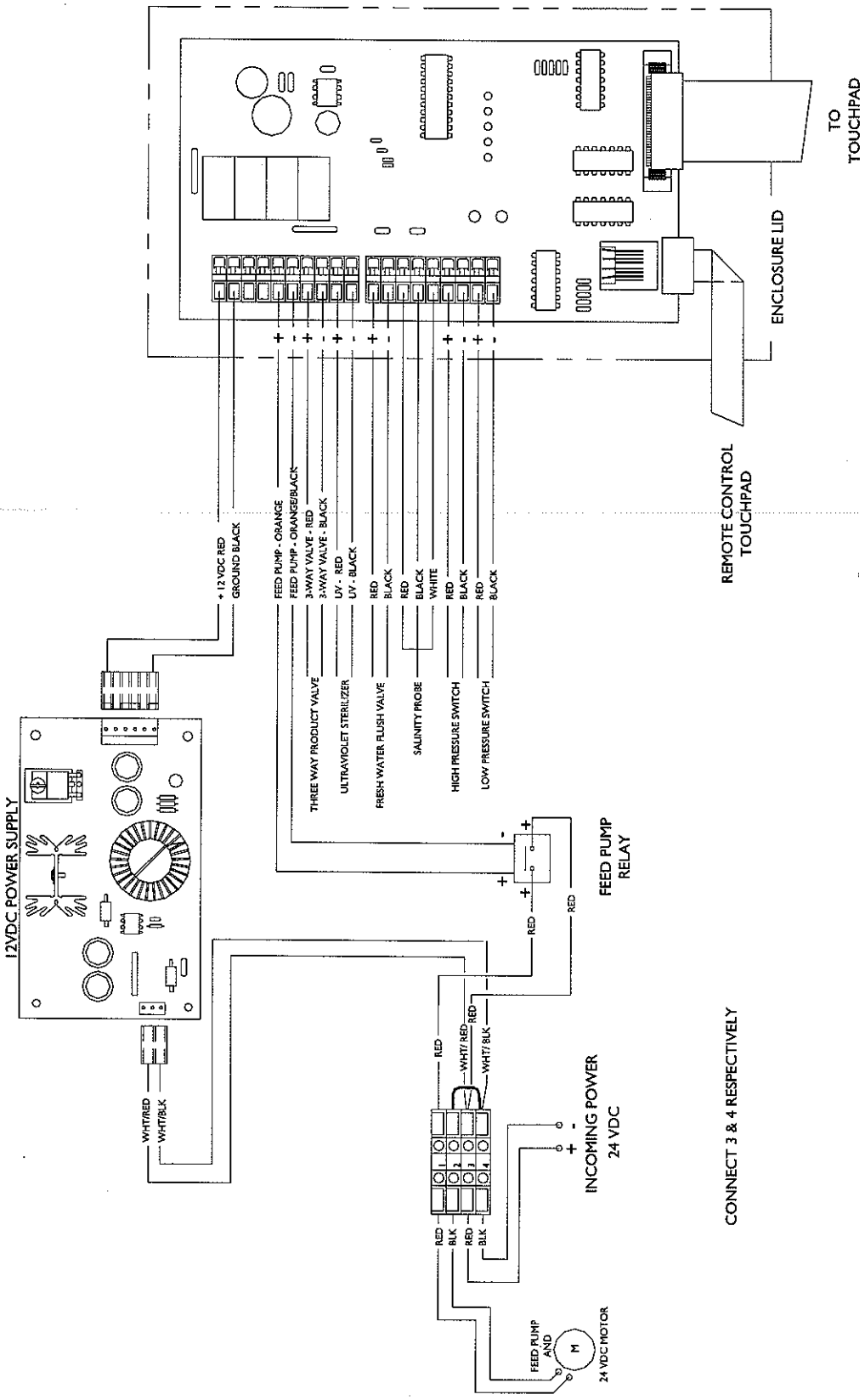
TABLE 7.2 RECOMMENDED CIRCUIT BREAKER, COPPER WIRE & SIZE FOR MAIN POWER LINE:

OPERATING VOLTAGE Recommended	Circuit Protection	Wire Size AWG (Min)
200 GPD COMPACT/MODULAR		
12 VDC	20 Amperes	14 AWG
24 VDC	10 Amperes	14 AWG
115 VAC	10 Amperes	14 AWG
230 VAC	6 Amperes	14 AWG
400 GPD COMPACT/MODULAR		
12 VDC	60 Amperes	8 AWG
24 VDC	30 Amperes	10 AWG
115 VAC	20 Amperes	14 AWG
230 VAC	10 Amperes	14 AWG
600 GPD COMPACT/MODULAR		
115 VAC	22 Amperes	14 AWG
230 VAC	12 Amperes	14 AWG

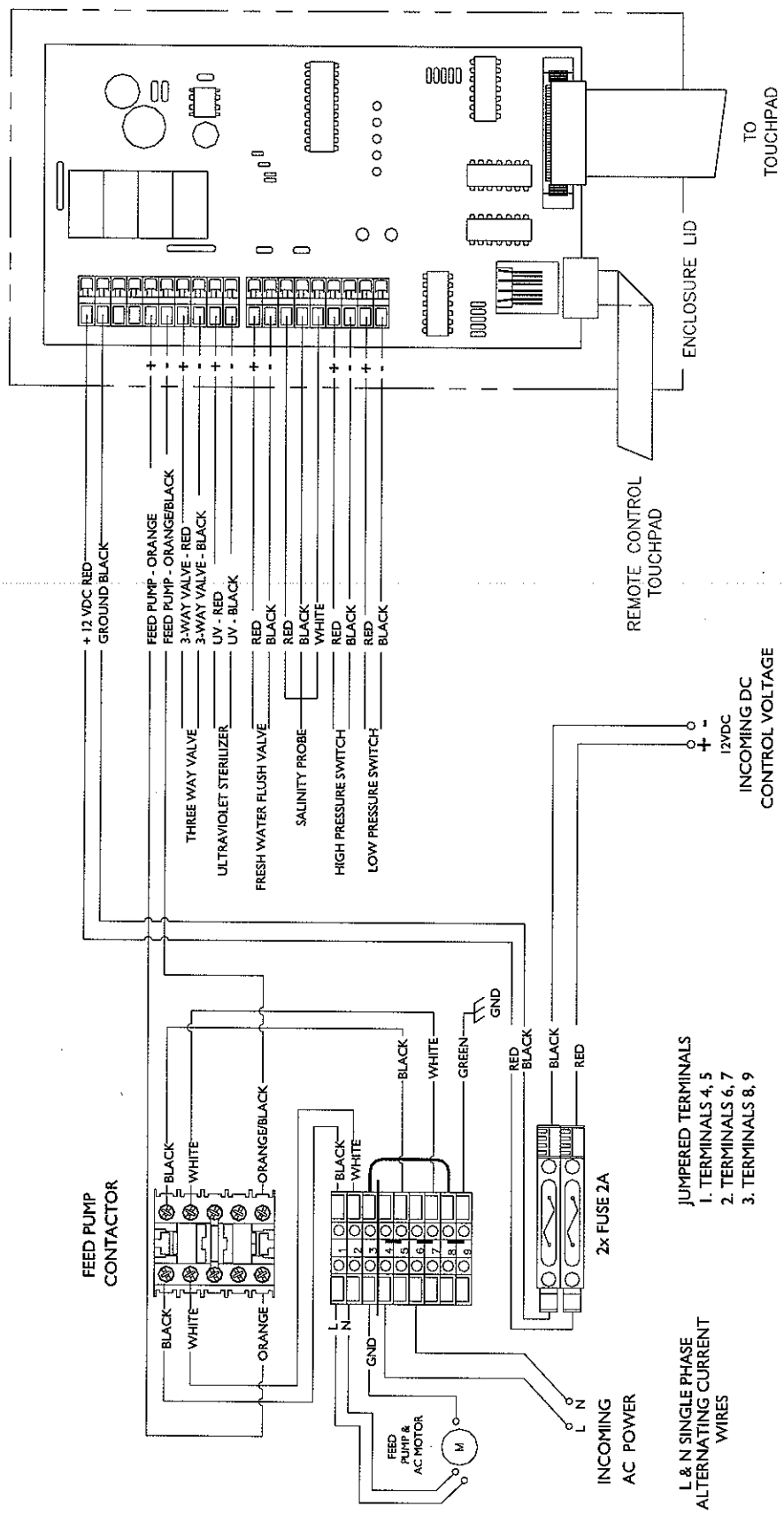
ULTRA WHISPER ELECTRICAL DIAGRAM
12 VDC CONTROLLER



ULTRA WHISPER ELECTRICAL DIAGRAM
24 VDC CONTROLLER



ULTRA WHISPER ELECTRICAL DIAGRAM
110/220 VAC SINGLE PHASE CONTROLLER
SYSTEM REQUIRES AN AC POWER SOURCE AND A 12VDPOWER SOURCE



MOTOR ROTATION:

After unpacking, check for visible damage. Be sure that the shaft on the motor and pump rotate freely. Check that the wire connections are firm and free from wire exposure.

BEFORE OPERATING, JOG TO CHECK ROTATION AS DESCRIBED IN CHAPTER 2. The rotation should be clock-wise when looking directly at the motor fan. Rotation does not matter on the Model 200 DC diaphragm pumps.

WIRING CONNECTIONS

Refer to each individual Electrical Motor, which include attached nameplate with wiring diagram or separate wiring diagram plate, decal or label.

MAINTENANCE

Inspect electrical components at regular intervals, approximately every 500 hours of operation. Keep the equipment clean and the motor ventilation openings clear. Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury.

8 CHARTS

8. CHARTS

This Chapter contains useful information, graphs and charts for determining the proper performance of this system. Proper system operating pressure depends upon the temperature and salinity of the feed water. This section informs the user of the Feed Water Salinity and Feed Water Temperature changes. It also contains useful conversion tables.

INTRODUCTION:

Seawater is a combination of pure water, dissolved minerals, and suspended solids such as dirt, sand, and biological matter. The purchased system uses three different stages to process the incoming seawater and produce Potable Drinking Water. The system constantly monitors the product water for quality and dumps water that is not suitable for drinking.

PRE-FILTRATION:

The First Stage uses a positive displacement pump to collect the seawater by pulling it through a barrier filter called the sea strainer and force it through other barrier filters that remove dirt, sand, biological matter, and any other solids suspended in the seawater down to 5 micron. This process protects the various components in the system, most notably the Reverse Osmosis Membrane.

REVERSE OSMOSIS:

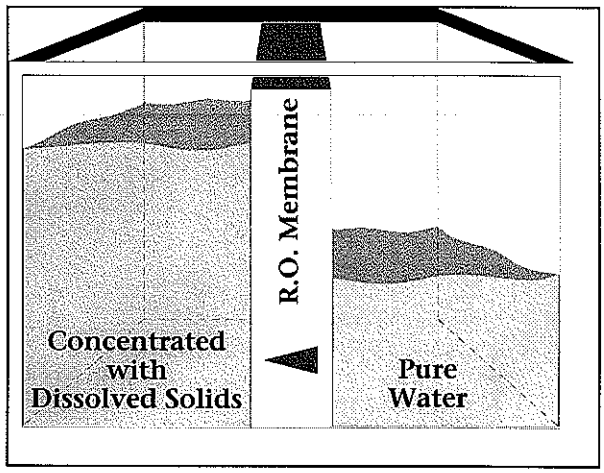
The Second Stage uses the principle of **Osmosis** to separate pure water from the salty seawater. Osmosis is a naturally occurring phenomenon. The enclosed pictures illustrate two solutions of differing dissolved solids concentrations separated by a **Semi-Permeable Membrane (R.O. Membrane).** Due to osmosis, the two solutions try to equalize each other's concentrations of dissolved solids. Since dissolved solids are to large to pass through the R.O. Membrane, pure water diffuses through the membrane and flows from the solution with the lower concentration to the solution with the higher concentration.

Reverse Osmosis is a manmade process, which reverses the Osmosis process. By pressurizing the higher concentration solution (seawater) and forcing the water molecules through a Semi-Permeable Membrane (R.O. Membrane) potable water is produced.

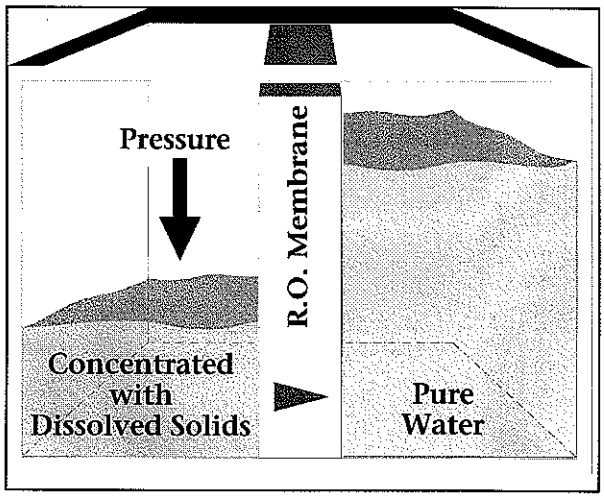
This system uses a pump called the Energy Transfer Device (ETD) to increase the pressure of the feed water and push it through the R.O. Membrane. This ETD is a hydraulic device that uses the high-pressure brine-reject flow from the membrane and the incoming feed pressure to pressurize a volume of feed water in a separate chamber which becomes the feed water at the system pressure. A Backpressure Regulator is not required because the difference in volume between the high-pressure reject chamber and the chamber being pressurized will be forced through the membrane regardless of the pressure produced. Therefore the production flow is relatively constant.

POST FILTRATION:

The Product Water flows out of the R.O. Membrane and passes into a Salinity/Temperature Probe, which adjusts automatically for temperature changes and displays the quality of the Product Water. Next, the Product Flowmeter registers the amount of Product Water. The Product Water then proceeds to the 3-Way Diversion Valve. Here, potable water is diverted to the Charcoal Filter where gasses and odors present are absorbed and removed from the Product Water. Other optional post filtration components may also include an Ultraviolet Sterilizer.

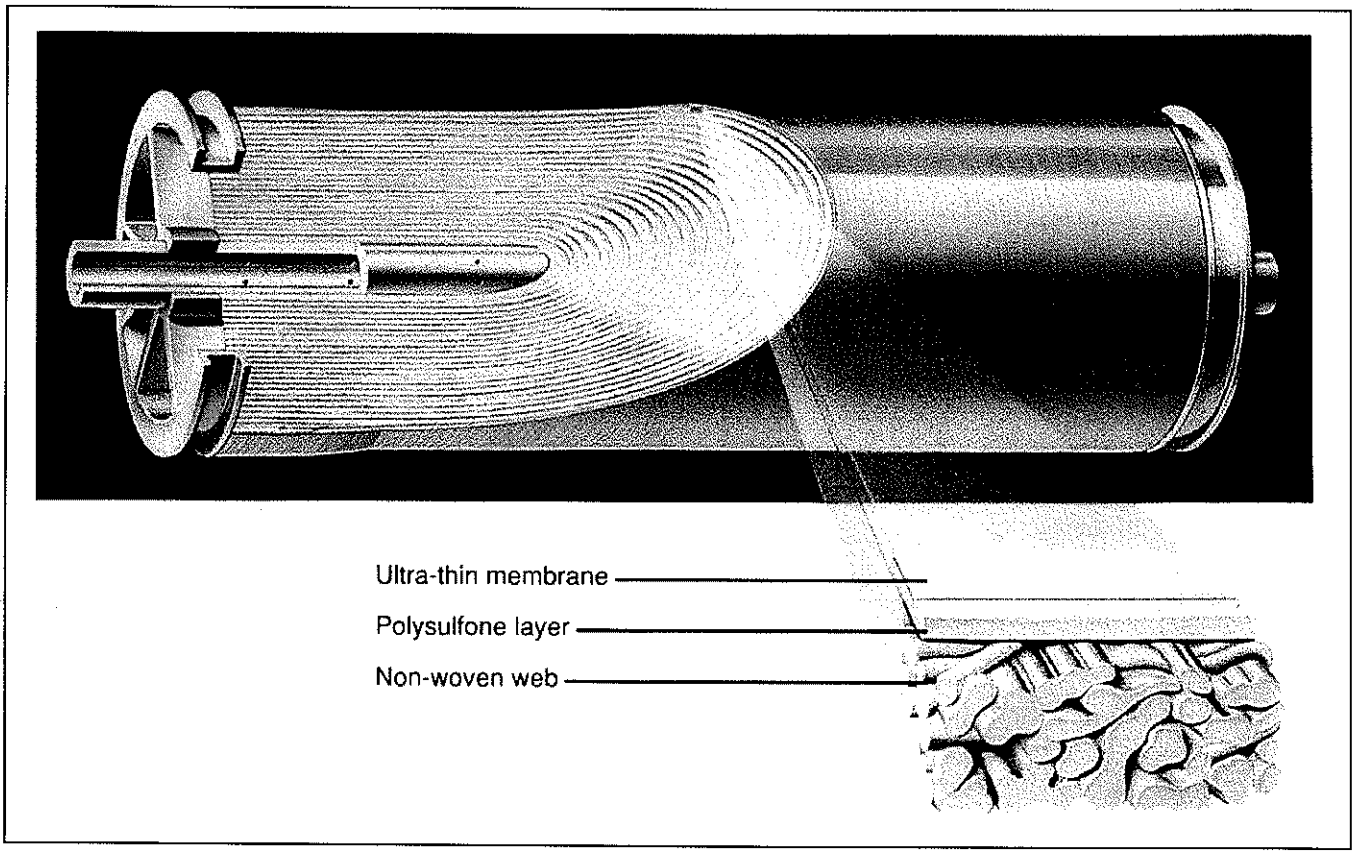


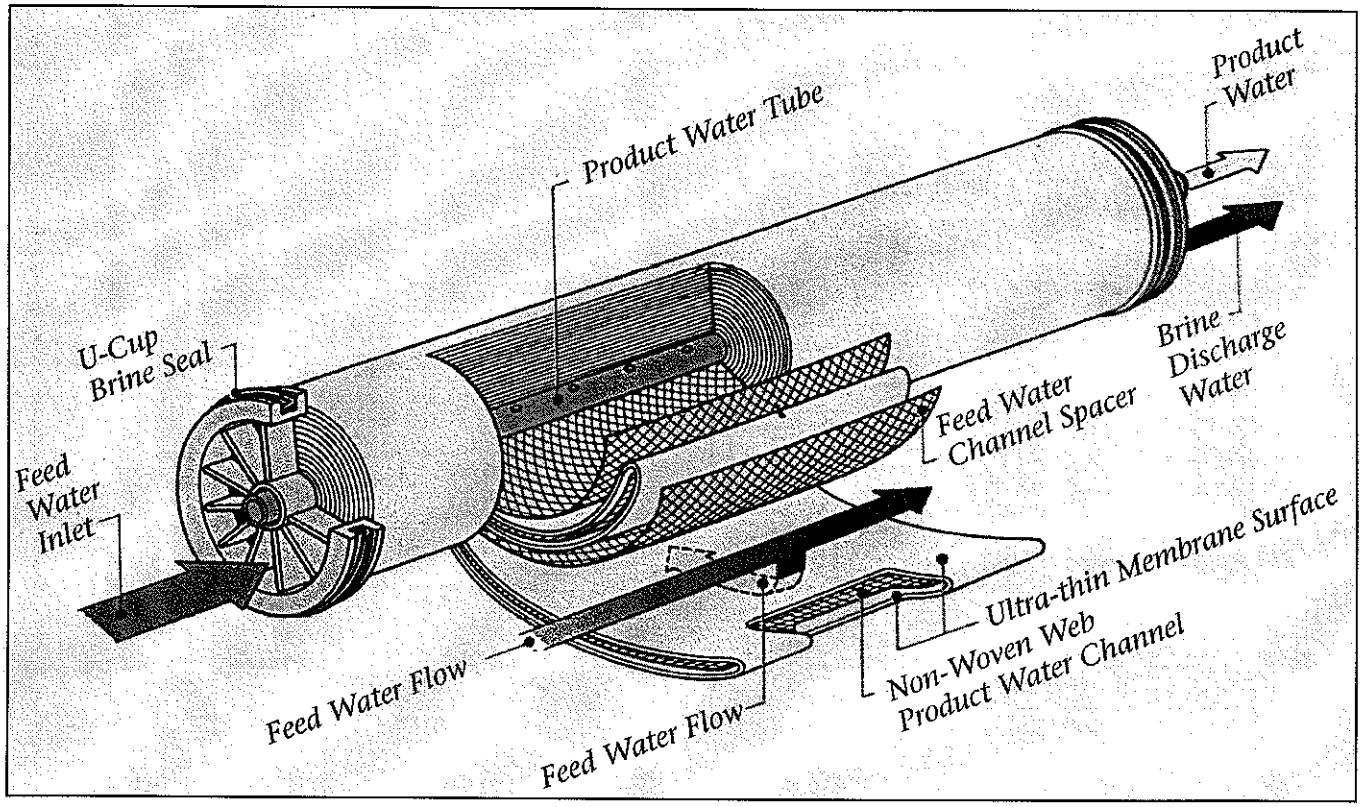
Naturally Occurring Osmosis



Reverse Osmosis (forced)

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 that 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, or 8 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 surface) 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 temperature of the water significantly affects the quality of the product water and the product water flow through the membrane. At higher temperatures, more particles pass in the same amount of time for a pressure value than it would at a lower temperature. Therefore, the pressure needs adjustment to maintain a constant product flow and the temperature affects the quality of the water.

H. **PRESSURE:** The system operating pressure has a direct affect on product water quantity. The system pressure automatically adjusts to overcome the membranes resistance (osmotic pressure) this achieves the designed product water flow.

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.

CONVERSION CHARTS

MICRON / INCH / MESH COMPARISON MEASUREMENTS

Micron	Inches		Mesh	Inches	Millimeters
1	0.000039		100	0.0070	0.178
5	0.000197		90	0.0075	0.191
10	0.000394		80	0.0075	0.191
15	0.000591		70	0.0078	0.198
20	0.000787		60	0.0110	0.279
25	0.000984		50	0.0130	0.330
30	0.001181		40	0.0180	0.457
40	0.001575		30	0.0260	0.660
50	0.001969		20	0.0410	1.041
75	0.002953		10	0.0850	2.159
100	0.003937		5	0.1770	4.496
200	0.007874		1	0.9370	23.800

CELSIUS & FAHRENHEIT TEMPERATURE CONVERSION CHART

Celsius	Fahrenheit		Celsius	Fahrenheit
0	32		122	252
32	90		131	268
41	106		140	284
50	122		149	300
59	138		158	316
68	154		167	333
78	172		176	349
86	187		185	365
95	203		194	381
104	219		203	397
113	235		212	414

Conversion Equations:

CELSIUS = 0.556 (° F – 32)

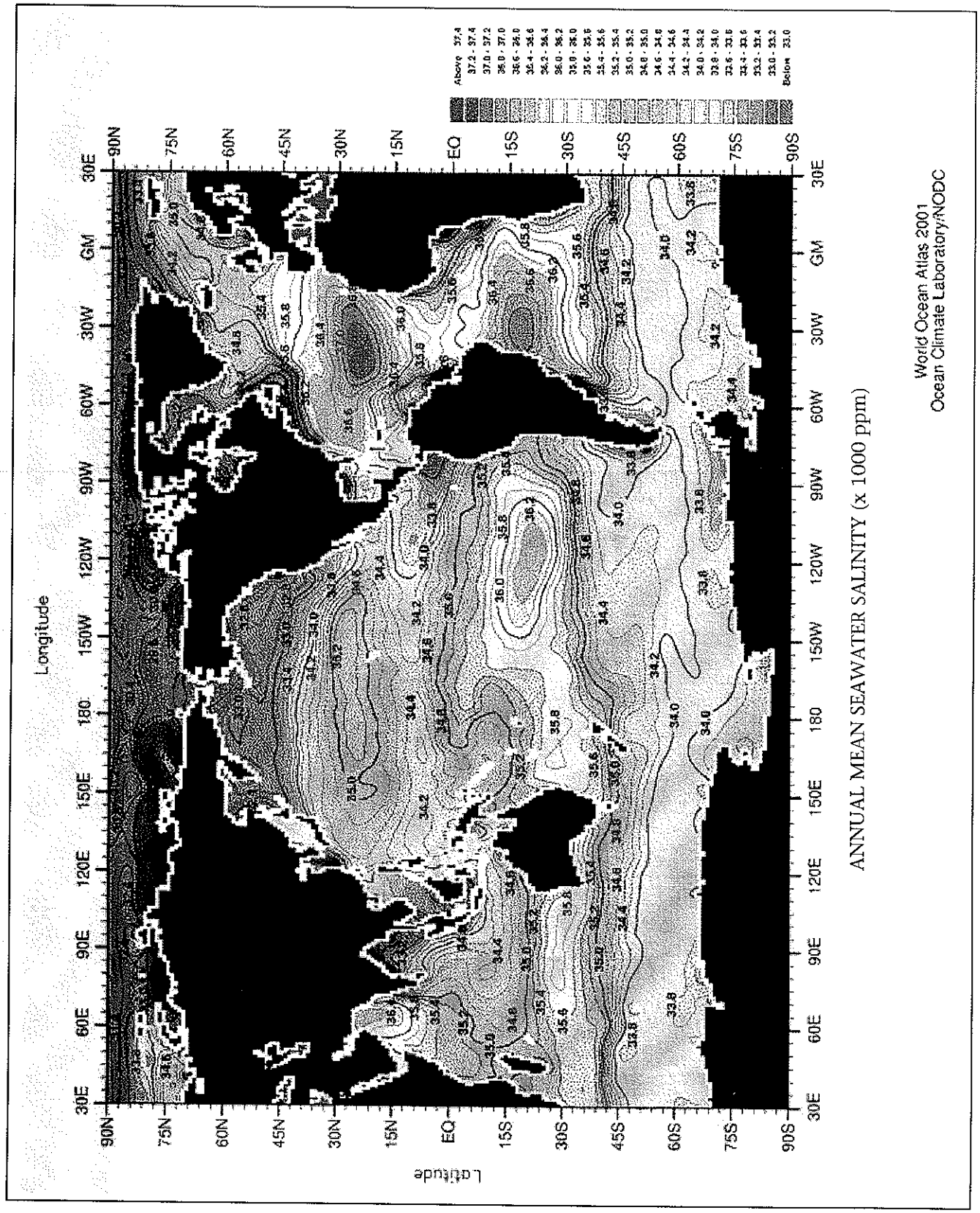
FAHRENHEIT = (1.8 * C) + 32

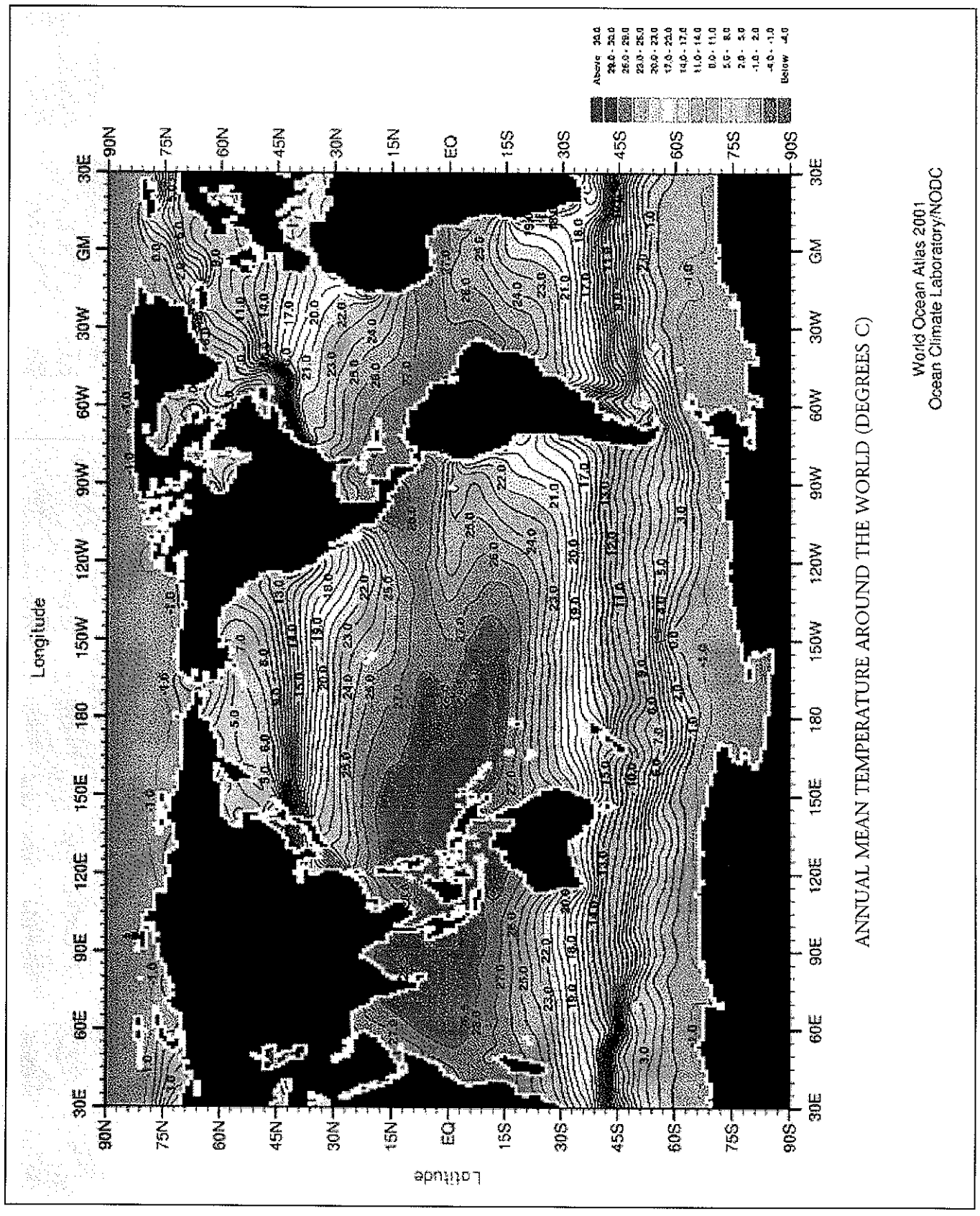
WATER COMPARISON CHART
GALLONS / VOLUME / WEIGHT

US Gallons	Cubic Feet	Cubic Yard	Cubic Meter	Short Ton	Metric Ton
1	13	0.005	0.004	0.004	0.004
5	67	0.025	0.019	0.021	0.019
10	1.34	0.05	0.038	0.041	0.038
25	3.34	0.129	0.1	0.104	0.094
50	6.68	0.248	0.19	0.208	0.189
100	13.37	0.5	0.38	0.42	0.38
200	26.74	0.99	0.76	0.83	0.76
300	40.1	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	2.5	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	3.4
1,000	133.68	4.95	3.79	4.17	3.78
2,500	334.2	12.38	9.46	10.41	9.45
5,000	668.4	24.76	18.93	20.83	18.89
7,500	1002.6	37.13	28.39	31.24	28.34
10,000	1336.81	49.51	37.85	41.65	37.79
25,000	3342	123.8	94.6	104.1	94.5
50,000	6684	247.6	189.3	208.3	188.9
75,000	100600	371.3	283.9	312.4	283.4
100,000	13368	495.11	378.54	416.5	377.85

METRIC / U.S. CUSTOMARY UNIT EQUIVALENTS

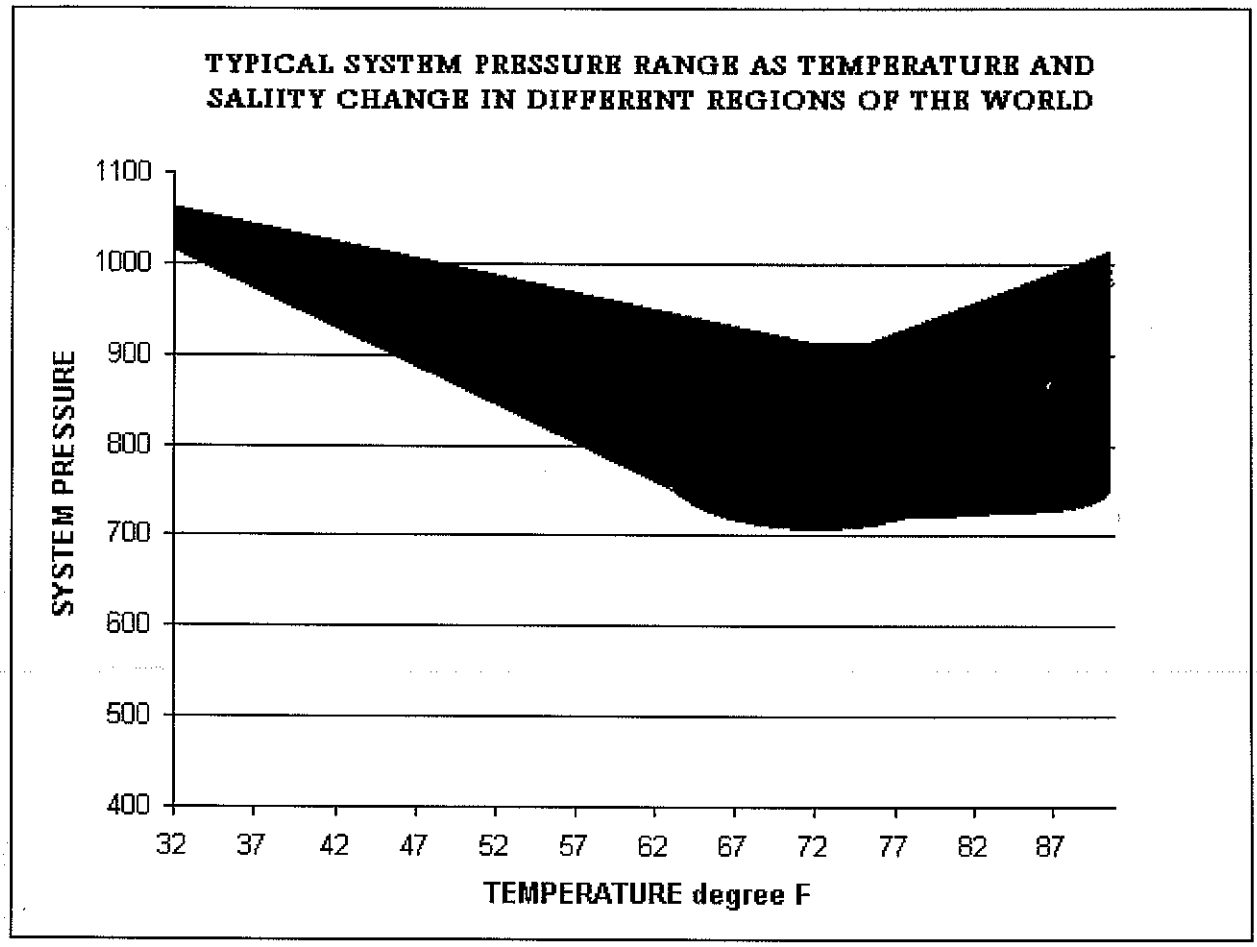
To Convert From	To	Multiply By	To Convert From	To	Multiply By
LENGTH					
inch	millimeters	25.4	millimeters	inch	0.03937
feet	meters	0.3048	meters	feet	3.281
yard	meters	0.9144	meters	yard	1.0936
inch	centimeters	2.54	centimeters	inch	0.3937
VOLUME					
fluid oz	milliliters	29.57	milliliters	fluid oz	0.03381
U.S. quart	liters	0.94635	liters	quarts	1.0567
U.S. gallon	liters	3.7854	liters	gallons	0.2642
$Feet^3$	liters	28.317	liters	$Feet^3$	0.03531
$Feet^3$	$Meters^3$	0.02832	$Meters^3$	$Feet^3$	35.315
$Yard^3$	$Meters^3$	0.7646	$Meters^3$	$Yard^3$	1.308
MASS					
Ounces	grams	28.35	grams	ounces	0.03527
pounds	kilograms	0.4536	kilograms	pounds	2.2046
tons (2000lb)	kilograms	907.18	kilograms	tons	0.001102
tons (2000lb)	metric tons	0.90718	metric tons	tons	1.1023
PRESSURE					
$lbs./in^2$ (psi)	kPa	6.895	kPa	$lbs./in^2$	0.145
$lbs./in^2$ (psi)	kg/cm^2	0.0704	kg/cm^2	$lbs./in^2$	14.2045
$lbs./in^2$ (psi)	bar	0.0689	bar	$lbs./in^2$	14.5138
in.-Hg	kPa	3.386	kPa	in.-Hg	0.2953
in.-Hg	kg/cm^2	0.0345	kg/cm^2	in.-Hg	28.9855
in.-Hg	bar	0.0339	bar	in.-Hg	29.4985
atm	kPa	101.317	kPa	atm	0.00987
atm	kg/cm^2	1.033	kg/cm^2	atm	0.968
atm	bar	1.0133	bar	atm	0.9869


Longitude
Latitude
ANNUAL MEAN SEAWATER SALINITY (x 1000 ppm)
World Ocean Atlas 2001
Ocean Climate Laboratory/NODC



ANNUAL MEAN TEMPERATURE AROUND THE WORLD (DEGREES C)

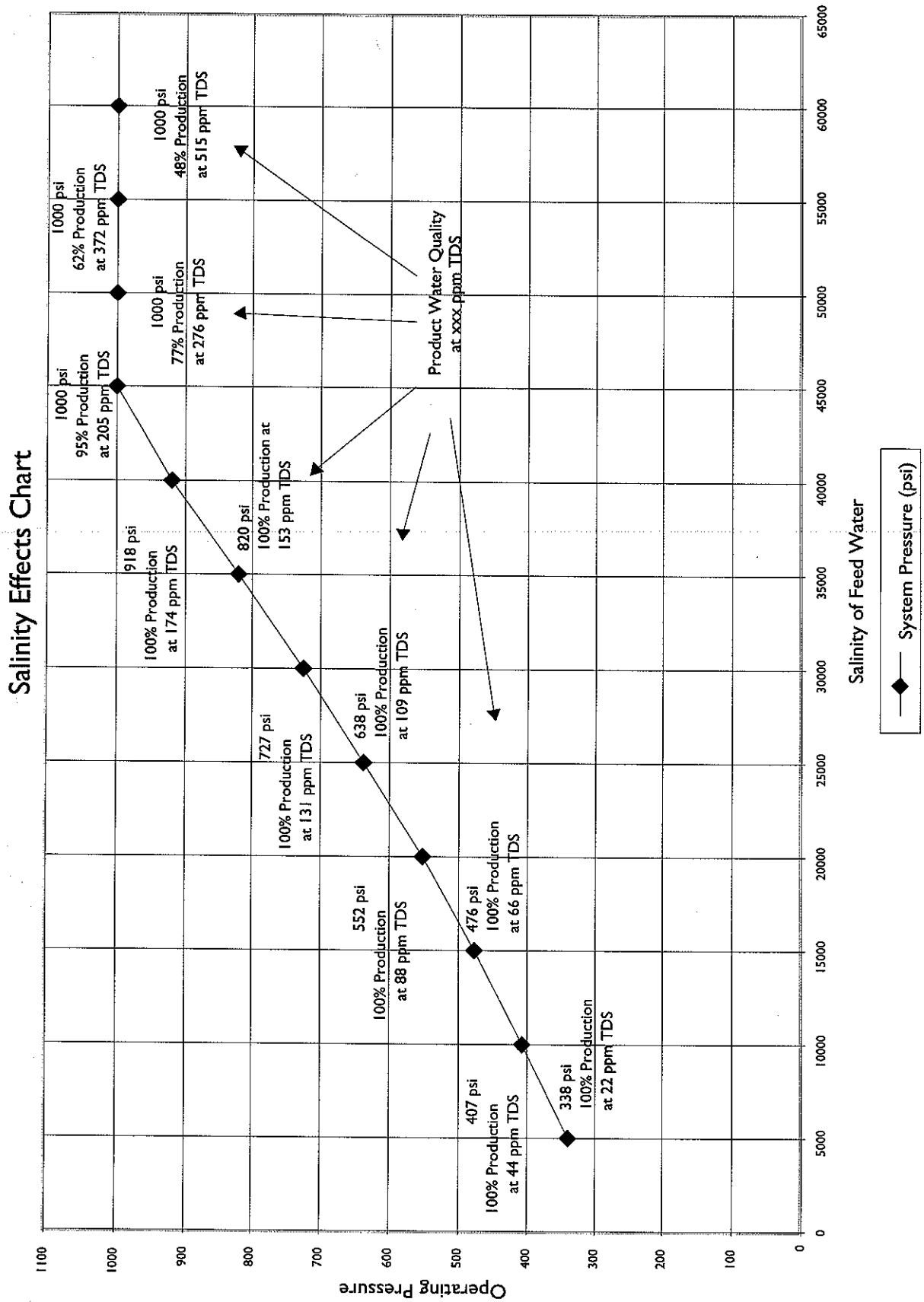
World Ocean Atlas 2001
Ocean Climate Laboratory/NODC

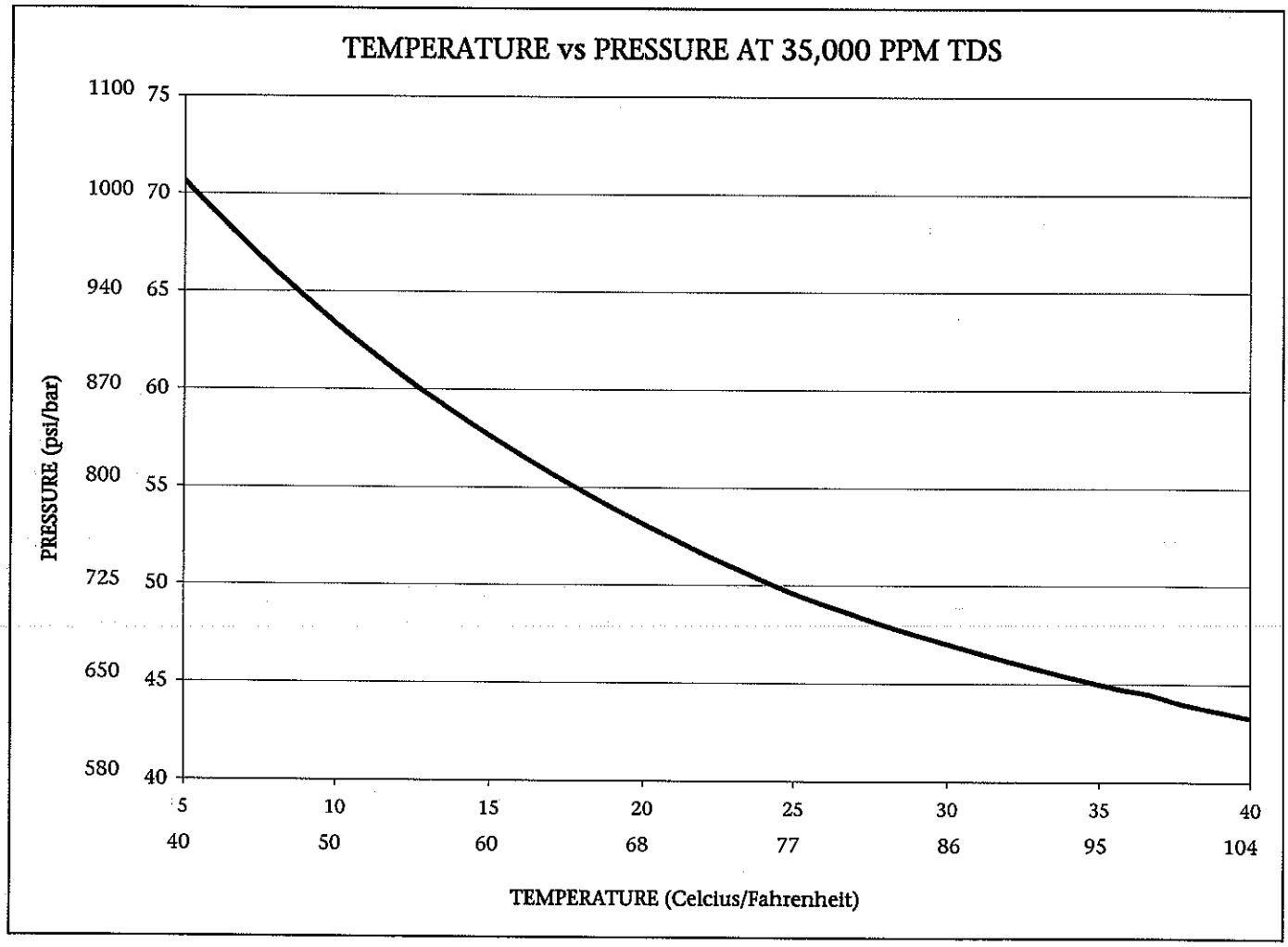


As illustrated with the world ocean graphs on the previous pages, the salinity and temperature of the world's oceans vary with location. This salinity and temperature variation changes the system pressure of reverse osmosis system. The typical "pressure range" graph above illustrates the typical system-pressures that this osmosis system will generate in different regions of the world.

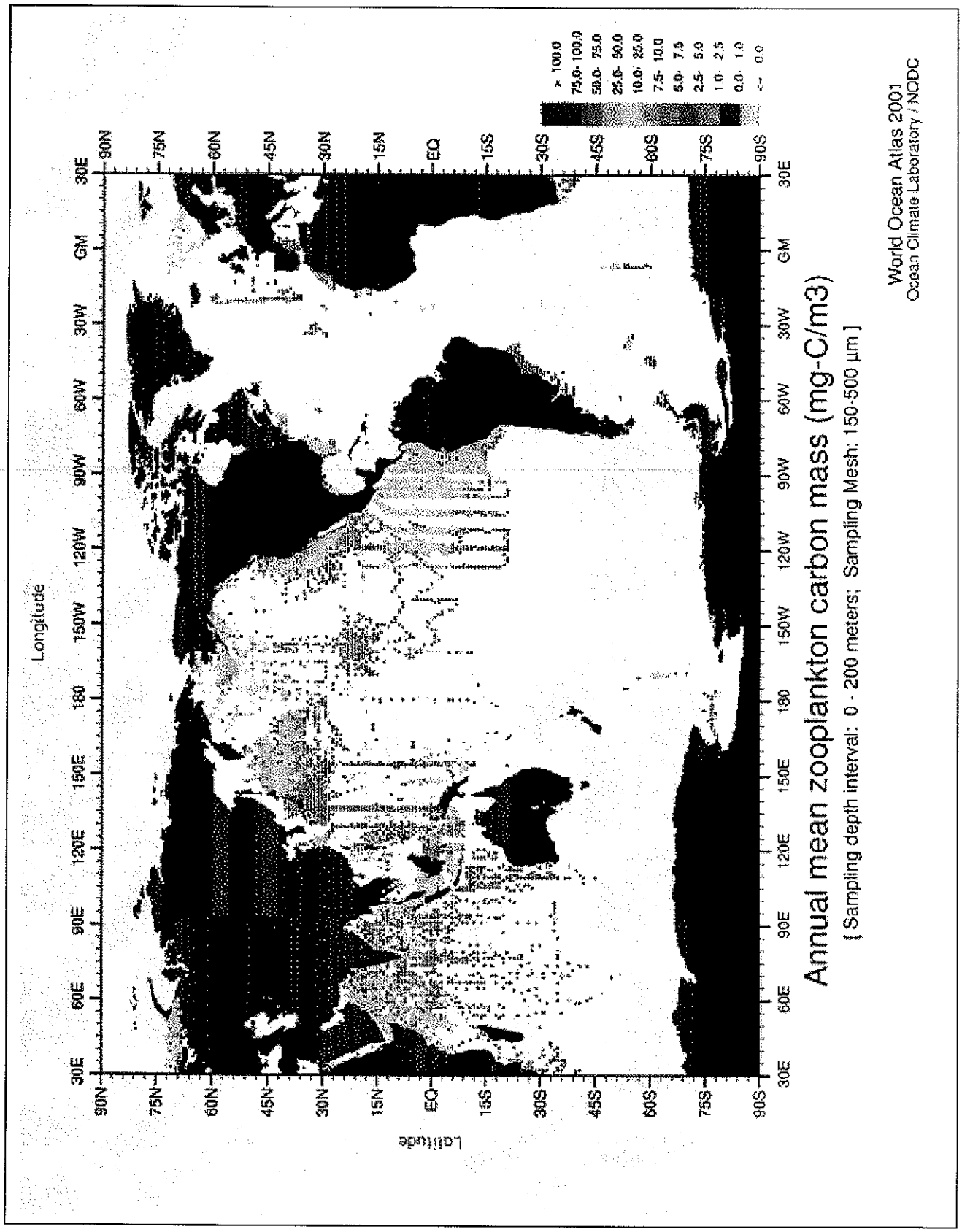
The system pressure is measured in psig (see conversion chart in this section for other units.) The 200 models have system pressures about 10 percent less than the values on the graph above. The data above is approximate and assumes some fouling in the membrane.

The chart on page 8.11 illustrates the effects of salinity of a standard reverse osmosis system maintaining a rated product water production at a constant temperature. Note that the product water production percentage is reduced after 1000 psig. This is done to prevent compacting of the membrane. See the graph on page 8.8 for actual seawater salinities around the world. Generally, the salinity of the product water is proportional to the salinity of the feed water.


Salinity Effects Chart
Operating Pressure
Salinity of Feed Water
System Pressure (psi)
Product Water Quality
at xxx ppm TDS
1000 psi
95% Production
at 205 ppm TDS
1000 psi
77% Production
at 276 ppm TDS
1000 psi
62% Production
at 372 ppm TDS
1000 psi
48% Production
at 515 ppm TDS
918 psi
100% Production
at 174 ppm TDS
820 psi
100% Production at
153 ppm TDS
727 psi
100% Production
at 131 ppm TDS
638 psi
100% Production
at 109 ppm TDS
552 psi
100% Production
at 88 ppm TDS
476 psi
100% Production
at 66 ppm TDS
407 psi
100% Production
at 44 ppm TDS
338 psi
100% Production
at 22 ppm TDS



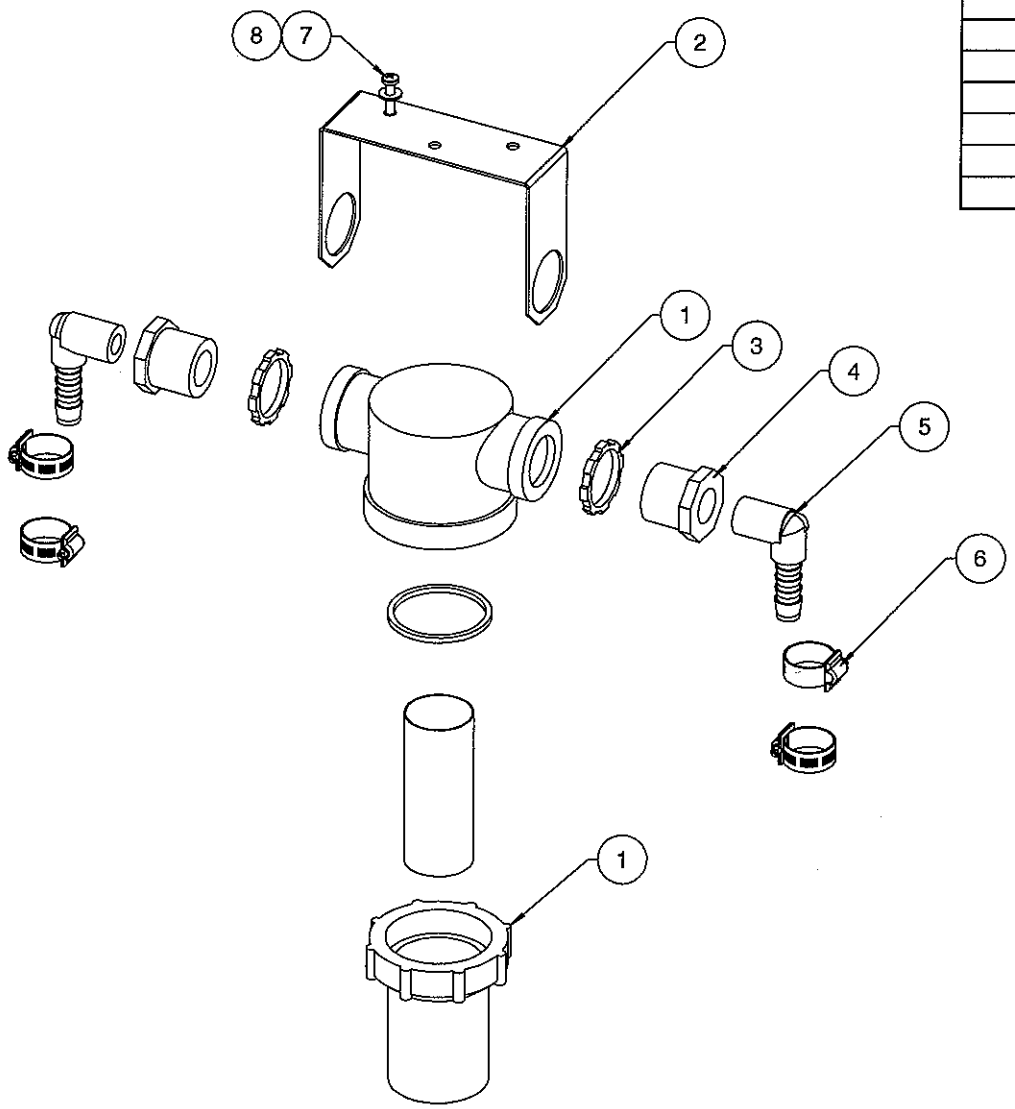
This graph illustrates the affect temperature has on the system-pressure when the salinity is held at a constant value. The system-pressure readings were recorded while heat was added to increase the temperature in a 35,000 PPM seawater tank. This graph information was taken from a Model 400 System with a 3 year old membrane. The series 200 models will have pressure values approximately 10% less than indicated on this graph.


Annual mean zooplankton carbon mass (mg-C/m3)
[Sampling depth interval: 0 - 200 meters; Sampling Mesh: 150-500 µm]
World Ocean Atlas 2001
Ocean Climate Laboratory / NODC
Longitude
Latitude
30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W GM 30E
90N 75N 60N 45N 30N 15N EQ 15S 30S 45S 60S 75S 90S
> 100.0
75.0- 100.0
50.0- 75.0
25.0- 50.0
10.0- 25.0
7.5- 10.0
5.0- 7.5
2.5- 5.0
1.0- 2.5
0.0- 1.0
<- 0.0

9 EXPLODED PARTS VIEWS

9. SYSTEM EXPLODED PARTS VIEWS

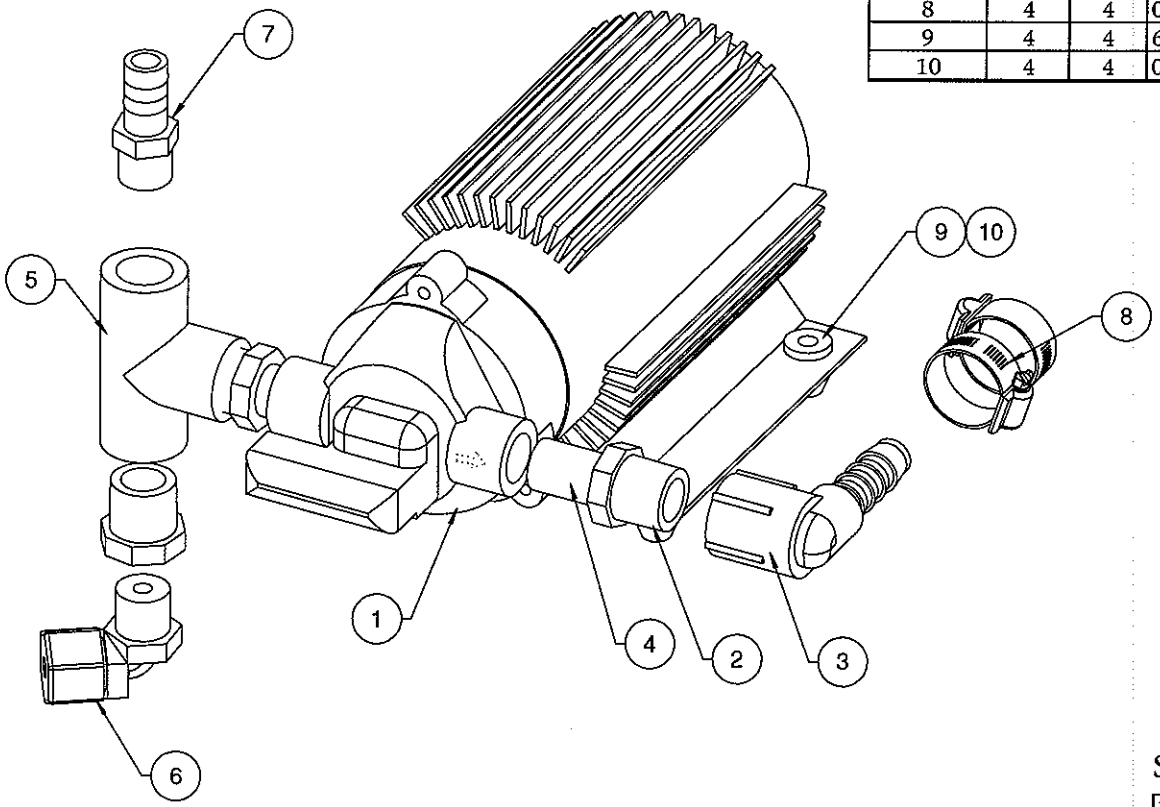
This Chapter details the major components of the Ultra Whisper system. It provides location of major components in the system and their part number and description. During maintenance and repair please refer to Chapter 4, Storage and Cleaning; Chapter 5, Troubleshooting; Chapter 6, Maintenance and Repair.



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	0412061278	SEA STRAINER-SUBASSY
2	1	20200402010	BRACKET SEA STRAINER
3	2	063200084000	NUT LOCK 1.00" STEEL
4	2	0101294283	RB 1.00 MPT X 1/2 FPT PVC
5	2	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC
6	4	05181434AA	HOSE CLAMP 3/4" SS
7	3	061172143016	SC HEX "A" 1/4 X 1 SS
8	3	061080043000	WASHER FLAT 1/4 SS

SPARE PARTS

PART NO.	DESCRIPTION
2614100178	O-RING SEA STRAINER -3
0804702578	MESH SCREEN -3



ITEM NO.	B007380001 12VDC-200 QTY	B007380002 24VDC-200 QTY	PART NO.	DESCRIPTION
1	1		12124011SF	FEED PUMP/MOTOR 1.5 GPM, 12 VOLT DC
		1	12124012SF	FEED PUMP/MOTOR 1.5 GPM, 24 VOLT DC
2	3	3	0101292483	RB 1/2 MPT X 3/8 FPT PVC
3	1	1	0101062583	ELB90 1/2 FPT X 1/2 BARB PVC
4	2	2	01013718CL	NIPPLE 3/8 NPT X CLOSE PVC
5	1	1	0101422583	TEE 1/2 FPT x 1/2 FPT x 1/2 FPT PVC
6	1	1	0204020969	ELB90 1/4 TUBE X 3/8 MPT PLASTIC
7	1	1	0101652583	ADAP 1/2 MPT X 1/2 BARB PVC
8	4	4	05181434AA	HOSE CLAMP 3/4 SS
9	4	4	61100043000	WASHER FLAT OS 1/4 SS
10	4	4	061172143020	BOLT HEX "A" 1/4 X 1 1/4 SS

SPARE PARTS

PART NO.	DESCRIPTION
12124013SF	FEED PUMP HEAD 1.5 GPM REPLACEMENT

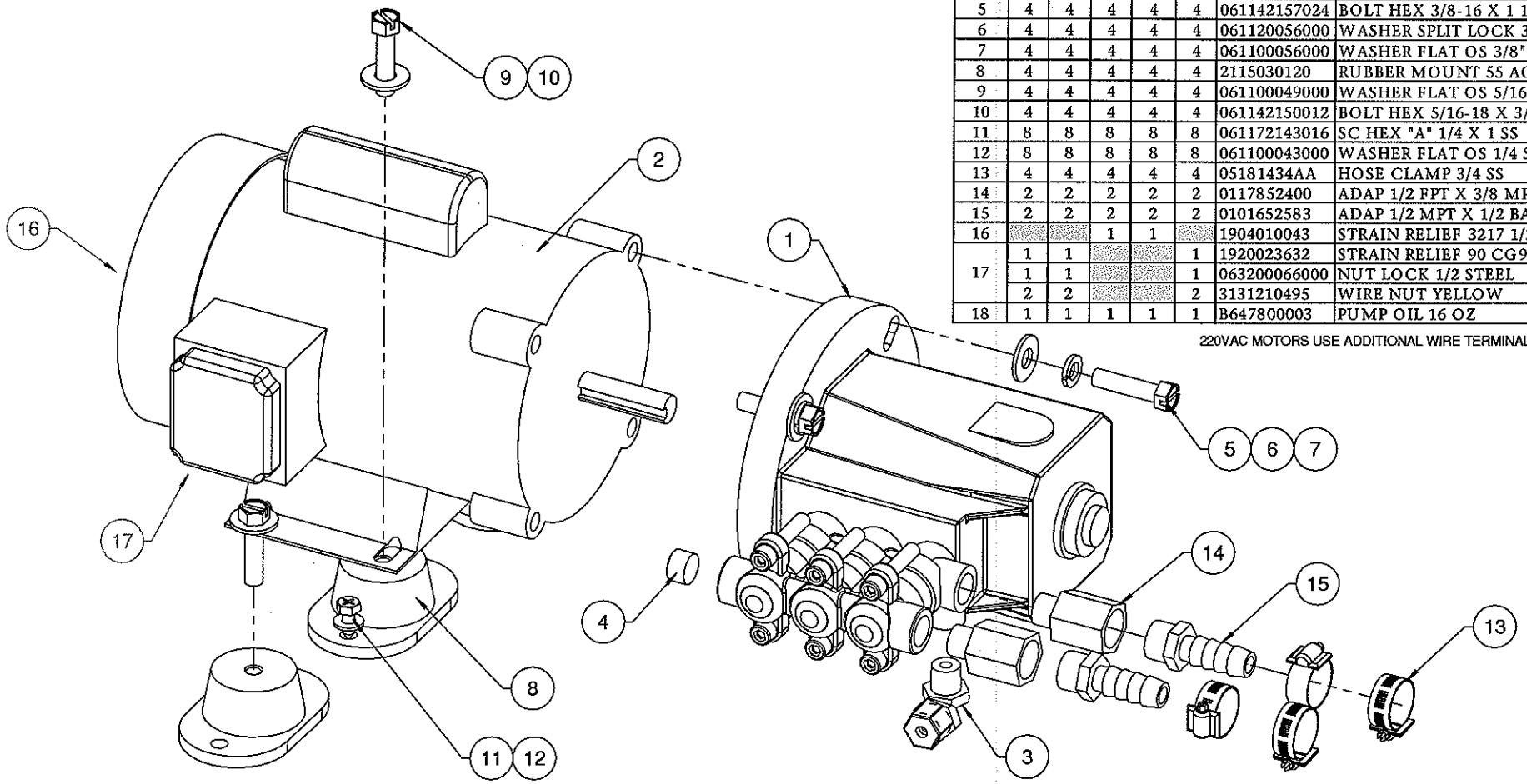
B007380003	SYSTEM 200 - 110 VAC
B007380004	SYSTEM 400 - 12 VDC
B007380005	SYSTEM 400 - 24 VDC
B007380006	SYSTEM 400 - 110/220 VAC
B007380007	SYSTEM 600 - 110/220 VAC

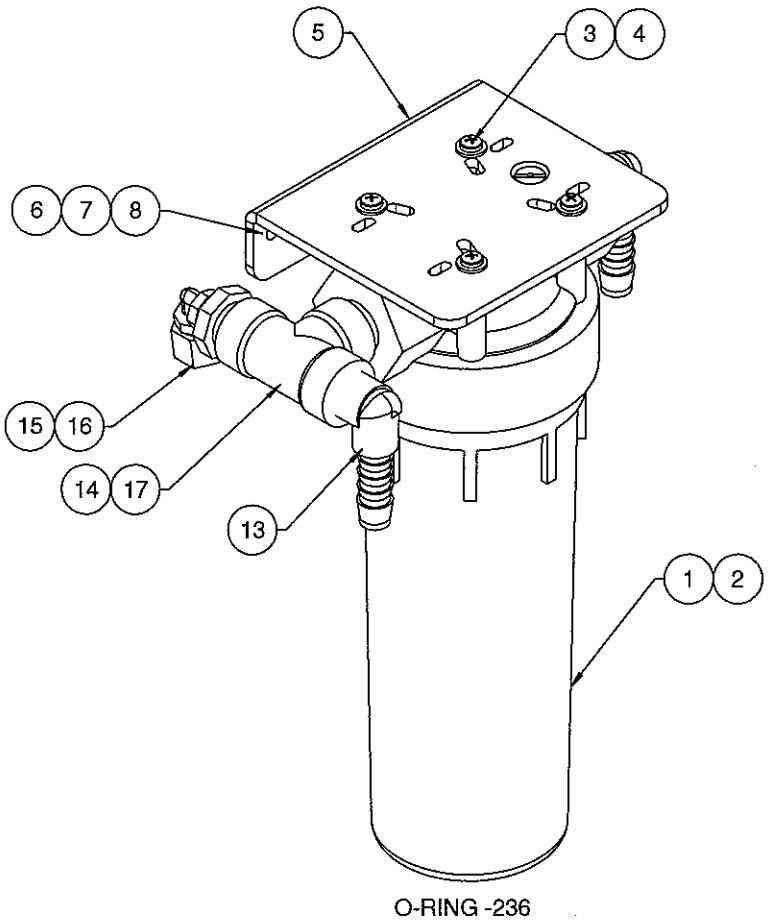
SPARE PARTS

PART NO.	DESCRIPTION
B652220001	VALVE & SEAL KIT H.P. PUMP -SF
B654220003	VALVE KIT HIGH PRES. PUMP -SF
B653220001	SEAL KIT HIGH PRES. PUMP -SF

	B007380007	B007380006	B007380005	B007380004	B007380003		
ITEM	QTY	QTY	QTY	QTY	QTY	PART NO.	DESCRIPTION
1					1	1218181622	HP PUMP 1.5 GPM SS
		1	1	1		1218182022	HP PUMP 2.5 GPM SS
	1					1218182422	HP PUMP 3.5 GPM SS
2				1		15093110CF	MOTOR 1/3 HP 12 VDC
			1			15103210CF	MOTOR 1/3 HP 24 VDC
		1			1	15AG250912	MOTOR 1/3 HP 50/60Hz 110/230-1PH
	1					1519071010	MOTOR 1/2 HP 50/60Hz 110/230-1PH
3	1	1	1	1	1	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLASTIC
4	1	1	1	1	1	0117341869	PLUG 3/8 MPT SS
5	4	4	4	4	4	061142157024	BOLT HEX 3/8-16 X 1 1/2 SS
6	4	4	4	4	4	061120056000	WASHER SPLIT LOCK 3/8" SS
7	4	4	4	4	4	061100056000	WASHER FLAT OS 3/8" SS
8	4	4	4	4	4	2115030120	RUBBER MOUNT 55 AQUA SERIES
9	4	4	4	4	4	061100049000	WASHER FLAT OS 5/16" SS
10	4	4	4	4	4	061142150012	BOLT HEX 5/16-18 X 3/4 SS
11	8	8	8	8	8	061172143016	SC HEX "A" 1/4 X 1 SS
12	8	8	8	8	8	061100043000	WASHER FLAT OS 1/4 SS
13	4	4	4	4	4	05181434AA	HOSE CLAMP 3/4 SS
14	2	2	2	2	2	0117852400	ADAP 1/2 FPT X 3/8 MPT SS
15	2	2	2	2	2	0101652583	ADAP 1/2 MPT X 1/2 BARB PVC
16			1	1		1904010043	STRAIN RELIEF 3217 1/2" GREY
17	1	1			1	1920023632	STRAIN RELIEF 90 CG90-6250
	1	1			1	063200066000	NUT LOCK 1/2 STEEL
	2	2			2	3131210495	WIRE NUT YELLOW
18	1	1	1	1	1	B647800003	PUMP OIL 16 OZ

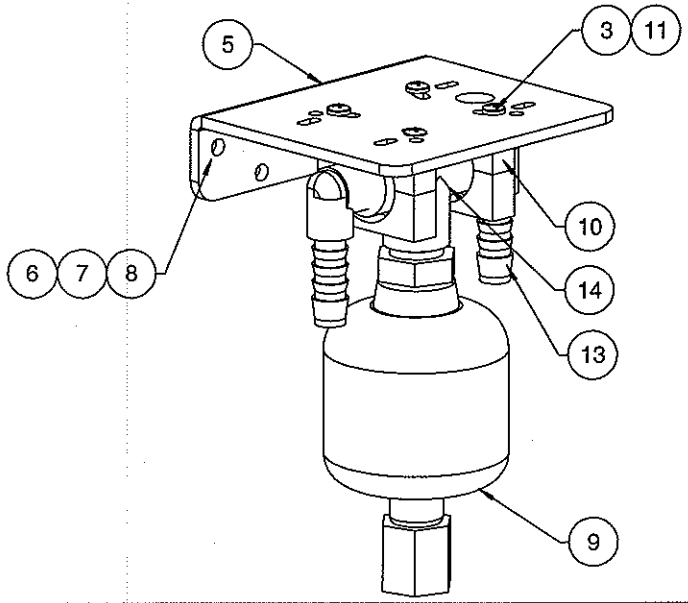
220VAC MOTORS USE ADDITIONAL WIRE TERMINAL PN 31313848CD

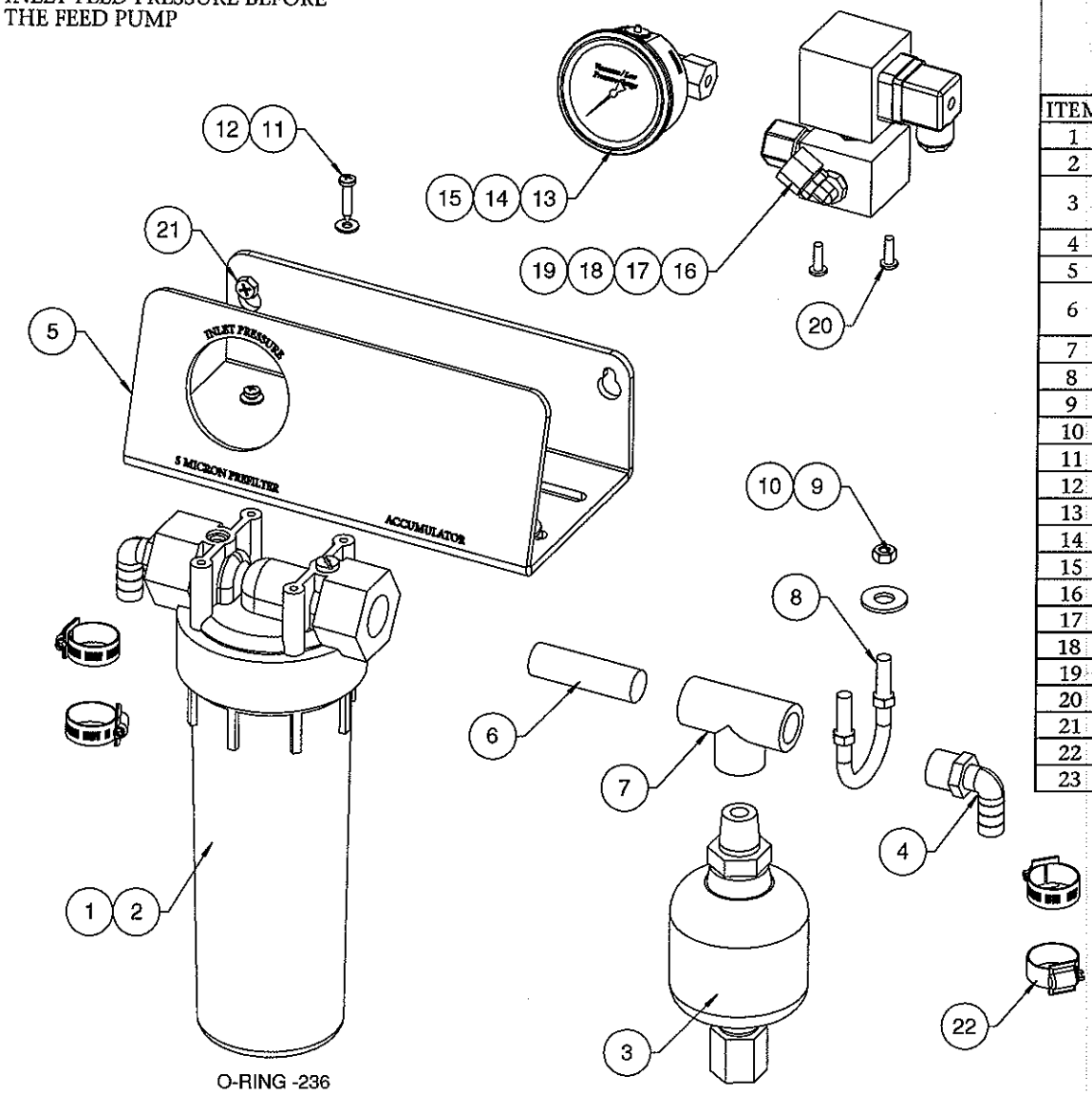




O-RING -236

ITEM	B159380002 ACC-4/600 QTY	B159380001 ACC-200 QTY	B107380001 PREFILTER QTY	PART NO.	DESCRIPTION
1			1	07650209ST	FILTER HOUSING/LID UW/SE
2			1	0801060157	ELEMENT PREFILTER 10/05
3	4	4	4	065080028000	WASHER FLAT #10 NYLON
4			4	061170628016	SC PHIL PAN "A" 10 X 1" SS
5	1	1	1	2020043811	BRACKET UW/SE PREFILTER/ACC
6	4	4	4	061142145012	BOLT HEX 1/4-20 X 3/4 SS
7	4	4	4	065070045000	NUT LOCKING 1/4-20 FLANGED NYL
8	4	4	4	061080043000	WASHER FLAT 1/4 SS
9	1			3817090600	ACCUMULATOR 10 CU IN
		1		38620905SF	ACCUMULATOR UW/SE SM 620 ML
10	2	2		1453131700-02	VALVE BRACKET 3/4" SET
11	4	4		061160630024	SC PHIL PAN 10-24 X 1 1/2 SS
12	4	4	4	05181434AA	HOSE CLAMP 3/4 SS
13	2	2	2	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC
14	1		1	0101422583	TEE 1/2 FPT X 1/2 FPT X 1/2 FPT PVC
15			1	0101292383	RB 1/2 MT X 1/4 FT PVC
16			1	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLAST
17			1	01013725CL	NIPPLE 1/2 NPT X CLOSE PVC

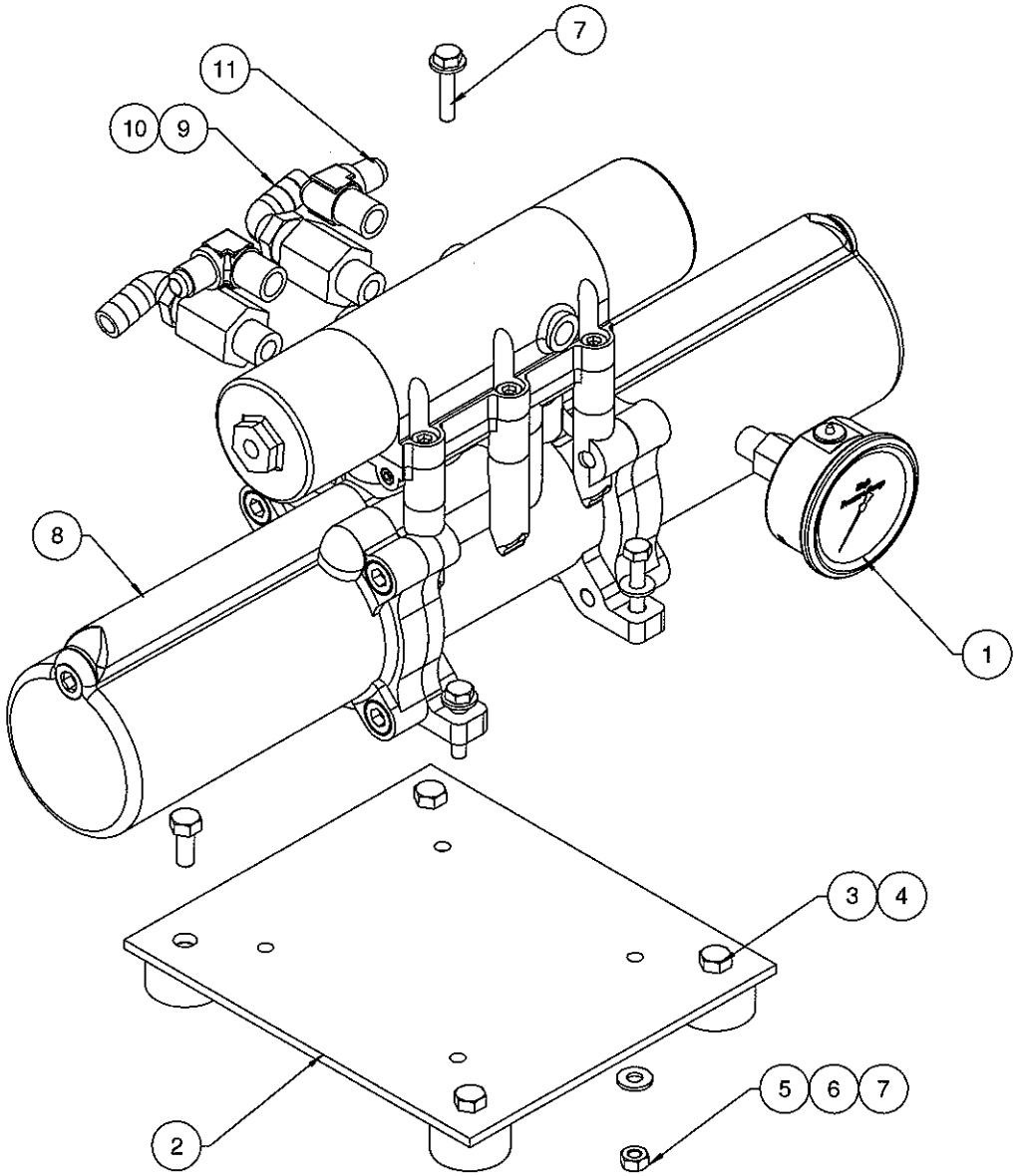




ITEM	B107380003 PF M200 QTY	B107380004 PF M4-600 QTY	PART NO.	DESCRIPTION
1	1	1	07650209ST	FILTER HOUSING/LID UW/SE
2	1	1	0801060157	ELEMENT PREFILTER 10/05
3	1		38620905SF	ACCUMULATOR UW/SE SM 650 ml.
		1	3817090600	ACCUMULATOR UW/SE 10 cu in.
4	2	2	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC
5	1	1	2020043809	BRACKET PREFILTER UW/SE
6		1	0101372515	NIPPLE 1/2 NPT X 1 1/2 PVC
	1		01013725CL	NIPPLE 1/2 NPT X CLOSE PVC
7		1	0101422583	TEE 1/2 FPT X 1/2 FPT X 1/2 FPT PVC
8	1	1	061292550016	BOLT "U" 5/16-18 X 1 1/2 SS
9	4	4	061080049000	WASHER FLAT 5/16"SS
10	4	4	061060050000	NUT HEX 5/16-18 W/INSERT SS
11	6	6	065080028000	WASHER FLAT #10 NYLON
12	4	4	061170628016	SC PHIL PAN "A" 10 X 1" SS
13	1	1	10181522CC	GAUGE -30/0/70 CBM.NPT
14	1	1	05180851CC	GAUGE BRACKET CBM SS
15	1	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLAS
16	1	1	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLAS
17	1	1	0204090869	CONN 1/4 TUBE X 1/4 MPT PLAS
18	1	1	5333380100	MANIFOLD LP NPT UW/SE
19	1	1	2321021658	SWITCH PRESS INC 100-225 PSI
20	2	2	061160630012	SCREW PHIL PAN 10-24 X 3/4 SS
21	3	3	061172143016	SCREW HEX "A" 1/4 X 1 SS
22	4	4	05181434AA	HOSE CLAMP 3/4 SS
23	AR	AR	4910210721	WIRE 20 GA 2 COND. GREY FLEX

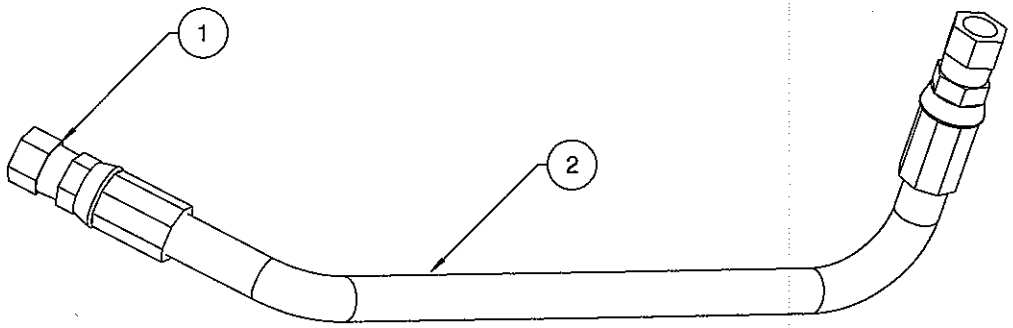
MANIFOLD ACCEPTS THE PREFILTER INLET PRESSURE
FOR THE SWITCH THEN CONNECTS TO FRONT PANEL

PAGE 9.6 B10738000X PREFILTER AND ACCUMULATOR MODULAR ASSEMBLY UW/SE



	B153380002 ETD M4-600	B153380001 ETD M200		
ITEM	QTY	QTY	PART NO.	DESCRIPTION
1	1	1	10181524CC	GAUGE 0-1400 CBM NPT
			0117660800	ADAP 1/4 MBSPP x 1/4 FPT SS
2	1	1	2020053813	PANEL ECO PUMP MNTG
3	4	4	2132021600	RUBBER MOUNT GROMMET 1 1/4
4	4	4	061182143032	SC LAG 1/4 X 2 SS
5	8	8	061100043000	WASHER FLAT 0S 1/4 SS
6	4	4	061060045000	NUT HEX 1/4-20 W/ INSERT SS
7	4	4	061142145020	BOLT HEX 1/4-20 x 1 1/4 SS
8		1	12182501EC	HP-PUMP ETD-22
	1		12182504EC	HP-PUMP ETD-25
9	2	2	0117661900	ADAP 3/8 MBSP x 1/2 FPT SS
10	2	2	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC
11	2	2	1317071700	ELB90 -6 FLARE X 3/8 MBSPP SS
12	4	4	05181434AA	HOSE CLAMP 3/4 SS

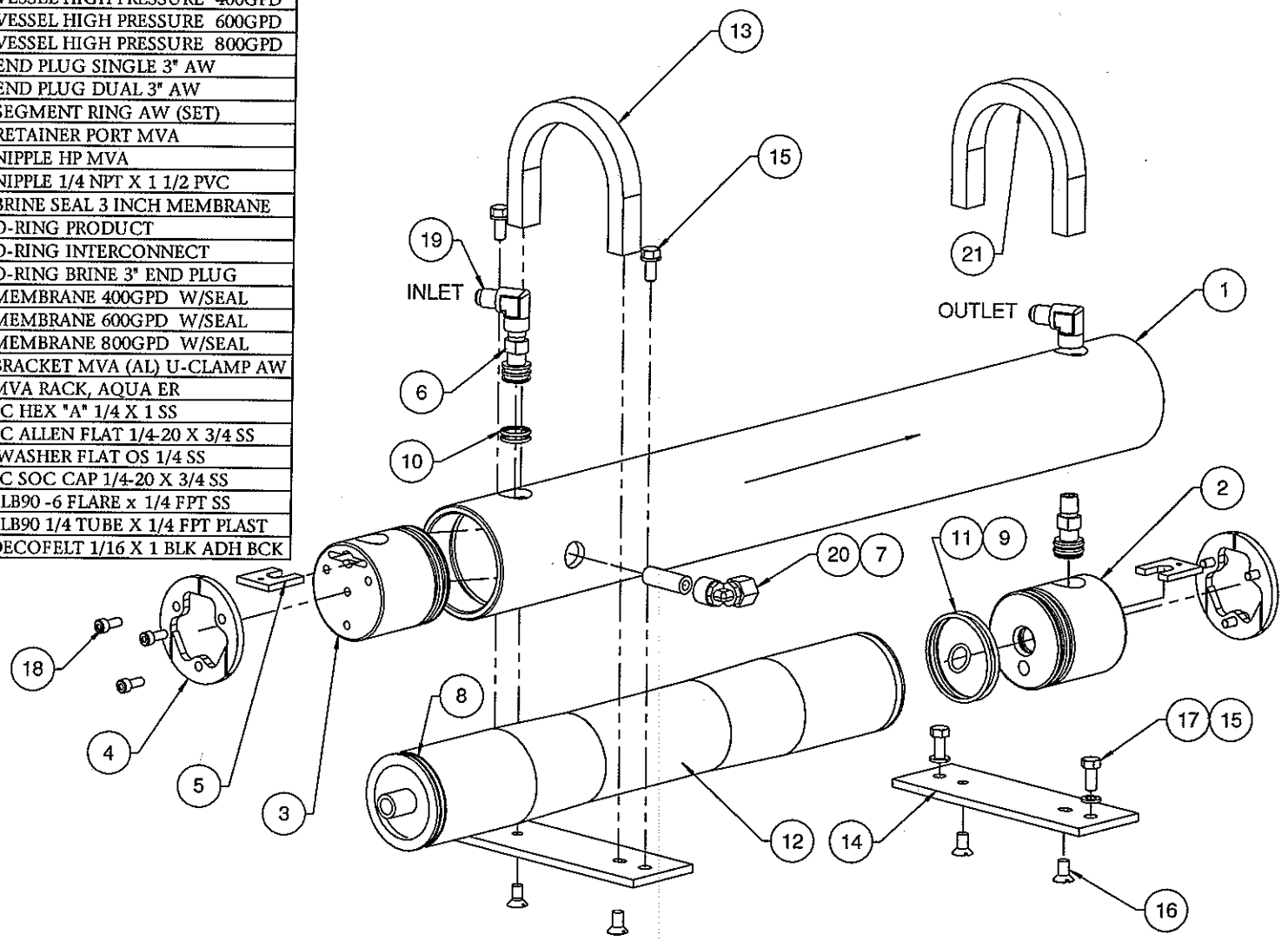
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	2	1317482001	SWIVEL FITTING -6AW TTC
2	AR	2404053701	HOSE HP-6AW GH195



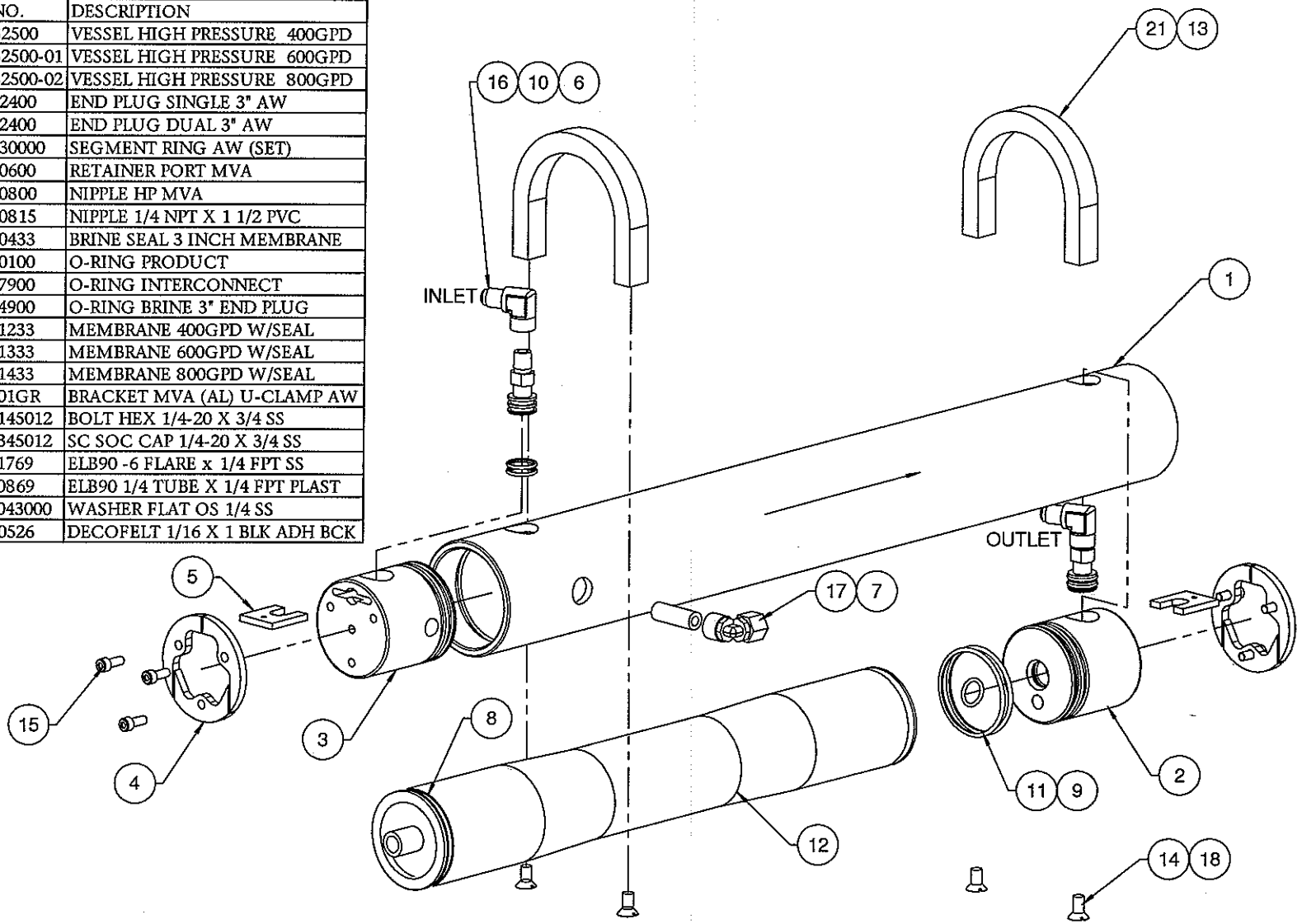
MODULE UNITS: INLET HOSE [13] 6 ft LG, OUTLET HOSE [15] 6 ft LG, PART NUMBER B390380001

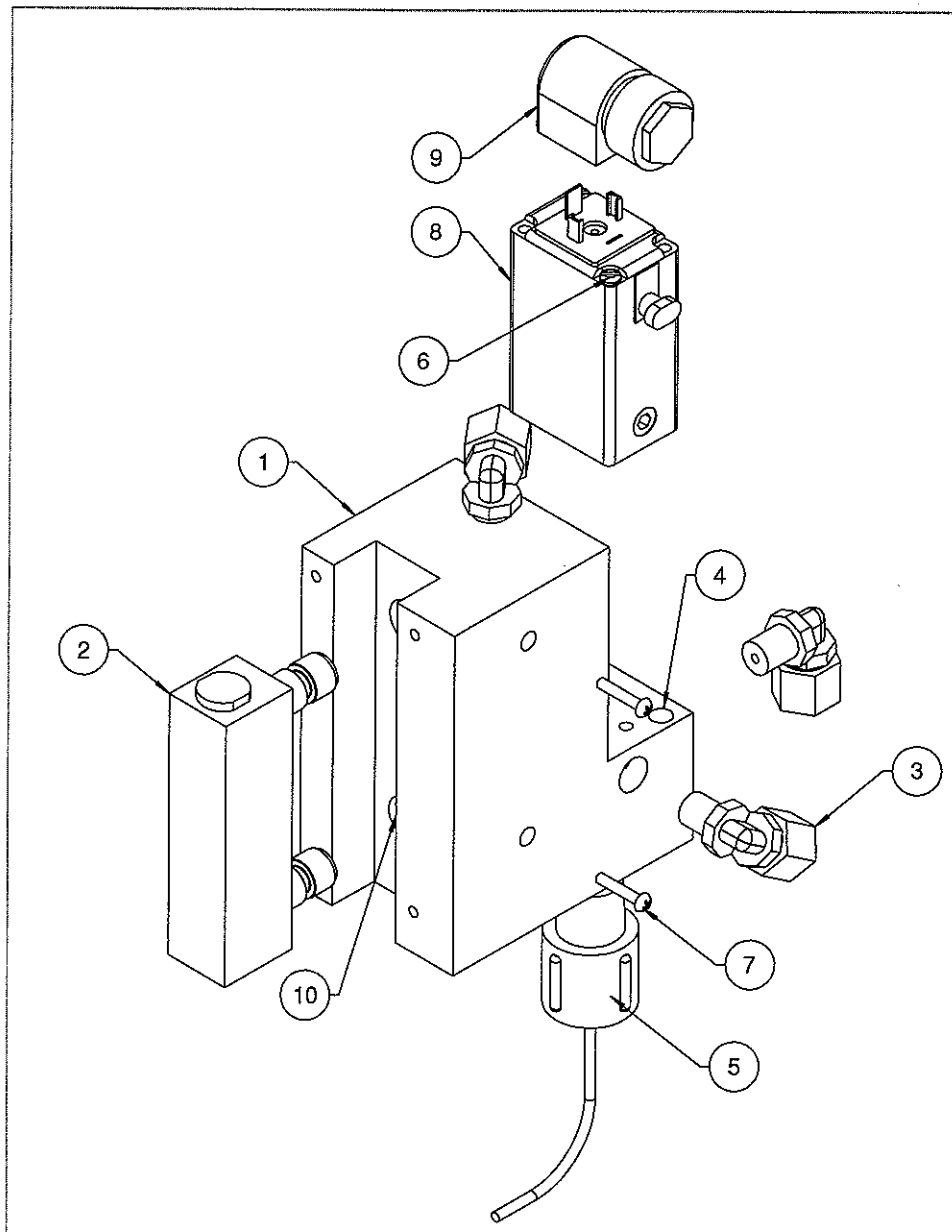
200 COMPACT: INLET HOSE [13] 9-3/4 inch LG, OUTLET HOSE [15] 9-3/4 inch LG, PART NUMBER B390380002
400 COMPACT: INLET HOSE [13] 14-3/4 inch LG, OUTLET HOSE [15] 14-3/4 inch LG, PART NUMBER B390380003
600 COMPACT: INLET HOSE [13] 19-1/4 inch LG, OUTLET HOSE [15] 19-1/4 inch LG, PART NUMBER B390380004

ITEM	B196380003 MVA M600 QTY	B196380002 MVA M400 QTY	B196380001 MVA M200 QTY	PART NO.	DESCRIPTION
1			1	2408132500	VESSEL HIGH PRESSURE 400GPD
		1		2408132500-01	VESSEL HIGH PRESSURE 600GPD
	1			2408132500-02	VESSEL HIGH PRESSURE 800GPD
2	1	1	1	2453502400	END PLUG SINGLE 3" AW
3	1	1	1	2453512400	END PLUG DUAL 3" AW
4	2	2	2	20201030000	SEGMENT RING AW (SET)
5	2	2	2	0520210600	RETAINER PORT MVA
6	2	2	2	0117410800	NIPPLE HP MVA
7	1	1	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
8				2614050433	BRINE SEAL 3 INCH MEMBRANE
9	2	2	2	2614010100	O-RING PRODUCT
10	4	4	4	2614017900	O-RING INTERCONNECT
11	4	4	4	2614014900	O-RING BRINE 3" END PLUG
12			1	2724011233	MEMBRANE 400GPD W/SEAL
		1		2724011333	MEMBRANE 600GPD W/SEAL
	1			2724011433	MEMBRANE 800GPD W/SEAL
13	2	2	2	05202401GR	BRACKET MVA (AL) U-CLAMP AW
14	2	2	2	0520051900	MVA RACK, AQUA ER
15	4	4	4	061172143016	SC HEX "A" 1/4 X 1 SS
16	4	4	4	061161845012	SC ALLEN FLAT 1/4-20 X 3/4 SS
17	4	4	4	061100043000	WASHER FLAT OS 1/4 SS
18	6	6	6	061162345012	SC SOC CAP 1/4-20 X 3/4 SS
19	2	2	2	1317011769	ELB90 -6 FLARE x 1/4 FPT SS
20	1	1	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLAST
21	AR	AR	AR	2632180526	DECOFELT 1/16 X 1 BLK ADH BCK



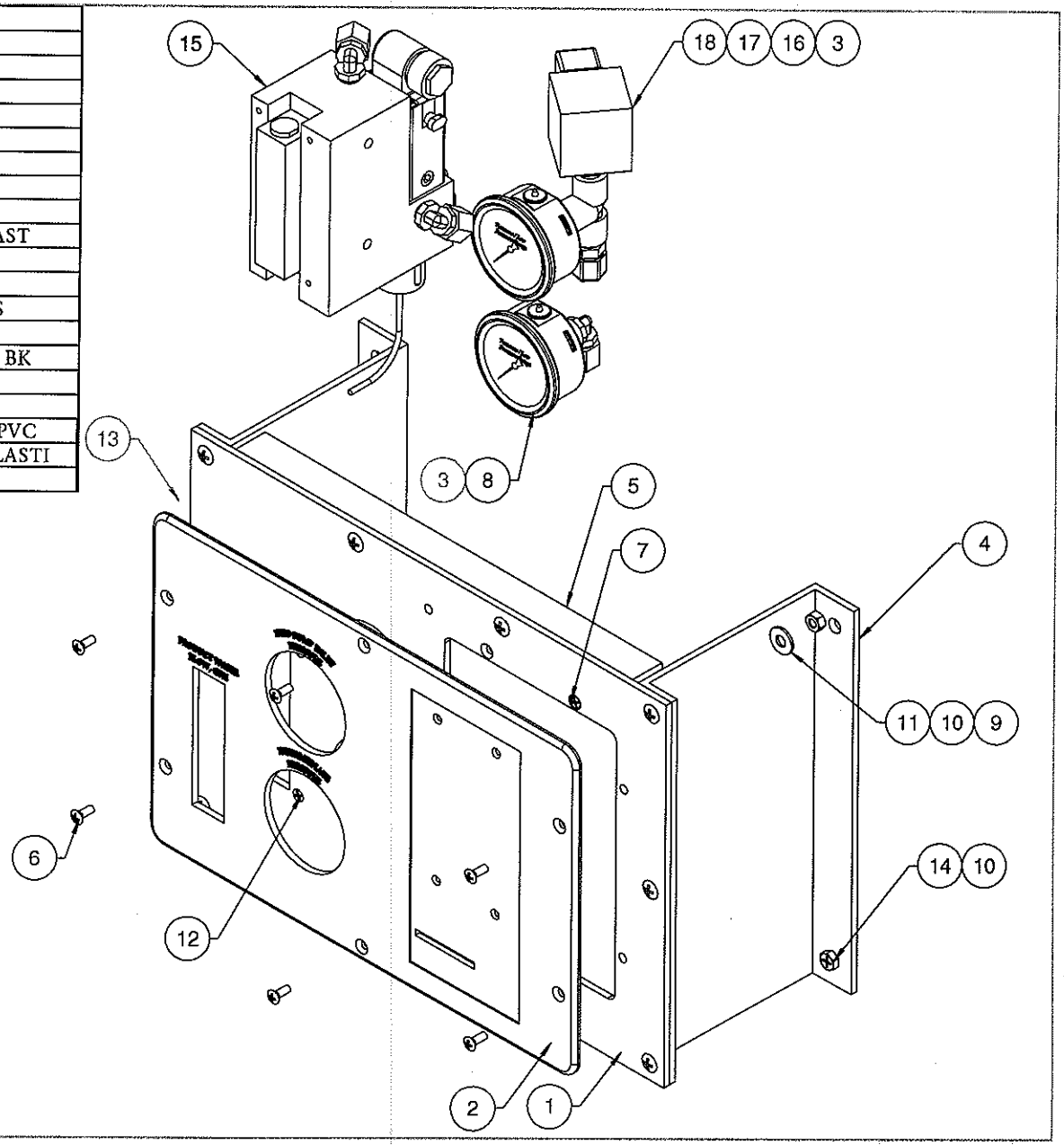
ITEM	B196380009 MVA C600 QTY	B196380008 MVA C400 QTY	B196380007 MVA C200 QTY	PART NO.	DESCRIPTION
1			1	2408132500	VESSEL HIGH PRESSURE 400GPD
		1		2408132500-01	VESSEL HIGH PRESSURE 600GPD
	1			2408132500-02	VESSEL HIGH PRESSURE 800GPD
2	1	1	1	2453502400	END PLUG SINGLE 3" AW
3	1	1	1	2453512400	END PLUG DUAL 3" AW
4	2	2	2	20201030000	SEGMENT RING AW (SET)
5	2	2	2	0520210600	RETAINER PORT MVA
6	2	2	2	0117410800	NIPPLE HP MVA
7	1	1	1	0101370815	NIPPLE 1/4 NPT X 1 1/2 PVC
8				2614050433	BRINE SEAL 3 INCH MEMBRANE
9	2	2	2	2614010100	O-RING PRODUCT
10	4	4	4	2614017900	O-RING INTERCONNECT
11	4	4	4	2614014900	O-RING BRINE 3" END PLUG
12			1	2724011233	MEMBRANE 400GPD W/SEAL
		1		2724011333	MEMBRANE 600GPD W/SEAL
	1			2724011433	MEMBRANE 800GPD W/SEAL
13	2	2	2	05202401GR	BRACKET MVA (AL) U-CLAMP AW
14	4	4	4	061142145012	BOLT HEX 1/4-20 X 3/4 SS
15	6	6	6	061162345012	SC SOC CAP 1/4-20 X 3/4 SS
16	2	2	2	1317011769	ELB90 -6 FLARE x 1/4 FPT SS
17	1	1	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLAST
18	4	4	4	061100043000	WASHER FLAT OS 1/4 SS
19	AR	AR	AR	2632180526	DECOFELT 1/16 X 1 BLK ADH BCK





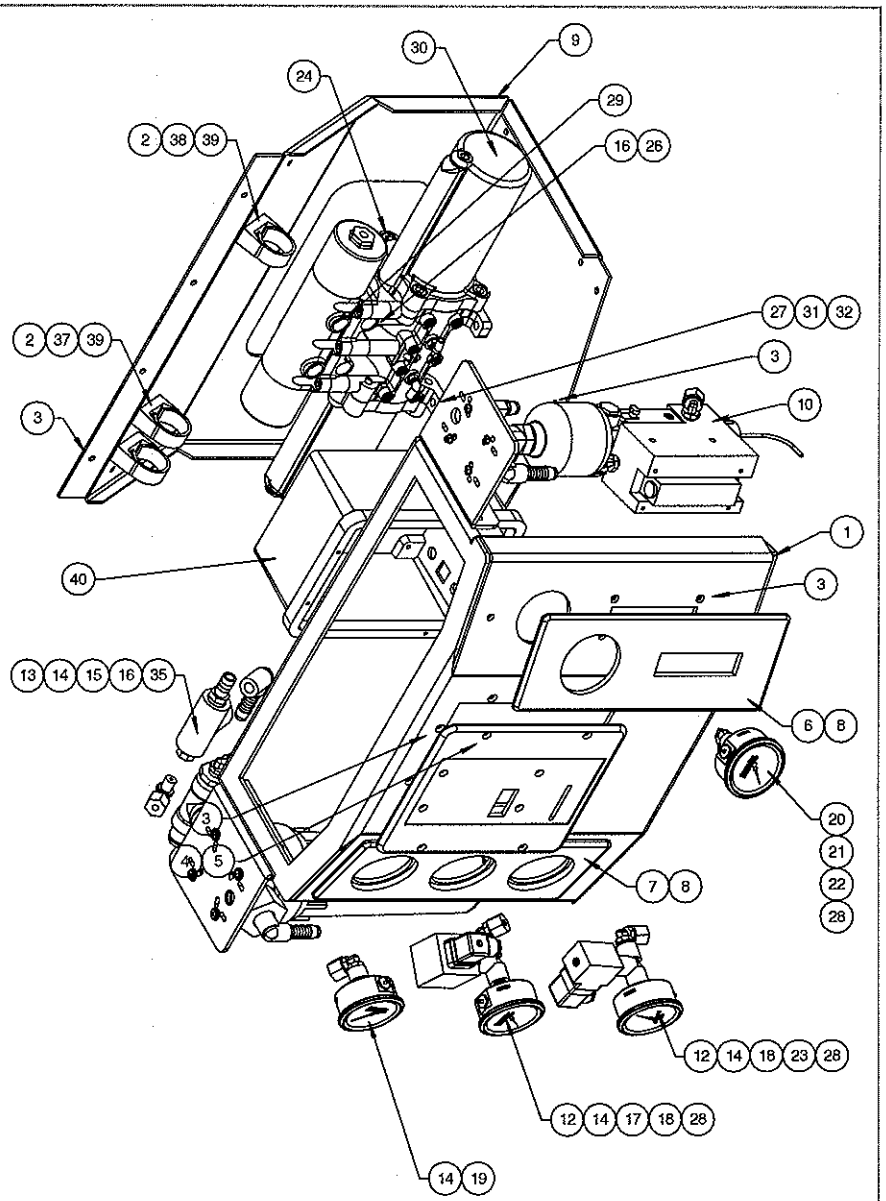
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	5333380200	MANIFOLD PRODUCT UW/SE
2	1	1105320253	FLOW METER 4-40 GPH
3	3	0204020869	ELB90 1/4 TUBE x 1/4 MPT PLAST
4	2	H30612730006	INSERT 8-32 X 5/16-18 SS
5	1	B511080001	SALINITY PROBE ASSY
6	2	061160526048	SC SLOT FILLISTER 8/32 x 3 SS
7	2	569031012A	SCREW SOC 6-32 X 3/4
8	1	1401096100	VALVE SOLENOID 12VDC CSOF
9	1	3131680100	PLUG CONNECTOR DIN 4 COND
10	2	2614014600	O-RING PLUG PRODUCT AW/FM-113

ITEM NO.	QTY	PART NO.	DESCRIPTION
1	1	3131223900	ENCLOSURE LID AQUA
2	1	2020053817	PANEL FRONT AQUA
3	2	10181510CC	GAUGE 0-200 CBM.NPT
	2	05180851CC	GAUGE BRACKET CBM SS
4	2	2020043801	BRACKET PANEL SUPPORT
5	2	2020043805	PANEL RAILS AQUA
6	6	061161130012	SC PHIL OVAL 10-24 x 3/4 SS
7	6	061161630008	SC PHIL FLAT 10-24 x 1/2 SS
8	1	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLAST
9	10	061161145014	SC PHIL OVAL 1/4-20 x 7/8 SS
10	14	061100043000	WASHER FLAT OS 1/4 SS
11	10	061060045000	NUT HEX 1/4-20 W/INSERT SS
12	4	061161630012	SC PHIL FLAT 10-24 x 3/4 SS
13	AR	2632180526	DECOFELT 1/16 X 1 BLK ADH BK
14	4	061172143016	SC HEX "A" 1/4 X 1 SS
15	1	B502380001	MANIFOLD PRODUCT ASSY
16	1	0101420883	TEE 1/4 FT X 1/4 FT X 1/4 FT PVC
17	1	0204090869	CONN 1/4 TUBE X 1/4 MPT PLASTI
18	1	2301021558	SWITCH PRESS DEC 15-35



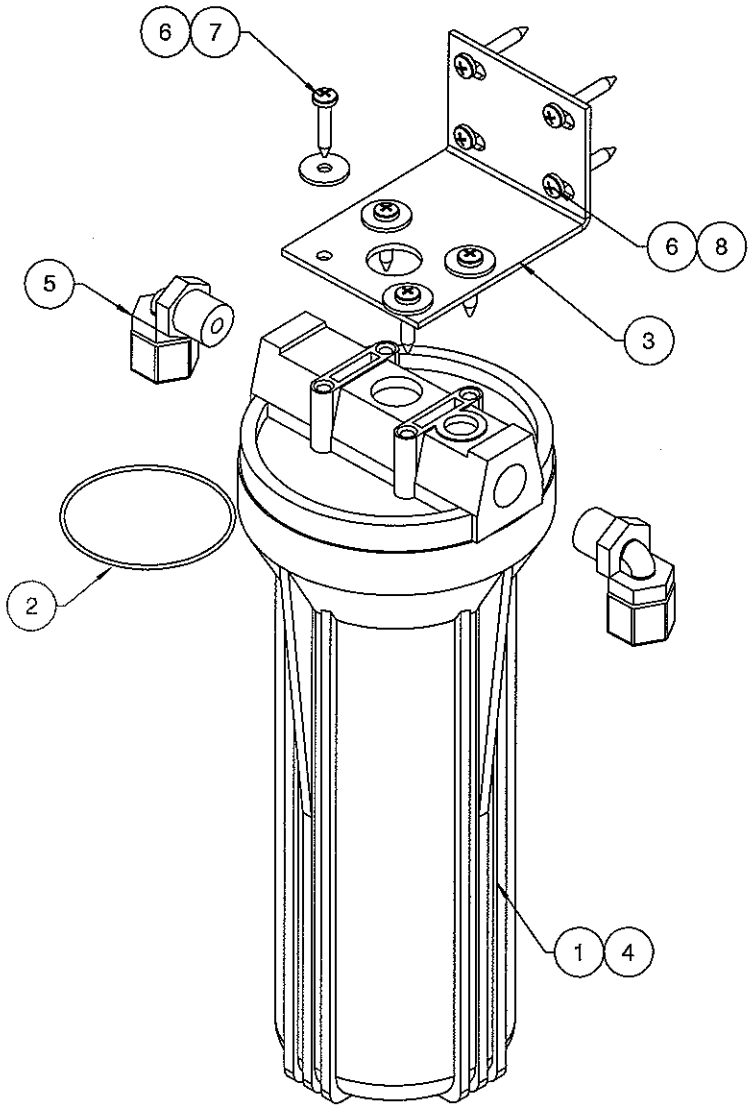
PAGE 9.12 B594380001 FRONT CONTROL PANEL UW/SE MODULAR ASSEMBLY

ITEM	PART NO.	DESCRIPTION	B589380001 110V 200C	B589380002 12V 200C	B589380003 24V 200C	B589380004 110/220V 400/600C	B589380005 12V 400C	B589380006 24V 400C
1	2020023801	FRAME COMPACT FRONT UW/SE	1	1	1	1	1	1
2	061161130010	SC PHIL OVAL 10-24 x 5/8 SS	3	3	3	3	3	3
3	061161630008	SC PHIL FLAT 10-24 X 1/2 SS	16	16	16	16	16	16
4	061161130016	SC PHIL OVAL 10-24 x 1 SS	4	4	4	4	4	4
5	2020053817	PANEL FRONT AQUA	1	1	1	1	1	1
6	2020053821	PANEL FRONT LEFT UWC/SEC	1	1	1	1	1	1
7	2020053822	PANEL FRONT RIGHT UWC/SEC	1	1	1	1	1	1
8	065070045000	NUT LOCKING 1/4-20 FLANGED NY	4	4	4	4	4	4
9	2020023802	FRAME COMPACT BACK UW/SE	1	1	1	1	1	1
10	B502380001	MANIFOLD PRODUCT ASSY	1	1	1	1	1	1
11	0204010869	ELB90 1/4 TUBE X 1/4 FPT PLAST	1	1	1	1	1	1
12	10181510CC	GAUGE 0-300 PSI CBM.NPT	2	2	2	2	2	2
13	0101292383	RB 1/2 MT X 1/4 FT PVC	1	1	1	1	1	1
14	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLAST	3	3	3	3	3	3
15	0101422583	TEE 1/2 FPT X 1/2 FPT X 1/2 FPT PV	1	1	1	1	1	1
16	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC	3	3	3	3	3	3
17	2301021558	SWITCH PRESS DEC 15-35 PSI	1	1	1	1	1	1
18	0101420883	TEE 1/4 FT X 1/4 FT X 1/4 FT PVC	2	2	2	2	2	2
19	10181522CC	GAUGE -30/0/70 CBM.NPT	1	1	1	1	1	1
20	10181524CC	GAUGE 0-1400 CBM NPT	1	1	1	1	1	1
21	0217010887	ELB90 1/4 TUBE X 1/4 FPT SS	1	1	1	1	1	1
22	0312181769	TUBE 1/4" BLACK SEMI-RIGID NYL	AR	AR	AR	AR	AR	AR
23	2321021658	SWITCH PRESS INC 100-225 PSI	1	1	1	1	1	1
24	0217030800	ELB90 1/4 TUBE X 1/4 MBSPP SS	1	1	1	1	1	1
25	3131680100	PLUG CONNECTOR DIN 4 COND	2	2	2	2	2	2
26	0117661900	ADAP 3/8 MBSPP x 1/2 FPT SS	2	2	2	2	2	2
27	061060045000	NUT HEX 1/4-20 W/ INSERT SS	4	4	4	4	4	4
28	05180851CC	GAUGE BRACKET CBM SS	4	4	4	4	4	4
29	1317071700	ELB90 -6 FLARE X 3/8 MBSPP SS	2	2	2	2	2	2
30	12182501EC	HP PUMP ETD-22	1	1	1			
	12182504EC	HP PUMP ETD-25				1	1	1
31	061161845020	SC ALLEN FLAT 1/4-20 X 1 1/4 SS	4	4	4	4	4	4
32	061100043000	FLAT WASHER 0S 1/4 SS	4	4	4	4	4	4
33	B107380001	PREFILTER ASSY 200/400/600C	1	1	1	1	1	1
34	B159380002	ACCUMULATOR ASSY 400/600C				1	1	1
	B159380001	ACCUMULATOR ASSY 200C	1	1	1			
35	0101652583	ADAP 1/2 MPT X 1/2 BARB PVC	1	1	1	1	1	1
36	05181434AA	HOSE CLAMP 3/4 SS	8	8	8	8	8	8
37	0501164400	PIPE SUPPORT 1.0" PLAST	2	2	2	2	2	2
38	0501164900	PIPE SUPPORT 3/4" PLAST	1	1	1	1	1	1
39	061010030000	NUT HEX 10-24 SS	3	3	3	3	3	3
40	B595380007	CONTROLLER UW/SE 110/220 VAC	1			1		
	B595380012	CONTROLLER UW/SE 12 VDC		1			1	
	B595380024	CONTROLLER UW/SE 24 VDC			1			1

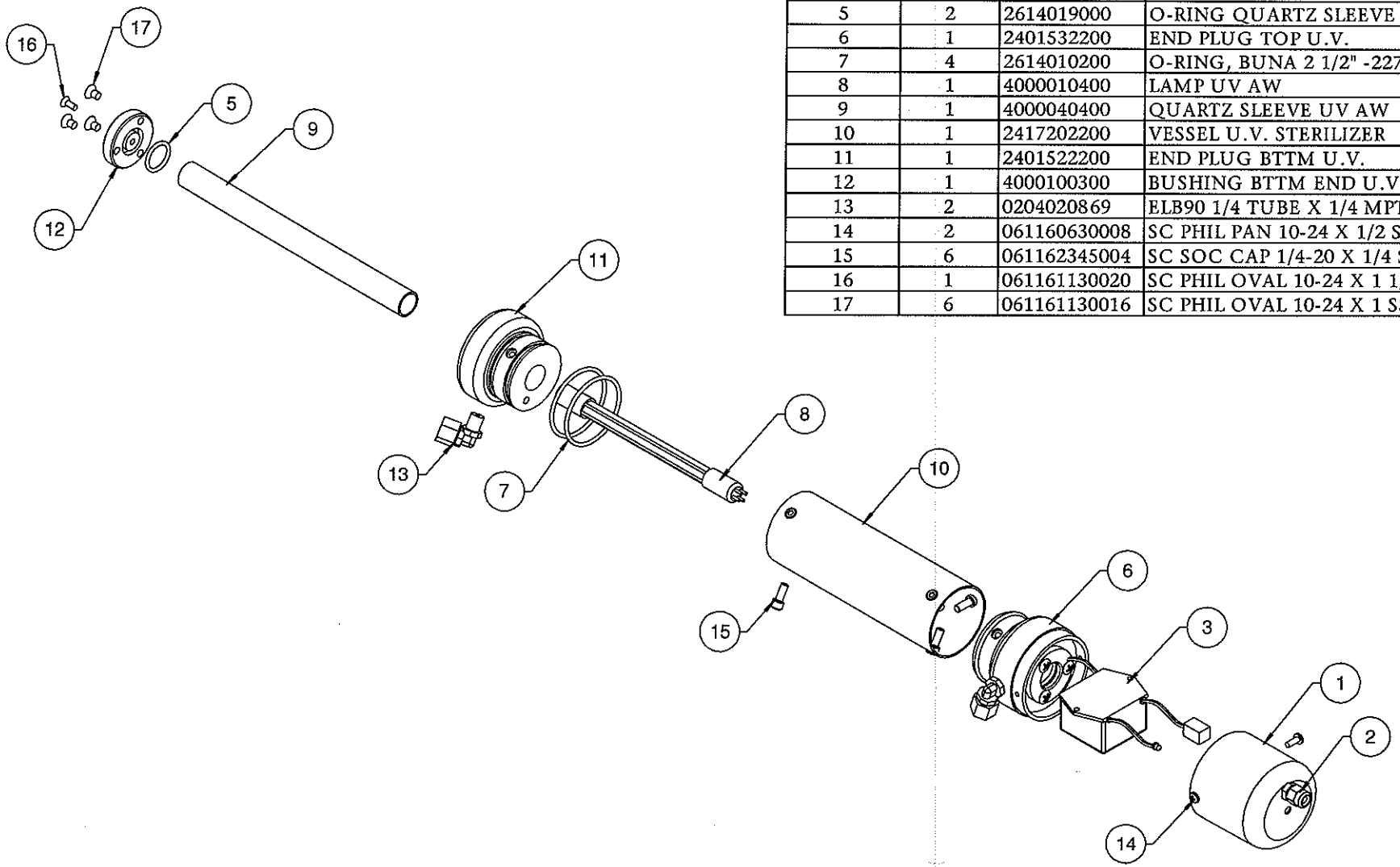


ALTERNATIVE ITEMS			
	24	0117660800	ADAP 1/4 MBSPP X 1/4 FPT SS
		0217020887	ELB90 1/4 TUBE X 1/4 MPT SS

PAGE 9.13 B5893800X CORE ASSEMBLY COMPACT UW/SE

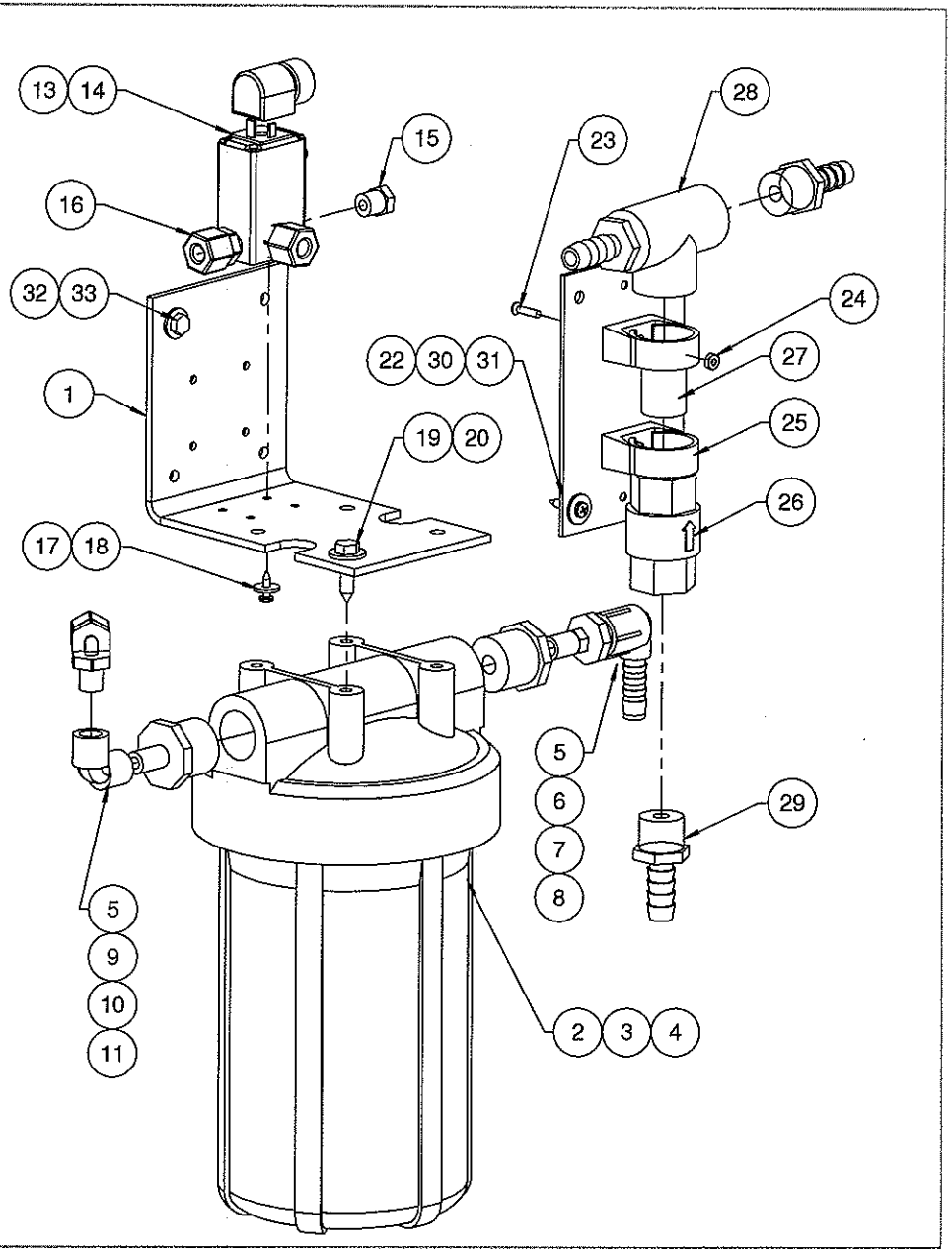


ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	0713020573	FILTER HOUSING/LID 3/8 X 10
2	1	2614010473	O-RING BLUE HOUSING -237
3	1	20200402100	BRACKET PREFILTER/CHRCL/PLNKTN
4	1	0803004773	ELEMENT CHARCOAL 9.8"
5	2	0204020969	ELB90 1/4 TUBE X 3/8 MPT PLASTIC
6	8	065080028000	WASHER FLAT #10 NYLON
7	4	061170628016	SC PHIL PAN "A" 10 X 1 SS
8	4	061170628020	SC PHIL PAN "A" 10 X 1 1/4 SS

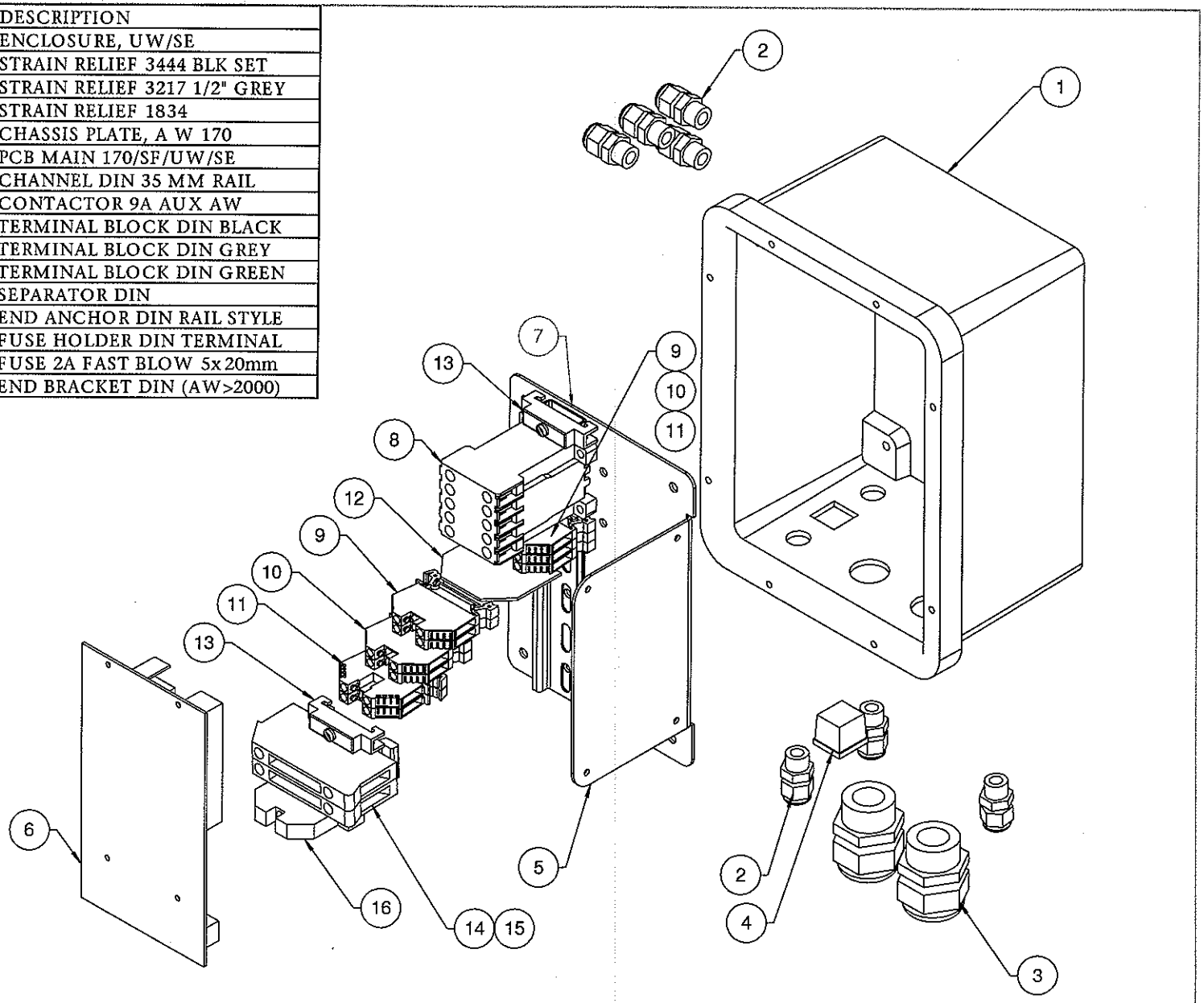


ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	4000160100	CAP ELECTRICAL U.V. STLR
2	1	1904010643	STRAIN RELIEF 3444 BLK
3	1	4000021400	BALLAST 12VDC-4C AW
4	1	4000100200	BUSHING TOP END U.V. STLR
5	2	2614019000	O-RING QUARTZ SLEEVE UVA -212
6	1	2401532200	END PLUG TOP U.V.
7	4	2614010200	O-RING, BUNA 2 1/2" -227
8	1	4000010400	LAMP UV AW
9	1	4000040400	QUARTZ SLEEVE UV AW
10	1	2417202200	VESSEL U.V. STERILIZER
11	1	2401522200	END PLUG BTTM U.V.
12	1	4000100300	BUSHING BTTM END U.V. STLR
13	2	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLASTIC
14	2	061160630008	SC PHIL PAN 10-24 X 1/2 SS
15	6	061162345004	SC SOC CAP 1/4-20 X 1/4 SS
16	1	061161130020	SC PHIL OVAL 10-24 X 1 1/4 SS
17	6	061161130016	SC PHIL OVAL 10-24 X 1 SS

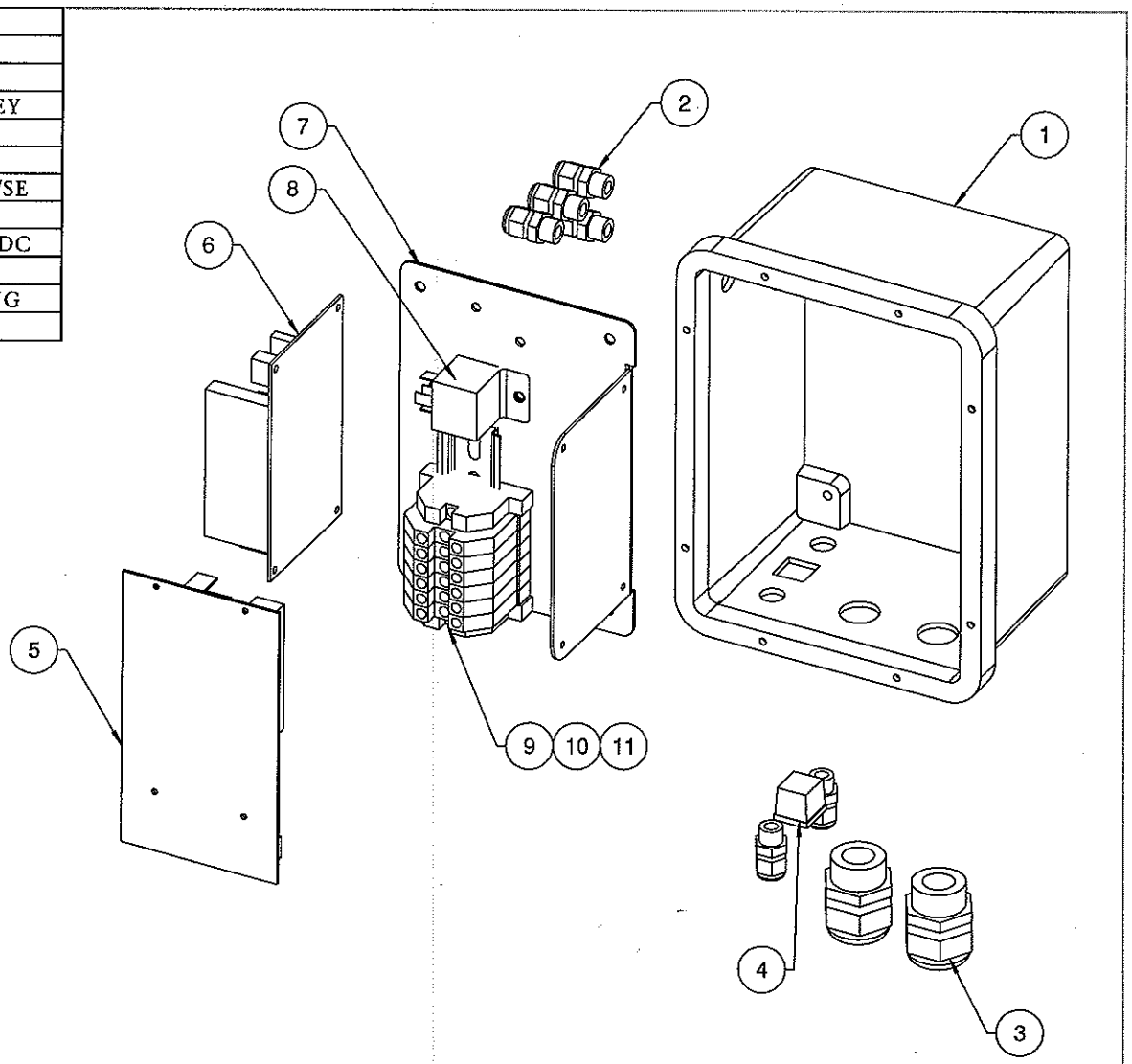
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	2020040001	BRACKET CARBON FILTER HSG FWF
2	1	0803004906	ELEMENT CARBON BRIQUETTE 10"
3	1	0713020606	FILTER HOUSING BIG BLUE
4	1	2614010500	O-RING BIG BLUE HOUSING
5	2	0101294083	REDUCER BUSHING 1 MT X 1/4 FT PVC
6	1	14172105AT	VALVE CHECK 1/4" MPT SS
7	1	0101292383	REDUCER BUSHING 1/2 MT x 1/4 FT PVC
8	1	0101062583	ELB90 1/2 FPT X 1/2 BARB PVC
9	1	01013708CL	NIPPLE 1/4 NPT X CLOSE PVC
10	1	0101010883	ELB90 1/4" FPT x 1/4" FPT PVC
11	1	0204021769	ELB90 3/8" TUBE x 1/4" MPT PLASTIC
12	AR	0312123569	TUBE 3/8 BLACK
13	1	1401095998	VALVE SOLENOID 12VCD AED/CSFE/
14	1	3131680100	PLUG CONNECTOR DIN 4 COND
15	1	0101340883	PLUG 1/4" MPT PVC
16	2	0204091769	CONN 3/8 TUBE X 1/4 MPT PLASTIC
17	4	065080023000	WASHER FLAT #8 NYLON
18	4	061170623010	SC PHIL PAN "B" 8 X 5/8 SS
19	4	061100049000	WASHER FLAT OS 5/16 SS
20	4	061172149020	SC HEX "A" 5/16 X 1 1/4 LAG SS
21			
22	1	2020040002	BRACKET CHECK VALVE FWF
23	2	061161626012	SC PHIL FLAT 8-32 X 3/4 SS
24	2	061060026000	NUT HEX 8-32 W/INSERT SS
25	2	0501164500	PIPE SUPPORT 1 1/4"
26	1	14012118AR	VALVE CHECK 3/4" FPT WYTH VITO
27	1	01013737CL	NIPPLE 3/4 NPT X CLOSE PVC
28	1	0101423783	TEE 3/4 FT X 3/4 FT X 3/4 FT PVC
29	3	0101653683	ADAP 3/4 MPT x 1/2 BARB PVC
30	4	065080028000	WASHER FLAT #10 NYLON
31	4	061170628016	SC PHIL PAN "A" 10 X 1 SS
32	4	061100043000	WASHER FLAT OS 1/4 SS
33	4	061172143016	SC HEX "A" 1/4 X 1 SS
34	AR	0339076100	HOSE CLEAR BRAID 5/8" HD
35	AR	49422208011	WIRE 18 GA 2 COND ORANGE FLEX
36	8	05181434AA	HOSE CLAMP 3/4 SS



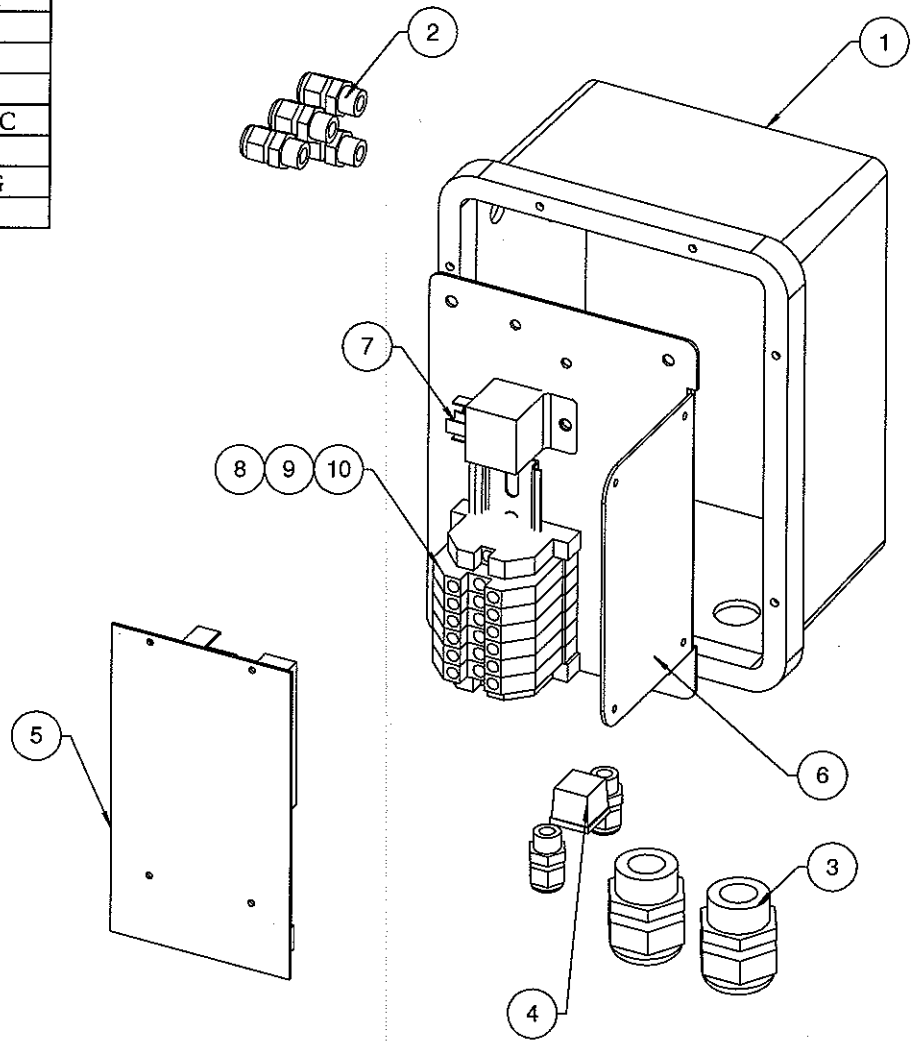
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	31312238AB	ENCLOSURE, UW/SE
2	7	1904010643	STRAIN RELIEF 3444 BLK SET
3	2	1904010043	STRAIN RELIEF 3217 1/2" GREY
4	1	1904019243	STRAIN RELIEF 1834
5	1	3131232200	CHASSIS PLATE, A W 170
6	1	B596380025	PCB MAIN 170/SF/UW/SE
7	1	3131170147	CHANNEL DIN 35 MM RAIL
8	1	31310110BF	CONTACTOR 9A AUX AW
9	3	31311501BY	TERMINAL BLOCK DIN BLACK
10	3	31311505BY	TERMINAL BLOCK DIN GREY
11	3	31311504BY	TERMINAL BLOCK DIN GREEN
12	2	31311602BY	SEPARATOR DIN
13	2	3131190347	END ANCHOR DIN RAIL STYLE
14	2	3131310400	FUSE HOLDER DIN TERMINAL
15	2	3131301800	FUSE 2A FAST BLOW 5x20mm
16	1	31311601BY	END BRACKET DIN (AW>2000)

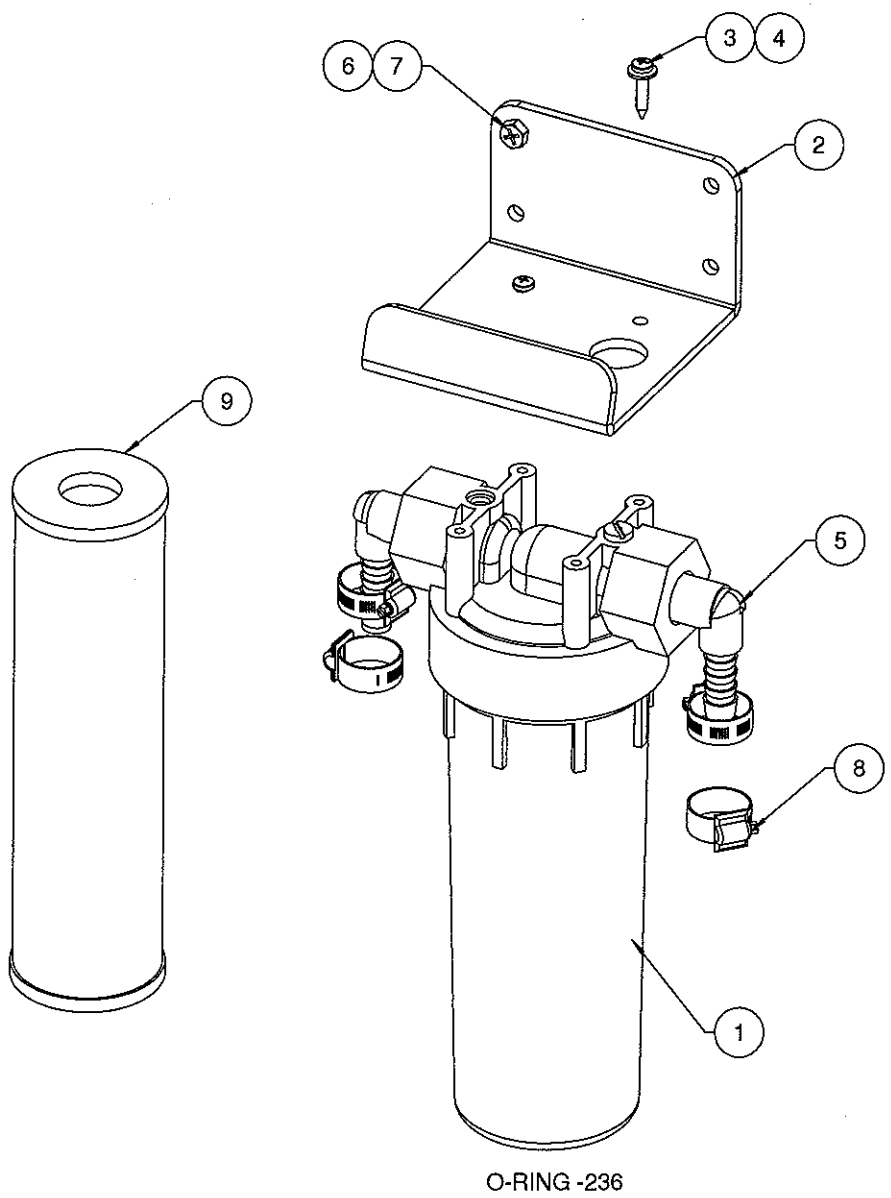


ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	31312238AB	ENCLOSURE, UW/SE
2	6	1904010643	STRAIN RELIEF 3444 BLK SET
3	2	1904010043	STRAIN RELIEF 3217 1/2" GREY
4	1	1904019243	STRAIN RELIEF 1834
5	1	B596380025	PCB MAIN 170/SF/UW/SE
6	1	B596220020	PCB STEPDOWN 170/SF/UW/SE
7	1	3131232200	CHASSIS PLATE, A W 170
8	1	3131110600	RELAY 1 FORM A (1PDT) 12VDC
9	2	31311601BY	END BRACKET DIN
10	4	31311522BY	DIN TERMINAL (GRAY) 6 AWG
11	1	3131170147	CHANNEL DIN 35 MM RAIL



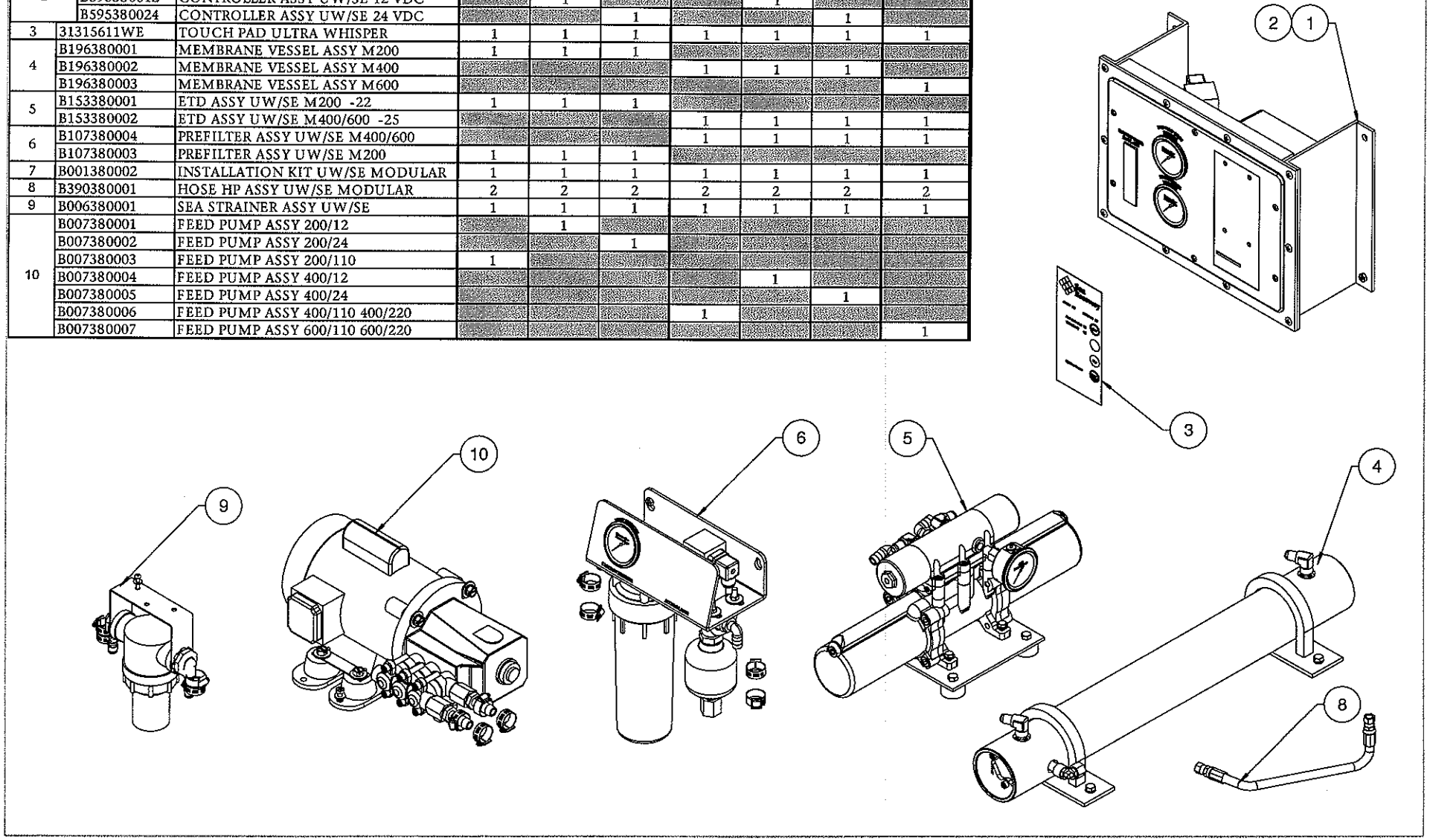
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	31312238AB	ENCLOSURE, UW/SE
2	6	1904010643	STRAIN RELIEF 3444 BLK SET
3	2	1904010043	STRAIN RELIEF 3217 1/2" GREY
4	1	1904019243	STRAIN RELIEF 1834
5	1	B596380025	PCB MAIN 170/SF/UW/SE
6	1	3131232200	CHASSIS PLATE, A W 170
7	1	3131110600	RELAY 1 FORM A (1PDT) 12VDC
8	2	31311601BY	END BRACKET DIN
9	4	31311522BY	DIN TERMINAL (GRAY) 6 AWG
10	1	3131170147	CHANNEL DIN 35 MM RAIL



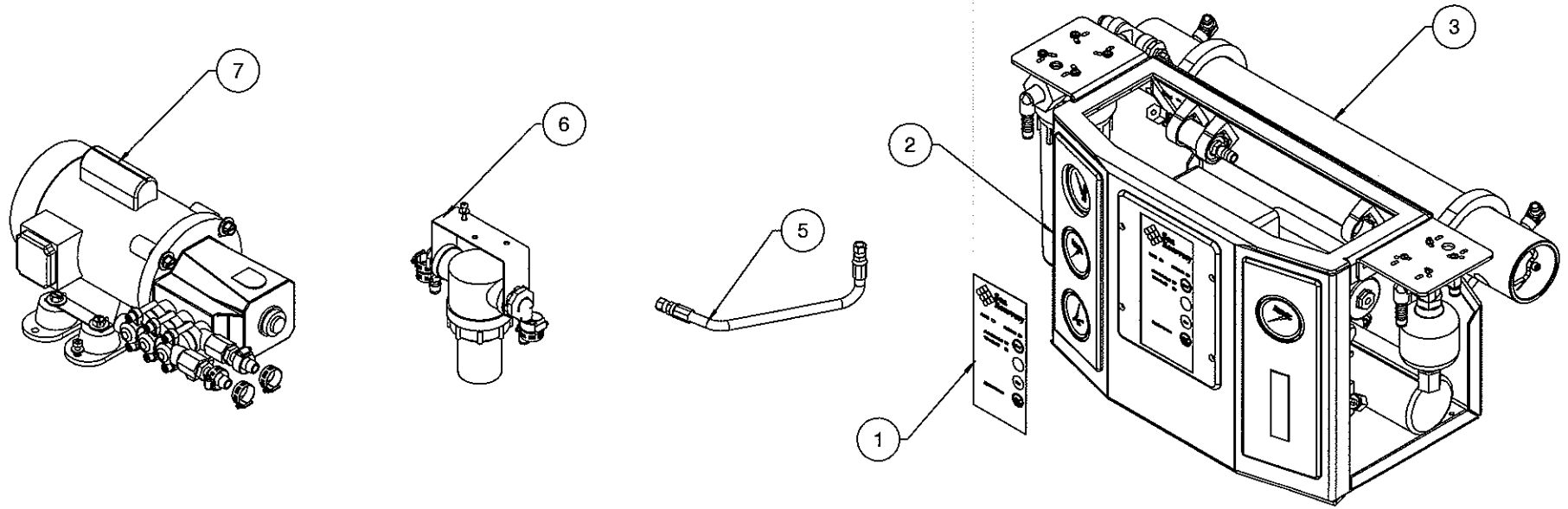


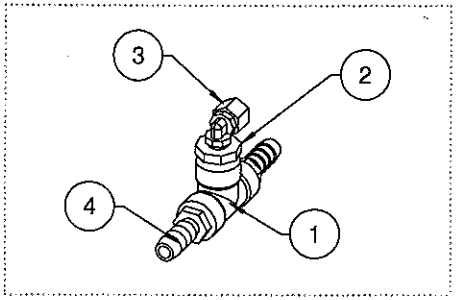
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	07650209ST	PREFILTER BOWL 250 PSI ASSY
2	1	2020043810	PLANKTON FILTER BRACKET ECO
3	4	061170628016	SC PHIL PAN "A" LAG 10 X 1.0 SS
4	4	065080028000	WASHER FLAT #10 NYLON
5	2	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC
6	4	061172143016	SCREW HEX "A" 1/4 X 1 SS
7	4	061100043000	WASHER FLAT OS 1/4 SS
8	4	05181434AA	HOSE CLAMP 3/4 SS
9	1	0805823579	ELEMENT PLANKTON

			A38000020M			A38000040M			A38000060M
			110V	12V	24V	110/220V	12V	24V	110/220V
ITEM	PART NO.	DESCRIPTION	UW-200M	UW-200M	UW-200M	UW-400M	UW-400M	UW-400M	UW-600M
1	B594380001	FRONT PANEL ASSY UW/SE	1	1	1	1	1	1	1
2	B595380007	CONTROLLER ASSY UW/SE 110/220VAC	1			1			1
	B595380012	CONTROLLER ASSY UW/SE 12 VDC		1			1		
	B595380024	CONTROLLER ASSY UW/SE 24 VDC			1			1	
3	31315611WE	TOUCH PAD ULTRA WHISPER	1	1	1	1	1	1	1
4	B196380001	MEMBRANE VESSEL ASSY M200	1	1	1				
	B196380002	MEMBRANE VESSEL ASSY M400				1	1	1	
	B196380003	MEMBRANE VESSEL ASSY M600							1
5	B153380001	ETD ASSY UW/SE M200 -22	1	1	1				
	B153380002	ETD ASSY UW/SE M400/600 -25				1	1	1	1
6	B107380004	PREFILTER ASSY UW/SE M400/600				1	1	1	1
	B107380003	PREFILTER ASSY UW/SE M200	1	1	1				
7	B001380002	INSTALLATION KIT UW/SE MODULAR	1	1	1	1	1	1	1
8	B390380001	HOSE HP ASSY UW/SE MODULAR	2	2	2	2	2	2	2
9	B006380001	SEA STRAINER ASSY UW/SE	1	1	1	1	1	1	1
10	B007380001	FEED PUMP ASSY 200/12		1					
	B007380002	FEED PUMP ASSY 200/24			1				
	B007380003	FEED PUMP ASSY 200/110	1						
	B007380004	FEED PUMP ASSY 400/12					1		
	B007380005	FEED PUMP ASSY 400/24						1	
	B007380006	FEED PUMP ASSY 400/110 400/220				1			
	B007380007	FEED PUMP ASSY 600/110 600/220							1

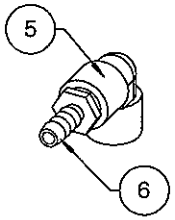


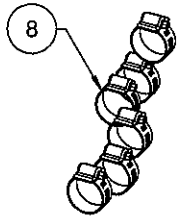
			A38000020C			A38000040C			A38000060C
			110V	12V	24V	110/220V	12V	24V	110/220V
ITEM	PART NO.	DESCRIPTION	UW-200C	UW-200C	UW-200C	UW-400C	UW-400C	UW-400C	UW-600C
1	31315611WE	TOUCH PAD ULTRA WHISPER	1	1	1	1	1	1	1
2	B589380001	COMPACT CORE ASSY 200C 110/220 VAC	1						
	B589380002	COMPACT CORE ASSY 200C 12 VDC		1					
	B589380003	COMPACT CORE ASSY 200C 24 VDC			1				
	B589380004	COMPACT CORE ASSY 400C/600C 110/220				1			1
	B589380005	COMPACT CORE ASSY 400C 12 VDC					1		
	B589380006	COMPACT CORE ASSY 400C 24 VDC						1	
3	B196380007	MEMBRANE VESSEL ASSY C200	1	1	1				
	B196380008	MEMBRANE VESSEL ASSY C400				1	1	1	
	B196380009	MEMBRANE VESSEL ASSY C600							1
4	B001380001	INSTALLATION KIT UW/SE	1	1	1	1	1	1	1
5	B390380002	HOSE HP ASSY UW/SE C200	1	1	1				
	B390380003	HOSE HP ASSY UW/SE C400				1	1	1	
	B390380004	HOSE HP ASSY UW/SE C600							1
6	B006380001	SEA STRAINER ASSY UW/SE	1	1	1	1	1	1	1
7	B007380001	FEED PUMP ASSY 200/12		1					
	B007380002	FEED PUMP ASSY 200/24			1				
	B007380003	FEED PUMP ASSY 200/110	1						
	B007380004	FEED PUMP ASSY 400/12					1		
	B007380005	FEED PUMP ASSY 400/24						1	
	B007380006	FEED PUMP ASSY 400/110 400/220				1			
	B007380007	FEED PUMP ASSY 600/110 600/220							1

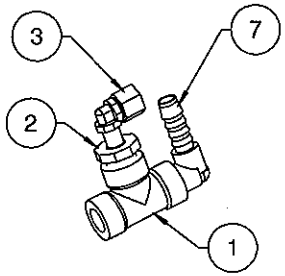


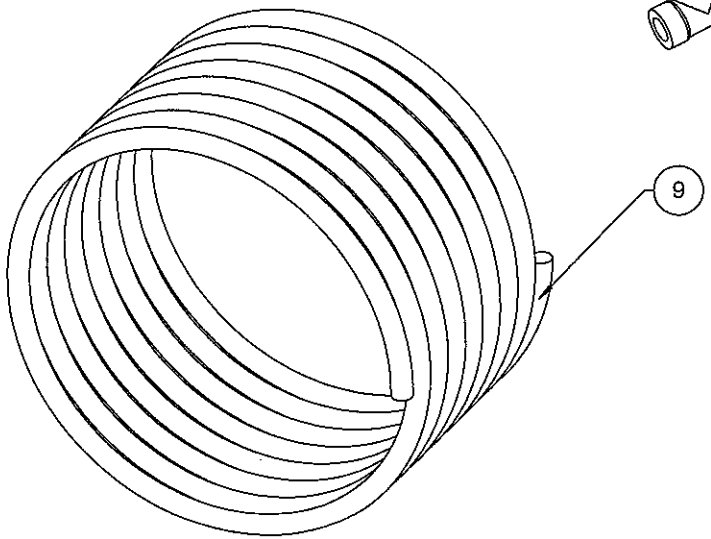


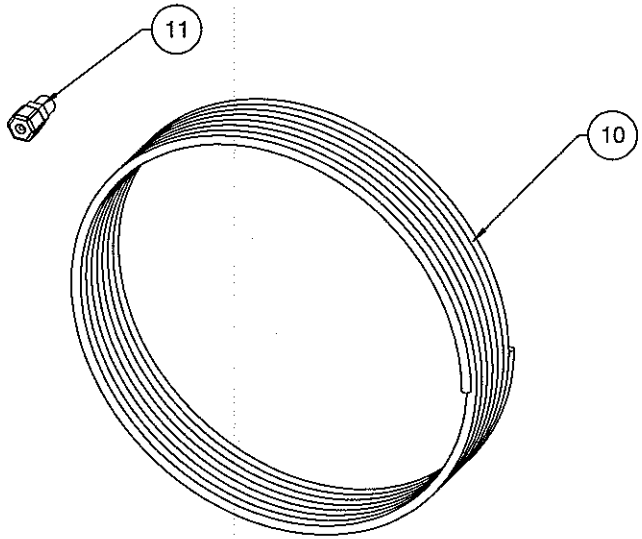
TWO TEE ASSEMBLIES ON MODULAR







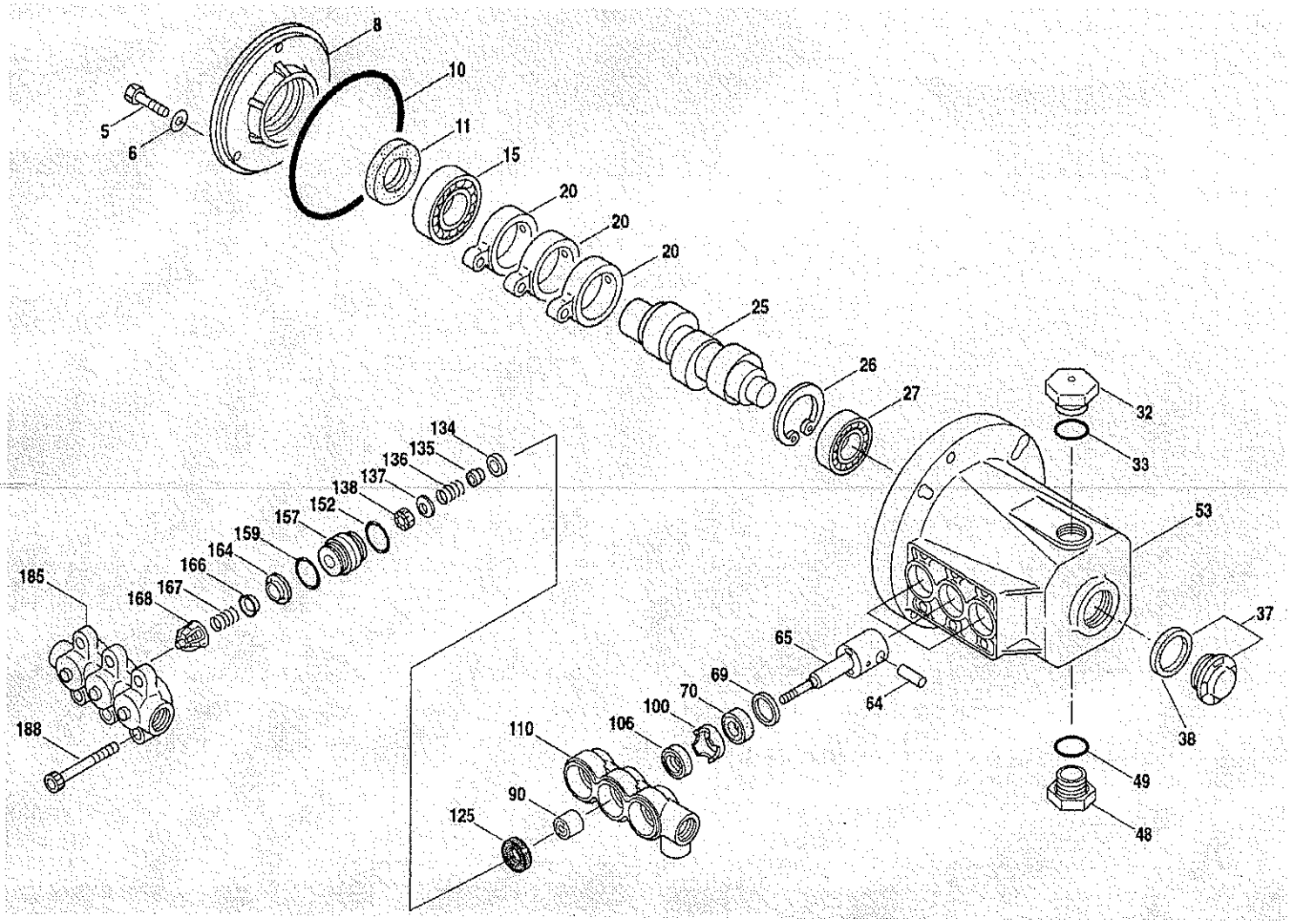




	B001380001 COMPACT	B001380002 MODULAR		
ITEM NO.	QTY.	QTY.	PART NO.	DESCRIPTION
1	1	3	0101422583	TEE 1/2 FT X 1/2 FT X 1/2 FT PVC
2	1	3	0101292383	RB 1/2 MT X 1/4 FT PVC
3	1	3	0204020869	ELB90 1/4 TUBE X 1/4 MPT PLASTIC
4		4	0101652583	ADAP 1/2 MPT X 1/2 BARB PVC
5	1	1	0101013783	ELB90 3/4 FPT X 3/4 FPT PVC
6	1	1	0101653683	ADAP 3/4 MPT X 1/2 BARB PVC
7	1	1	0101072583	ELB90 1/2 MPT X 1/2 BARB PVC
8	4	12	05181434AA	HOSE CLAMP 3/4" SS
9	30ft	30ft	0339076100	HOSE CLEAR BRAID 5/8
10	50ft	50ft	0312121969	TUBE 1/4 BLACK
11	1	1	0204090869	CONN 1/4 TUBE X 1/4 MPT PLASTI

ITEM	PART NUMBER	DESCRIPTION	QTY
5 – 255	**1218181422**	**HP PUMP x.5 GPM SS**	**1**
5 – 90	**1218181422 – 01**	**HP PUMP x.5 GPM SS CRANKCASE ASSY**	**1**
100 – 188	**1218181422 – 02**	**HP PUMP x.5 GPM SS MANIFOLD ASSY**	**1**
5	not sold separately	Screw, HHC (M6 X 16)	3
6	not sold separately	Washer, Seal (M6)	3
8	not sold separately	Cover, Bearing	1
10	not sold separately	O-Ring Bearing Cover	1
11	not sold separately	Seal, Oil, Crankshaft	1
15	not sold separately	Bearing, Ball	1
20	not sold separately	Rod, Connecting	3
25 for 400model	not sold separately	Crankshaft, 7.3 mm	1
25 for 600 model	not sold separately	Crankshaft, 10.2 mm	1
26	not sold separately	Ring, Retaining, Bearing	1
27	not sold separately	Bearing, Ball	1
32	**1218181422 - 04**	**OIL FILL CAP x.5**	**1**
33	**1218181422 - 05**	**O-RING OIL FILL CAP x.5**	**1**
37	not sold separately	Sight Glass	1
38	not sold separately	Gasket, Flat, Sight Glass	1
48	not sold separately	Oil Drain Plug	1
49	not sold separately	O-Ring, Oil Drain Plug	1
53	not sold separately	Crankcase	1
64	not sold separately	Pin, Crosshead	3
65	not sold separately	Rod, Plunger	3
69	not sold separately	Washer, Oil Seal	3
70	not sold separately	Seal, Oil Crankcase	3
90	not sold separately	Plunger, Ceramic	3
100	not sold separately	Retainer, Seal	3
106	not sold separately	Seal, LPS w/SS-Spg	3
110	not sold separately	Manifold, Inlet	1
125	not sold separately	Seal, HPS w/SS	3
134	not sold separately	Valve Inlet	3
135	not sold separately	Spacer	3
136	not sold separately	Spring, Inlet Valve	3
137	not sold separately	Washer, Conical	3
138	not sold separately	Nut	3
152	not sold separately	O-Ring, Adapter Spacer, Inner	3
157	not sold separately	Spacer, Discharge Valve	3
159	not sold separately	O-Ring, Adapter Spacer, Outer	3
164	not sold separately	Seat	3
166	not sold separately	Valve	3
167	not sold separately	Spring	3
168	not sold separately	Retainer, Spring	3
185	**1218181422 - 03**	**MANIFOLD, DISCHARGE x.5GPM SS**	**1**
188	not sold separately	Screw HSH	6
255	**061142157024**	**BOLT HEX 3/8-16 X 1 ½ SS**	**4**
	061120056000	**WASHER SPLIT LOCK 3/8 SS**	**4**
	061100056000	**WASHER FLAT OS 3/8 SS**	**4**
106, 125, 152, 159, 134, 135, 136, 137, 138, 164, 166, 167, 168	**B652220001**	**HP PUMP-C PUMP KIT (SEALS & VALVES)**	**3 Seals, 6 Valves**
106, 125, 152, 159	**B653220001**	**HP PUMP-C SEAL KIT**	**3 Seals**
134, 135, 136, 137, 138, 152, 159, 164 166, 167, 168	**B654220003**	**VALVE KIT HIGH PRES PUMP-SF**	**6 Valves**

FEED PRESSURE PUMP



10 SPECIFICATIONS

10.0 SYSTEM SPECIFICATIONS

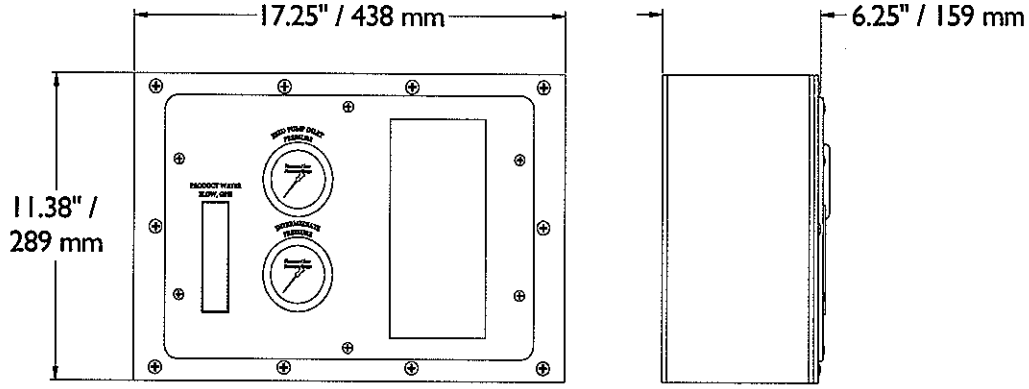
This section lists the general specifications of the Ultra Whisper Series. The series consists of a Compact Style and a Modular Style with three production rates for each style. All systems are delivered with a white power-coated aluminum frame and stainless steel or engineering plastic components for long life. Each of these systems can be ordered in different configurations. Depending on the configuration purchased the weight may vary slightly from the listed information listed in Table 10.1.

SPECIFICATIONS

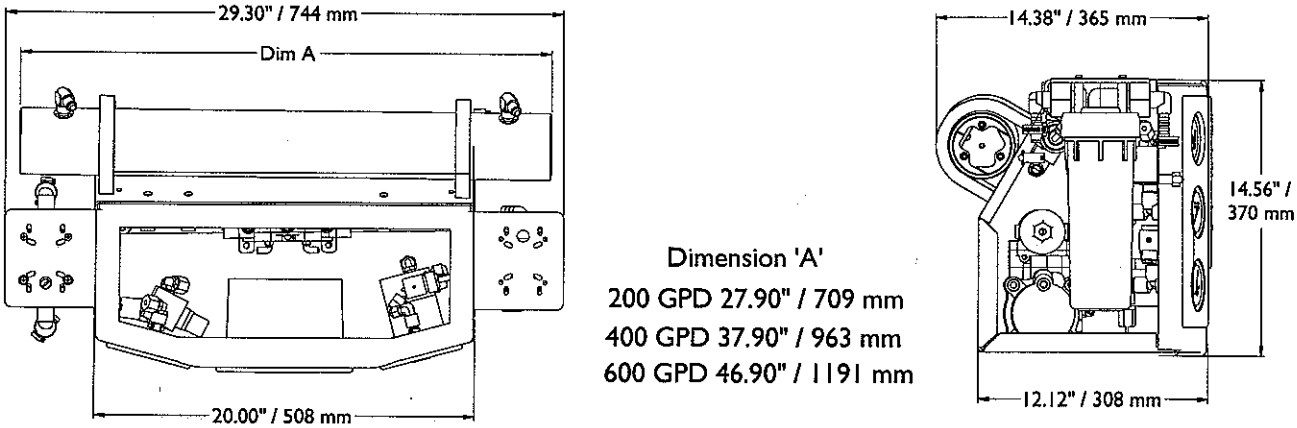
DIMENSIONS & WEIGHT:

TABLE 10.1 ILLUSTRATES THE DIMENSIONS AND WEIGHTS OF THE ULTRA WHISPER SYSTEM

MODEL	WEIGHT		LENGTH		WIDTH		HEIGHT	
	lbs	kg	inch	mm	inch	mm	inch	mm
SRC UW 200 Modular	125	56.7	17.0	432	6.3	160	11.4	290
SRC UW 400 Modular	140	63.5	17.0	432	6.3	160	11.4	290
SRC UW 600 Modular	150	68.0	17.0	432	6.3	160	11.4	290
	lbs	kg	inch	mm	inch	mm	inch	mm
SRC UW 200 Compact	130	59.0	29.3	744	14.9	378	14.4	366
SRC UW 400 Compact	145	65.8	37.9	963	14.9	378	14.4	366
SRC UW 600 Compact	155	70.3	46.9	1191	14.9	378	14.4	366



MODULAR CONTROL PANEL



COMPACT FRAME

PERFORMANCE:

PRODUCT WATER PRODUCED PER HOUR(S) OF OPERATION:

Unlike common Reverse Osmosis System, this system does not use a pressure-regulating valve to control the production rate. This system uses a hydraulic pump called, "Energy Transfer Device" (ETD) that forces the system to create a constant production rate influenced by the feed pump flow. The Energy Transfer Device keeps the production rate constant within 5 percent. The ETD's pistons change direction every couple of seconds, this change in direction cause a discontinuous flow in production but the production flow is immediately recovered. The Table 10.2 shows the potable water production rate for the Ultra Whisper Series

TABLE 10.2 ILLUSTRATES THE PRODUCTION OF EVERY ULTRA WHISPER SYSTEM

	Production per 24 hours of operation:			Production per 1 hour of operation:		
Model Number	**U.S. Gallons**	**Cubic Meters**	**Liters**	**U.S. Gallons**	**Cubic Meters**	**Liters**
SRC Ultra Whisper 200 Modular	200	0.8	757	8	0.03	30
SRC Ultra Whisper 400 Modular	400	1.5	1514	17	0.06	64
SRC Ultra Whisper 600 Modular	600	2.3	2271	25	0.09	95
	U.S. Gallons	**Cubic Meters**	**Liters**	**U.S. Gallons**	**Cubic Meters**	**Liters**
SRC Ultra Whisper 200 Compact	200	0.8	757	8	0.03	30
SRC Ultra Whisper 400 Compact	400	1.5	1514	17	0.06	64
SRC Ultra Whisper 600 Compact	600	2.3	2271	25	0.09	95

SALT REJECTION (CHLORIDE ION):

Minimum 99.2 %, Average 99.4%

PRODUCT WATER TEMPERATURE:

Product water temperature is ambient to feed water temperature. A slight increase (1-6 degrees) in the product water temperature may occur due to the heat transfer from the engine room and feed pump.

SPECIFICATIONS:

SALINITY MONITORING:

Automatic computer controlled electronic monitoring: A computer controlled monitoring system analyzes the system's product water salinity. This temperature compensating system communicates with the end user via the Water Quality Indicator on the front panel. The salinity monitoring components of the system give a continuous signal that is translated by the controller to direct the product water flow.

SALINITY RANGE OF FEED WATER:

Seawater up to 50,000 PPM TDS (NaCl)
(Typical seawater salinity is 35,000 PPM)

FEED SEAWATER TEMPERATURE RANGE:

Max. 91°F / 33°C,
Min. 33 / .5°C °F

TABLE 10.3 ILLUSTRATES THE FEED WATER FLOW RATE OF THE ULTRA WHISPER SYSTEM

	Volume of Feed Water per minute at 60 Hz			Volume of Feed Water per minute at 50 Hz		
Model Number	**U.S. Gallons**	**Cubic Meters**	**Liters**	**U.S. Gallons**	**Cubic Meters**	**Liters**
SRC Ultra Whisper 200 Modular	1.5	0.006	5.68	1.25	0.005	4.73
SRC Ultra Whisper 400 Modular	2.5	0.009	9.46	2.08	0.008	7.89
SRC Ultra Whisper 600 Modular	3.5	0.013	13.25	2.92	0.011	11.04
	U.S. Gallons	**Cubic Meters**	**Liters**	**U.S. Gallons**	**Cubic Meters**	**Liters**
SRC Ultra Whisper 200 Compact	1.5	0.006	5.68	1.25	0.005	4.73
SRC Ultra Whisper 400 Compact	2.5	0.009	9.46	2.08	0.008	7.89
SRC Ultra Whisper 600 Compact	3.5	0.013	13.25	2.92	0.011	11.04

SYSTEM SEAWATER FEED:

The feed water flow rate will always be much higher than the production flow rate. Only 9 percent (200 model) or 12 percent (models 400/600) of the feed water is forced through the membrane to produce fresh water. The rest of the feed water is used to carry the solid particles overboard. The feed water is pressurized by a positive displacement feed pump. These positive displacement pumps displace a fixed volume of water every cycle. The cycle is controlled by the motors frequency. Therefore, a motor operating at a higher frequency will have a larger flow rate than when it is operating at a lower frequency. Table 10.3 lists the feed flows at 60Hz and 50 Hz for each system.

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:

SEAWATER FEED PRESSURE:
The Feed Water Pressure is directly related to the System Pressure. The feed-pressure is the pressure after the feed-pump and the System-pressure is the pressure after the Energy Transfer Device to the membrane. The System Pressure is determined by the membrane and other factors to produce a fixed volume of product water. The Feed Water Pressure is the pre-amplified pressure needed to produce the rated product flow of water. This relationship has a limit on the maximum feed pressure to maintain a safe and operable arrangement. This limit also limits the system pressure to 1020 pound per square inch-gauge.

TABLE 10.4 ILLUSTRATES MAXIMUM ALLOWABLE FEED PRESSURES FOR EACH MODEL

MODEL	Maximum Allowable Feed Pressure					
	PSI	Bar	Kg/cm2	KiloPascal	inch of Hg	cm of Hg
SERIES 200	125	8.6	8.8	862	255	646
SERIES 400	190	13.1	13.4	1310	387	983
SERIES 600	220	15.2	15.5	1517	448	1138

In seawater below 41°F / 5°C, the feed water pressure may rise near to the pressures listed in Table 10.4. The system will generally run in a typical seawater condition with the feed pressures listed in Table 10.5. Chapter 8 better represents the systems pressure response in the world oceans.

TABLE 10.5 ILLUSTRATES TYPICAL FEED PRESSURE FOR EACH MODEL

MODEL	Feed Pressure in Typical Seawater					
	PSI	Bar	Kg/cm2	KiloPascal	inch of Hg	cm of Hg
SERIES 200	80	5.5	5.6	552	163	414
SERIES 400	140	9.7	9.8	965	285	724
SERIES 600	185	12.8	13.0	1276	377	957

SYSTEM/OPERATION PRESSURE:

Typical seawater has a salinity of 35,000 PPM TDS and averages a temperature of 77°F / 25°C. Under these conditions the system operating pressure will be approximately 700 psig. The operation pressure table lists the annual mean operating system pressures in regions around Alaska, off the coast of California and in the Red Sea respectively.

Figures in Chapter 8 illustrate the salinity and temperature of seawater around the world. These Figures were used to determine the values for Table 10.6. Chapter 8 also contains charts that illustrate the change in pressure as a result of the change in temperature and salinity of incoming feed water. The system pressure (membrane's osmotic resistance/pressure) is determined by the temperature and salinity of the incoming feed water.

TABLE 10.6 ILLUSTRATES THE SYSTEM PRESSURES IN DIFFERENT CLIMATES OF THE WORLD

MODEL	System pressure in different regions of the world						Water	Salinity
	PSI	Bar	Kg/cm2	KiloPascal	inch of Hg	cm of Hg	Temperature	Condition
SERIES 200	828	57.1	58.2	5709	1686	4282	COLD	LOW
SERIES 200	641	44.2	45.1	4420	1305	3315	TYPICAL	TYPICAL
SERIES 200	715	49.3	50.3	4930	1456	3698	HOT	HIGH
SERIES 400	999	68.9	70.2	6888	2034	5166	COLD	LOW
SERIES 400	727	50.1	51.1	5012	1480	3760	TYPICAL	TYPICAL
SERIES 400	816	56.3	57.4	5626	1661	4220	HOT	HIGH
SERIES 600	1020	70.3	71.7	7033	2077	5275	COLD	LOW
SERIES 600	761	52.5	53.5	5247	1549	3936	TYPICAL	TYPICAL
SERIES 600	823	56.7	57.9	5674	1676	4256	HOT	HIGH

EXTERNAL INSTALLATION WATER CONNECTIONS:

See Chapter 1, for external components supplied by the installer. External component pipe sizes shall mate to the supplied components listed below. The items below are included in the system installation kit.

Feed Inlet: ¾ " FEMALE NPT ELBOW & ¾ " MALE NPT x ½ " HOSE BARB CONNECTOR
Brine Discharge: ½ " FEMALE NPT TEE
Product Tank: ¼ " MALE NPT x ¼" TUBE ELBOW

ELECTRICAL MOTOR SPECIFICATIONS:

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

ALTERNATING CURRENT SYSTEMS:

The H.P. column in Table 10.7 lists the horsepower rating of the motor installed on each unit. Note the motors are rated higher than the actual power used to ensure production flows in any condition. The actual power used will vary depending on the pressure required to produce the rated flow of product water. Keep in mind that the system pressure and power requirement will increase with lower temperature and higher salinity feed water and will drop with higher temperatures and lower salinities.

TABLE 10.7 LISTS THE H.P. RATING OF THE MOTOR AND THE LOAD RANGE IN AMPERES

SYSTEM	VAC	H.P. 50 Hz	FLA	LRA		VAC	H.P. 60 Hz	FLA	LRA
200 COM/MOD	115	1/3	5.9	10.3		115	1/3	5.5	9.4
200 COM/MOD	230	1/3	2.9	5.3		230	1/3	2.7	4.2
400 COM/MOD	115	1/3	8.6	14.4		115	1/3	7.2	12
400 COM/MOD	230	1/3	4.3	6.7		230	1/3	3.6	5.6
600 COM/MOD	115	1/2	11.8	18		115	1/2	9.8	15
600 COM/MOD	230	1/2	5.9	9.6		230	1/2	4.9	8

DIRECT CURRENT SYSTEMS:

SYSTEM	VDC	H.P.	FLA
200 COMPACT/MODULAR	12	1/8	9
200 COMPACT/MODULAR	24	1/8	4.5
400 COMPACT/MODULAR	12	1/3	22
400 COMPACT/MODULAR	24	1/3	11

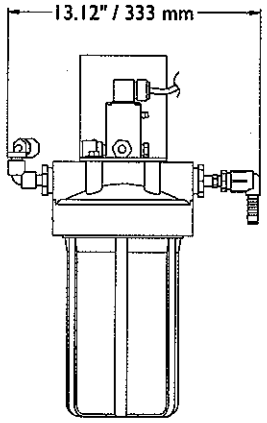
The Direct Current systems are designed more for power-efficiency. These systems will have a greater variation in the product flow rate but will use less power. In very cold waters, the amount of power required to produce the rated product water may exceed the motors power rating. This power requirement is compensated by slightly lowering the product flow rate. These production variations may only be noticeable of the Series-200.

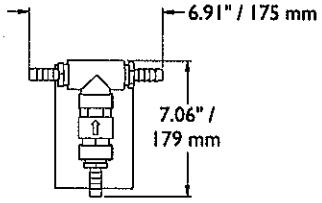
RECOMMENDED CIRCUIT PROTECTION:

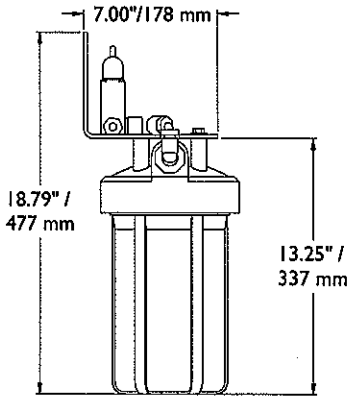
OPERATING VOLTAGE Recommended	Circuit Protection	Wire Size AWG (Min)
200 GPD COMPACT/MODULAR		
12 VDC	20 Amperes	14 AWG
24 VDC	10 Amperes	14 AWG
115 VAC	10 Amperes	14 AWG
230 VAC	6 Amperes	14 AWG
400 GPD COMPACT/MODULAR		
12 VDC	60 Amperes	8 AWG
24 VDC	30 Amperes	10 AWG
115 VAC	20 Amperes	14 AWG
230 VAC	10 Amperes	14 AWG
600 GPD COMPACT/MODULAR		
115 VAC	22 Amperes	14 AWG
230 VAC	12 Amperes	14 AWG

A circuit protection fuse is mandatory in order to protect the system and prevent over-current. An over-current is an abnormally high current that has the potential to cause failure in an electrical circuit. An out-of-range condition in the power source, voltage sag or a decrease in load impedance can cause an over-current. A fuse is a current sensitive device that is designed as the intentional weak link in the electrical circuit. The function of the fuse is to provide protection of the system by reliably melting under current overload conditions.

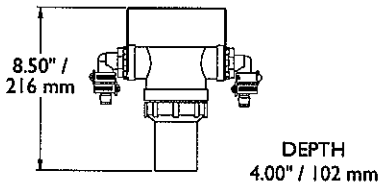
Wires have a limited current-handling capacity. The wire can be damaged if the current increases beyond its normal operating limits. The wire size is important because wires have voltage-drops when carrying current similar to pressure-drops in a pipe moving fluid. All of these considerations must be taken when sizing a wire for a system. If the installation requires wire length greater than the supplied wires, please seek the advice of a licensed electrician for proper wire sizing. Always take precautions to prevent damage or injury from loads



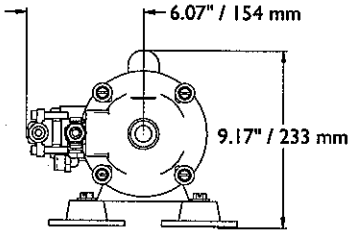


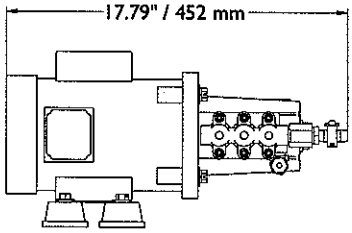


(OPTIONAL) FRESH WATER FLUSH

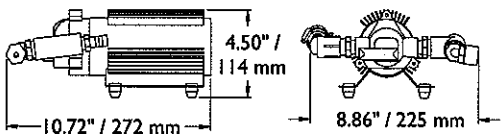


SEA STRAINER

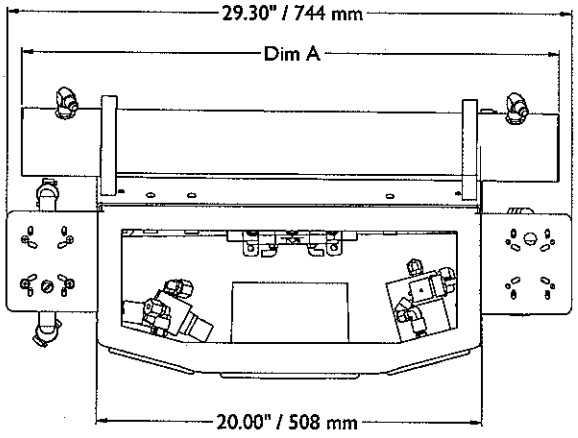




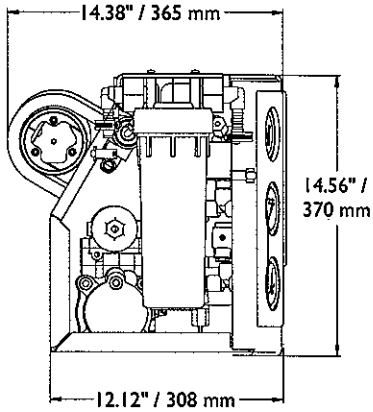
FEED PUMP 200, 400 & 600 GPD (AC)



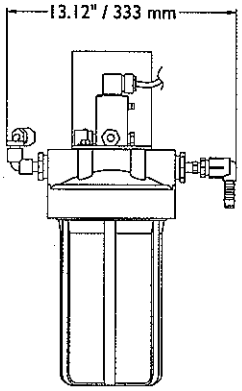
FEED PUMP 200 GPD (DC)

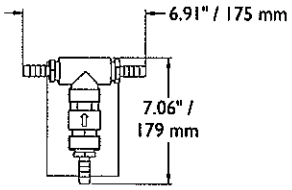


Dimension 'A'
200 GPD 27.90" / 709 mm
400 GPD 37.90" / 963 mm
600 GPD 46.90" / 1191 mm

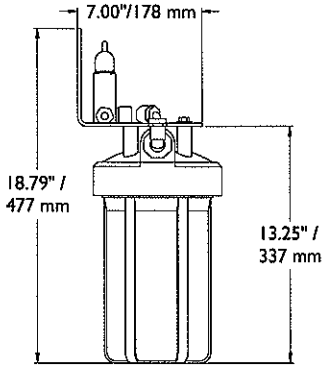


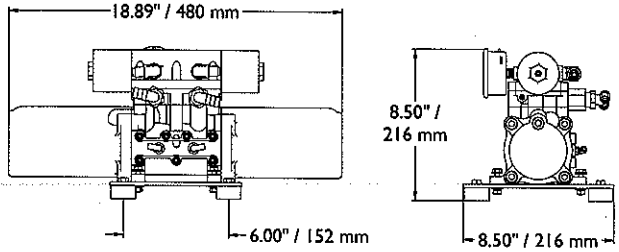
ULTRA WHISPER COMPACT SYSTEM DIMENSIONS (SEE PAGE 9.22 FOR COMPLETE ITEM LIST)



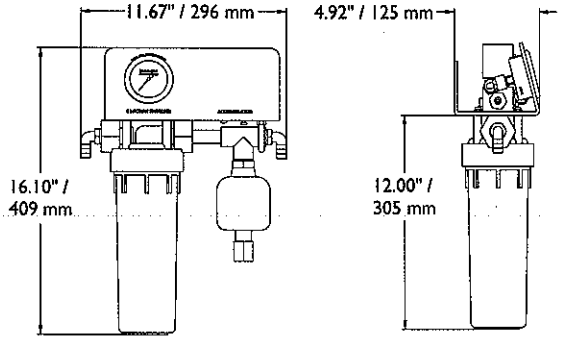


(OPTIONAL) FRESH WATER FLUSH

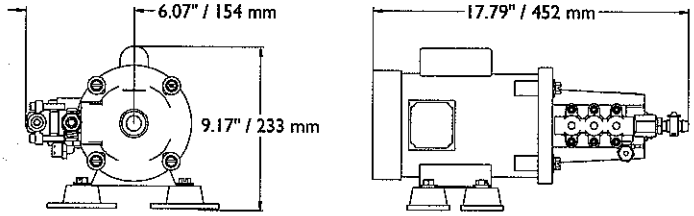




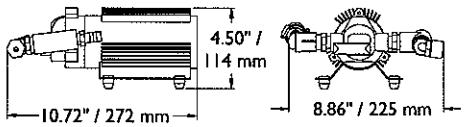
MODULAR ETD ASSEMBLY



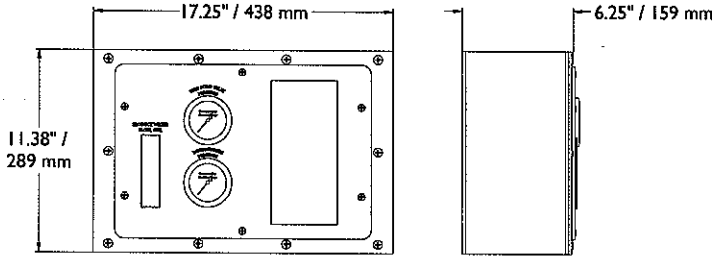
PREFILTER ASSEMBLY



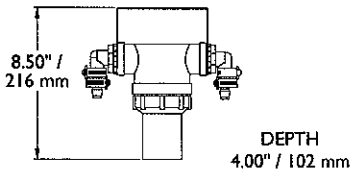
FEED PUMP 200, 400 & 600 GPD (AC VOLTAGE)



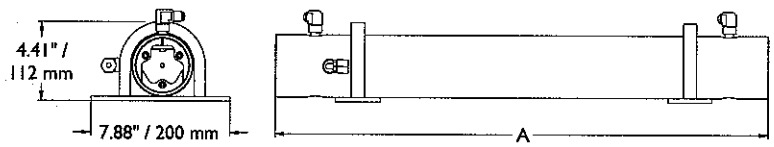
FEED PUMP 200 GPD (DC VOLTAGE)



MODULAR CONTROL PANEL



SEA STRAINER



MEMBRANE VESSEL ASSEMBLY

DIMENSION 'A'

200 GPD - 27.90" / 709 mm
400 GPD - 37.90" / 963 mm
600 GPD - 46.90" / 1191mm

ULTRA WHISPER MODULAR SYSTEM DIMENSIONS (SEE PAGE 9.21 FOR COMPLETE ITEM LIST)

11 GLOSSARY

11 GLOSSARY OF TERMS

ACCUMULATOR- a component in a hydraulic circuit that stores, contains and discharges pressure used to remove shocks.
BALLAST- Electrical device to develop and regulate a steady supply of current (normally used in a UV Sterilizer) to a flourescent type bulb
BIOCIDE- Storage chemical is normally used within the reverse osmosis membrane to inhibit bacteria growth when the membrane is not in use (sodium bisulfite)
BPT- British Standard Pipe Thread
BRINE- refers to water discharged from the desalinator which is saturated with additional salts (also known as concentrate)
BUSHING- cylindrical fitting to connect or space two components
CHARCOAL FILTER- activated carbon filter used to neutralize chlorine and improve the taste and smell of product water
COARSE STRAINER- initial water strainer used on a desalinator's feed water to remove large particles (also known as sea strainer)
CONDUCTIVITY- electronic conductance measurement to distinguish the amount of impurities within a water source (also known as salinity)
CONTACTOR- electrical device or heavy duty relay used to switch electrical current
CONTROL MANIFOLD- the main mechanical control devise housing various components of a reverse osmosis desalinator
CONTROLLER- the main electrical control housing of a deslinator
DESALINATOR- a machine which removes salts from a feed water source and produces potable water
DESALINATION- the process of reverse osmosis or the process of removing salts from a feed water source to produce potable water through reverse osmosis.
DIRECT DRIVE- the direct coupling of a pump/motor or pump/ clutch
DIVERSION VALVE- 3 way control valve used to manually or automatically route product water to the brine discharge or to the product water holding tank
ELEMENT- a term used to distinguish a particular component of a reverse osmosis desalinator (also known as a membrane or pre-filter)
END PLUG- device which holds high pressure, diverts water to and from the reverse osmosis membrane and seals the end of a pressure vessel
ENERGY TRANSFER DEVICE (ETD)- a pump that pressurizes the feed water by transferring the pressure from the high-pressure brine water exiting the membrane and the pressure from the feed pump to this feed water.
ESCUTCHEON- a protective or ornamental (graduated scale) shield to a desalinators flow meter (also known as a flow meter label)
FEED FLOW- the volume of the water source feeding the desalinator
FEED PUMP- the pump used to push water though the pre-filtration system and drive the Energy Transfer Device.
FILTER- a device used to remove suspended solids from a water source.
FLARE FITTING- fitting which spreads open to cause a seal tension as you tighten it
FLOW METER- component which measures the flow rate of water
FNPT- Female National Pipe Thread (American Standard)
FOULING - to become or be decomposed: to become encrusted, clogged, or choked with a foreign substance
GENERATOR- a device which converts mechanical energy into electrical power
GLYCERIN- an inert chemical used in pressure gauges to reduce needle vibration and in membrane storage to reduce the freezing point
GPD- Gallons Per Day (US. Gallons)
GPH- Gallons Per Hour (US. Gallons)
HOSE BARB- grooved fitting which holds a hose in place allowing the hose to slide on the fitting and develops friction to avoid sliding off
LPD- Liters Per Day (Liter= 3.785 gallons)
LPH- Liters Per Hour
MANIFOLD- device which unites various components into a single unit
MEMBRANE- thin film composite layered sheets of material spiral wound to act as a filter element capable of rejecting salts while passing product water; used in a reverse osmosis desalinator
MICROMHOS- the unit of measurement of the conductivity of water
MICRON- a unit of size equal to one thousandth of millimeter
MNPT- Male National Pipe Thread (US. Standard)
O-RING- a cylindrical band which holds water and pressure by sealing between two smooth surfaces
OEM- Original Equipment Manufacturer (commonly boat builders)
OSMOSIS- a diffusion or absorption of two water sources through a semipermeable membrane typically diluting each fluid into equal purity

PERMEATE- water that has passed through a reverse osmosis membrane (also known as product water or potable water)
pH- a negative logarithm of the effective acidity and alkalinity on a scale from 1-14 with 7= neutral, 1= most acidic and 14= most alkaline
PICKLING- processing of storing the reverse osmosis element with storage chemical.
POTABLE- tested water produced by the desalinator which is of acceptable quality (less than 800 ppm or 1600 micro mhos as defined by the World Health Organization as acceptable quality drinking water)
POTTING- material used to enclose or fill voids within an enclosure
PPM- Parts Per Million based on weight
PRE-FILTER- device used to remove suspended solids from a desalinator's feed water , used as a first step to protect the reverse osmosis membrane
PRESSURE VESSEL- cylindrical housing for the reverse osmosis membrane
PRODUCT WATER- water exceeding quality standards normally going into storage for use, or the potable water produced from a desalinator
PSI- Pounds Per Square Inch
RECOVERY- percentage of product water produced from the volume of feed water
RELAY- electrical device used as a switch; device actuated by electrical current
(as a switch) with the same or a different circuit
REVERSE OSMOSIS- the act of reversing the osmotic process through pressure to push feed water through a semi-permeable membrane and produce potable water
SALINITY- the amount of salts and minerals contained in a water source (normally measured in ppm, TDS or Micro MHOS)
SALT REJECTION- the percentage of salts in the brine water rejected by the reverse osmosis membrane.
SCALING- refers to the precipitation and deposition of sparingly soluble salts such as calcium sulfate or barium sulfate.
SCHEMATIC- a diagram, technical drawing or presentation usually indicating plumbing or electrical connections
SEA STRAINER- device to remove larger particles from the desalinators feed water (also known as Coarse Strainer)
SEAL- device to prevent fluid leakage
SEMI-PERMEABLE- refers to a reverse osmosis membrane which allows passage of product water while withholding salts from passage (normally referring to the membrane)
SLINGER- barrier which deflects fluid from passing
SPANNER WRENCH- wrench having a socket or head to fit a specific hole, nut or slot
SUBDIVISION- something produced by subdividing a system into sets of components that perform individual tasks.
SWEET WATER- reverse osmosis product water
SYSTEM - an assemblage of components that together perform one or more vital functions.
TDS- Total Dissolved Solids (see also Conductivity)
TFC- Thin Film Composite material used in the reverse osmosis membrane
TONS OF WATER- a measure of water (1m3 (ton) - 264 US. Gallons)
TRANSFORMER- electrical device used to change the potential of an AC power source
ULTRAVIOLET STERILIZER- device which radiates an intense light capable of sterilizing bacteria, viruses and pathogens
VESSEL- hollow enclosure used to hold pressure and encompass the reverse osmosis membrane
VESSEL / MANIFOLD- the combination of membranes, vessels, end-plugs, o-rings, manifolds and controls
VIBRATION ISOLATOR- rubber floating bracket which absorbs sound and vibration