Aqua Whisper Series
SYSTEM MANUAL

Sea Recovery®
REVERSE OSMOSIS DESALINATORS

Aqua Whisper Series – Frame Style with Internal Booster Pump
SRC AWF 400-1 & SRC AWF 800-2
SRC AWF 600-1 & SRC AWF 1200-2
SRC AWF 800-1 & SRC AWF 1500-2

Aqua Whisper Series – Compact Style with External Booster Pump
SRC AWC 400-1 & SRC AWC 800-2
SRC AWC 600-1 & SRC AWC 1200-2
SRC AWC 800-1 & SRC AWC 1500-2

Aqua Whisper Series – Modular Style with Individually Mounted Components
SRC AWM 400-1 & SRC AWM 800-2
SRC AWM 600-1 & SRC AWM 1200-2
SRC AWM 800-1 & SRC AWM 1500-2

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: 1/12/99, 3/23/99, 1/3/00, 6/1/01 9/1/01, 11/1/01, 3/1/02
6651870001

Declaration Of Conformity

CE

CONFORMITY DECLARATION

Manufacturer's Name: **SEA RECOVERY CORP.**

Manufacturer's Address: **19610 S. RANCH WAY RANCHO DOMINGUEZ, CA 90220, U.S.A.**

SEA RECOVERY CORP. Declares that the product:

Product Name: **AQUA WHISPER SERIES and COMMERCIAL SEA SERIES of REVERSE OSMOSIS DESALINATORS**

Model Numbers: **NORTH SEA, TASMAN SEA, CORAL SEA, AQUA WHISPER FRAME, AQUA WHISPER COMPACT, AQUA WHISPER MODULE, AQUA EXTERNAL DRIVEN, AQUA CUBE and CRYSTAL SEA.**

Conforms to the following Standard(s): EN 55011A and EN 50082-2

SUPPLEMENTARY INFORMATION:

"The product complies with the requirements of the EMC Directive 89/336/EEC."

SEA RECOVERY CORPORATION * GARDENA, CALIFORNIA * Seal of Quality

Official Seal

CHRIS ROLLINS
VP Director of Quality Assurance, SRC
Manufacturer's Contact

Sea Recovery®
REVERSE OSMOSIS DESALINATORS

ABS®

TYPE APPROVAL PROGRAM

99LA27575-X	24 FEBRUARY 1999
CERTIFICATE NUMBER	DATE

SEA RECOVERY CORPORATION
P.O.BOX 2560 GARDENA,CA.90247-2560
PLANT LOCATION
LOS ANGELES,CA.
PORT OFFICE

CERTIFICATE OF Type Approval

This is to Certify

that a representative of this Bureau did, at the request of the Company, attend their facilities on the date and location noted above, in order to carry out survey of the facilities and associated quality procedures. The facility is considered capable of manufacturing a product which meets the designated standards. The equipment listed on the Attachment is eligible to be placed on this Bureau's ***List of Type Approved Equipment,*** subject to annual facility surveys by a representative of this Bureau and renewal of this Certificate after five (5) years.

EQUIPMENT DESCRIPTION: REVERSE OSMOSIS DESALINATORS

ISSUE DATE: 24FEB. 1999 EXPIRATION DATE: 24FEB. 2004

SURVEYOR'S SIGNATURE: John C. Seitz

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of American Bureau of Shipping or a statutory, industrial or manufacturer's standard and is issued solely for the use of the Bureau, its committees, its clients or other authorized entities. This certificate is governed by the terms and conditions on the reverse side hereof.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Information to user. - Changes or modifications not expressly approved by Sea Recovery Corporation could void the your authority to operate this equipment.

Statement of Compliance

Presented to

Sea Recovery Corporation

The following model was tested and found to be fully compliant
with FCC/CISPR 22/85 Class A (ANSI C63.4 1992),
EN55011 Class A Group 1 (1991) & EN50082-2 (1995)

Water Desalinator, AW Series

Tested at CKC Laboratories, Inc. on September 28-29, 1998
Report Number: **FA98-126 & CE98-254**

CKC LABORATORIES, INC. — Testing the Future

DAR Registration No. DAT-P-051/95-00

Tracy Phillips
Tracy Phillips
Documentation Control Supervisor

Dennis Ward
Dennis Ward
Director of Laboratories

Congratulations!

You have just purchased the QUIETEST and MOST ADVANCED WATER MAKER IN THE WORLD!

PLEASE TAKE A MOMENT AFTER OPENING THE SYSTEM SHIPPING CONTAINER TO VERIFY IT'S CONTENTS:

Aqua Whisper Frame Style:
- Carton #1:
  - *"AquaWhisper"*™ Frame Style Reverse Osmosis Desalinator System
  - Raw Water Sea Strainer with Installation Hardware
  - Installation Kit
  - Owners Manual
- Carton #2:
  - *"AquaWhisper"*™ Reverse Osmosis Membrane & Vessel Assembly
    - NOTE: Depending upon the configuration in which the System was ordered, the Reverse Osmosis Membrane & Vessel Assembly may be either in the main shipping carton and attached to the frame of the AquaWhisper Frame Style System in or it may be in a separate carton.

or

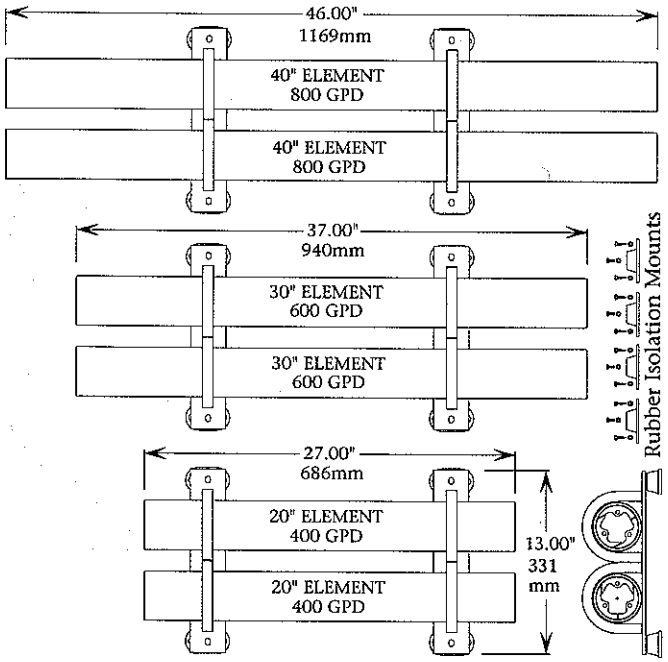
Aqua Whisper Compact Style:
- Carton #1:
  - *"AquaWhisper"*™ Compact Style Reverse Osmosis Desalinator System
  - Raw Water Sea Strainer with Installation Hardware
  - Installation Kit
  - Booster Pump
  - Owners Manual
- Carton #2:
  - *"AquaWhisper"*™ Reverse Osmosis Membrane & Vessel Assembly
    - NOTE: Depending upon the configuration in which the System was ordered, the Reverse Osmosis Membrane & Vessel Assembly may be either in the main shipping carton and attached to the frame of the AquaWhisper Compact Style System in or it may be in a separate carton.

or

Aqua Whisper Modular Style:
- Carton #1:
  - *"AquaWhisper"*™ Modular Style Reverse Osmosis Desalinator Components
  - Raw Water Sea Strainer with Installation Hardware
  - Installation Kit
  - Booster Pump
  - Owners Manual
- Carton #2:
  - *"AquaWhisper"*™ Reverse Osmosis Membrane & Vessel Assembly
    - NOTE: Depending upon the configuration in which the System was ordered, the Reverse Osmosis Membrane & Vessel Assembly may be either in the main shipping carton or it may be in a separate carton.

DO NOT DISCARD THE PACKAGING
UNTIL THE SYSTEM HAS BEEN INSTALLED AND COMMISSIONED

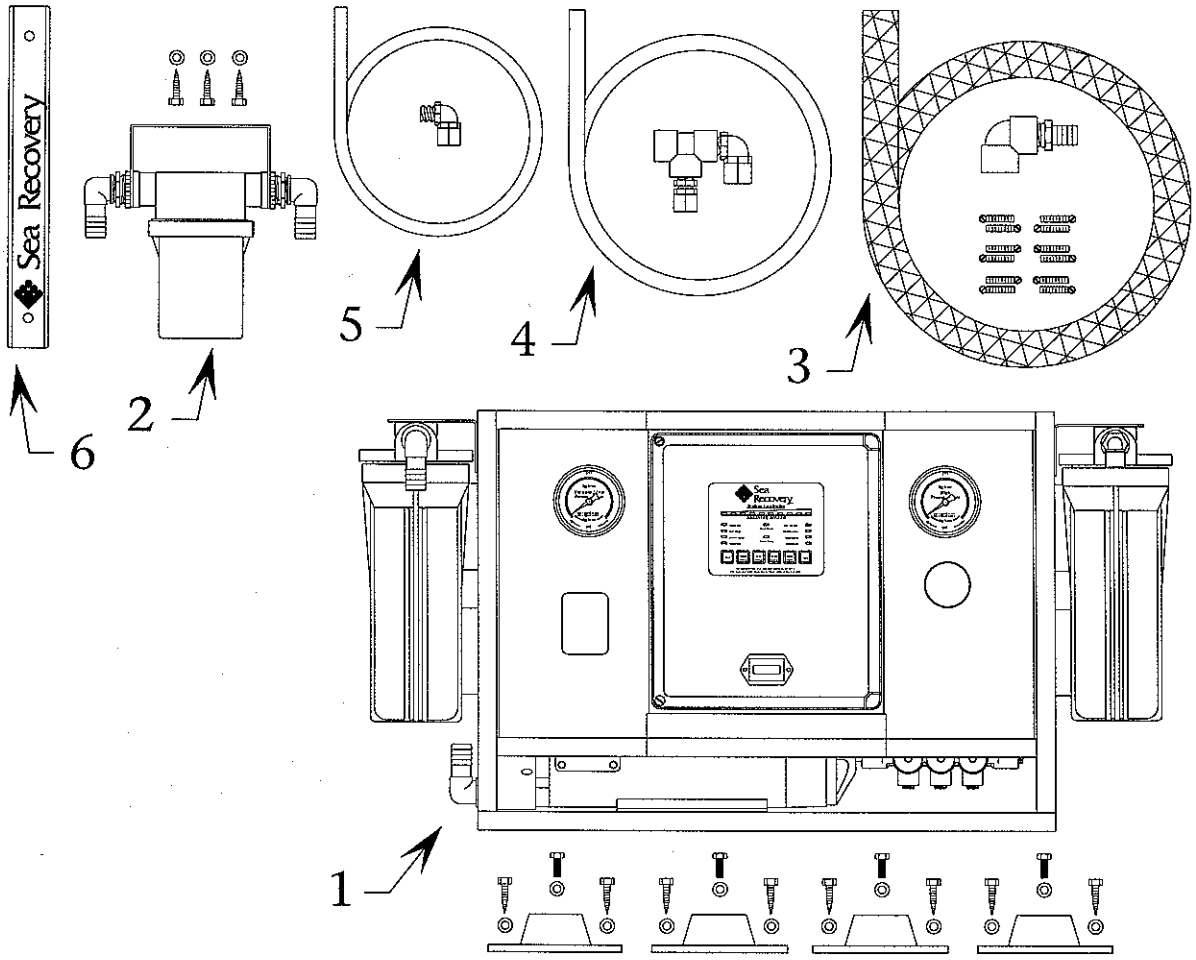
INCLUDED WITH YOUR:
Sea Recovery *"AquaWhisper"*
Frame Style Reverse Osmosis Desalinator



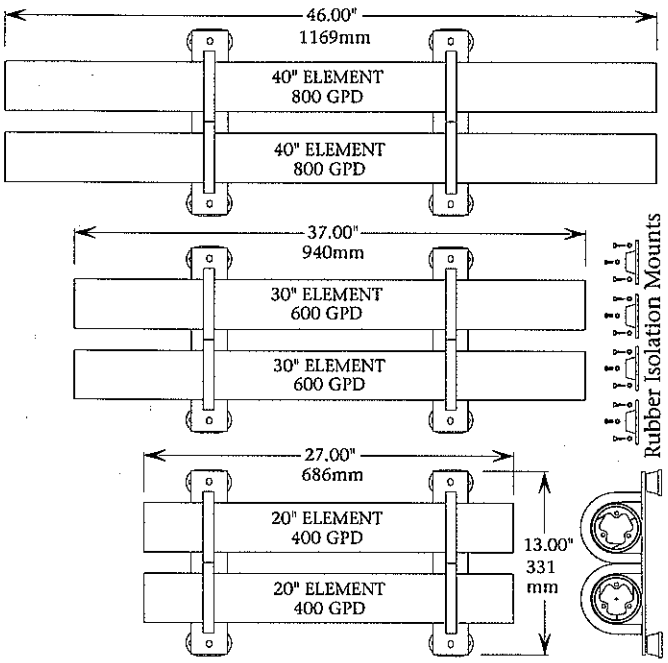
The R.O. Membrane Vessel Assembly will consist of one or two Pressure Vessels depending upon the system ordered and it may be preinstalled onto the Frame or loose in a separate carton.

The AquaWhisper 400-1 includes one 27 inch long Pressure Vessel
The AquaWhisper 800-2 includes two 27 inch long Pressure Vessels
The AquaWhisper 600-1 includes one 37 inch long Pressure Vessel
The AquaWhisper 1200-2 includes two 37 inch long Pressure Vessels
The AquaWhisper 800-1 includes one 46 inch long Pressure Vessel
The AquaWhisper 1500-2 includes two 46 inch long Pressure Vessels

Refer to Section E for a complete description of each component included.



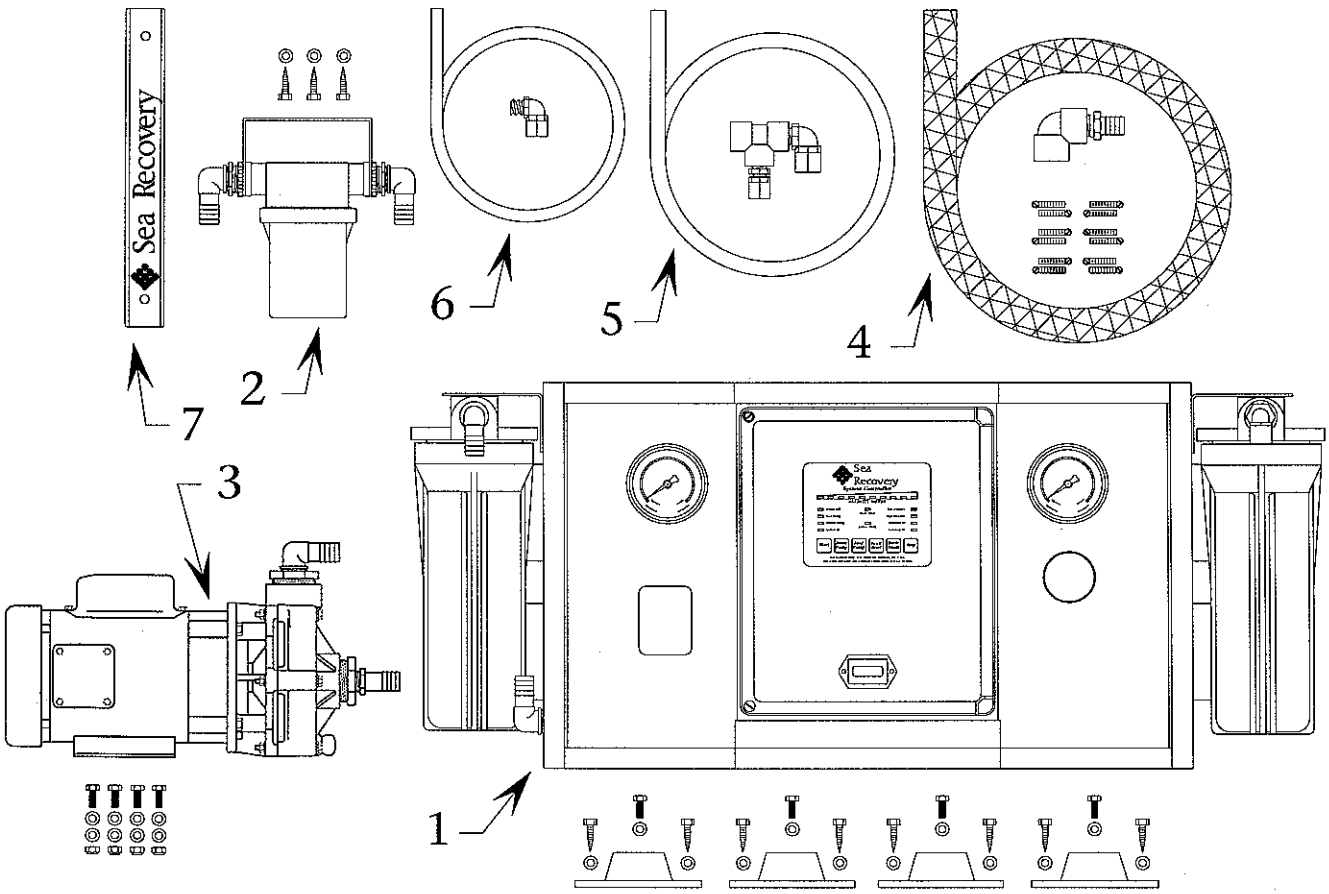
INCLUDED WITH YOUR:
Sea Recovery *"AquaWhisper"*
Compact Style Reverse Osmosis Desalinator



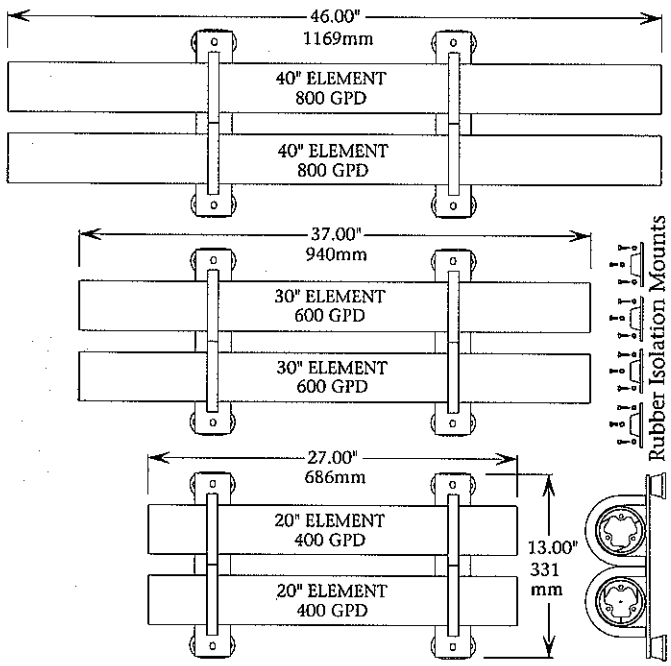
The R.O. Membrane Vessel Assembly will consist of one or two Pressure Vessels depending upon the system ordered and it may be preinstalled onto the Compact System or loose in a separate carton.

The AquaWhisper 400-1 includes one 27 inch long Pressure Vessel
The AquaWhisper 800-2 includes two 27 inch long Pressure Vessels
The AquaWhisper 600-1 includes one 37 inch long Pressure Vessel
The AquaWhisper 1200-2 includes two 37 inch long Pressure Vessels
The AquaWhisper 800-1 includes one 46 inch long Pressure Vessel
The AquaWhisper 1500-2 includes two 46 inch long Pressure Vessels

Refer to Section E for a complete description of each component included.



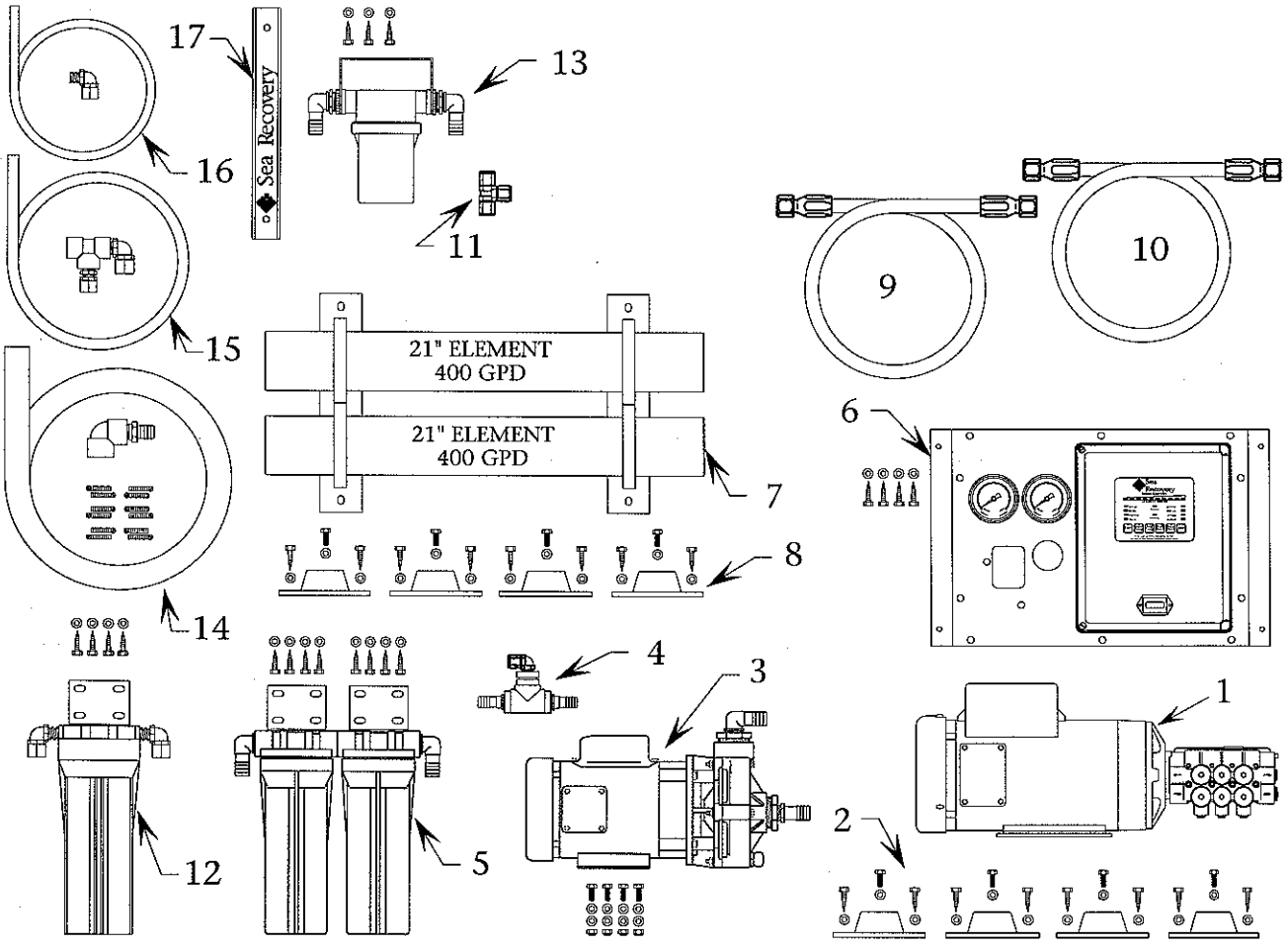
INCLUDED WITH YOUR:
Sea Recovery *"AquaWhisper"*
Modular Style Reverse Osmosis Desalinator



The R.O. Membrane Vessel Assembly will consist of one or two Pressure Vessels depending upon the system ordered and it will be packaged in a separate carton.

The AquaWhisper 400-1 includes one 27 inch long Pressure Vessel
The AquaWhisper 800-2 includes two 27 inch long Pressure Vessels
The AquaWhisper 600-1 includes one 37 inch long Pressure Vessel
The AquaWhisper 1200-2 includes two 37 inch long Pressure Vessels
The AquaWhisper 800-1 includes one 46 inch long Pressure Vessel
The AquaWhisper 1500-2 includes two 46 inch long Pressure Vessels

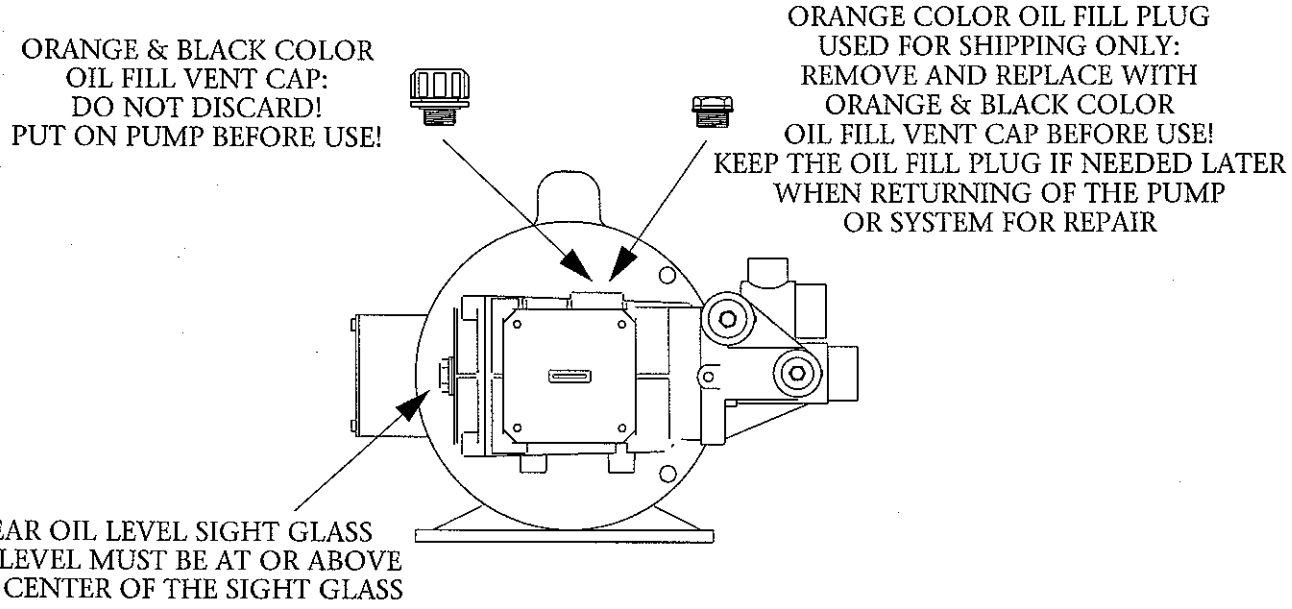
Refer to Section E for a complete description of each component included.



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

FOR PROPER R.O. MEMBRANE ELEMENT STORAGE PROCEDURES AND FURTHER CAUTIONS REFER TO SECTION J" OF THIS MANUAL.

HIGH PRESSURE PUMP OIL CAP WARNING



Sea Recovery®

SYSTEM IDENTIFICATION INFORMATION

INSTRUCTIONS: At the time of purchase of the Sea Recovery R.O. Desalinator, please complete the following information. In order to better serve you, this information will be requested by the Sea Recovery Service Department whenever contacting Sea Recovery for technical assistance or by the Sea Recovery Marketing Department whenever ordering parts.

System Information:

Model Number: _____ Serial Number: _____

Operating Voltage:

Alternating Current Single Phase:

__ 120 VAC, 60 Hz; __ 230 VAC, 60 Hz; __ 220 VAC 50 Hz

Alternating Current Three Phase:

__ 208/230 VAC, 60 Hz; __ 460 VAC, 60 Hz;

__ 220 VAC, 50 Hz; __ 380 VAC 50 Hz

Date Purchased: _____

Date Commissioned (first tested or operated): _____

Dealer Information:

Dealer's Name: _____

Address: _____

City: _____

State: _____

Country: _____ Postal Code: _____

Dealer's Invoice Number: _____

KEEP THIS COPY IN THE OWNERS MANUAL

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

World Wide Web Site **http://www.searecovery.com**
e-mail **searecovery@searecovery.com**

NOTES:

Sea Recovery®

WARRANTY REGISTRATION INFORMATION

INSTRUCTIONS: At the time of purchase of the Sea Recovery R.O. Desalinator, please complete the warranty information listed below. After completing this form please 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 this copy to:

Sea Recovery Corp.
P.O. BOX 5288
CARSON, CALIFORNIA 90745-5288 U.S.A.
Attn: Warranty Registration

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

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

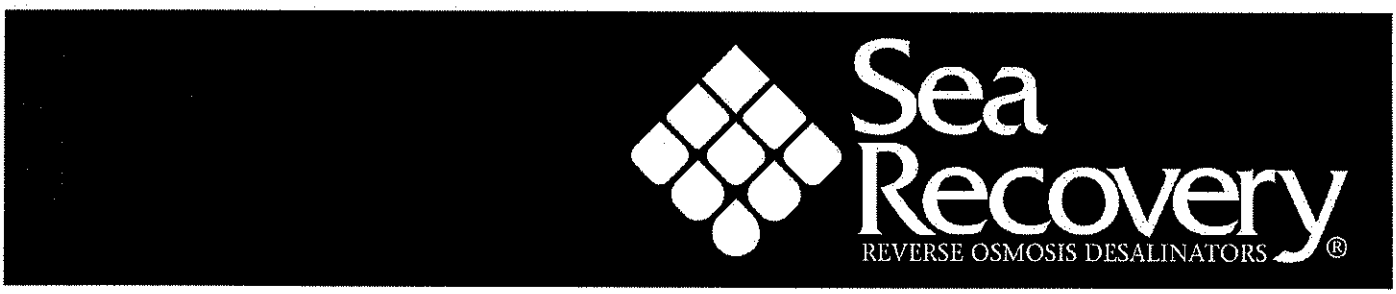
Sea Recovery Corp.

P.O. BOX 5288
CARSON, CALIFORNIA 90745-5288 U.S.A.
Attn: Warranty Registration

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

TABLE OF CONTENTS

NOTES:



SECTION A

Warranty

NOTES:

Sea Recovery
REVERSE OSMOSIS DESALINATORS®

LIMITED WARRANTY

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

The warranty period is from the date of original shipment from Sea Recovery's factory.

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

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

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

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

Installation of components not supplied by Sea Recovery, are not covered by this or any limited warranty.

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

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

In the event of a defect, malfunction or failure, specifically covered by this warranty and during the warranty period, 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 (dealer) or direct to Sea Recovery Corp. The end user must pay any transportation and labor expenses incurred in removing and returning the product to the service center or Sea Recovery pending evaluation and warranty approval. Upon warranty approval, reasonable expenses will be reimbursed.

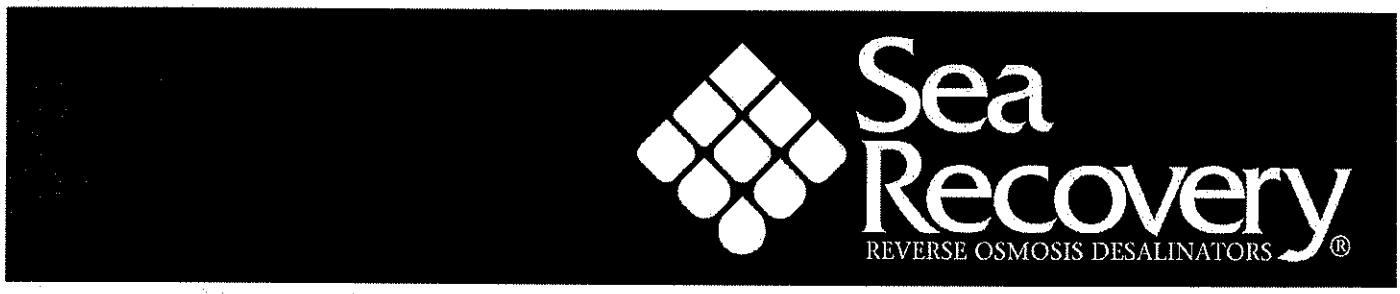
The limited warranty does not extend to any system or system component which has been subjected to alteration, misuse, neglect, accident, improper installation, inadequate or improper repair or maintenance or subject to use in violation of instructions furnished by Sea Recovery, nor does the warranty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

Sea Recovery Corp. 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 Corp. 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, prefilter elements, cleaning and storage chemical, pump oil, spare parts, replacement parts, system components, installation components and/or system accessories, shall void all warranty expressed or implied.

NOTES:



SECTION B

Specifications

NOTES:

SPECIFICATIONS

AquaWhisper™ Series

AquaWhisper™ Series - Frame Style with Internal Booster Pump
SRC AWF 400-1 & SRC AWF 800-2 v SRC AWF 600-1 & SRC AWF 1200-2
SRC AWF 800-1 & SRC AWF 1500-2

AquaWhisper™ Series - Compact Style with External Booster Pump
SRC AWC 400-1 & SRC AWC 800-2 v SRC AWC 600-1 & SRC AWC 1200-2
SRC AWC 800-1 & SRC AWC 1500-2

AquaWhisper™ Series - Modular Style
SRC AWM 400-1 & SRC AWM 800-2 v SRC AWM 600-1 & SRC AWM 1200-2
SRC AWM 800-1 & SRC AWM 1500-2

PERFORMANCE:

PRODUCT WATER PRODUCED PER 24 HOURS OF OPERATION:
(+-15% at 820 psig / 56 BAR, 77°F / 25°C & 35,000 ppm TDS Feed Water Salinity)

Model Number	Production per 24 hours of operation:
SRC AW 400-1	400 U.S. Gallons / 1,514 liters
SRC AW 800-2	800 U.S. Gallons / 3,028 liters
SRC AW 600-1	600 U.S. Gallons / 2,271 liters
SRC AW 1200-2	1200 U.S. Gallons / 4,542 liters
SRC AW 800-1	800 U.S. Gallons / 3,028 liters
SRC AW 1500-2	1500 U.S. Gallons / 5,678 liters

PRODUCT WATER PRODUCED PER HOUR OF OPERATION:
(+-15% at 820 psi / 56.5 bar, 77°F / 25°C & 35,000 ppm TDS Feed Water Salinity)

Model Number	Production per 1 hour of operation:
SRC AW 400-1	16 U.S. Gallons / 63 liters
SRC AW 800-2	33 U.S. Gallons / 126 liters
SRC AW 600-1	25 U.S. Gallons / 94 liters
SRC AW 1200-2	50 U.S. Gallons / 189 liters
SRC AW 800-1	33 U.S. Gallons / 126 liters
SRC AW 1500-2	63 U.S. Gallons / 237 liters

SALT REJECTION (CHLORIDE ION): Minimum 99.2 %, Average 99.4%

PRODUCT WATER TEMPERATURE: Ambient to feed water temperature

SPECIFICATIONS:

SALINITY MONITORING:
Automatic computer controlled electronic monitoring. Temperature compensated with the copy righted Sea Recovery solid state continuous "Bar LED" readout. The salinity monitoring components of the system give a continuous readout in micromhos per cubic centimeter, are temperature compensated and of a fail-safe design.

SALINITY RANGE OF FEED WATER:
Seawater up to 50,000 ppm TDS (NaCl) (typical seawater salinity is 35,000 ppm)

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

SYSTEM FEED WATER:

Model Number	Power Source Cycles (Hz)	Feed Water Flow Per Minute:		
SRC AWF 400-1 & 800-2	50Hz	3.5 U.S. Gallons	/	13.2 liters
SRC AWC 400-1 & 800-2	50Hz	3.5 U.S. Gallons	/	13.2 liters
SRC AWF 600-1 & 1200-2	50Hz	3.5 U.S. Gallons	/	13.2 liters
SRC AWC 600-1 & 1200-2	50Hz	3.5 U.S. Gallons	/	13.2 liters
SRC AWF 800-1 & 1600-2	50Hz	3.5 U.S. Gallons	/	13.2 liters
SRC AWC 800-1 & 1600-2	50Hz	3.5 U.S. Gallons	/	13.2 liters
SRC AWF 400-1& 800-2	60Hz	3.0 U.S. Gallons	/	11.4 liters
SRC AWC 400-1 & 800-2	60Hz	3.0 U.S. Gallons	/	11.4 liters
SRC AWF 600-1 & 1200-2	60Hz	4.2 U.S. Gallons	/	15.9 liters
SRC AWC 600-1 & 1200-2	60Hz	4.2 U.S. Gallons	/	15.9 liters
SRC AWF 800-1 & 1600-2	60Hz	4.2 U.S. Gallons	/	15.9 liters
SRC AWC 800-1 & 1600-2	60Hz	4.2 U.S. Gallons	/	15.9 liters

REVERSE OSMOSIS MEMBRANE:

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

CHLORINE TOLERANCE: 0.1 PPM

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

SYSTEM PRESSURE:

FEED WATER:

Minimum	6 psi	/ .41 bar	/	.42 Kg/cm^2
Maximum	35 psi	/ 2.41 bar	/	2.46 Kg/cm^2

OPERATION:

Seawater nominal	820 psi	/ 56.5 bar	/ 57.66 Kg/cm^2
Brackish	Varies w/ppm		

DIMENSIONS & WEIGHT:

DIMENSIONS: Refer to Installation Section "E"

MODEL	WEIGHT	MODEL	WEIGHT
SRC AWC & AWF 400-1	147 lbs / 67 kg	SRC AWM 400-1	113 lbs / 51 kg
SRC AWC & AWF 800-2	159 lbs / 72 kg	SRC AWM 800-2	125 lbs / 57 kg
SRC AWC & AWF 600-1	150 lbs / 68 kg	SRC AWM 600-1	116 lbs / 53 kg
SRC AWC & AWF 1200-2	165 lbs / 75 kg	SRC AWM 1200-2	131 lbs / 59 kg
SRC AWC & AWF 800-1	152 lbs / 69 kg	SRC AWM 800-1	118 lbs / 54 kg
SRC AWC & AWF 1500-2	170 lbs 77 kg	SRC AWM 1500-2	136 lbs / 62 kg

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

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

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

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

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

ELECTRICAL MOTOR SPECIFICATIONS:

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

HIGH PRESSURE PUMP MOTOR:

400-1 & 800-2 SYSTEMS

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

600-1 & 1200-2, and 800-1 & 1500-2 SYSTEMS

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

BOOSTER PUMP MOTOR:

1/2 horse power

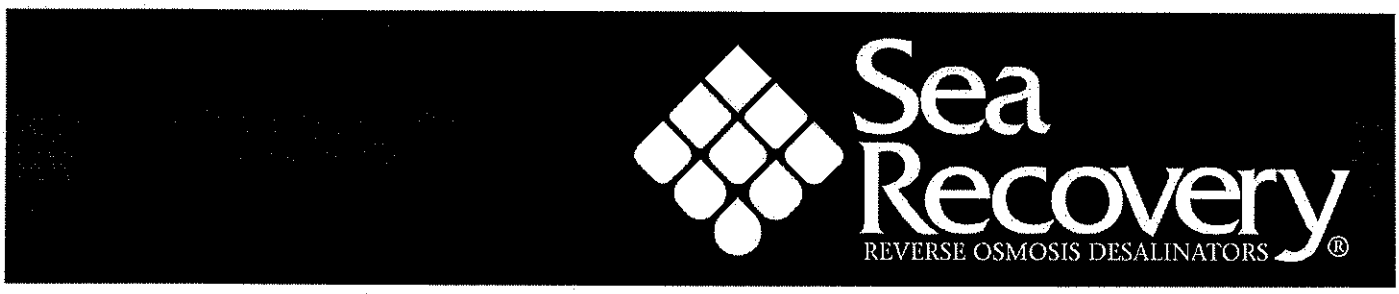
PHASE	Hz	VAC	H.P.	FLA	LRA
Single	50/60	115	.5	7.4	34
Single	50/60	220/230	.5	3.7	17
Three	50/60	220/230	.5	2	12
Three	50/60	380/460	.5	1	6

RECOMMENDED CIRCUIT BREAKER:

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

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

NOTES:



SECTION C

Introduction

NOTES:

SYSTEM INTRODUCTION

Thank you for purchasing a Sea Recovery Reverse Osmosis Desalination System. Please read this Owners Manual carefully before attempting installation or operation. A subsequent better understanding of the system ensures optimum performance and longer service life from the system.

All Sea Recovery 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 Sea Recovery system. By understanding the function, importance, and normal operation of each component within each subsystem of the unit, the operator can readily diagnose minor problems. Such problems, when they first develop, usually require minor maintenance and are easily corrected. Left unattended, though, a problem in one component affects the rest of the system and leads to further required repairs.

Please take time to read this entire manual several times.

Sea Recovery's Approach to Water Desalination.

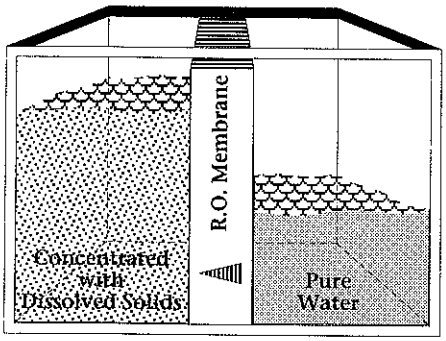
The Obstacle:

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

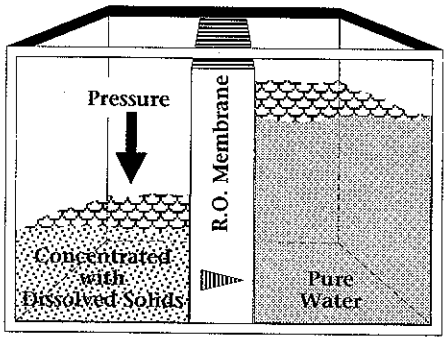
Sea water or brackish water is a high concentration solution. Potable water is a low concentration solution.

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

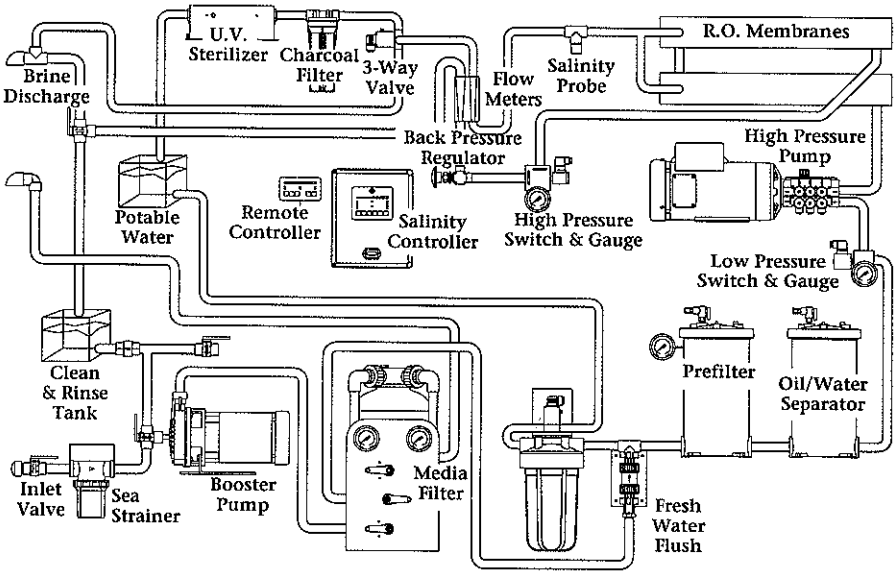
Sea Recovery's Solution:



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



Sea Recovery "AquaWhisper" Series 400-1600 U.S. GPD Reverse Osmosis Desalination System Illustrated with All Options



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

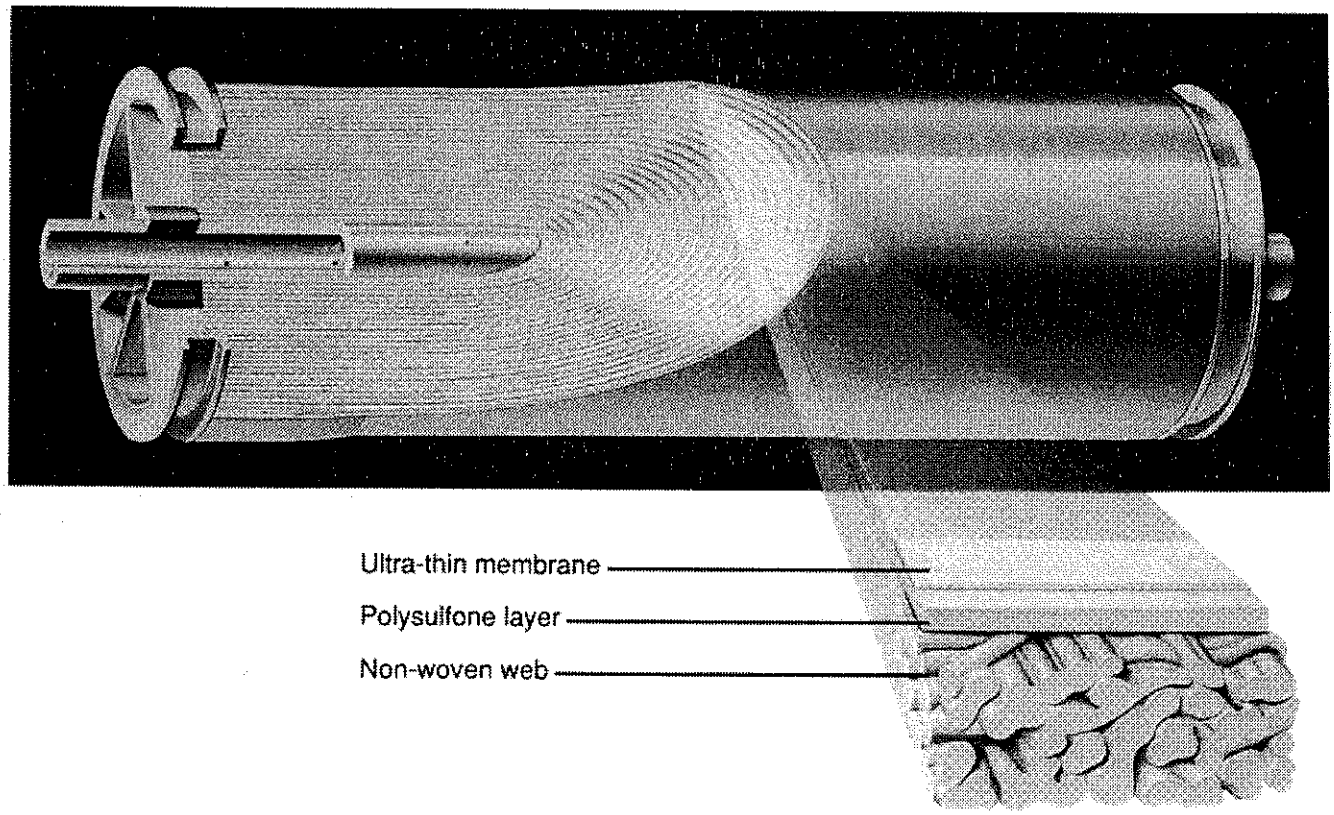
High Pressure: The Stainless Steel High Pressure Pump then increases the filtered feed water to a high pressure level and forces it into the Reinforced Fiberglass Membrane Vessel Assembly. The Back Pressure Regulator controls and automatically maintains the necessary high pressure level in the membrane.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

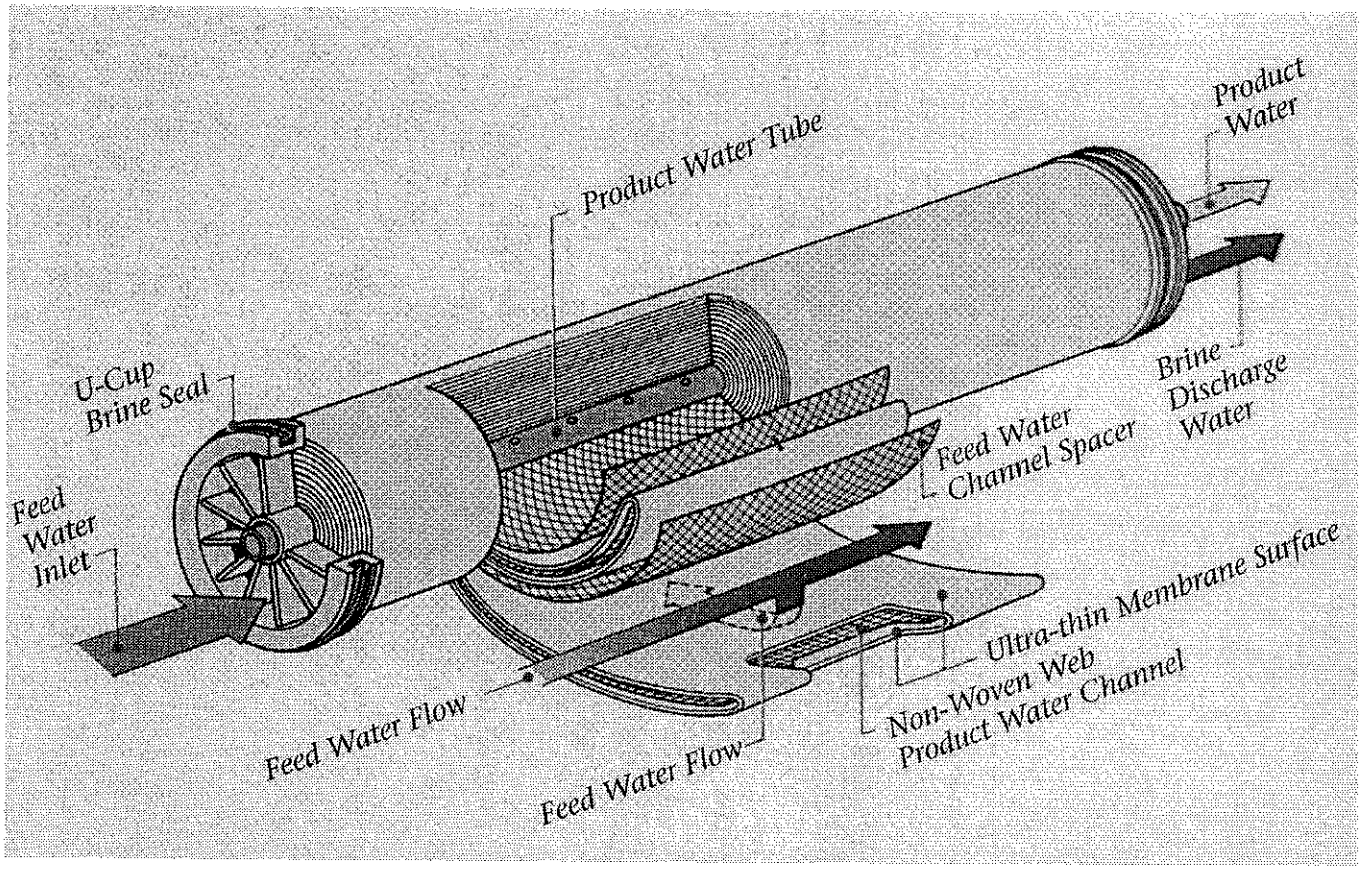
Product Water: The product water flows out of the R.O. Membrane and passes into a Salinity Probe which adjusts automatically for temperature changes and registers, electronically, the salt content of the product water. Next, the Product Flow Meter registers the amount of potable water being produced. The product water then proceeds into the 3-Way Solenoid Diversion Valve. Here, potable water is diverted to the Charcoal Filter where gasses or odors present are absorbed and removed from the product water. The final filtration process occurs in the Ultraviolet Sterilizer where 99.9 % of all microorganisms, including viruses and bacteria, are destroyed.

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

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

1. ANATOMY OF A REVERSE OSMOSIS MEMBRANE ELEMENT:





2. PRINCIPLES OF REVERSE OSMOSIS:

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

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

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

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

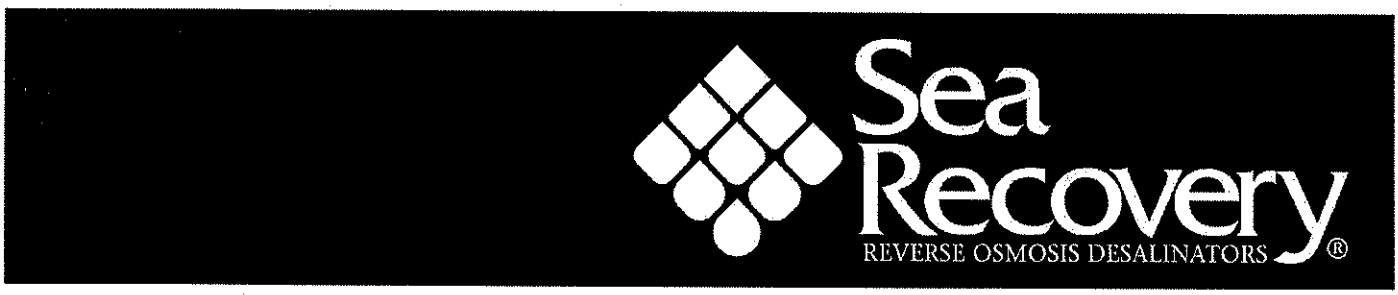
E. BOUNDARY LAYER/CONCENTRATION POLARIZATION: When water permeates through the membrane, nearly all the salt is left behind in the brine channel. In any dynamic hydraulic system the fluid adjacent to the wall of the vessel is moving relatively slowly. Even though the main body of the stream is turbulent,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

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

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

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

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



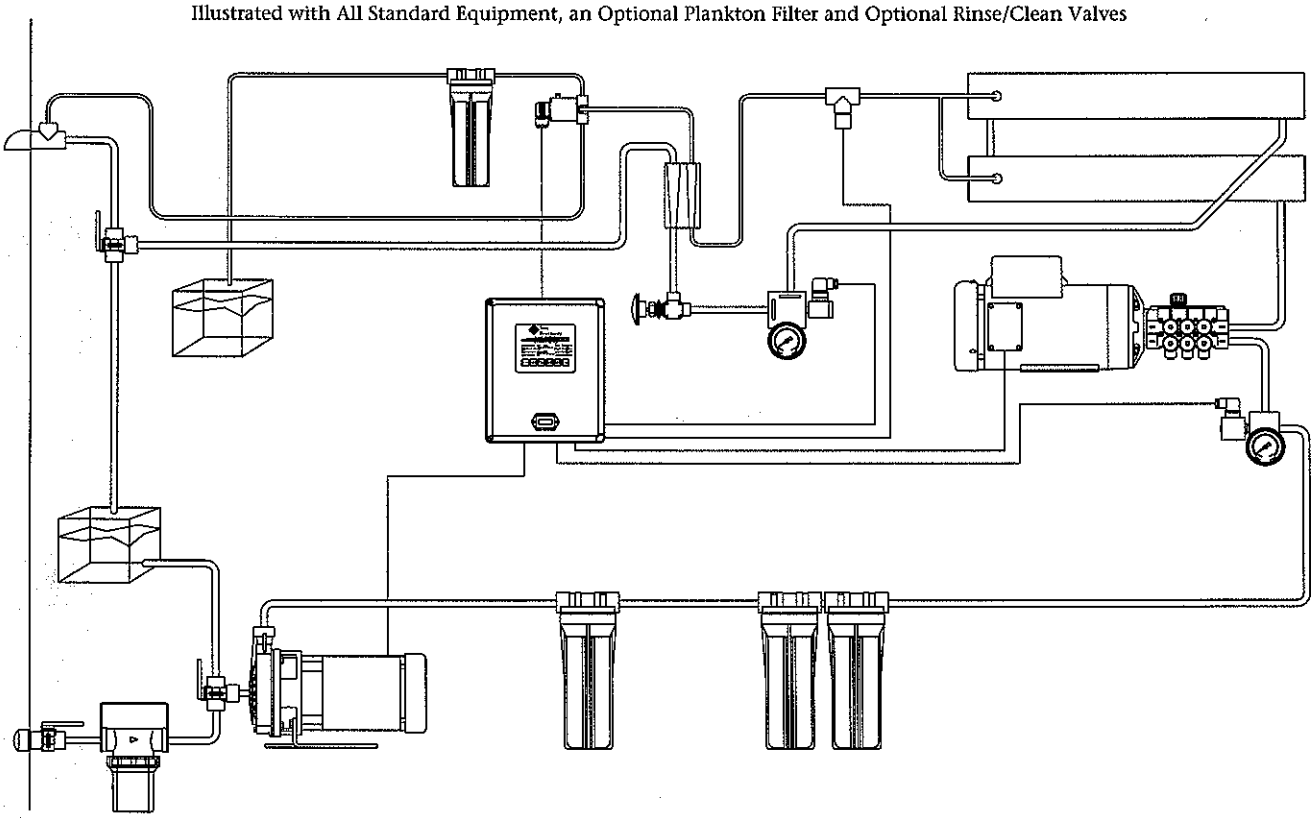
SECTION D

System Schematic
with
Component Identification & Descriptions

NOTES:

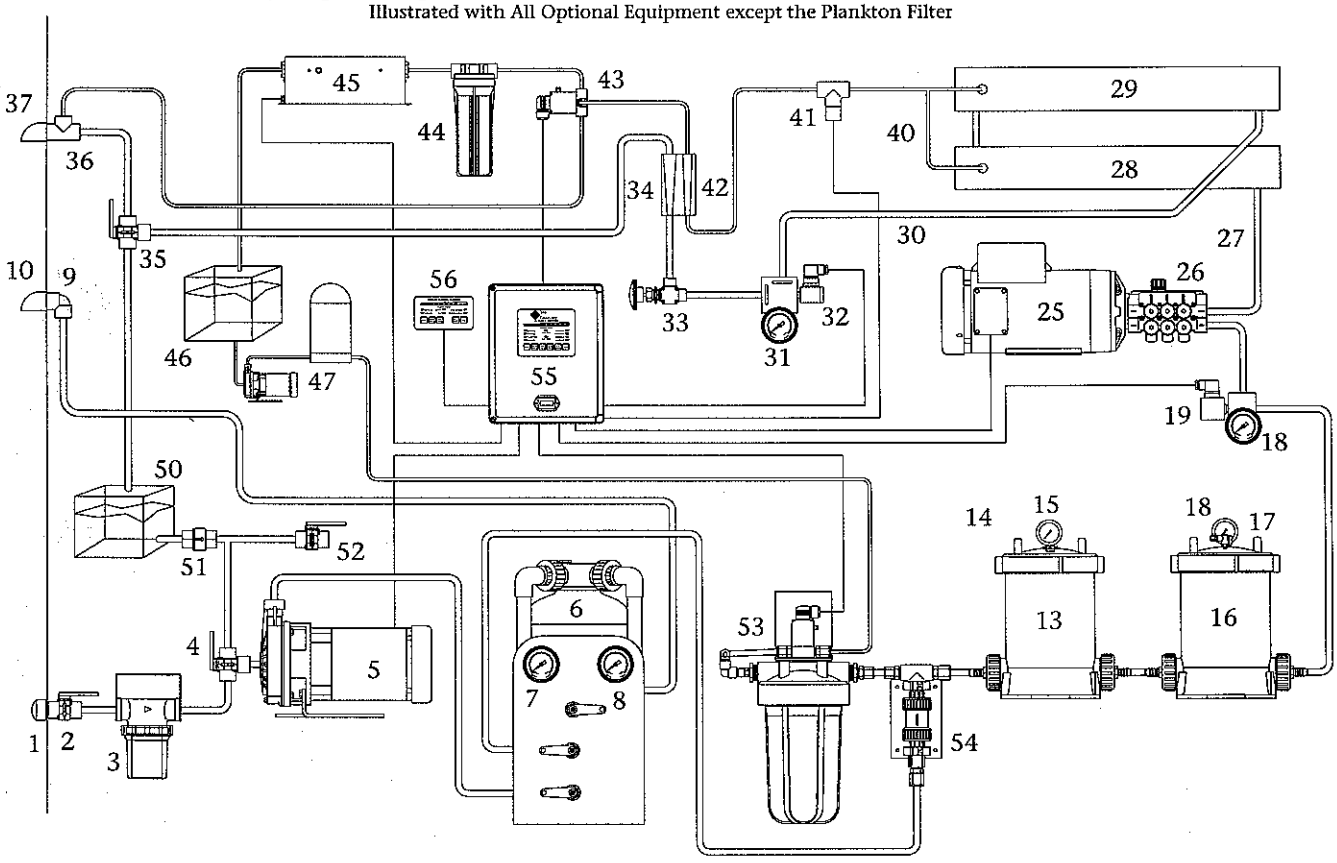
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System

Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System

Illustrated with All Optional Equipment except the Plankton Filter



IDENTIFICATION OF SYSTEM COMPONENTS: Identification numbers correspond to the System Schematic numbers shown on page D - 3 illustrating the AquaWhisper Systems with and without optional equipment. ** Denotes items supplied by installer; *** denotes optional extra charge equipment. Items listed as "Future Reference" indicate that at this time no component has been assigned this number.

A. PREFILTRATION SUBSYSTEM:

1. Inlet Thru Hull **
2. Sea Cock Valve **
3. Sea Strainer
4. Rinse/Clean Inlet Valve
5. Booster Pump
6. Multi Media Filter ***
7. Low Pressure Gauge, Booster Pump Outlet / Multi Media Filter Inlet ***
8. Low Pressure Gauge, Multi Media Filter Outlet / Prefilter Inlet ***
9. Multi Media Filter Waste Connection ***
10. Multi Media Filter Thru Hull Waste Fitting **
11. Plankton Filter ***
12. Cartridge Prefiltration, Standard 25 to 5 micron
13. Cartridge Prefiltration, Commercial 50 sq ft, 5 micron
14. Air Bleed, Commercial Cartridge Prefilter Housing
15. Low Pressure Gauge, Commercial Prefilter Inlet
16. Oil Water Separator Filter
17. Air Bleed Valve, Oil Water Separator Filter
18. Low Pressure Gauge, High Pressure Pump Inlet
19. Low Pressure Switch
20. Future Reference
21. Future Reference
22. Future Reference
23. Future Reference

B. PRESSURIZATION SUBSYSTEM:

24. Future Reference
25. Electric Motor, High Pressure Pump
26. High Pressure Pump
27. High Pressure Hose, HP Pump Outlet MVA Inlet
28. R.O. Membrane & Vessel Assembly
29. R.O. Membrane & Vessel Assembly
30. High Pressure Hose MVA Outlet Back Pressure Regulator Inlet
31. High Pressure Gauge
32. High Pressure Switch
33. Back Pressure Regulator

C. BRINE DISCHARGE SUBSYSTEM:

34. Flow Meter, Brine Discharge Water
35. Rinse/Clean Outlet Valve
36. Discharge Tee Connection
37. Thru Hull Discharge Fitting **
38. Future Reference
39. Future Reference

D. PRODUCT WATER MONITORING SUBSYSTEM:

40. Product Water Tube and Tee
41. Salinity Probe, Temperature Compensated
42. Flow Meter, Product Water
43. 3-Way Electric Product Diversion Valve
44. Charcoal Filter ***
45. U.V. Sterilizer ***
46. Potable Water Storage Tank **
47. Ships Fresh Water Pressure System **
48. Future Reference
49. Future Reference

E. RINSE & CLEAN TANK SUBSYSTEM:

50. Rinse/Clean Tank **
51. Check Valve, Non Return **
52. Filtered Dock Water Isolation Valve **
53. Fresh Water Flush Charcoal Filter and Solenoid Valve***
54. Fresh Water Flush Check Valve Assembly***

F. ELECTRONIC SUBSYSTEM:

55. Salinity Controller
56. Remote Controller ***

COMPONENT DESCRIPTIONS

The following is a full description of each subsystem and subassembly within the Sea Recovery AquaWhisper Reverse Osmosis Desalination System, including the purpose and integration of the components in the system. All components supplied by SRC, both standard and optional, are described below along with items required or desired by the installer. The identification numbers used correspond to the System Schematic numbers from page D - 3.
** Denotes items supplied by installer;
*** denotes optional equipment.

A. PREFILTRATION SUBSYSTEM:

This section of the system collects, pretreats and delivers the Feed Water into the System. The Feed Water may be collected directly from the source, from a well, or through a ship's Sea Chest / Inlet Thru Hull Fitting. The raw feed water is filtered to remove suspended solids larger than 5 micron size (5/1,000,000 of a meter). Such controlled prefiltration protects the SRC R.O. Membrane Element from undue fouling.

The Prefiltration Subsystem must always be kept free flowing in order to allow the proper rate of System Feed Water to travel through it and into the High Pressure Pump. A plugged Prefiltration Subsystem causes cavitation damage to the High Pressure Pump and will eventually cause permanent fouling of the R.O. Membrane Element. Therefore, always ensure that the Prefiltration Subsystem is clear and monitor it frequently.

1. **Inlet Thru Hull Fitting with Forward Facing Scoop** ** (supplied by the installer) is shown here. This is the point at which the feed water is collected for entry into the Sea Recovery System. This may be a Thru Hull fitting on a ship, a Sea Chest on a ship, a pipe directly in the feed water source, a shallow beach well or a feed water tank. It is the installers responsibility to arrange for and configure this feed water pick up point. This fitting and all piping in the feed water line must be non ferrous. No iron piping, valving or fittings should be used in the feed water line as resulting rust damages the Sea Recovery Reverse Osmosis Membrane Element. This point must be in constant contact with the water. If the pick up point is a thru hull fitting on a boat it must be a forward facing scoop well below water level and positioned on the hull so as to ensure a constant supply of feed water. If the pick up is from a sea chest it must be connected at a low point in the sea chest or stand up pipe so that no air enters the system. The feed water line must not be tied into any other auxiliary piping because suction conflicts will occur with other auxiliary equipment.

2. **Sea Cock Valve** ** (supplied by the installer) is used in a ship installation for safety reasons to close the feed water line during non use of the Sea Recovery System. In some installations this valve may be replaced by or complemented with a check valve (non return valve) in order to maintain prime in the feed water line. This valve and all piping in the feed water line must be non ferrous. No iron piping, valving or fittings should be used in the feed water line as resulting rust damages the Sea Recovery Reverse Osmosis Membrane Element.

3. **Sea Strainer (Coarse Strainer)** has a clear bowl with nylon body filter housing containing a cleanable monel fine mesh filter screen. The design allows for quick bowl removal. The Sea Strainer filters out large particulate matter and suspended particles that would otherwise enter and damage the Booster Pump. The result is lowered maintenance costs.

4. **Rinse/Clean Inlet Valve** is used to change the system from an operational mode to a rinse, storage or cleaning mode. This valve directs water into the Booster Pump from either the raw water feed line or the Rinse/Clean Tank. The Rinse/Clean Inlet Valve is preassembled onto the outlet of the Sea Strainer.

5. **Booster Pump** supplies a positive pressure to the Prefilters, and in turn to the High Pressure Pump. Positive pressure will provide longer life to the Prefilters, provide longer life to the High Pressure Pump and also decrease required maintenance. Sea Recovery utilizes a high efficiency, marine quality pump with a performance curve of 80 Ft Head (35 psi) at 4.2 GPM. Actual resulting pressure into the High Pressure Pump depends on the final installation.

6. **Multi Media Filter** *** (optional) consists of an FRP (Fiberglass Reinforced Plastic) vessel which contains a graduated media filter bed (gravel and sand). The media traps suspended solids, that are larger than 30 micron, and thus provides further protection and longer life to the Prefilter element. The Multi Media Filter is back washable which thereby minimizes maintenance costs. Consult

the factory regarding recommended use and applications for the media filter. It is not recommended for small vessel (less that 20 meters) applications due to its size and weight.

7. **Low Pressure Gauge, Booster Pump Outlet / Multi Media Filter Inlet** *** (supplied with the Multi Media Filter) displays the Inlet Pressure to the Multi Media Filter from the Outlet of the Booster Pump. In correlation with Low Pressure Gauge #8 the operator can easily view the condition of the Multi Media Filter and determine when back washing is necessary.

8. **Low Pressure Gauge, Multi Media Filter Outlet / Cartridge Prefilter Inlet** *** (supplied with the Multi Media Filter) displays the Outlet Pressure of the Multi Media Filter across the filter bed. In correlation with Low Pressure Gauge #7 the operator can easily view the pressure differential across the media and determine when back washing is necessary.

9. **Multi Media Filter Waste Connection** *** (supplied with the Multi Media Filter) is for waste line connection to the Multi Media Filter Thru Hull Waste Fitting.

10. **Multi Media Filter Thru Hull Waste Fitting** ** (Multi Media Waste Discharge Over Board) (supplied by the installer) must be provided for discharge of the Multi Media Waste Discharge Water.

11. **Plankton Filter** *** (optional) is highly recommended for system operation areas which are rich in biological growth such as the Pacific North West, Arctic Waters or Fishing Grounds. This filter assembly contains a cleanable ultra fine monel mesh screen. The ultra fine mesh screen removes suspended solids or biological growth such as plankton and thereby provide longer life to the Prefilter Elements and in turn provide lower system maintenance costs.

12. **Cartridge Prefiltration, Standard 25 to 5 micron** (standard dual 10 inch) consists of two filter housings connected in series with each other. The unique elements filter out suspended solids from the System Feed Water. The first Prefilter contains a special pleated element which filters the feed water to 25 micron. The second Prefilter contains a finer pleated element which filters the feed water to 5 micron. Special applications may dictate the need for different micron retention.

13. **Cartridge Prefiltration, Commercial 50 sq ft, 5 micron** provides extended periods of time between filter element changes. The Commercial Prefilter contains a large filter element with 40 square feet of filtering area. The filter element is rated at 5 micron. Due to its high capacity this one filter replaces the two standard Prefilters.

    Note: The Sea Recovery Prefilter Element may appear to be similar to commercially available elements. However, Sea Recovery manufactures their own unique filter elements to specific stringent specifications designed to withstand unique Sea Water applications and simultaneously protect the SRC R.O. Membrane Element. Only Sea Recovery filter elements, supplied by Sea Recovery, may be used as replacements. This ensures proper flow and filtration of the System Feed Water. Use of non Sea Recovery filter elements damage the R.O. Membrane Elements, foul them quickly and render them uncleanable.

14. **Air Bleed, Commercial Cartridge Prefilter Housing** allows the operator to purge the Commercial Prefilter Housing of any air introduced from the feed line.

15. **Low Pressure Gauge, Commercial Prefilter Inlet** provides visual indication of the pressure into the Commercial Prefilter Housing from the Booster Pump.

16. **Oil/Water Separator Filter** is recommended if system operation occurs in Harbor or Coastal conditions. The unique separator element separates oil and removes suspended solids from the System Feed Water. As oil permanently destroys the SRC R.O. Membrane Element, it is recommended that the user avoid operating the SRC system in polluted Harbors. If it is impractical to avoid using oily intake water, then use of the Oil/Water Separator Assembly is required to keep the R.O. Membrane Element free from irreversible oil damage.

17. **Air Bleed Valve, Oil Water Separator Filter Housing** allows the operator to purge the Oil Water Separator Filter Housing of any air and collated oil introduced from the feed line.

18. **Low Pressure Gauge, High Pressure Pump Inlet** displays the Inlet Pressure to the High Pressure Pump, from the

Booster Pump, after passing through all Prefiltration Sections of the System. The gauge assists the operator in diagnosing the Sea Strainer, Booster Pump, Plankton Filter Element, Prefilter Element and Oil/Water Separator Element condition. The gauge is made of high quality stainless steel and is glycerin oil filled for smooth and accurate operation.

19. **Low Pressure Switch** turns the System off automatically if a plugged filter element or other abnormality causes a low flow situation. This protects the High Pressure Pump, the R.O. Membrane Element and the Booster Pump from damage. The typical reason for the Low Pressure Switch to shut off the System is a fouled (plugged, clogged, dirty) Sea Strainer Element, fouled Prefilter Element or fouled Oil/Water Separator Element.

20. **Future Reference**

21. **Future Reference**

22. **Future Reference**

23. **Future Reference**

B. **PRESSURIZATION SUBSYSTEM:**

Proper pressure and proper flow across the SRC R.O. Membrane Element are two basic requirements of Reverse Osmosis. Both of these parameters must be maintained at specified levels or the System simply does not function correctly. This is why it is important to maintain the Prefiltration Subsystem, so that the Pressurization Subsystem receives a proper flow of Feed Water. The normal operating pressure of the SRC system is 750-850 psi for Sea Water use or 200 to 400 psi for Brackish Water use. The maximum pressure the Sea Water system develops is 950 psi, because the supplied high pressure switch automatically shuts the system off at 950 psi (+-50 psi).

Proper flow into the System and across the SRC R.O. Membrane is listed in the Specification Section "B" of this Manual. Insufficient flow causes an increase in the salt content of the Product Water. Insufficient flow also causes rapid and premature fouling of the R.O. Membrane Element as a result of higher than normal recovery. As the temperature of the Feed Water source fluctuates, it affects System productivity. Refer to the Temperature Effect Chart in Section "M" of this Manual.

24. **Future Reference**

25. **Electric Motor** is directly coupled to the High Pressure Pump. This unique and exclusive direct coupling results in the most efficient, quiet and compact configuration possible. Single Phase Systems utilize specially designed electric motors which provide sufficient starting torque with the lowest possible current and include a thermal overload protection switch which shuts the System off should excess amperage result due to low voltage or over loading.

26. **High Pressure Pump** is a marine quality, Stainless Steel manifold, positive displacement, ceramic plunger pump. This proven High Pressure Pump is unique and exclusive to the Sea Recovery System. The Sea Recovery High Pressure Pump operates with minimal noise and vibration making the Sea Recovery R.O. Systems the quietest available. The High Pressure Pump lasts for years with proper installation, use and maintenance.

27. **High Pressure Hose, HP Pump Outlet MVA Inlet** transfers pressurized Sea Water from the High Pressure Pump to the inlet of the SRC R.O. Membrane Element. The special High Pressure Hose supplied with the System is of standard lengths (special lengths may be ordered from the factory) with swivel flare fittings for ease of installation. The hose is marine rated, reinforced and has a corrosion resistant inner tube and outer core.

28 & 29. **R.O. Membrane Element & Vessel** consists of an exclusive and unique high pressure, corrosion resistant all fiberglass vessel which houses a special Spiral Wound Reverse Osmosis Membrane Element. The Membrane Element rejects the salt ions present in the feed water, yet allows the potable water molecules to pass through the thin membrane surface. A sufficient flow of water across the membrane surface must be maintained in order for the correct percentage of salt rejection to occur. Only about 10% of the System Feed Water becomes fresh Product Water (per individual membrane element). The remainder becomes a concentrated brine solution which carries the rejected salt ions out of the R.O. Membrane Element.

30. **High Pressure Hose, MVA Outlet / Back Pressure Regulator Inlet** transfers pressurized Sea Water from the Outlet of the R.O. Membrane Vessel to the Back Pressure Regulator. The special High Pressure Hose supplied with the System is of standard lengths (special lengths may

be ordered from the factory) with swivel flare fittings for ease of installation. The hose is marine rated, reinforced and has a corrosion resistant inner tube and outer core.

31. **High Pressure Gauge** displays the R.O. Membrane Vessel outlet pressure. The gauge is made of high quality stainless steel and is glycerin oil filled for smooth and accurate operation. The gauge assists the operator in diagnosing the R.O. Membrane Element performance and High Pressure Pump condition.

32. **High Pressure Switch** is used in the SRC System to automatically turn the System off in case of over-pressurization during operation.

33. **Back Pressure Regulator** is constructed of 316 Stainless Steel. By turning the valve adjustment handle clockwise, increased restriction results in pressure build up. By turning the valve adjustment handle clockwise and counterclockwise pressure is increased and decreased accordingly, which in turn increases and decreases production of the R.O. Membrane Element.

C. **BRINE DISCHARGE SUBSYSTEM:**

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

34. **Flow Meter, Brine Discharge Water** (Registers Feed Water when there is no pressure applied to the System and no Product Water is flowing / measures Brine Flow when the System is pressurized and product water is flowing) is located on the left side of the dual port Brine/Product Water Flow Meter.

    This is one of the most important visual check points of the SRC System and should be monitored on a regular basis. Proper interpretation of the flow meter readings and movements allows the owner to determine the need for maintenance or the occurrence of a malfunction in other components. The Flow Meter is, therefore, important to the proper operation of the System and must be monitored on a regular basis.

35. **Clean/Rinse Outlet Valve** is used in conjunction with the Clean/Rinse Inlet Valve to set the System Brine Discharge Line into a normal, storage or cleaning mode.

36. **Discharge Tee Connection** provides for connection of the Brine Discharge Line and Bad (unpotable) Product Water Line to the over board Thru Hull Discharge Fitting.

37. **Thru Hull Discharge Fitting** ** (supplied by installer) should be installed above water level for discharge of the Brine Discharge Water from the System.

38. **Future Reference**

39. **Future Reference**

D. **PRODUCT WATER MONITORING SUBSYSTEM:**

This section of the System gives a visual indication of the clarity, quantity and quality of product water being produced. By comparing the quantity and quality of product water produced to the pressure, temperature and salinity of the System Feed Water, the user can establish whether the SRC R.O. Membrane Element requires cleaning. This also allows the user to estimate the running time required to fill or refill the Product Water Storage Tank(s).

Post Filtration of the SRC system is the final step in Product Water quality control. The type and quantity of Post Filtration required is dependent on the quality of the System Feed Water. By the time the Product Water reaches the Post Filtration stage, the R.O. Membrane Element has removed most of the dissolved solids present in the Feed Water. The Sea Recovery exclusive Temperature Compensated Electronic Subsystem has rejected any high salinity Product Water, so the water is potable in regards to salinity. The Post Filtration Subsystem is designed to limit unpleasant odor, taste, and biological matter such as bacteria, viruses, and other microorganisms which may have passed through the R.O. Membrane Element and would therefore be present in the Product Water.

40. **Product Water Tube and Tee** collects and routes the produced product water from the R.O. Membrane Element onward to the Product Water Monitoring components.

41. **Temperature Compensated Salinity Probe** is directly connected to and sends a continuous signal to the Salinity Controller. It electrically determines whether the salinity content of the Product Water is acceptable. This unique Salinity Probe compensates automatically for water temperature variations which provides an accurate measurement of the quality of the Product Water.

42. **Flow Meter, Product Water** is graduated from 5 to 70 GPH (gallons per hour). This relates to 120 to 1680 gallons per day or 454 to 6,360 liters per day. The flow-through design of the meter allows it to measure the rate of Product Water progress from the R.O. Membrane Element toward the Product Water Post Filtration Components.

43. **3-Way Electric Product Diversion Valve** functions according to signals received from the Salinity Controller. After the controller has determined, from the temperature compensated Salinity Probe, that Potable (drinkable) water is being produced, the Controller energizes this valve to the "Potable" position which allows the potable Product Water to pass through the Post Filtration and into the Potable Water Storage Tank. If the Product Water being produced is "Unpotable" then the valve does not receive a signal and thus remains in the normally open position which diverts the unpotable Product Water to discharge out the Brine Discharge Line.

44. **Charcoal Filter** is designed to assist in the removal of foul odors from the Product Water. A second charcoal filter may be added between the Product Water Storage Tank and the point of use. This is desirable to remove impurities, sediment particles, or the taste of chlorine, all of which may be present in the Product Storage Tank, due to sources other than the SRC System.

45. **Ultra Violet Sterilizer ***** (optional) destroys at least 99.9% of any virus, bacteria and other micro-organisms which may pass through the SRC R.O. Membrane Element. The U.V. sterilizer is highly recommended if the Product Water Storage Tank is not otherwise treated by means such as chlorination. Use of the U.V. Sterilizer is also recommended if the System Feed Inlet is near a polluted source such as a raw sewage outlet. However, such polluted sources must always be avoided.

46. **Potable Water Storage Tank **** (supplied by others) may be any container suitable for storing Potable Water. Usually the existing potable water tank.

47. **Ships Fresh Water Pressure System **** is the existing pumping/pressurizing system for distribution of the fresh water on to all of the various faucets and fixtures.

48. **Future Reference**

49. **Future Reference**

E. **RINSE & CLEAN TANK SUBSYSTEM:** Consists of supplied valves and required tank or container for the cleaning, rinsing or storage of the Sea Recovery R.O. System. The System should be rinsed, stored or cleaned from time to time or as appropriate. These valves and tank or container provide a convenient means to accomplish these tasks.

50. **Rinse/Clean Tank **** (supplied by the installer) can be any container, permanent or temporary, which can hold from 5 to 20 gallons of water.

51. **Check Valve, Non Return **** (supplied by the installer) would be desired if Valve #52 is used for Dock Side water flushing of the System.

52. **Filtered Dock Water Isolation Valve **** (supplied by the installer) simply keeps the Dock Side Rinse Water from entering the Clean/Rinse tank.

53. **Fresh Water Flush Charcoal Filter and Solenoid Valve***** (optional) The main component of the optional Fresh Water Flush System, which flushes the system with fresh water when the Fresh Flush switch is pressed on the touch pad. The Solenoid Valve controls the flow of fresh water though the system. The charcoal filter removes particulate matter and chlorine from the fresh water to prevent damage to the R.O. membrane element(s). Fresh Water Flushing replaces the sea water in the system with fresh water which is much less corrosive, extending the life of the system components.

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

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

55. **Salinity Controller** is the central connection point for all electrical lines in the system. The controller monitors the salt content of the product water, and signals the 3-Way Product Diversion Valve when Potable

Water is being produced. The 3-Way Product Diversion Valve, Motors, Remote Control and U.V. Sterilizer are all connected to and governed by the Salinity Controller. The controller also has a digital hourmeter which displays the total hours of system operation.

TOUCH PAD CONTROL DESCRIPTIONS:

Mounted on the front of the Salinity controller is the Touch Pad. The Touch Pad contains all of the system control switches. The following control switches are located at the bottom of the gray Touch Pad.

START: This switch initiates the start cycle. The Booster Pump [5] starts first introducing low pressure water to the High Pressure Pump [26]. After a short delay, the High Pressure Pump Motor [25] starts.

BOOST PUMP: This switch controls the Booster Pump independent of the High Pressure Pump. When pressed, the booster pump starts and continues to run by itself until the START switch is pressed starting the High Pressure Pump.

FEED PUMP: This switch is not used

FAULT RESET: This switch resets the five faults and allows the system to start.

FRESH FLUSH: This switch initiates the Fresh Water Flush system when installed.

STOP: This switch stops all of the system functions when pressed.

Above the switches on the Touch Pad are the indicator lamps. These lamps either indicate the operation of the corresponding equipment or a fault condition. The following are descriptions of the indicator lamps

System Off: This indicator is lit when the system is not operating, but power is still present to the controller.

Feed Pump: This indicator lamp lights during system operation, but is irrelevant.

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

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

Fresh Flush: This indicator illuminates during the Fresh Water Flush operation.

Service Pump: The service pump lamp is illuminated when 500 hours has elapsed. The lamp indicates the High Pressure Pump oil requires changing.

Low Pressure: The low pressure fault lamp illuminates when the system shuts down due to a low pressure condition.

High Pressure The high pressure fault lamp illuminates when the system shuts down due to a high pressure condition.

Auxiliary #1 The auxiliary #1 lamp indicates a high temperature shutdown for the high pressure pump motor on Compact and Frame single phase systems. The auxiliary #1 fault indicator may be used for other shutdown conditions, please contact installer.

Auxiliary #2 On systems installed with an optional Soft Start, the Auxiliary 2 fault lamp indicates an overheating of the Soft Start. Overheating occurs when the system is exposed to excessive heat, or the system is started and stopped repeatedly in a brief period of time.

The auxiliary #2 fault lamp may be used for other shutdown conditions when a Soft Start is not installed, please contact installer.

The Touch Pad also has a visible display consisting of 10 lamps in a horizontal band. The band increases from left to right. This band is used for the following functions:

The primary function of the meter is to display the salinity of the product water. For this reason the band is labeled **SALINITY METER**. Each lamp represents 100ppm, e.g. 3 lamps lit indicates 300ppm.

When power is first introduced to the system, the **SALINITY METER** registers the hours remaining until the High Pressure Pump crankcase oil must be changed. In this function, each lamp represents 50 hours. When there are less than 50 hours remaining, only the red lamp immediately on the right of the meter illuminates. After the full 500 hrs has elapsed, the system shuts down and the Service pump lamp illuminates. This lamp remains illuminated until the **FAULT RESET** switch is pressed, which resets the hours remaining until the next oil change to 500 hours.

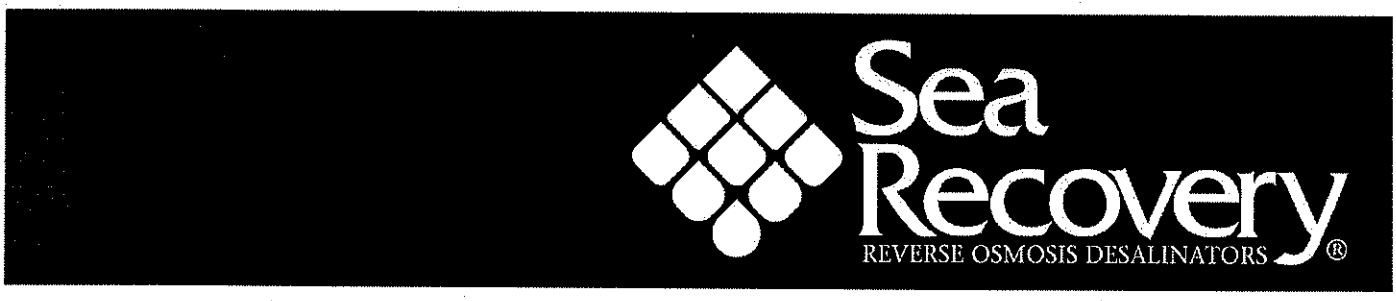
This same **SALINITY METER** is used as a visual indicator in the Calibration mode of the main Circuit board.

OPTIONAL EQUIPMENT

Soft Start*** (optional) An optional High Pressure Pump motor starter is available from Sea Recovery. The soft start lowers the starting torque of the high pressure pump motor, and gradually brings the motor to full speed. This has the effect of lowering the initial startup amps required to start the motor. The soft start is available on single phase systems.

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

NOTES:



SECTION E

On Site Storage
&
System Installation Procedure

NOTES:

ON SITE STORAGE & PREPARATION FOR INSTALLATION:

A. STORAGE PRIOR TO UNCRATING:

1. Adhere to crate markings:
   - DO NOT store in direct sunlight;
   - DO NOT store above 120 degrees F / 50 degrees C;
   - DO NOT freeze;
   - STORE ONLY on base with ARROWS UP;
   - DO NOT store longer than 3 months without additional storage chemical rinsing.

2. Refer to Section "J" of this manual for further cautions of the R.O. Membrane Element.

B. AVOID CHEMICAL ATTACK TO THE SYSTEM:

CAUTION: Do not expose the Sea Recovery R.O. System to:

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

or any other specific chemical not approved in writing by Sea Recovery Corp. Use of non authorized or misuse of authorized chemicals voids any warranty.

Do not connect any water line to the Sea Recovery R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Sea Recovery R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the co-polymer components within the system. Do not connect the Sea Recovery R.O. System to any line that may contain chlorine or other oxidants as they destroy the R.O. Membrane Element.

Numbers in [brackets] refer to the I.D. numbers illustrated on page D-3.

C. NECESSARY COMPONENTS SUPPLIED BY OWNER:

1. Inlet Thru Hull Fitting with Inlet Sea Cock Valve [1&2]: The Thru Hull Fitting must include a 1/4 turn Sea Cock Valve with a minimum 3/4" orifice, and a 3/4" MNPT nipple exposed for the system inlet fitting. ***The entire fitting and valve assembly must be of non-ferrous material.*** Naval Bronze, PVC, CPVC, Stainless Steel or another noncorrosive material is correct for the fitting. Any ferrous material causes rust fouling of the SRC R.O. Membrane Element.

   The Inlet Thru Hull Fitting must be installed well below water level at a suitable location that does not come in contact with air. The Sea Recovery R.O. System MUST receive a constant supply of air free feed water. This inlet Thru Hull fitting should be the forward facing scoop type which assists in delivering a constant supply of feed water to the Sea Recovery R.O. System. Flush mount type Thru Hull fittings must be avoided as they can cause a reverse suction effect and cause the Sea Recovery R.O. System to lose prime.

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

   DO NOT tie or tee into another line that already feeds another auxiliary system. DO NOT tie or tee another auxiliary system into the Sea Recovery System Feed Line. Continual shut down of the Sea Recovery System results if another auxiliary system is tied or teed into the Sea Recovery Feed Line.

2. Brine Thru Hull Fitting [37] (above water level) for the Brine Discharge Line Tee from the system. This fitting must be minimum 1/2" size with a 1/2" MNPT nipple exposed for coupling with the system Brine Discharge Line Fitting [36]. It is preferred to install the Brine Thru Hull Fitting above water level. ***There should be no valving in the Brine Discharge Line as damage to the system occurs if the Brine Discharge Line is blocked by a closed valve during system operation.***

3. If the Optional Multi Media Filter is installed, the Multi Media Filter Waste Fitting [10] (above water level) is required for the Multi Media Filter Waste Line. This fitting must be minimum 3/4" size with a 3/4" MNPT nipple exposed for coupling with the Multi Media Filter Waste connector [9]. It is preferred to install the Multi Media Filter Waste Fitting above water level. ***There should be no valving in the Multi Media Filter Waste Fitting.***

4. Ship's Potable Water Storage Tank [50] with Product Water Storage Tank Connection: This fitting must be minimum 3/8" FNPT size for coupling with the system product water fitting. It is preferred that the product water line terminate above water level. The product water line must be connected to a vented system to ensure no pressure build up during production. ***There must be no valving in the Product Water Line as damage to the system occurs if the Product Water Line is blocked by a closed valve or kink during system operation.***

5. Power cable with the proper gauge rating for this system's power consumption.:

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

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

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

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

6. An electrical power source capable of supplying the proper current at the proper Voltage to the Sea Recovery System.

D. TOOLS REQUIRED FOR INSTALLATION:

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

E. SPECIAL CONSIDERATIONS:

1. **LENGTH OF CONNECTION LINES:** The system operates most efficiently with interconnect lines as short and straight as possible. As the distance of suction lines increases, the feed pressure decreases. As the distance of discharge lines increases, the greater the back pressure on those lines. There should be no back pressure on the brine discharge line or product water line.

2. **PLACEMENT AND ROUTING OF THE FEED WATER LINE:** Any high loops in the feed water line traps air which may not be displaced by the feed water. Always plumb the line so that all air may naturally bleed from the feed water line. Excessive bends and elbows in the Feed Line results in pressure loss into and or from the Booster Pump. Loss of Feed Water pressure causes shortened prefilter life. Premature System shutdown due to improper plumbing of the feed line is not considered a warranty condition as Sea Recovery has no control over the System feed line installation. The installer is responsible to ensure proper plumbing.

3. **SYSTEM FEED INLET (INLET THRU HULL FITTING [1])** must be in constant contact with the feed water. Any air suction leaks coming into the system feed line causes the system to shut down due to low feed pressure condition. If the installation is aboard a vessel care must be taken to plumb the feed line at the bottom of the Hull or Sea Chest so that the Sea Recovery System receives an uninterrupted supply of air free feed water. The Inlet Thru Hull Fitting should be dedicated for only the Sea Recovery R.O. System.

   DO NOT use one Thru Hull Fitting for several auxiliary systems. Typical cause of system failure and continual stopping and loss of prime is due to air suction leaks from other systems tied into a common Thru Hull Fitting.

4. **R.O. MEMBRANE VESSEL ASSEMBLY [17]** must not be exposed to heat in excess of 122˚F / 50˚C. At temperatures above 122˚F / 50˚C the Reverse Osmosis Membrane Element experiences irreversible flux loss (loss in production).

5. **GIVE SPECIAL CONSIDERATION TO ACCESS FOR MAINTENANCE** of all components. Such access includes, but is not be limited to: Prefiltration Element removal, High Pressure Pump oil changes, R.O. Membrane Element removal and Post Filtration Element removal. ***Remember, if it is inaccessible it is not maintained. If it is not maintained it breaks. When it breaks the user calls you. When you call us, we will tell you to read this paragraph! Install it as if you were going to do the maintenance yourself!***

6. **THE CONTROL PANEL** contains System controls which must be accessible for operation and viewing.

F. DISTANCE BETWEEN COMPONENTS:

1. **Inlet Sea Cock Valve [2] through the prefiltration and into the inlet of the AquaWhisper System:** 12.5 feet of 3/4" I.D. (3.8 meters of 19 mm ID) flexible rigid wall tubing is supplied with the system for plumbing of the feed water line from the Inlet Sea Cock to the Inlet of the High Pressure Pump.

   Additional tubing may be ordered if necessary from Sea Recovery. However, caution must be exercised in extending the length of the feed water line. As the distance of draw into the Booster Pump or push from it increases there is less pressure at the inlet of the System. Feed pressure loss from the Booster Pump yields shorter Prefilter Element life, causes more frequent Prefilter Element changing and makes it difficult to prime the High Pressure Pump. Therefore, keep the distance from the Sea Cock to the High Pressure Pump as short and straight as possible.

   If the feed water lines are extremely long or if there are many fittings and elbows planned which causes excessive line loss then it is necessary to utilize a larger Booster Pump. Larger Booster Pumps are available from Sea Recovery at an additional charge. Any credit consideration for upgrading the supplied standard Booster Pump to a larger one is only given if the original Booster Pump is sent back to Sea Recovery freight prepaid and only if it is received at Sea Recovery freight prepaid in ***NEW UNUSED*** condition. ***Once the original supplied Booster Pump is installed and subjected to feed water or if it is damaged in return shipment then no credit is given towards an upgrade.*** **It is the installers responsibility to determine the need for a larger Booster Pump PRIOR to installing the original supplied Booster Pump.**

   The need for a larger Booster Pump is not a System problem, this would be an installation obstacle and would not be considered a warranty issue.

2. **Brine Dump Tubing from the System to the Brine Discharge Outlet Fitting [36]:** 20 feet of 1/2" OD (15 meters of 12.7 mm OD) tubing is supplied with the system to connect the Brine Discharge Line components.

   Additional tubing may be ordered from Sea Recovery if required. Caution must be taken in plumbing the Brine Discharge line and Clean/Rinse line to ensure that no back pressure is present on this line as any back pressure causes bypassing at the 3-way product water diversion valve.

3. **Product water tubing from the Product Water outlet connection to the Product Water Storage Tank Inlet [46]:** 50 feet of 3/8" OD (15 meters of 9.5 mm OD) tubing is supplied with the system. Plan to keep the product water tubing as straight and short as possible. This practice reduces the potential for a build-up of unnecessary back pressure in the product water section of the System. ***Do Not Install Any Valves in this line from the system to the storage tank and ensure that there are no kinks in this line. Blockage of the Product Water Line causes extensive damage to the System and the R.O. Membrane Element. Damage caused by a blocked Product Water Line is not covered under warranty.***

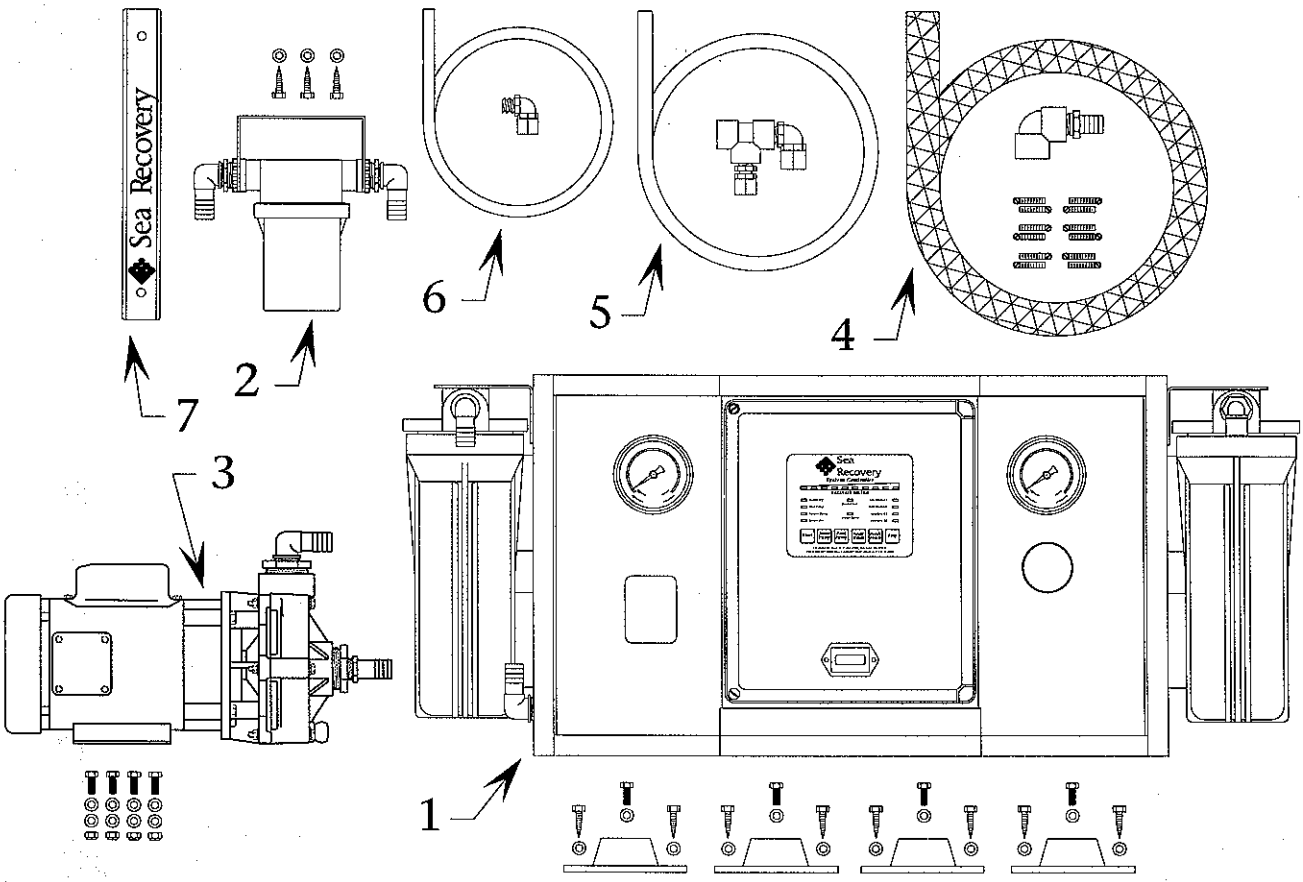
G. UNCRATING: DO NOT DISCARD ANY PACKAGING MATERIAL UNTIL YOU HAVE FOUND AND IDENTIFIED ALL PARTS!

1. **Remove the Sea Recovery system from the shipping crate.** Note that some of the components are loose or separately packaged in the shipping container. Do Not discard any packaging or boxes as they may contain small mounting hardware pieces or small system components. Thoroughly check each box, bag and bundle of packing material for parts.

The following 3 pages Illustrate all standard items included with the AquaWhisper Systems

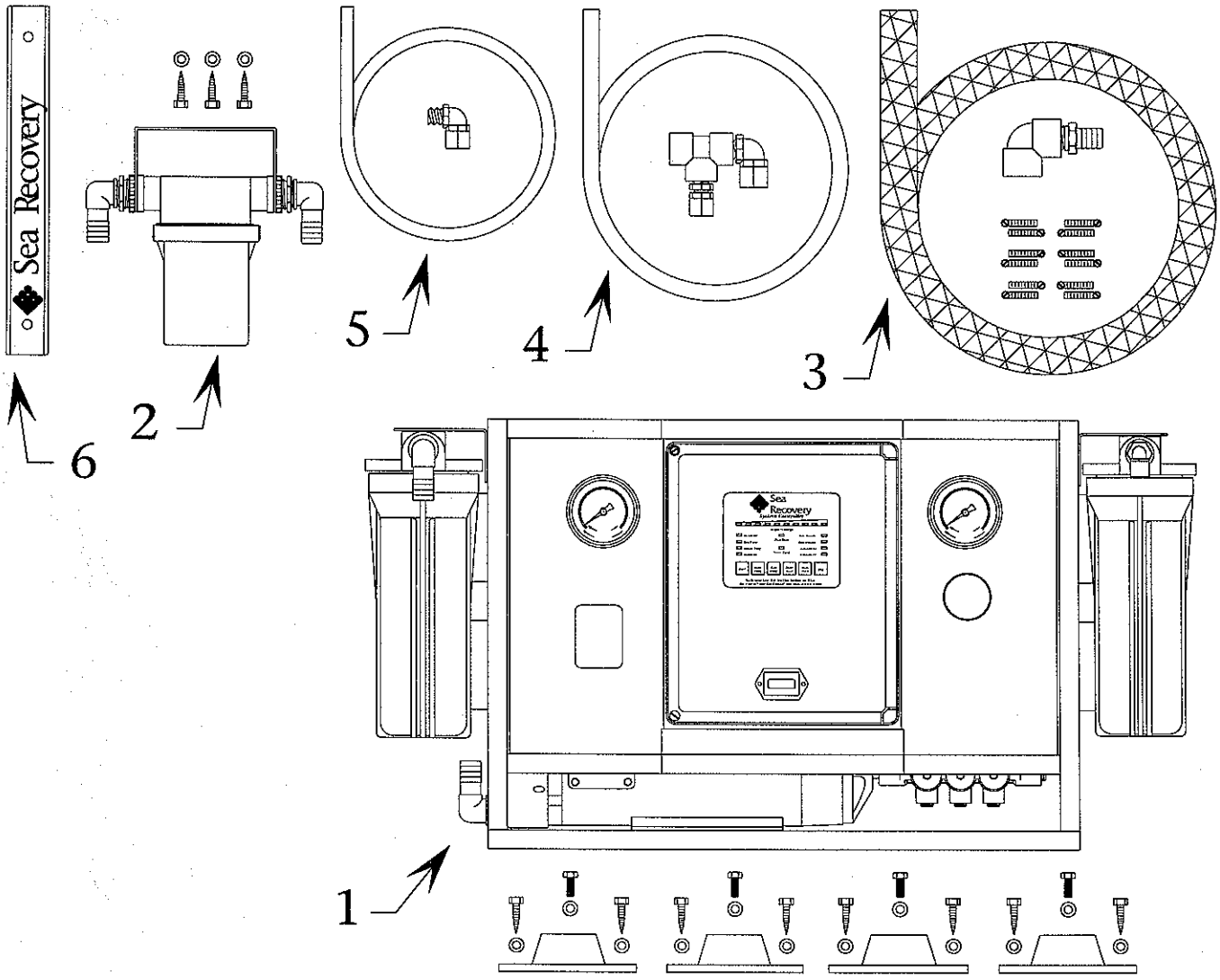
AquaWhisper Compact Style Packing List:

1. AquaWhisper Compact System with Isolation Mounts and Mounting Hardware. (If an optional Commercial Prefilter shipped with the system then the standard Prefilter, shown on the left of the system, is not included).
2. Sea Strainer with Mounting Hardware
3. Booster Pump with Mounting Hardware
4. 12.5 feet of 3/4 inch I.D. Suction Hose with Sea Cock Connection and 12 Hose Clamps
5. 20 feet of 1/2 inch O.D. Brine Discharge Tubing with Over Board Dump Connector
6. 50 feet of 3/8 inch O.D. Product Water Tubing with Product Water Tank Connector
7. Owners Manual 3 Ring Binder



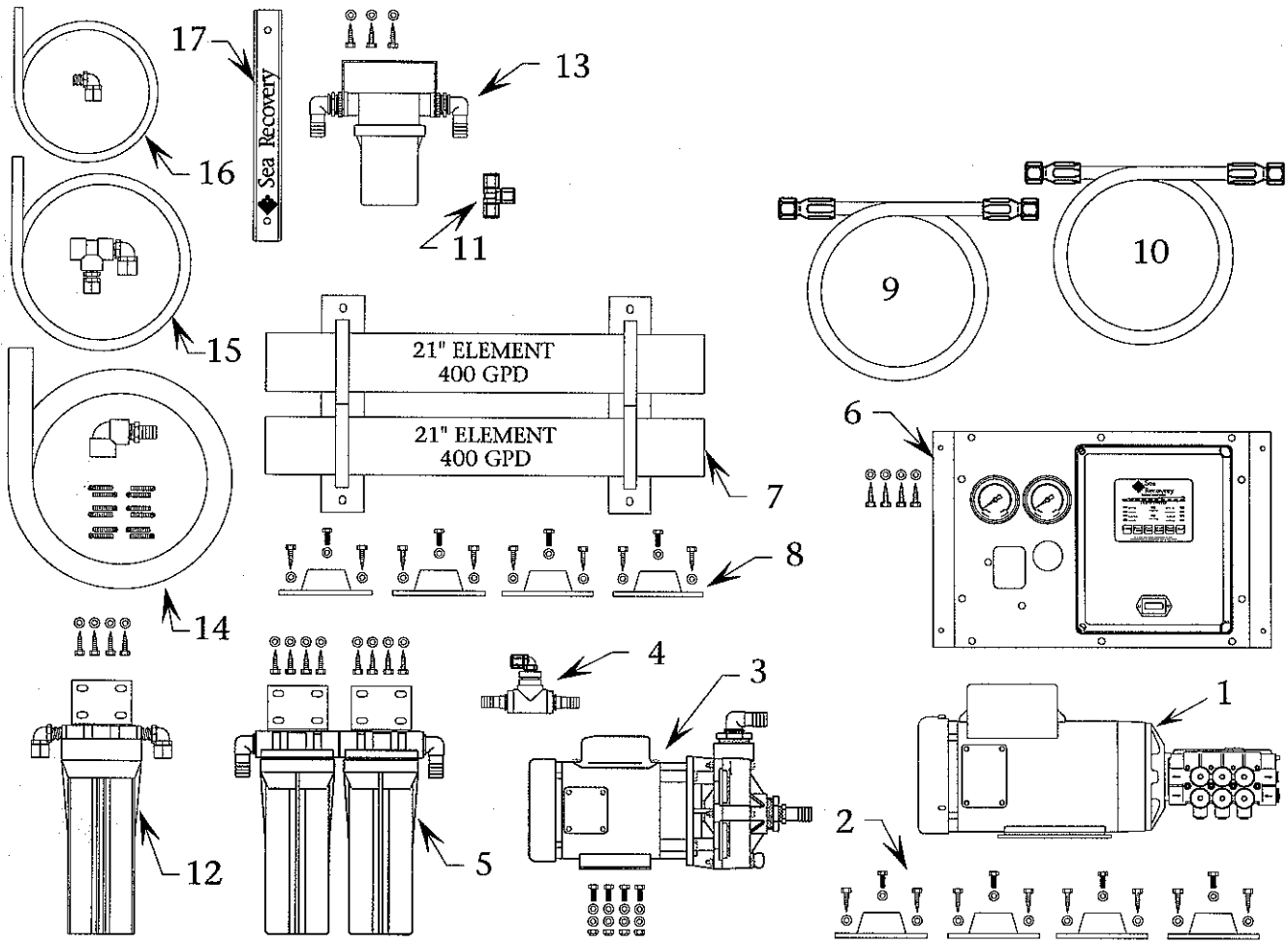
AquaWhisper Frame Style Packing List:

1. AquaWhisper Frame System with internal Booster Pump, Isolation Mounts and Mounting Hardware. (If an optional Commercial Prefilter shipped with the system then the standard Prefilter, shown on the left of the system, is not included).
2. Sea Strainer with Mounting Hardware
3. 12.5 feet of 3/4 inch I.D. Suction Hose with Sea Cock Connection and 12 Hose Clamps
4. 20 feet of 1/2 inch O.D. Brine Discharge Tubing with Over Board Dump Connector
5. 50 feet of 3/8 inch O.D. Product Water Tubing with Product Water Tank Connector
6. Owners Manual 3 Ring Binder



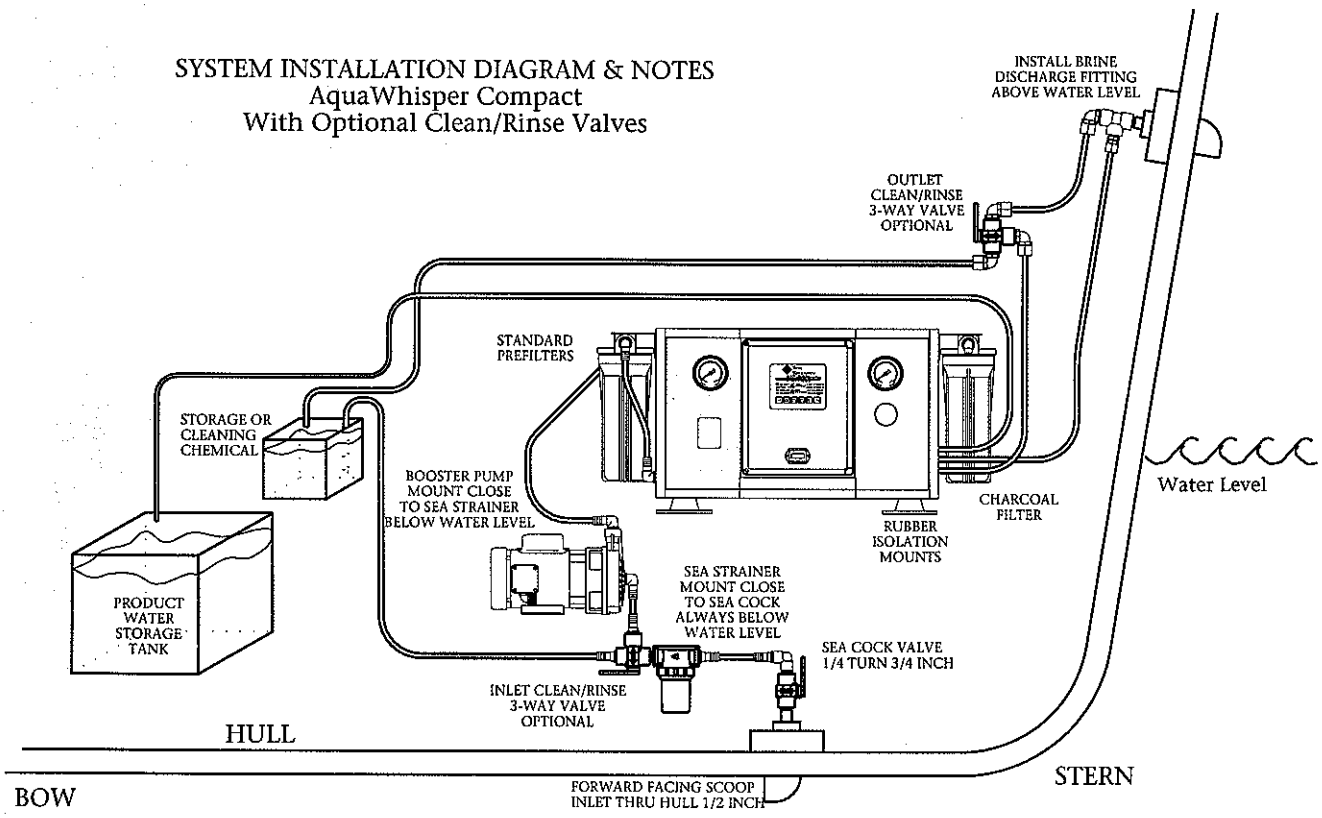
AquaWhisper Modular Style Packing List:

1. High Pressure Pump and Motor Assembly
2. Isolation Mounts and Mounting Hardware for High Pressure Pump Motor.
3. Booster Pump with Mounting Hardware
4. Low Pressure Gauge & Low Pressure Switch Pressure Pick Up.
5. Standard Prefilters with Mounting Hardware. (If an optional Commercial Prefilter shipped with the system then the standard Prefilter, shown, is not included).
6. Control Panel with Mounting Hardware
7. Membrane / Vessel Assembly.
8. Isolation Mounts and Mounting Hardware for Membrane / Vessel Assembly.
9. High Pressure Hose, Inlet of Membrane / Vessel Assembly
10. High Pressure Hose, Outlet of Membrane / Vessel Assembly
11. Product Water Tee
12. Product Water Charcoal Filter with Mounting Hardware.
13. Sea Strainer with Mounting Hardware
14. 12.5 ft of 3/4 in I.D. Suction Hose w/ Sea Cock Connection & 12 Hose Clamps
15. 20 ft of 1/2 in O.D. Brine Discharge Tube with Over Board Dump Connector
16. 50 ft of 3/8 in O.D. Product Water Tube with Product Water Tank Connector
17. Owners Manual 3 Ring Binder

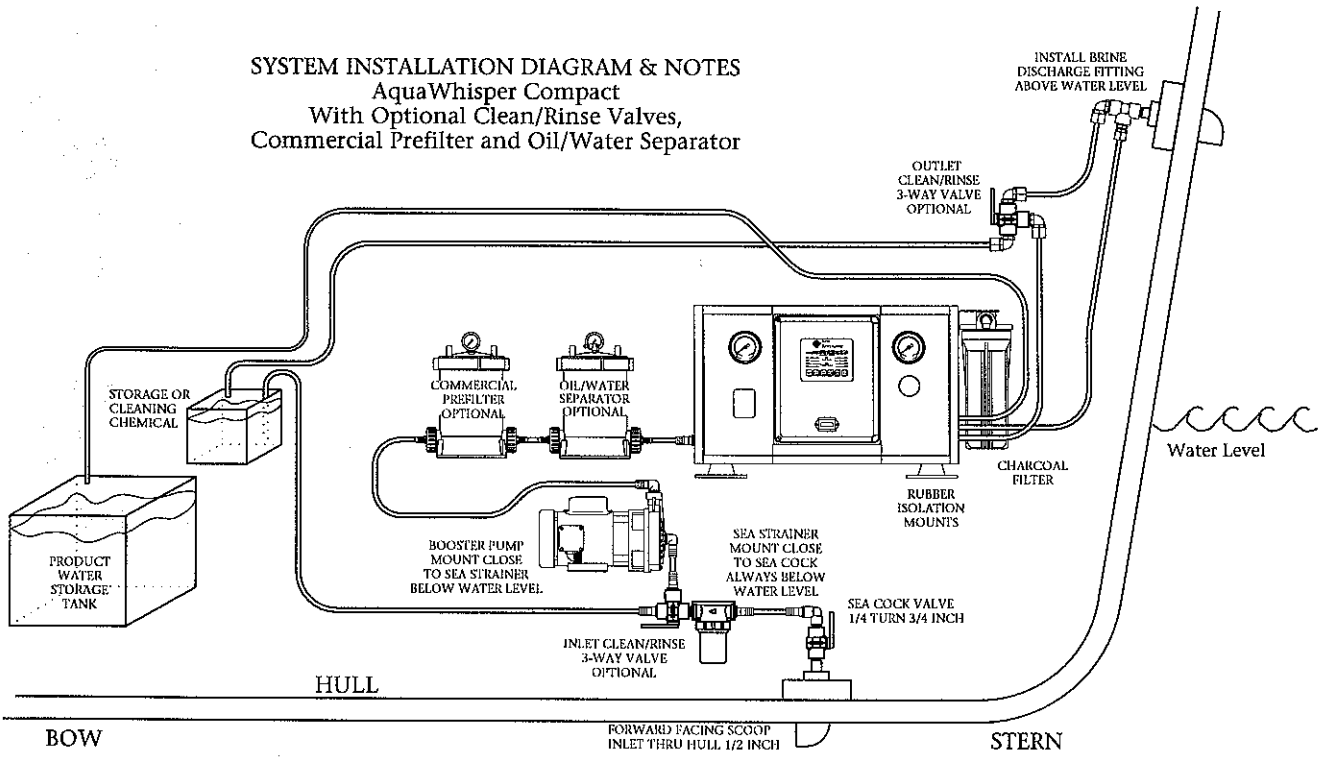


The following 5 pages Illustrate Installation Views for the AquaWhisper Compact and Aqua Whisper Modular. The Illustrations show various installation configurations with different optional equipment. The AquaWhisper Frame Style System Installation is identical to that of the AquaWhisper Compact except the Booster Pump is located within the frame of the AquaWhisper Frame.

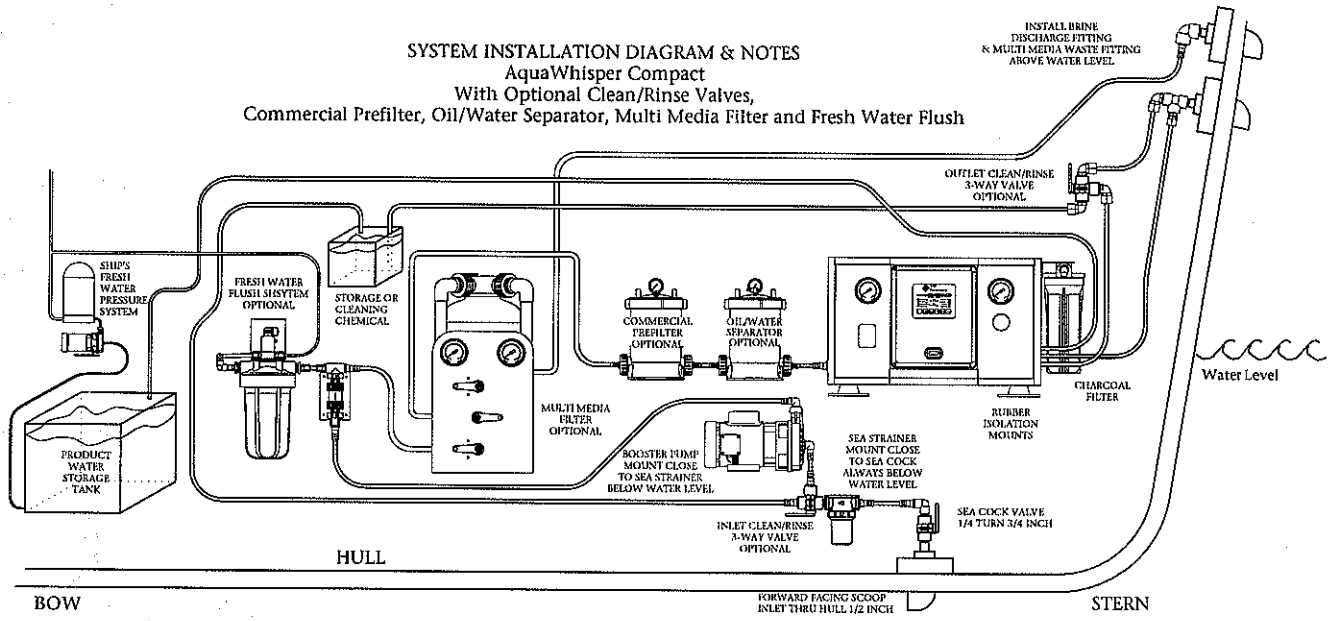
SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Compact
With Optional Clean/Rinse Valves



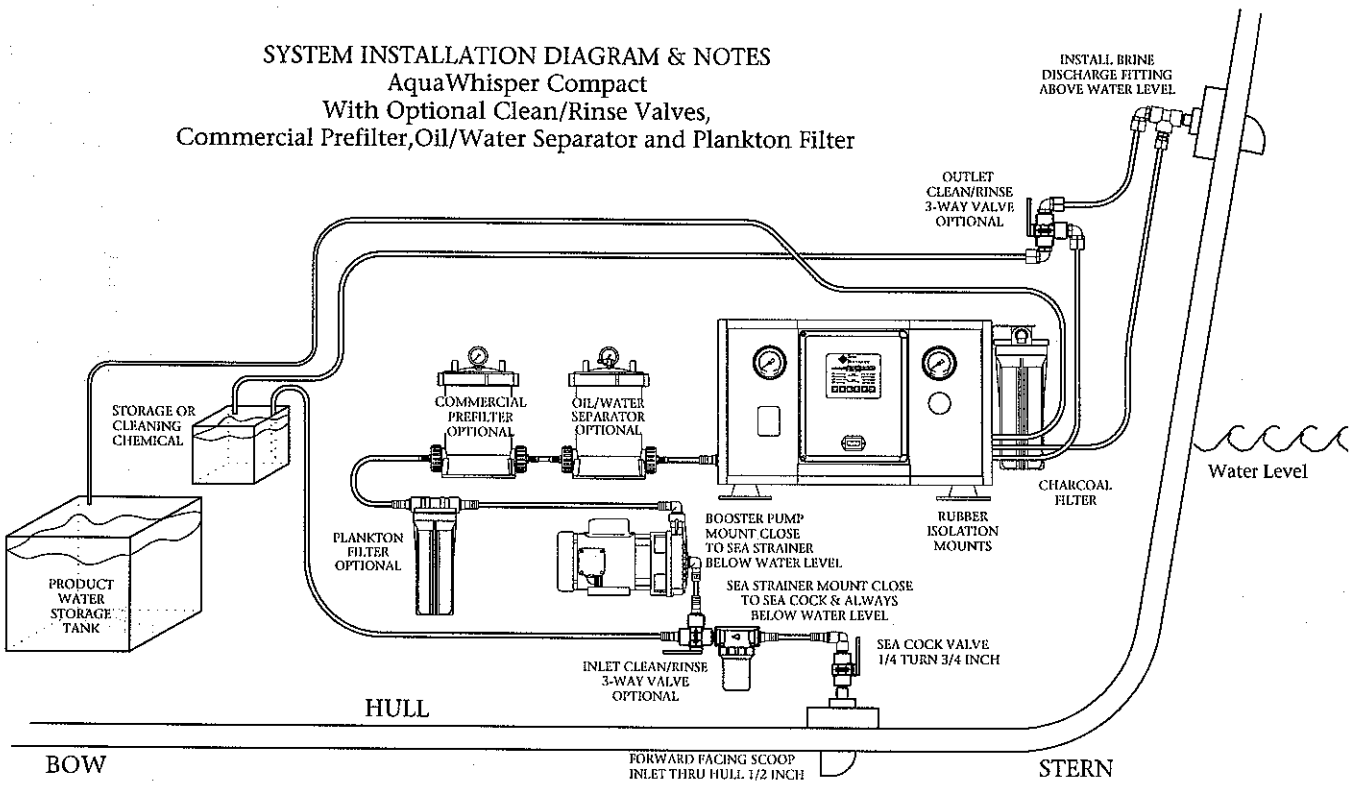
SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Compact
With Optional Clean/Rinse Valves,
Commercial Prefilter and Oil/Water Separator



SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Compact
With Optional Clean/Rinse Valves,
Commercial Prefilter, Oil/Water Separator, Multi Media Filter and Fresh Water Flush

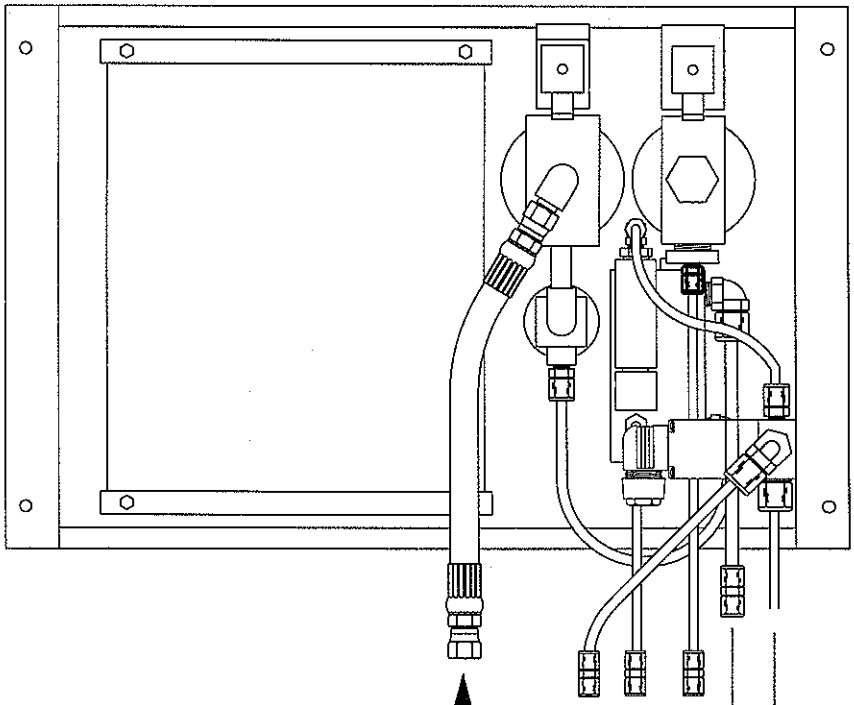


SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Compact
With Optional Clean/Rinse Valves,
Commercial Prefilter,Oil/Water Separator and Plankton Filter



Aqua Whisper Modular Style System
Rear View of the Control Panel showing
hose and tubing connections.

AquaWhisper Modular Style System
Rear View of Control Panel
With Hose and Tube Connections



High Pressure Hose
To Hi Pres Switch, Hi Pres Gauge & Back Pres Regulator
From Last R.O. Membrane Outlet

3/8" O.D. Tube (Good Product Water)
Outlet of Port "A" of Diversion Valve
To Inlet of Charcoal Filter

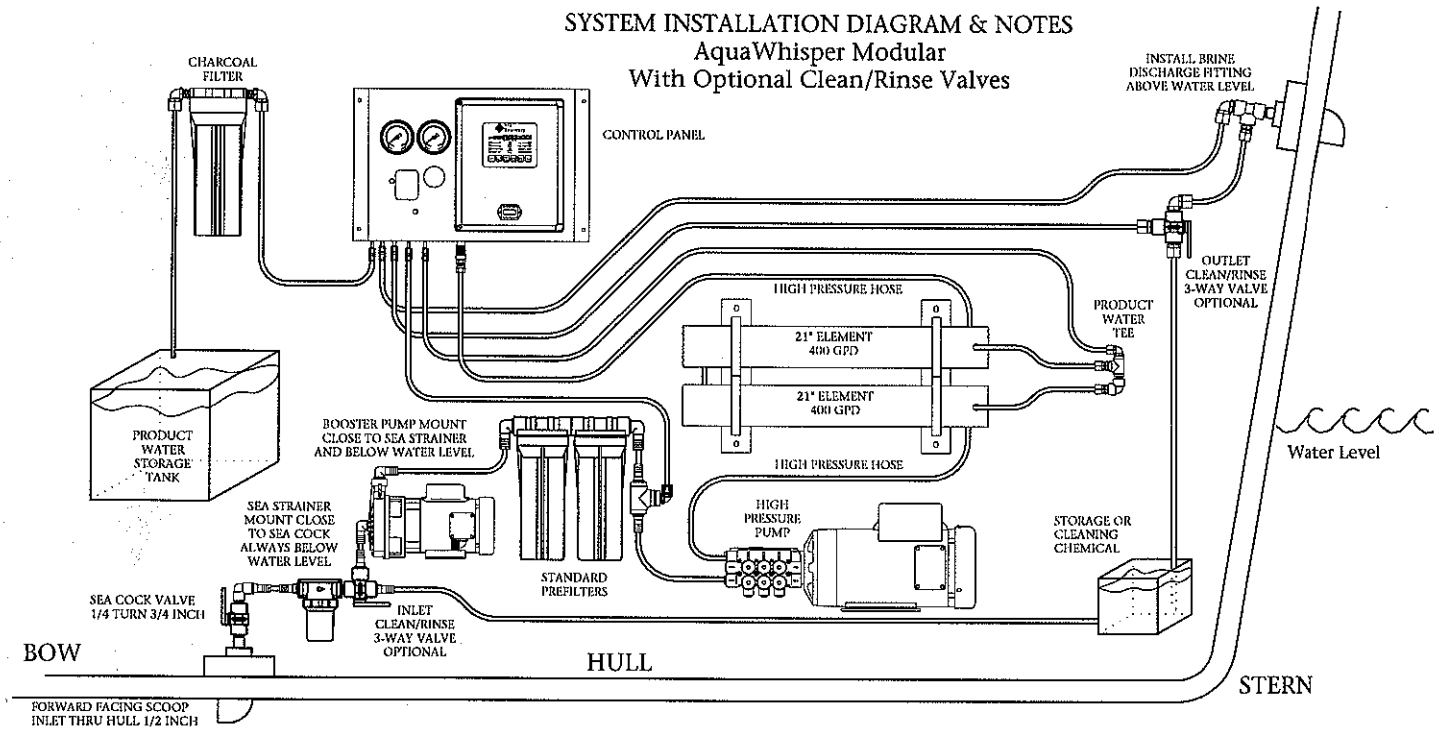
3/8" O.D. Tube
Outlet of Product Water Tee
To Inlet of Product Water Flow Meter

1/4" O.D. Tube
Outlet of Prefilter / Inlet of High Pressure Pump
To Low Pressure Swutch & Low Pressure Gauge

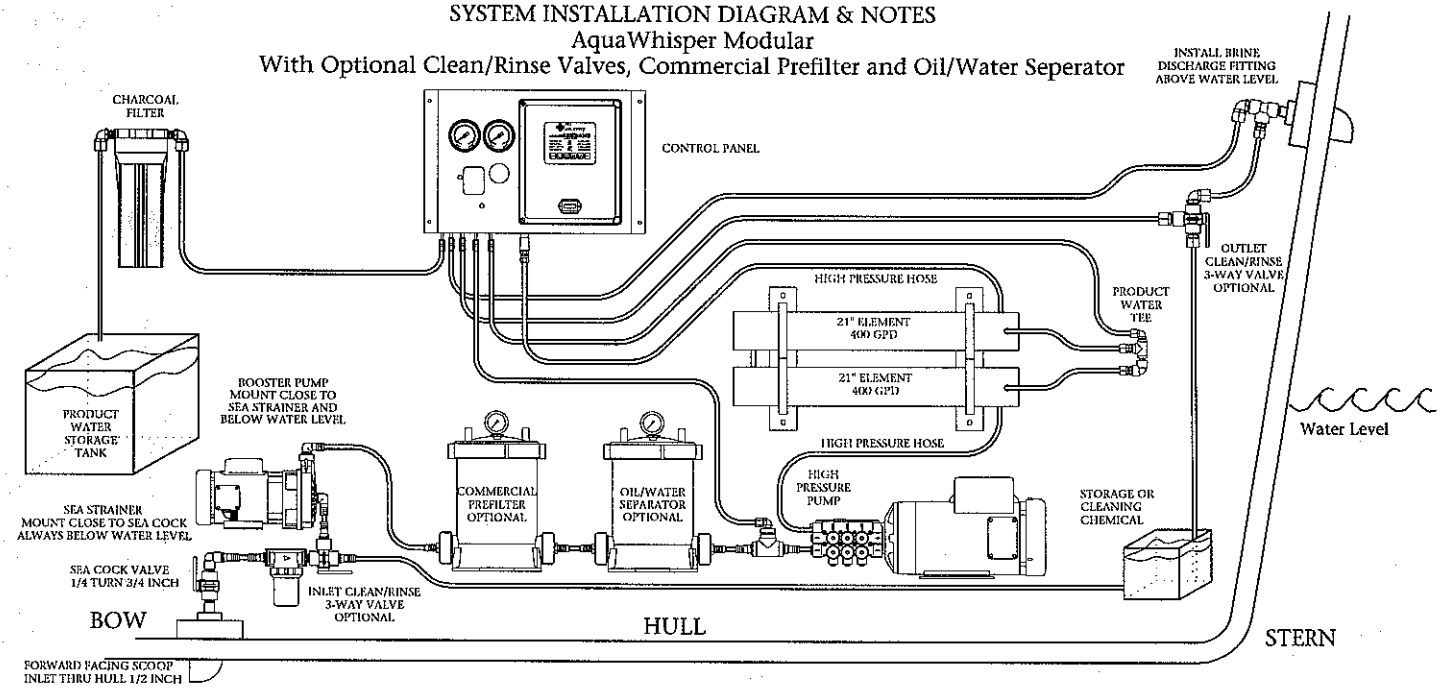
1/2" O.D. Tube
Outlet of Brine Discharge Flow Meter
To Brine Discharge Tee

3/8" O.D. Tube (Bad Product Water)
Outlet of Port "B" of Diversion Valve
To Brine Discharge Tee

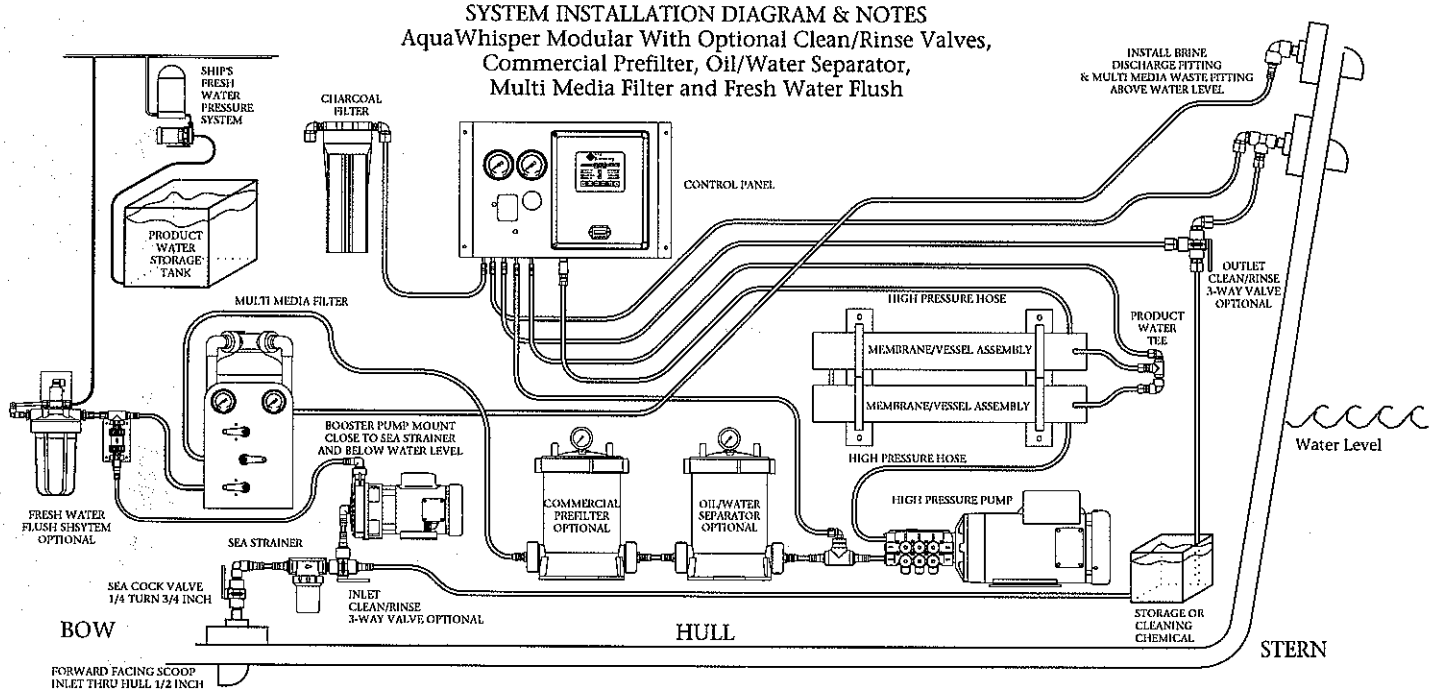
SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Modular
With Optional Clean/Rinse Valves



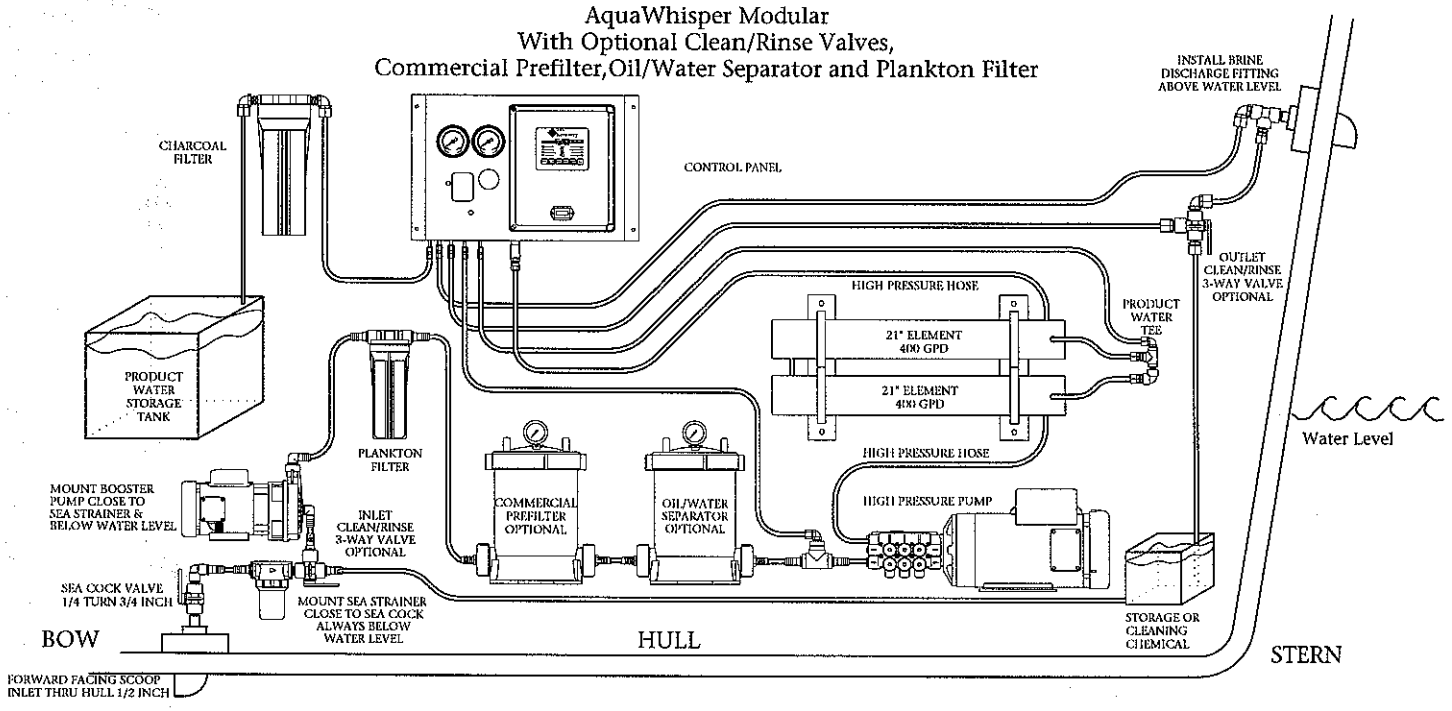
SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Modular
With Optional Clean/Rinse Valves, Commercial Prefilter and Oil/Water Seperator



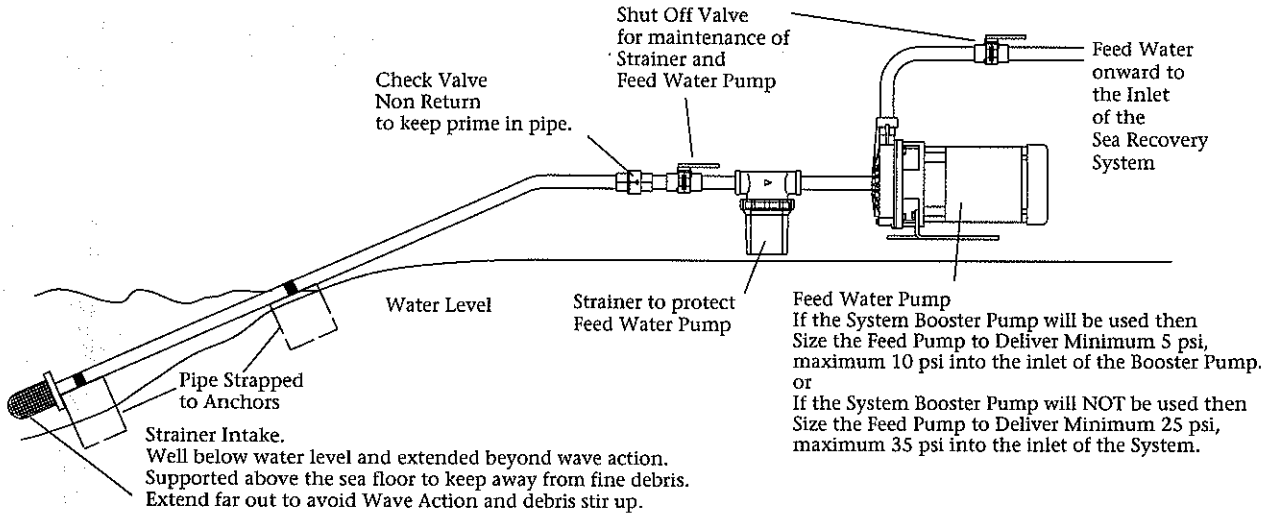
SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Modular With Optional Clean/Rinse Valves,
Commercial Prefilter, Oil/Water Separator,
Multi Media Filter and Fresh Water Flush



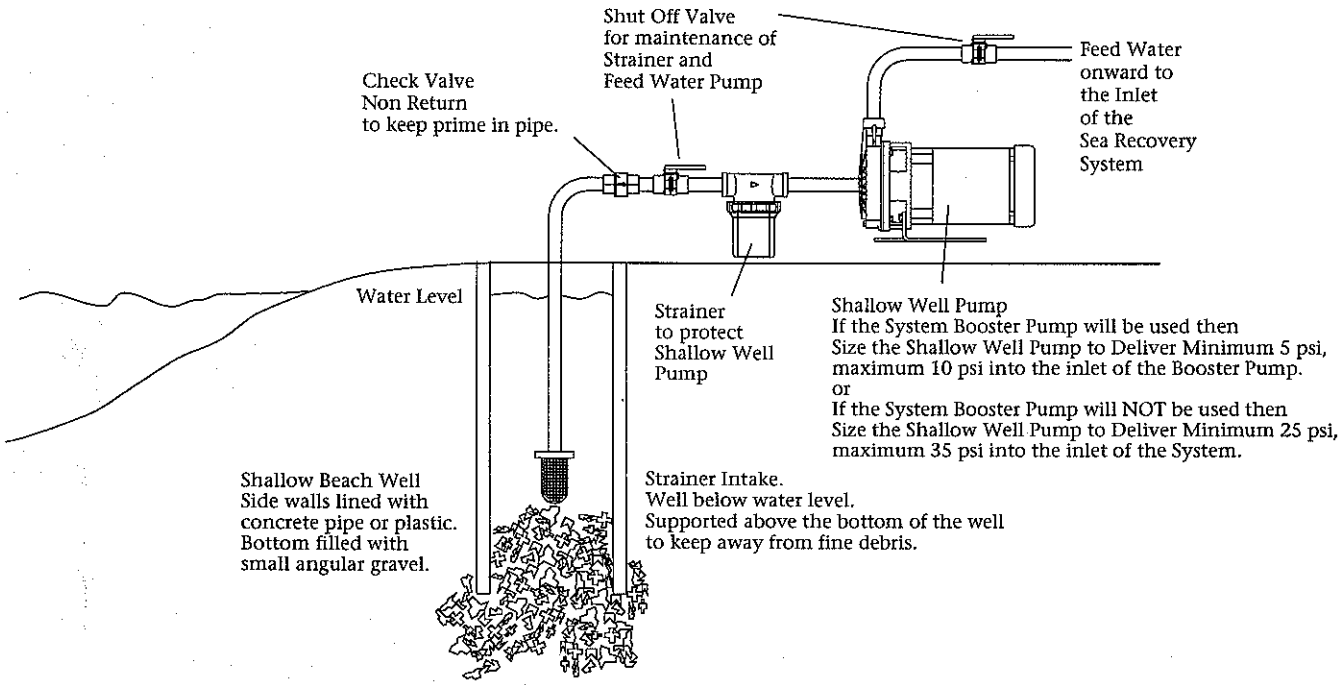
SYSTEM INSTALLATION DIAGRAM & NOTES
AquaWhisper Modular
With Optional Clean/Rinse Valves,
Commercial Prefilter,Oil/Water Separator and Plankton Filter



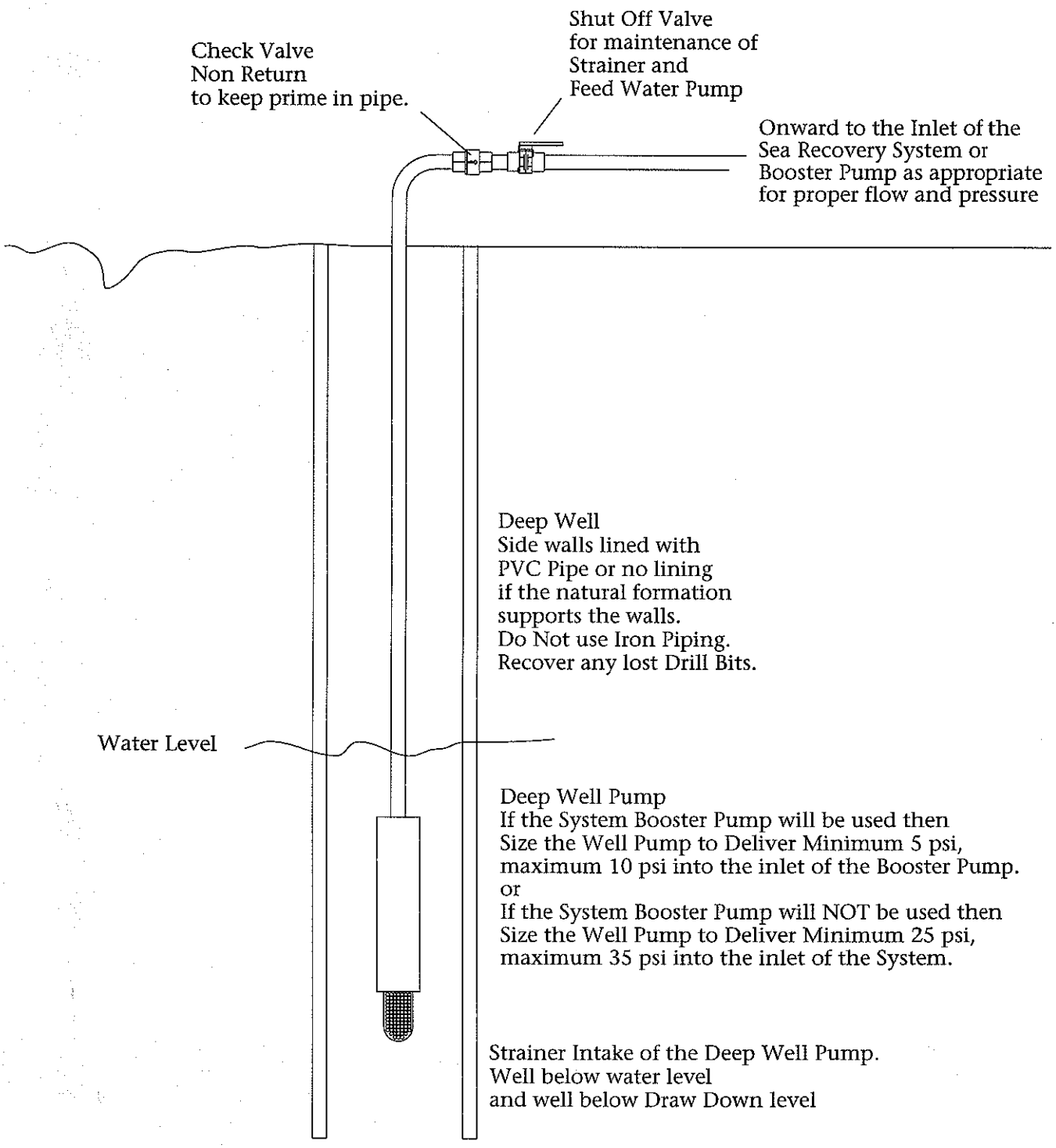
Example of Feed Water Intake Direct from the Feed Source for a Land Installation.



Example of Feed Water Intake from a Shallow Beach Well for a Land Installation.

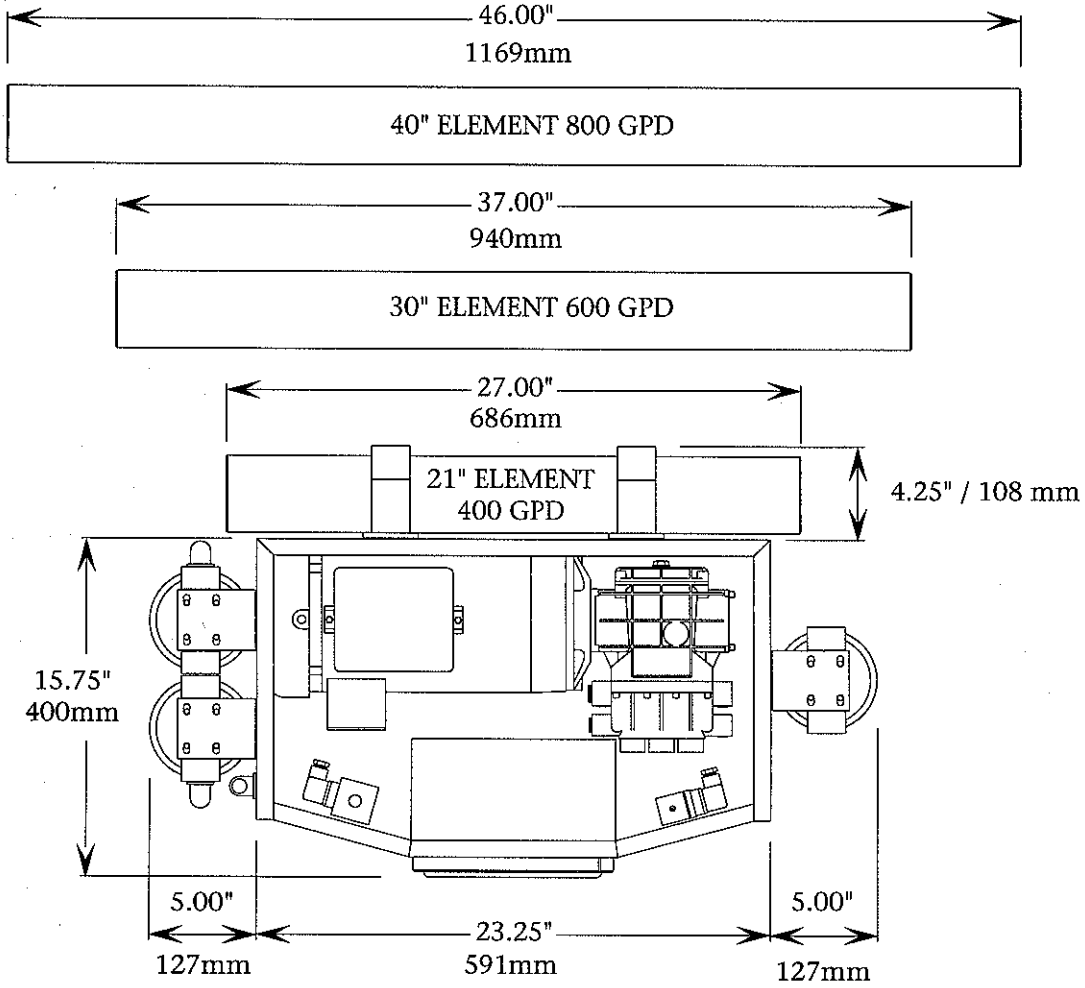


Example of Feed Water Intake from a Deep Well for a Land Installation.

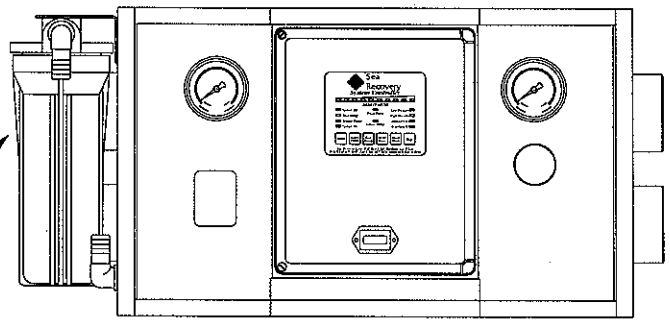


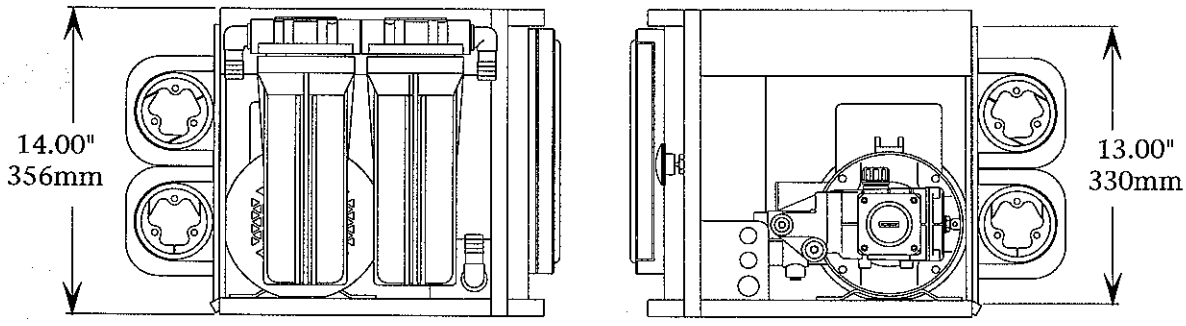
AquaWhisper Compact Style Dimensions

System Shown with Standard Prefiltration



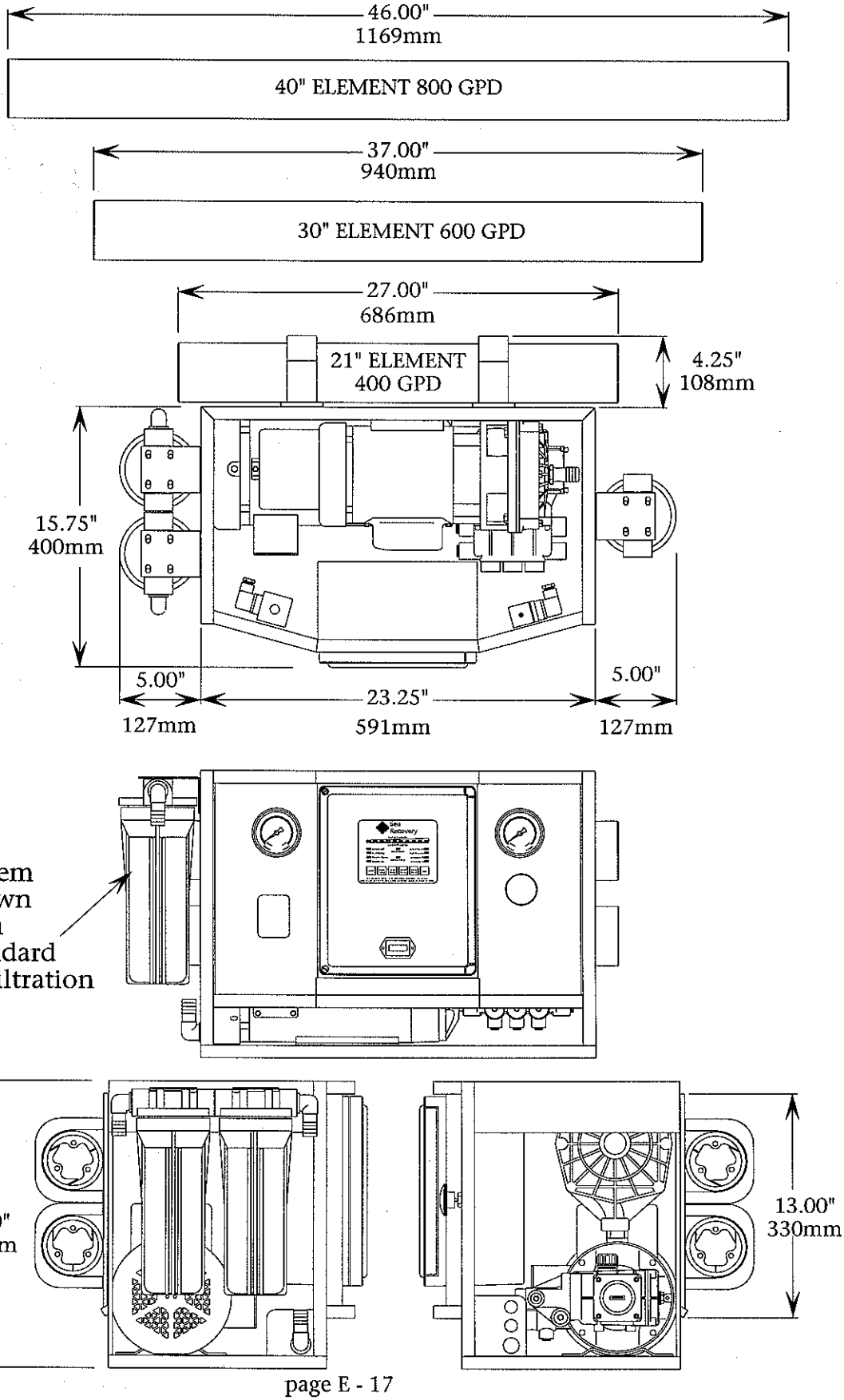
System Shown with Standard Prefiltration



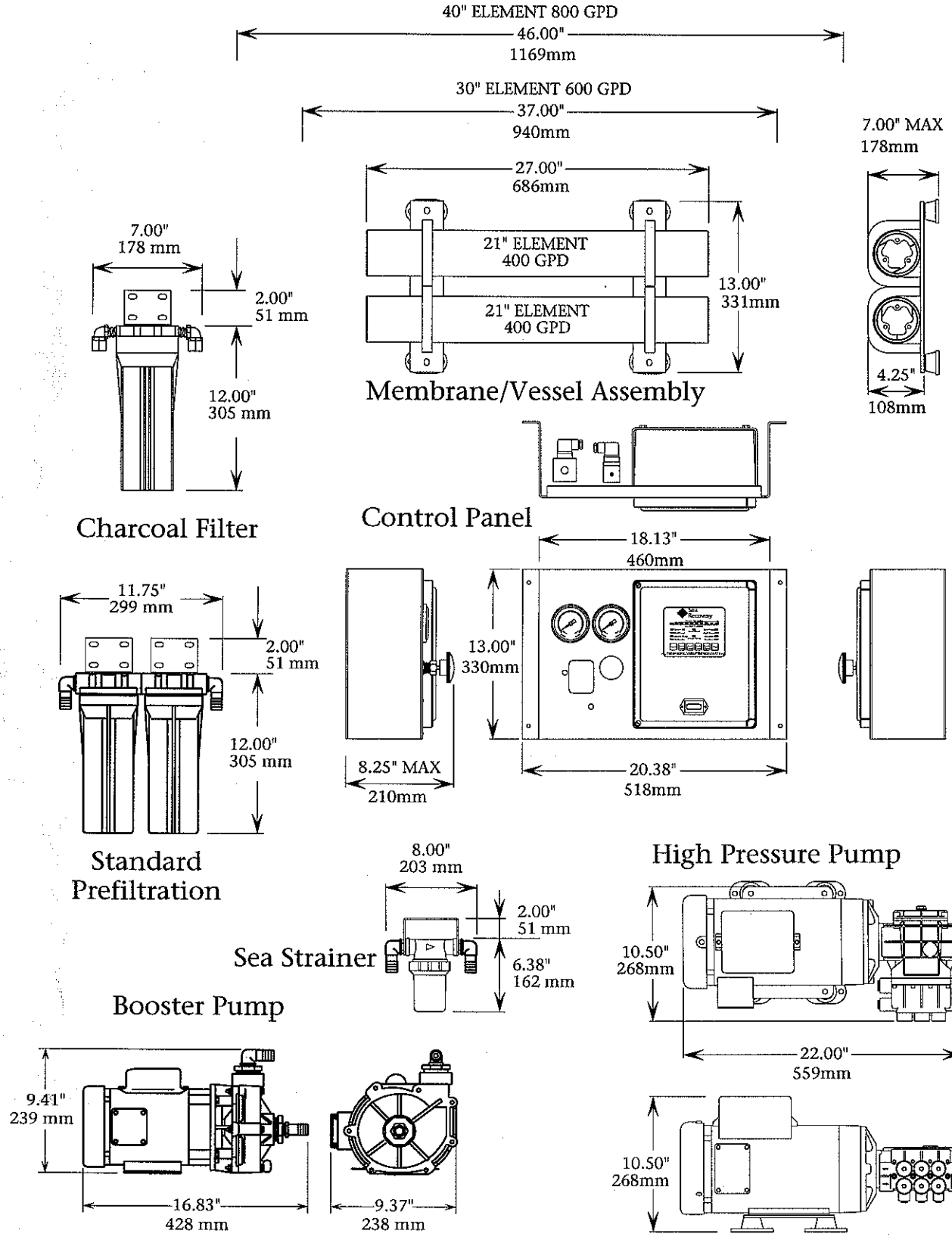


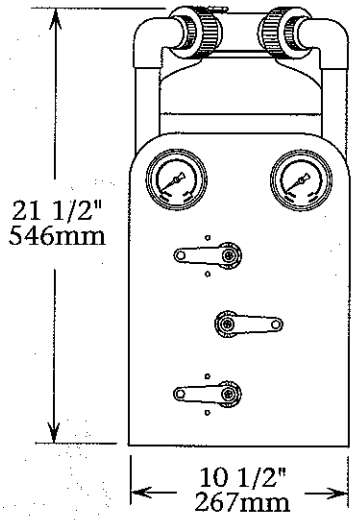
AquaWhisper Frame Style Dimensions

System Shown with Standard Prefiltration

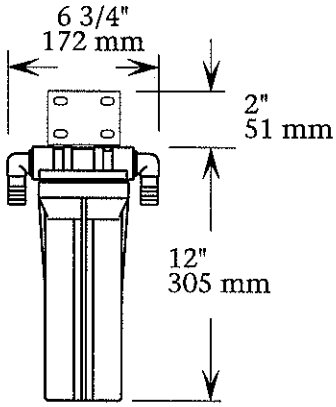


AquaWhisper Modular Style Dimensions

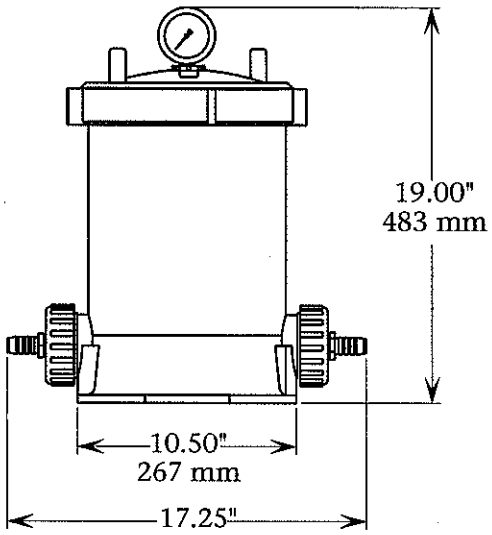




15" (38 cm) DEEP
WEIGHT: 19 lbs empty / 70 lbs full
9.6 kg empty / 30 kg full

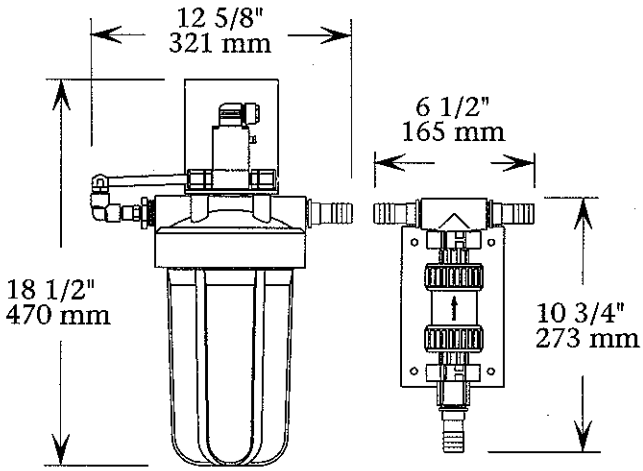


5" deep
SINGLE
PLANKTON FILTER
Allow 4" below
for filter removal

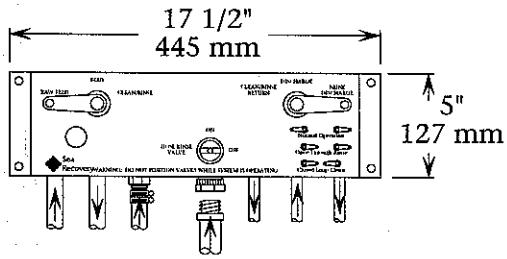


COMMERCIAL PREFILTER
& OIL/WATER SEPARATOR
Allow 12" above for Filter Removal

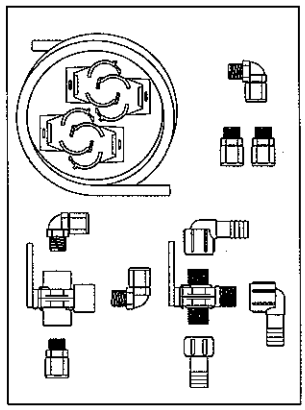
FRESH WATER
FLUSH ASSEMBLY
Allow 4" below
for filter removal



8" deep



Clean/Rinse Valve Panel
Allow 12" below for hose and tube routing



INDIVIDUAL
CLEAN / RINSE VALVES

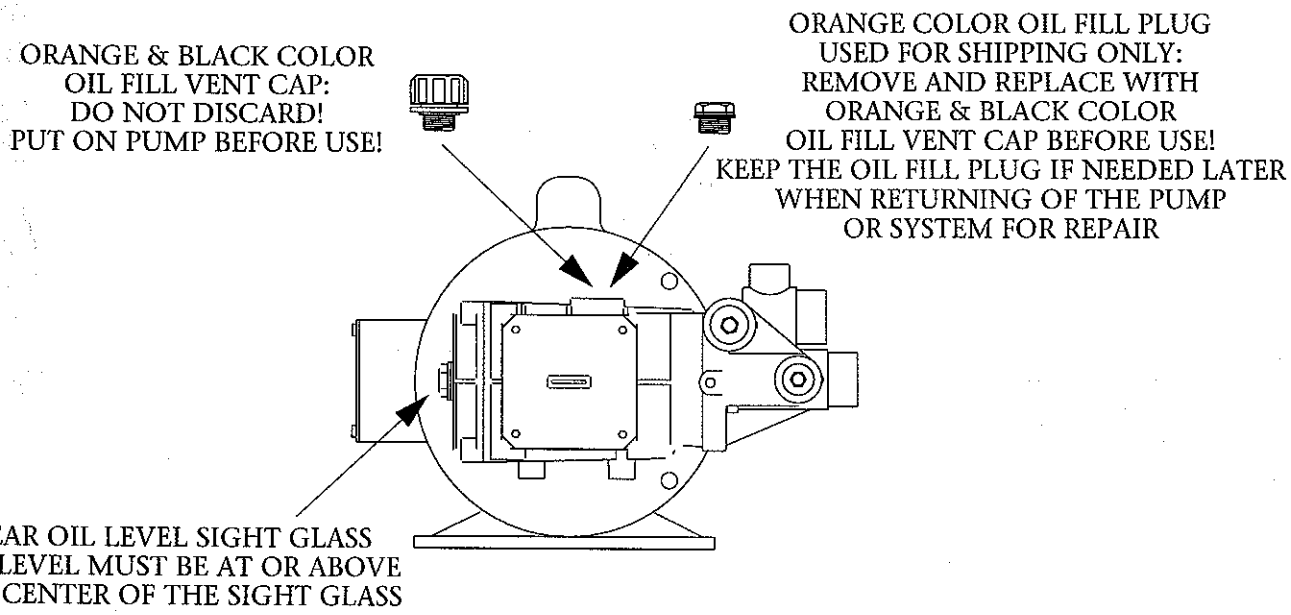
2. Check the level of the oil in the High Pressure Pump crankcase. Oil level is viewed through the rear Oil Level Sight Glass located at the back of the High Pressure Pump crankcase section. Ensure that the oil level is higher than the center of the sight glass. Low filling of oil causes overheating and damage to the rear crankcase section. Over filling does not cause damage. Over filling keeps the crankcase section cooler and properly lubricated. However, if too much oil is placed into the crankcase the excess oil percolates out the vented oil fill cap until the oil finds it's own level. Filling just to the top of the sight glass is ideal and best.

   Use only Sea Recovery supplied pump oil as the Sea Recovery oil is a special hydraulic oil which contains anti rust and wear inhibitors which is essential to the high pressure pump crankcase section.

H. HIGH PRESSURE PUMP PREPARATION:

1. ***The High Pressure Pump is shipped with a <u>Non Vented Plug</u> so that oil does not spill from the High Pressure Pump during shipment. This orange color Non Vented Plug (located on top of the black color rear crankcase section) <u>must be removed and replaced</u> with the supplied orange and black color <u>Vented Oil Fill Cap</u>.***

   If the crankcase is not vented with the proper cap, pressure builds within the crankcase and causes oil seal failure, loss of crankcase oil and, in turn, damage to the High Pressure Pump due to lack of lubricating oil. <u>Such a failure due to the installers neglect voids all warranty of the High Pressure Pump</u>. Sea Recovery Corp. is not liable for the installers neglect. The Installer is held totally responsible for any damages due to neglect and failure to install the supplied <u>High Pressure Pump Oil Fill Vented Cap</u>.

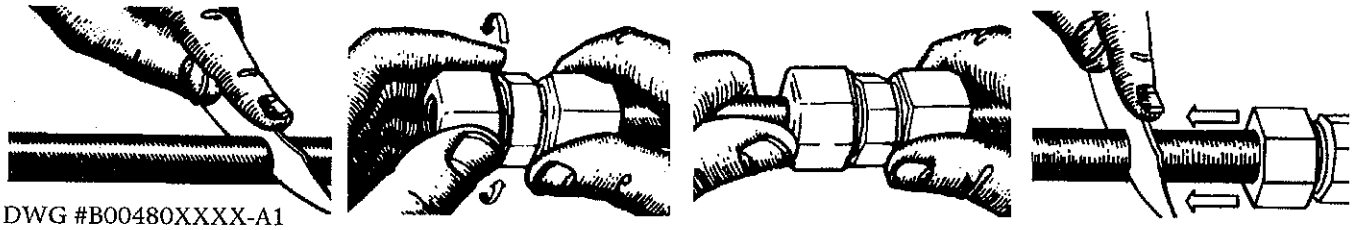


1. FAST-N-TITE TUBING CONNECTIONS:

CROSS SECTION OF FAST-N-TIGHT TUBE FITTING

TUBE FITTING ASSEMBLY AND DISASSEMBLY INSTRUCTIONS

STEP 1 STEP 2 STEP 3 STEP 4



DWG #B00480XXXX-A1

ASSEMBLY:

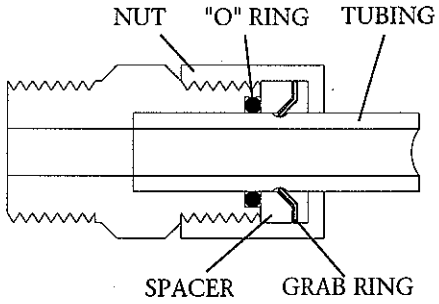
Step 1 Cut tube end square and clean.

Step 2 Loosen nut on fitting three turns.

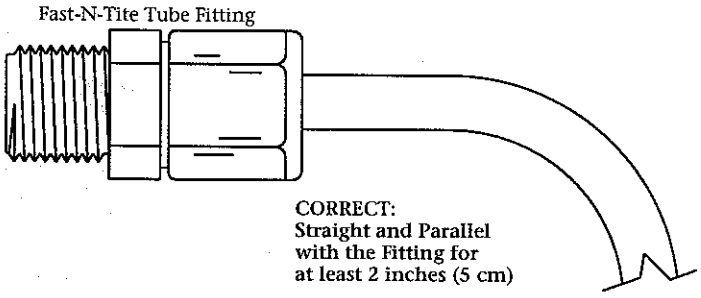
Step 3 Insert tube into fitting until it bottoms. Loosen nut completely and remove tube with attached parts from body. Check to ensure that the "O" ring is seated onto the tube under the spacer (and not pinched into the body). Insert tube with attached parts into the body and tighten nut finger tight.

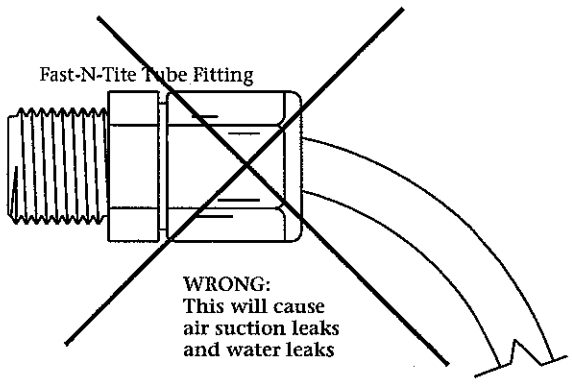
DISASSEMBLY:

Step 4 To remove tubing in order to reuse the fitting assembly, cut tubing close to nut, push tubing through nut, grab ring and spacer.



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





I. COMPONENT INSTALLATION:

CAUTION: Do not over tighten PVC fittings. Tighten PVC fittings hand tight only. Use a wrench with extreme caution only. Do not apply excessive force when tightening PVC or thermoplastic fittings. If pipe threaded fittings leak after installation then remove the fitting, clean the male mating threads, apply 3 to 4 wraps of Teflon tape to the male threads and then thread the parts back together hand tight. Use a wrench to tighten additionally maximum 1 turn only, and only if necessary due to looseness or leakage.

The unique installation requirements of each component are described in this section. It is important that the stated conditions be adhered to for proper operation and ease of component maintenance.

The Inlet Connection [2], Sea Strainer [3], Inlet Clean/Rinse Valve [4] and Booster Pump [5] must be mounted below water level to ensure constant contact with the Feed Water and in order to provide positive pressure into the inlet of the Booster Pump.

WARNING: REMOVE ALL TUBE SHIPPING PLUGS FROM THE RIGHT SIDE OF THE AquaWhisper Compact and Frame SYSTEMS OR FROM THE MEMBRANE/VESSEL ASSEMBLIES OF THE AquaWhisper Modular SYSTEMS. THESE TUBE SHIPPING PLUGS WERE INSTALLED PRIOR TO SHIPMENT IN ORDER TO MAINTAIN WATER WITHIN THE MEMBRANE/VESSEL ASSEMBLIES FAILURE TO REMOVE THESE PLUGS RESULTS IN SYSTEM DAMAGE IF THE SYSTEM IS OPERATED WITH THE PLUGS IN PLACE.

Use the supplied 3/4 inch I.D. (19 mm) Flexible Hose to connect all Prefiltration Components from the Outlet of the Sea Cock through the Inlet of the System. Use 2 each supplied Hose Clamps at each connection to secure the hose to it's respective Hose Barb Fitting and seal it from leaks.

1. **Inlet Thru Hull Fitting [1] with Inlet Sea Cock Valve [2]** (installer/owner supplied) should be installed by a competent boat yard. The pipe size of the inlet must be 3/4 inch (19 mm) minimum. The Sea Cock Valve [2] must be fitted with 3/4" MNPT (Male National Pipe Thread American Standard Tapered Pipe Thread) at the Sea Cock Valve [2] outlet.

   Special consideration in placement is necessary. The Thru Hull Fitting must be located well below the water line so that (on a boat: in rough water, while cruising, and while at maximum tack on a sailboat) the inlet remains in constant contact with the feed water.

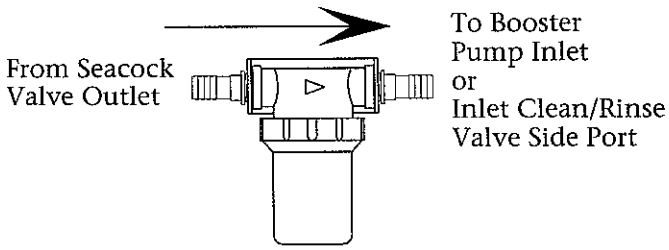
   It must be of a forward facing scoop type. NOTE: Flush style inlet Thru Hull Fittings are not recommended because they cause a reverse suction on the System Feed Line and for this reason a flush style Inlet Thru Hull Fitting is not recommended. The System must receive a positive and uninterrupted supply of feed water. The Sea Cock Valve, 1/4 turn ball valve, normally attached to the Thru Hull Fitting must be accessible for daily and emergency closure.

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

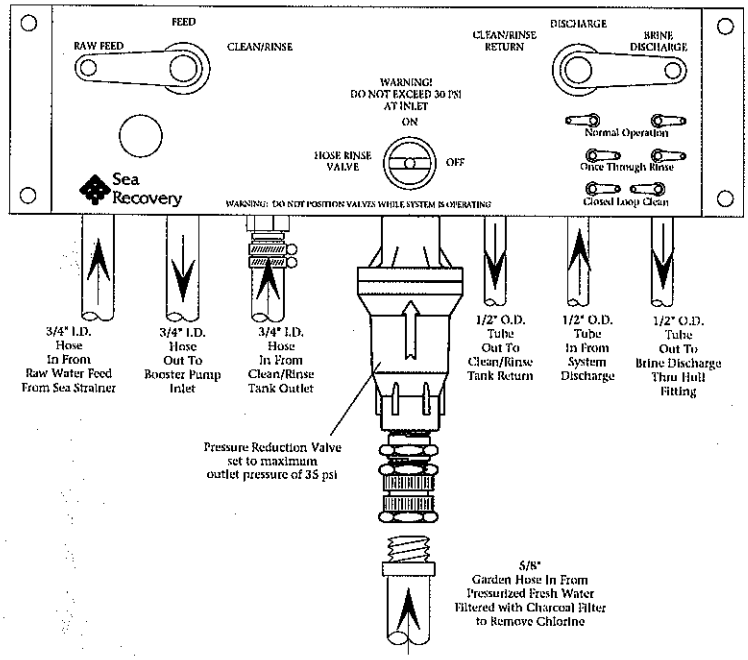
   DO NOT tie or tee the Sea Recovery System Feed Line into another line that already feeds another auxiliary system. DO NOT tie or tee another auxiliary system into the Sea Recovery System Feed Line. Continual shut down of the Sea Recovery System results if another auxiliary system is tied or teed into the Sea Recovery Feed Line.

2. **Inlet Connection** supplied in the installation kit is a 3/4 inch FNPT (Female National Pipe Thread American Standard Tapered Pipe Thread) PVC 90° elbow with a 3/4 inch Hose Barb fitting. Wrap Teflon tape onto the Sea Cock Valve Male Thread Fitting. Thread the inlet connection hand tight to ensure a leakproof fit. Align the outlet of the fitting so that it points toward the Sea Strainer [3] inlet.

3. **Sea Strainer [3]**

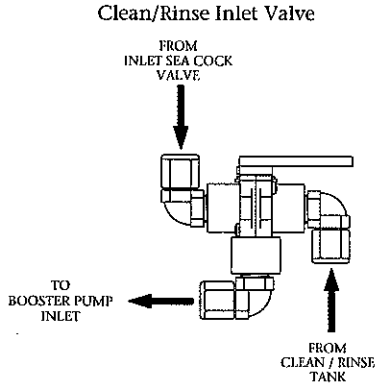


must be mounted well below water level and in a position for easy access for maintenance cleaning. Allow a minimum of 2 inch (50mm) clearance below the bottom of the bowl for screen removal. Connect the Outlet of the Sea Cock Valve to the Inlet of the Sea Strainer.



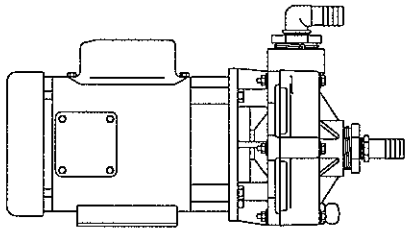
4. **Clean/Rinse Panel with Inlet Clean/Rinse Valve [4], Outlet Clean/Rinse Valve [35] and Garden Hose Valve for Pressurized Fresh Water Rinse Connection:** This optional valve panel assembly replaces the individual Clean/Rinse Valves. Plumb as illustrated in the drawing to the right.

5. **Inlet Clean/Rinse Valve [4]:**



This optional valve, when used in conjunction with the Outlet Clean/Rinse Valve #35, assists in rinsing and cleaning of the System. Install the Inlet Clean/Rinse Valve between the Sea Strainer and the Booster Pump in an area that is access able. The Valve may be directly mounted to the Outlet Port of the Sea Strainer or the Inlet Port of the Booster Pump there by eliminating one length of hose.
If used, connect one ***side*** port of the Inlet Clean/Rinse Valve to the Outlet of the Sea Strainer. Connect the other ***side*** port to a Clean/Rinse Tank [50] or to a length of hose that can later be placed into a temporary Clean/Rinse Tank, Container or Bucket. Connect the ***Center*** (common) port to the Inlet of the Booster Pump [5]

6. **Booster Pump [5].**



The AquaWhisper Frame Series System contains the Booster Pump within the Frame. Priming of the Frame Style System, if it is mounted above water level, is covered in the Commissioning Section of this manual.

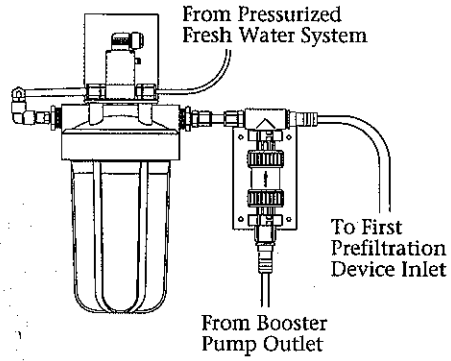
Aqua Frame Style System skip here and go to item 6. AquaWhisper Compact and Modular Style Systems read on.

The Booster Pump is a centrifugal pump and it is not self priming. It must be mounted below water level to ensure that it receives feed water immediately upon starting. If placed above water level time to prime the System is increased and damage to the Booster Pump seals and High Pressure Pump seals results if these pumps are operated without feed water flow. **Always install the Booster Pump Below Water Level and Close to the Sea Strainer.**

The Booster Pump may be mounted either horizontally or vertically. If the Booster Pump is mounted Vertically the Wet End MUST be mounted DOWN (on bottom) and the Motor End MUST be mounted UP (on top). If the Booster Pump is mounted vertically with the wet end on top then the motor may develop an electrical short should the wet end of the Booster Pump leak.

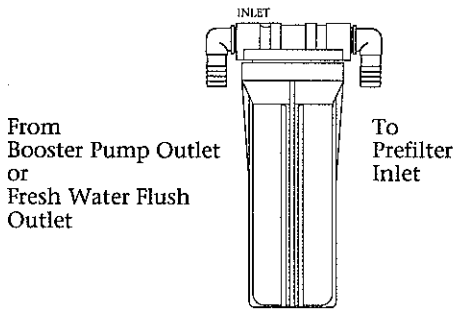
Connect the Booster Pump inlet to the Sea Strainer Outlet, or if the Inlet Rinse/Clean Valve is installed then connect the Booster Pump Inlet to the Center (common) port of the Inlet Clean/Rinse Valve [5]. Keep this line as short and straight as possible. Avoid up and down loops; avoid 90 degree elbows; avoid kinks.

7. Fresh Water Flush Assembly [53 & 54]



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

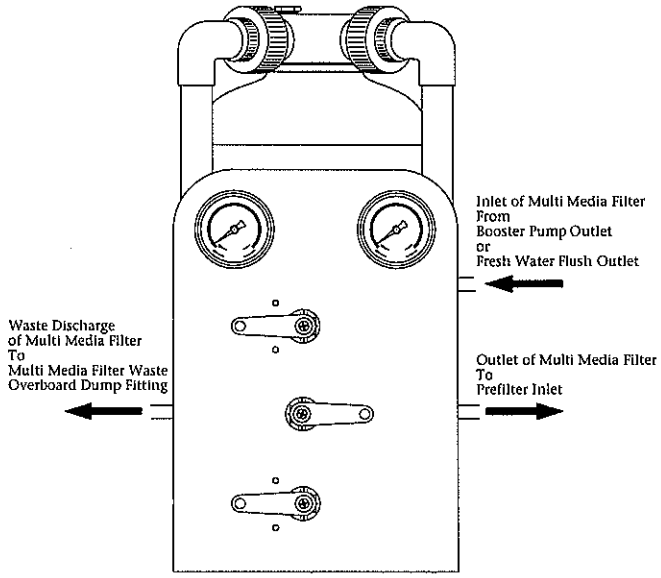
8. Plankton Filter [11]



(optional. Double shown, single also available) must be mounted against a flat vertical surface using the supplied mounting brackets and hardware.

It is preferable to mount the assembly below water level to minimize feed pressure loss. Allow minimum 4" below the bottom of the bowl for mesh screen element removal. Connect the inlet to the Booster Pump Outlet or the Fresh Water Flush Outlet.

9. Multi Media Filter [6] (optional) is supplied premounted to it's own base. Mount the Multi Media Filter base onto a flat horizontal surface and secure the base in place using the supplied mounting hardware. It is preferable to mount the assembly below water level to minimize feed pressure loss.



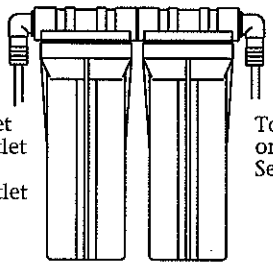
Connect the inlet to the Booster Pump Outlet or Fresh Water Flush Outlet. Connect the Outlet to the Prefilter Inlet. Connect the Multi Media Filter Waste Discharge Fitting [9] to the Over Board Dump Waste Fitting [10]. Connect the Waste Outlet to the Multi Media Filter Over Board Dump Waste Fitting.[9].

NOTE: The Multi Media Filter is supplied with media loose in two separate bags. This media, small gravel and fine sand, must be placed into the Multi Media Filter before use. The Multi Media Filter requires approximately 15 lbs (7 kg) of small gravel (1/8 x 1/4 inch) first (on the bottom) then approximately 26 lbs (12 kg) of #20 silica sand last (on top of the small gravel).

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

NOTE: the new gravel and sand contain fines and contaminates. The Multi Media Filter must be back washed prior to use otherwise the fines foul the prefilters and possibly the R.O. Membrane Element(s). This back washing procedure is explained in the Commissioning / Initial Start Up Section F of this manual.

10. Standard Prefilter [12]



is premounted to the AquaWhisper Frame Style and also to the AquaWhisper Compact Style. If this Dual Prefilter is to be removed and remote mounted from the Frame or Compact Style System or if you have a Modular Style System then the Standard Prefilter must be mounted against a flat vertical surface using the supplied mounting brackets and hardware.

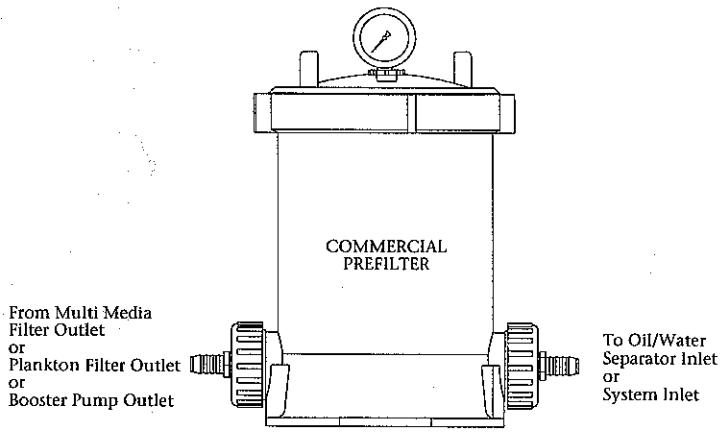
It is preferable to mount the Standard Prefilters a straight line with and in close proximity to the Booster Pump (or Plankton Filter if used or Multi Media Filter if used) and the Frame Style System, Compact Style System or Modular Control Panel.

Allow minimum 4" below the bottom of the bowl for Prefilter Element removal.

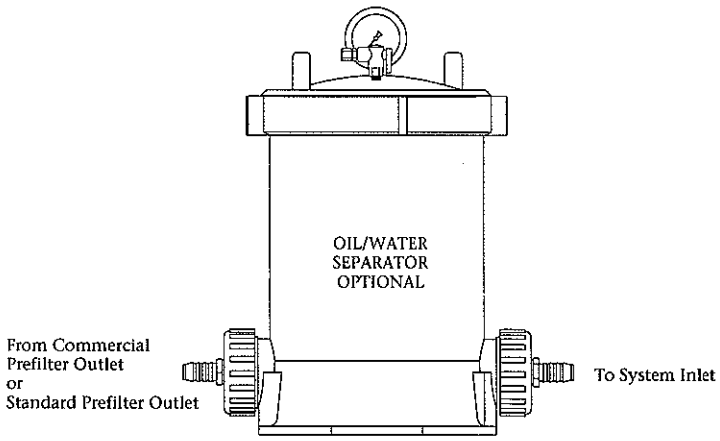
Connect the Booster Pump Outlet (or Plankton Filter Outlet if used or Multi Media Filter Outlet if used) to the Prefilter Inlet.

If the Oil/Water Separator is not used then connect the Standard Prefilters Outlet to the Low Pressure Feed Manifold located at the Control Panel.

11. Commercial Prefilter [13]



(optional) if used replaces the Standard Prefilters. It is not necessary to use both the Commercial Prefilter and Standard Prefilters. If both the Commercial Prefilter and Standard Prefilters are used then excessive line loss, loss of pressure, is experienced. The Commercial Prefilter, must be positioned on a firm, flat surface and mounted in place with the supplied hardware. Allow 12 inches above the Commercial Prefilter assembly for filter element removal. Connect the Commercial Prefilter Inlet Port to the Booster Pump Outlet (or Plankton Filter Outlet if used or Multi Media Filter Outlet if used).



12. Oil/Water Separator [16]

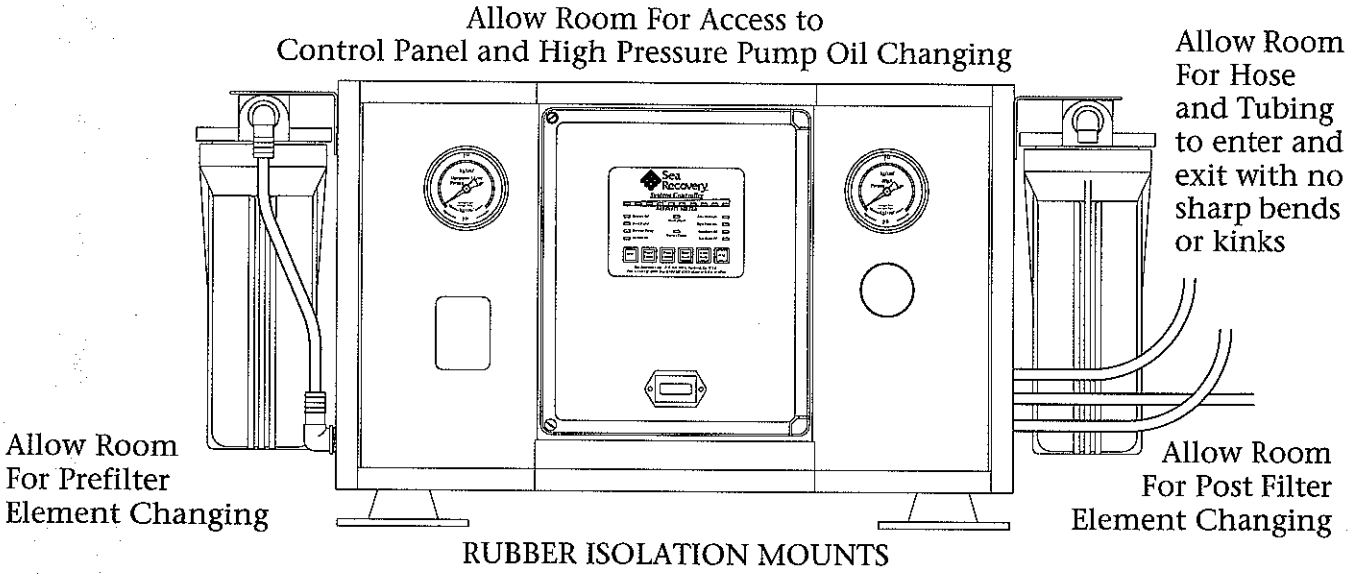
if used, ***must follow*** the Prefilter (Commercial Prefilter or Standard Prefilters). Position the Oil/Water Separator on a firm, flat surface and mount in place with the supplied hardware.

NOTE: The Oil/Water Separator Assembly is plumbed for water flow in the ***opposite*** manner as the Prefilter. The water flows up into the center of the Oil/Water Separator Element and out of the outer circumference of the Element.

Using the supplied 3/4 inch I.D. hose, connect the Oil/Water Separator Inlet to the Commercial Prefilter Outlet or the Standard Prefilters Outlet. Connect the Oil/Water Separator Outlet to the Frame Style System Inlet, Compact Style System Inlet or Modular Style Feed Water Low Pressure Manifold located on the Control Panel.

13. AquaWhisper Frame Style System, Compact Style System or Modular Style Control Panel.

Frame or Compact Style System mounting:



Give consideration to access for operation and maintenance. The controls and valving within the System must be readily accessible for daily operation.

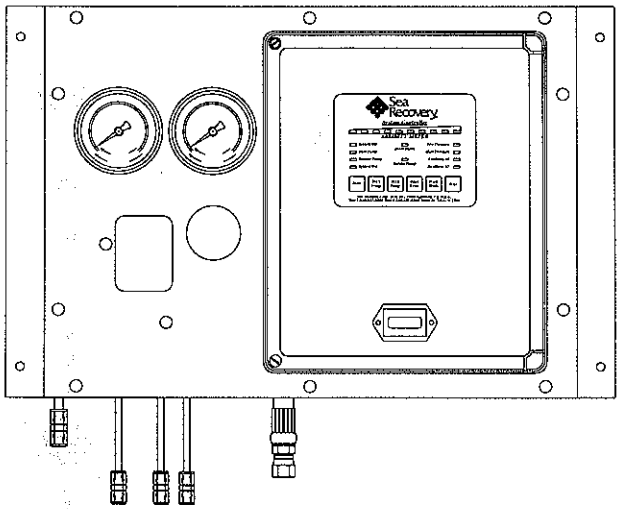
Components within the System, including High Pressure Pump Rear Crankcase Section, Prefiltration and Post filtration, must be readily access able for scheduled maintenance.

Give further consideration to Water Line connections. Ensure that all tubing and hose connections have sufficient space to be routed without kinks or sharp bends. Keep the System within close proximity to the Prefiltration Components to ensure minimal line loss.

Using the supplied Rubber Isolation Mounts and Mounting Hardware position the System on a firm flat surface and secure in place.

Modular Style Control Panel mounting:
Give consideration to access of the

CONTROL PANEL
Mount in Accessable Location



Allow Space for Hose and Tubing Entry and Exit with no sharp bends or kinks

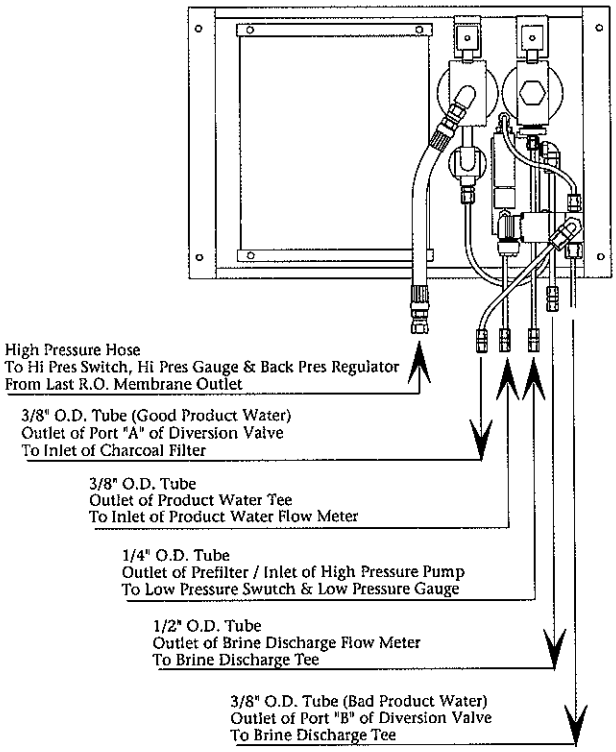
Modular Control Panel for operation and maintenance. The controls and valving within the System must be readily access able for daily operation.

Give further consideration to Water Line connections. Ensure that all tubing and hose connections have sufficient space to be routed without kinks or sharp bends. Keep the Control Panel within close proximity to the Prefiltration Components and High Pressure Pump to ensure minimal line loss.

Using the supplied Mounting Hardware position the Control Panel on a firm flat vertical surface and secure in place.

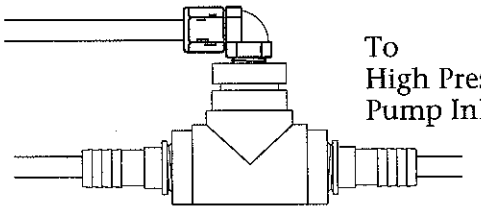
The Control Panel's side mounting brackets may be removed for flush mounting against a bulkhead or cabinet cut out.

AquaWhisper Modular Style System
Rear View of Control Panel
With Hose and Tube Connections



14. Low Pressure Pick Up Tee (Modular Style System Only)

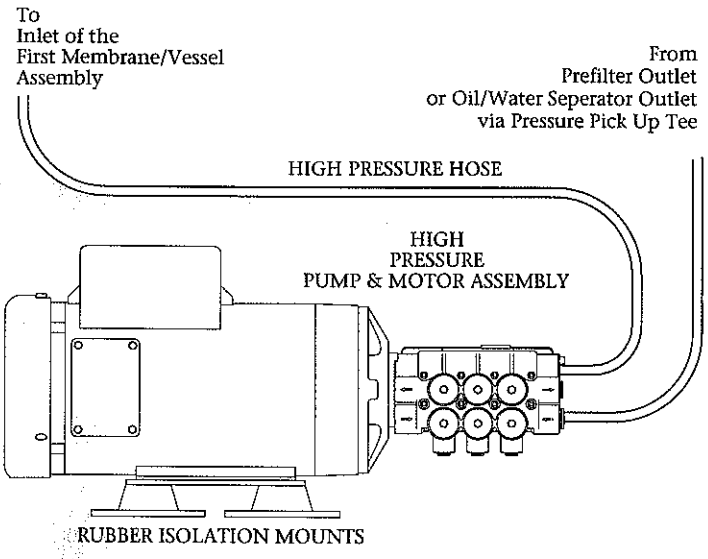
To Low Pressure Gauge
& Low Pressure Switch Pickup
at Control Panel



From
Prefilter Outlet
or Oil/Water Seperator Outlet

Connect the Outlet of the Prefilter or Oil Water Separator (if used) to one end of the Low Pressure Pick Up Tee. Connect the 1/4" O.D. tube fitting of the Low Pressure Pick Up Tee, using the supplied 1/4" tube, to the Low Pressure Manifold at the Control Panel.

14. High Pressure Pump with Electric Motor Assy [25 & 26]



is premounted within the AquaWhisper Frame and Compact Style Systems, but separate with the Modular Style System.

The Modular Style System High Pressure Pump and Motor Assembly is a separate assembly and requires installation. When mounting the High Pressure Pump and Motor Assembly, give consideration for access to pump crankcase oil changes and motor bearing grease. Ensure that the electric motor rear fan cover is not blocked and allows ventilation of the electric motor. For proper pump lubrication purposes, the Pump and Motor Assembly must be mounted horizontally on a flat base.

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

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

15. R.O. Membrane/Vessel Assy [14]

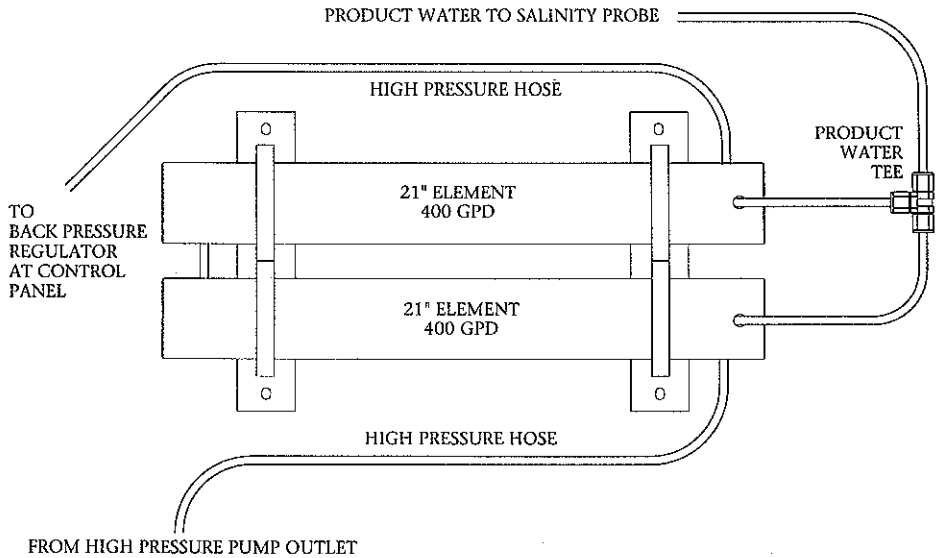
CAUTION: Temperature extremes of the R.O. Membrane mounting area are an important consideration. Do not mount the R.O. Membrane assembly in an area exposed to direct sunlight, temperatures above 120°F (40°C) or freezing temperatures. (NOTE: Any time the assembly is exposed to 140°F (60°C) while not running or running unpressurized, or to 120°F while running and pressurized, the membrane can be damaged).

Remote mount the R.O. Membrane/Vessel Assembly away from extreme heat. Feed water temperatures below 32°F can also damage the R.O. Membrane Element. Unfiltered Sea Water may not freeze because of its salt content. However, with the salt removed, the water could freeze in the post-filtration subsystem, or product side of the membrane.

CAUTION: The Sea Recovery R.O. Membrane/Vessel Assembly is packaged with storage solution. Avoid skin and eye contact with this 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. (THE STORAGE CHEMICAL IS SODIUM BISULFITE)

The R.O. Membrane Vessel Assembly is premounted to its own mounting brackets onto the rear of the Frame and Compact Style Systems but may be remote mounted similar to the Modular Style System.

Mount the Membrane Vessel Assembly Horizontally ONLY. Do Not mount the Assembly Vertically. Vertical mounting permits air to become trapped in one of the Vessels and damage to the R.O. Membrane Element occurs under certain circumstances of pressurization and depressurization.

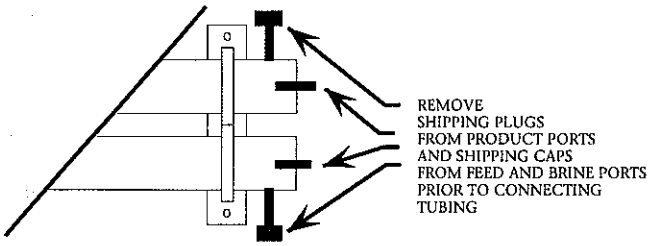


Mount the Membrane Vessel Assembly lower than the Brine Discharge fitting. If the Membrane Vessel Assembly is mounted above the Brine Discharge Fitting the feed water drains from the Vessels and causes drying out of the R.O. Membrane Element(s).

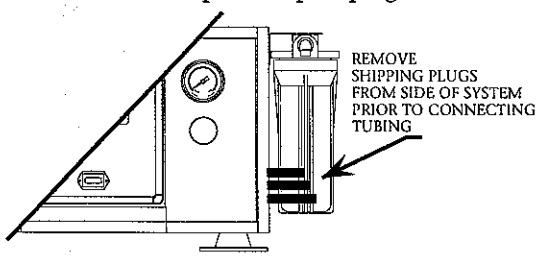
Mount the Assembly using the supplied mounting hardware. Rubber Isolation Mounts are provided, with the Modular Style System, for mounting. Isolation Mounts are optional for remote mounting the Assembly from the AquaWhisper Frame or Compact System.

Remove all Shipping Tube Plugs from the Membrane Vessel Assembly and from the side of the System as illustrated below. Connect one end of the Inlet High Pressure Hose to the Inlet of the R.O. Membrane Vessel Assembly and the other end to the Outlet of the High Pressure Pump.

AquaWhisper Modular System
R.O. MEMBRANE VESSEL ASSEMBLY
Shipped with feed/brine port caps
and product port plugs



AquaWhisper Frame and Compact System
Shipped with
feed/brine port plugs
and product port plugs

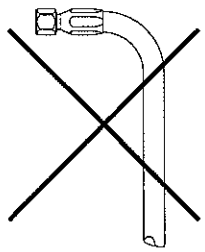


Longer lengths of Inlet and Outlet High Pressure Hoses are available from Sea Recovery. Use caution when extending the High Pressure Hose as excessive lengths cause line pressure loss and degrade from System Production.

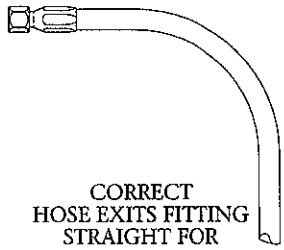
Secure the High Pressure Hoses so that they do not rub and abrade on rough surfaces.

Vibrations transmit from the High Pressure Hoses to the Ships hull or bulkhead. Isolate the High Pressure Hoses with rubber or foam padding at each point the High Pressure Hose is secured and at each point that the High Pressure Hose touches the Ship.

Allow the High Pressure Hose to exit or enter straight for several inches, to or from the High Pressure Pump and Membrane Vessel Assemblies, prior to beginning a bend. Give the High Pressure Hoses slack. If the High Pressure Hoses are not allowed to gently enter or exit failure of the High Pressure Hose and or leaks result.



WRONG
BEND TOO TIGHT
NO SLACK



CORRECT
HOSE EXITS FITTING
STRAIGHT FOR
SEVERAL INCHES
RELAXED BEND
WITH SLACK

Connect one end of the Outlet High Pressure Hose to the Outlet of the R.O. Membrane Vessel Assembly and the other end to the Inlet of the Back Pressure Regulator located within the Control Panel.

Tighten the flare swivel fittings finger tight. Hold the male fitting with one wrench and the swivel nut with another wrench. Lightly snug the swivel fitting onto the male elbow fitting then, while holding the male fitting securely with one wrench, tighten the swivel nut 1/4 turn maximum. Do not over tighten the swivel nut. Over tightening of the swivel nut causes it to crack.

Note:

A 400-1 gpd System has one 27 inch long Membrane/Vessel Assembly;

an 800-2 gpd System has two 27 inch long Membrane/Vessel Assemblies;

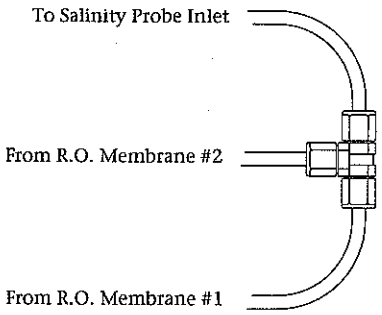
a 600-1 gpd System has one 37 inch long Membrane/Vessel Assembly;

a 1200-2 gpd System has two 37 inch long Membrane/Vessel Assemblies;

an 800-1 gpd System has one 46 inch long Membrane/Vessel Assembly;

and a 1500-2 gpd System has two 46 inch long Membrane/Vessel Assemblies.

16. Product Water Tee

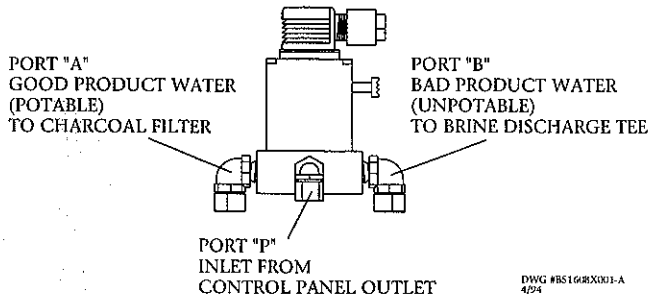


Mount the Product Water Tee in line with the R.O. Membrane Vessel Assemblies Product Water Outlet Port and the Control Panel, using the supplied mounting hardware.

Using the supplied 1/4 inch O.D. tubing connect the R.O. Membrane Vessel Assembly Product Water Outlet Port(s) to the Product Water Tee Fitting(s). Using the supplied 3/8 inch O.D. tubing, connect the final Product Water Tee Fitting to the Salinity Probe located within the Control Panel.

17. 3-Way Product Water Diversion Solenoid Valve [43]:

3-WAY PRODUCT DIVERSION VALVE



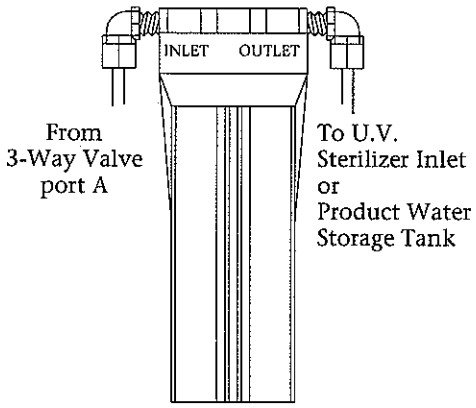
This valve is already installed within the AquaWhisper Frame, Compact, and Modular.

For the Modular Style System, connect Port "A" of the Diversion valve to the vessel's product tank. Also connect Port "B" of the Diversion Valve to the Brine Discharge Tee.

See also Page E - 11 for location of the 3-Way Product Diversion Valve within the Modular Panel.

18. Charcoal Filter [44] :

The Charcoal Filter is premounted to the AquaWhisper Frame and Compact Style Systems. It may be remote mounted similar to the Modular Style System.



Use the supplied mounting hardware to secure the filter to a flat vertical surface. Leave a minimum 4" space below the bowl for removal of the Charcoal Filter Element.

Connect the Charcoal Filter Inlet to Port "A" (Good Water) of the 3-Way Product Diversion Valve using the supplied 3/8 inch O.D. tubing.

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

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

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

Use the incorporated screw holes at both ends of the unit to secure it with the supplied hardware.

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

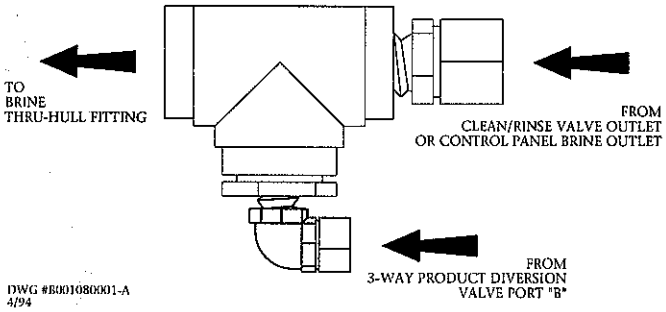
20. Product Water Storage Tank Connector:

supplied is a black thermal plastic 3/8 inch O.D. tube fitting with 3/8 inch male national pipe thread. Normally, the easiest and acceptable procedure is to create a 3/8 inch female national pipe thread in the Ship's Product Water Storage Tank Fill Line or in the top of the tank itself. Wrap Teflon tape to the connector male threads and screw it into the 3/8 inch FNPT tap. Using the supplied 3/8 inch O.D. Tubing, connect the Outlet of the Charcoal Filter to the connector or if the U.V. Sterilizer is used then connect the Outlet of the U.V. Sterilizer to the connector.

21. Brine Thru Hull Fitting [37]

must be minimum 1/2" NPT size and installed above the feed water level. The Brine Thru Hull Fitting may be installed below water level if above water level installation is impractical. It must have a 1/2" MNPT nipple fitting inside the hull for connection of the Brine Discharge Tee [36].

22. Brine Discharge Tee [36]

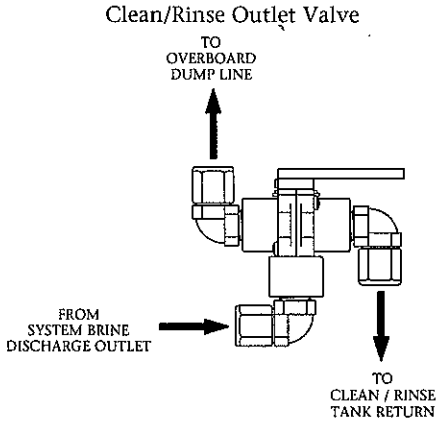


is supplied with 20 feet of 1/2" OD tubing. Wrap Teflon tape around the 1/2" Brine Thru Hull Fitting [37] nipple. Screw the Brine Discharge Tee [36] onto the Thru Hull nipple [37], hand tight. No pressure is present at this point when the system is running, so a hand tightened connection is sufficient to prevent leakage. Use a wrench to tighten this connection slightly, only if it leaks. Be careful not to over tighten with the wrench, since this causes the connector to crack.

Connect the System or Modular Control Panel Brine Discharge Outlet (or the Clean/Rinse Outlet Valve Outlet if used - see next step below) line to the Brine Discharge Tee, using the 1/2 inch O.D. tubing supplied.

Using the supplied 3/8 inch O.D. tubing, connect the Unpotable Product Water (bad water) from the 3-Way Product Diversion Valve [43] port "B" Outlet to the Brine Discharge Tee [37].

DO NOT INSTALL ANY SHUTOFF VALVES IN THE BRINE DISCHARGE LINE OR BAD PRODUCT WATER LINE GOING TO THE BRINE DISCHARGE TEE CONNECTOR. IF THERE IS A BLOCKAGE IN THESE LINES EXTENSIVE DAMAGE RESULTS IF SYSTEM OPERATION IS ATTEMPTED.



23. Clean/Rinse Outlet Valve [35]

This optional valve is used with the Inlet Clean/Rinse Valve #4 to assist in rinsing and cleaning of the System.

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

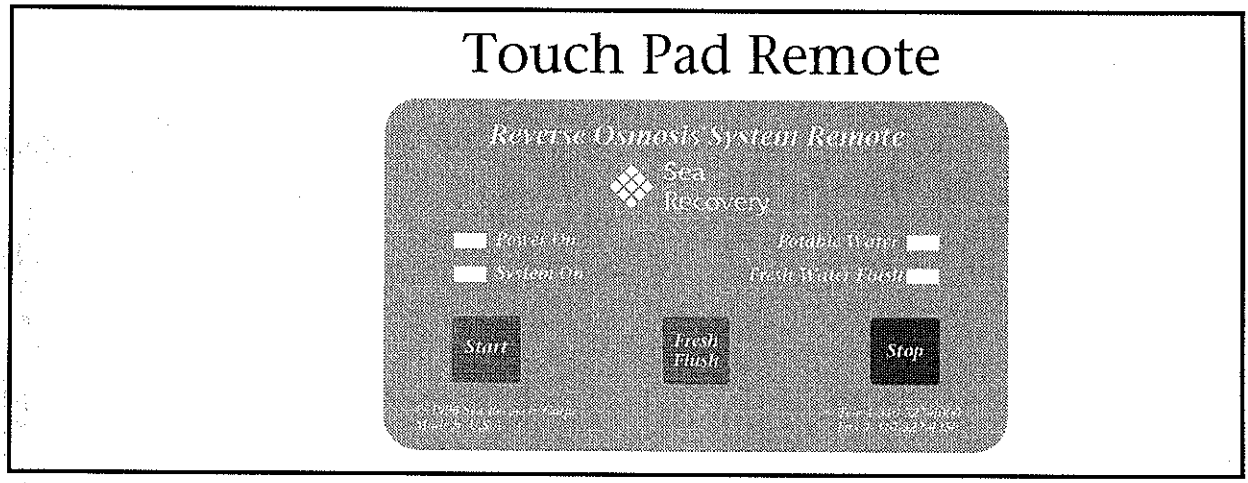
Connect one ***side*** port of the Outlet Clean/Rinse Valve to the Brine Discharge Tee Connector [36].

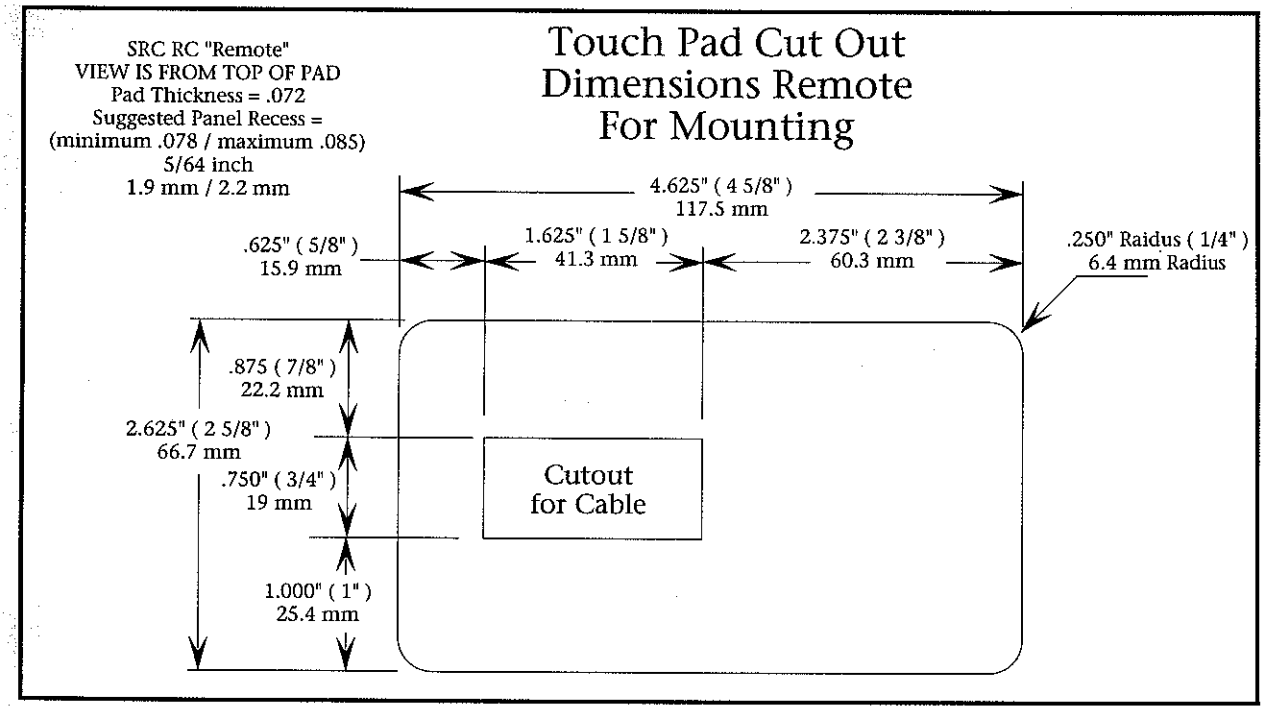
Connect the other ***side*** port to a Clean/Rinse Tank [50] Return or to a length of hose that can later be placed into a temporary Clean/Rinse Tank, Container or Bucket.

Connect the ***Center*** (common) port to the Brine Discharge Tee Connector [36].

Sea Recovery also offers an optional Clean/Rinse Panel Mounted Valve Manifold Assembly that contains both the Inlet and Outlet Clean/Rinse Valves [4 & 35] which may be ordered from Sea Recovery and replaces the individual Clean/Rinse Valves.

24. Remote:


Touch Pad Remote
Reverse Osmosis System Remote
Sea Recovery
Start
Fresh Flush
Stop


SRC RC "Remote"
VIEW IS FROM TOP OF PAD
Pad Thickness = .072
Suggested Panel Recess =
(minimum .078 / maximum .085)
5/64 inch
1.9 mm / 2.2 mm
Touch Pad Cut Out
Dimensions Remote
For Mounting
4.625" (4 5/8")
117.5 mm
.625" (5/8")
15.9 mm
1.625" (1 5/8")
41.3 mm
2.375" (2 3/8")
60.3 mm
.250" Raidus (1/4")
6.4 mm Radius
.875 (7/8")
22.2 mm
2.625" (2 5/8")
66.7 mm
.750" (3/4")
19 mm
Cutout
for Cable
1.000" (1")
25.4 mm

Remotes Continued:

To install the Touch Pad <u>without</u> the aluminum bezel refer to the appropriate **Touch Pad Cut Out Dimensions** (center drawing) drawings on page E-30, E-31, or E-32 as appropriate for the Remote that you have purchased. After routing out the indent and cutting the Cable hole, place the Touch Pad into the indent and check for sizing. Clean up the indent as required for a good fit. If the indent was made in wood or other porous surface then it is best to seal the surface of the indent so that the Touch Pad properly adheres to the indent surface. Once the indent hole has been sized and sealed ensure that the indent is "squeaky clean" and free of dust so that the double stick tape attached to the Touch Pad properly adheres to the indent surface. Remove the green paper from the back of the Touch Pad to expose the double stick tape attached to the back of the Touch Pad. Position the Touch Pad directly over the Indent and press firmly into place for a permanent bond.

To install the Touch Pad <u>with</u> the aluminum bezel refer to the appropriate Bezel Dimensions for Mounting with the Bezel (bottom drawing) drawings on page E-30, E-31, or E-32 as appropriate for the Remote that you have purchased. Place the Bezel onto the mounting surface and mark the four mounting holes and cutout. Make the cutout then drill the four mounting holes to accept a #6 Oval Head Screw. Attach the Bezel in place with the four #6 Oval Head Screws supplied. Ensure that the indent in the Bezel is "squeaky clean" and free of dust so that the double stick tape attached to the Touch Pad properly adheres to the Bezels indent surface. Remove the Scotch 3M green paper from the back of the Touch Pad to expose the double stick tape attached to the back of the Touch Pad. Position the Touch Pad directly over the Bezels indent and press firmly into place for a permanent bond.

25. **Electrical Connections:**
    Electrically connect, if not already connected, the following to the AquaWhisper Controller:

AquaWhisper Frame Style System:
Optional U.V. Sterilizer
Optional Fresh Water Flush Solenoid Valve
Optional Remote Unit
Main Incoming Power

AquaWhisper Compact Style System:
Booster Pump Motor
Optional U.V. Sterilizer
Optional Fresh Water Flush Solenoid Valve
Optional Remote Unit
Main Incoming Power

AquaWhisper Modular Style System:
Booster Pump
High Pressure Pump Motor
High Pressure Pump Motor Thermal Switch
Low Pressure Switch
High Pressure Switch
3-Way Product Water Diversion Valve
Salinity Probe
Optional U.V. Sterilizer
Optional Fresh Water Flush Solenoid Valve
Optional Remote Unit
Main Incoming Power

Refer to the following pages for electrical information and wiring diagrams.

WIRING

INFORMATION CONNECTIONS & DIAGRAMS

ELECTRICAL REQUIREMENTS

The Electric Motors within the AquaWhisper Systems start in series with time delay between each motor starting. First the Feed Water Pump starts (if an optional Feed Water Pump is installed which is normally only required for certain Land installations and not usually necessary for Marine Ship installations) then the Booster Pump starts then the main High Pressure Pump Electric Motor starts.

For a normal Marine Ship installation the current surges with the Booster Pump Starting then drop down to Booster Pump Electric Motor running Amperes. At the instant of the High Pressure Pump starting the current surges up again then drop down to normal System running amperage.

Therefore, the Maximum surge current equals the Booster Pump Running Amperage plus the High Pressure Pump Starting Amperage. The normal running Amperage equals both the Booster Pump Motor and High Pressure Pump Motor combined running Amperage.

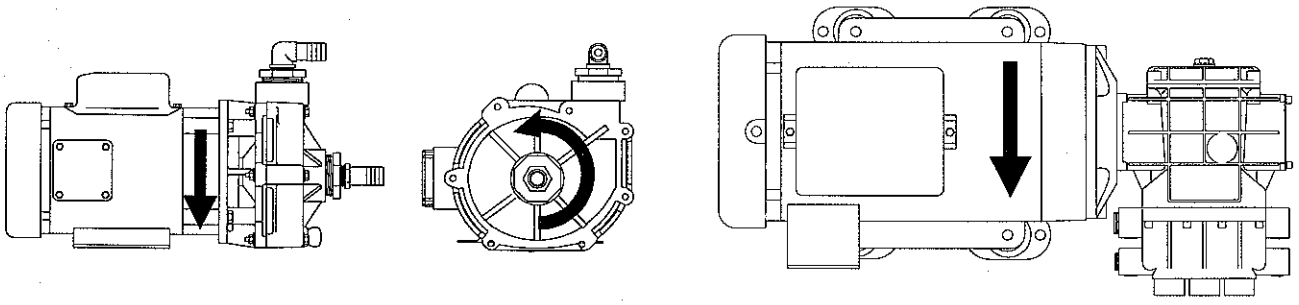
AC INDUCTION MOTORS

After unpacking, check for damage. Be sure that shaft rotates freely.

Check line voltage, frequency and phase, ensure that it agrees with system nameplate. Grounding and fusing should be done in accordance with National Electrical Code. See connection diagram on nameplate of motor or refer to the diagrams on the following pages of this manual.

POWER SOURCE REQUIREMENTS:

Voltage	Hz (AC)	Min. Voltage	Max. Voltage	Min. Hz	Max. Hz
AC Systems Single Phase:					
120 VAC	60 Hz	108 VAC	132 VAC	58 Hz	62 Hz
230 VAC	60 Hz	207 VAC	253 VAC	58 Hz	62 Hz
220 VAC	50 Hz	198 VAC	242 VAC	48 Hz	52 Hz
AC Systems Three Phase:					
208 VAC	60 Hz	187 VAC	228 VAC	58 Hz	62 Hz
230 VAC	60 Hz	207 VAC	253 VAC	58 Hz	62 Hz
460 VAC	60 Hz	414 VAC	506 VAC	58 Hz	62 Hz
220 VAC	50 Hz	198 VAC	242 VAC	48 Hz	52 Hz
380 VAC	50 Hz	342 VAC	418 VAC	48 Hz	52 Hz



SYSTEM AND BOOSTER PUMP STARTING AND RUNNING AMPERAGE:

The specifications listed below are Full Load Motor Name Plate Specifications.

HIGH PRESSURE PUMP ELECTRIC MOTOR

Aqua Whisper 400-1 & 800-2 with 50 Hz Power

Main 2.6 H.P. Elect. Motor Single Phase:

At 110 VAC, 50 Hz, 1Ø
121 Amperes Starting
21 Amperes Running

At 220 - 230 VAC, 50 Hz, 1Ø
60.5 Amperes Starting
10.5 Amperes Running

3 H.P. Electric Motor Three Phase:

At 220 VAC, 50 Hz, 3Ø
78 Amperes Starting
9.2 Amperes Running

At 380 VAC, 50 Hz, 3Ø
39 Amperes Starting
4.6 Amperes Running

Aqua Whisper 400-1 & 800-2 with 60 Hz Power

Main 2.1 H.P. Elect. Motor Single Phase:

At 115 VAC, 60 Hz, 1Ø
94 Amperes Starting
18 Amperes Running

At 220 - 230 VAC, 60 Hz, 1Ø
47 Amperes Starting
9 Amperes Running

3 H.P. Electric Motor Three Phase:

At 208 VAC, 60 Hz, 3Ø
77 Amperes Starting
9 Amperes Running

At 230 VAC, 60 Hz, 3Ø
70 Amperes Starting
8.2 Amperes Running

At 460 VAC, 60 Hz, 3Ø
35 Amperes Starting
4.1 Amperes Running

Aqua Whisper 600-1 & 1200-2 and 800-2 & 1500-2 with 50 or 60 Hz Power

Main 2.6 H.P. Elect. Motor Single Phase:

At 115 VAC, 1Ø
109 Amperes Starting
21.2 Amperes Running

At 220 - 230 VAC, 1Ø
54.5 Amperes Starting
10.6 Amperes Running

3 H.P. Electric Motor Three Phase:

At 208 VAC, 3Ø
77 Amperes Starting
9 Amperes Running

At 230 VAC, 3Ø
70 Amperes Starting
8.2 Amperes Running

At 380 VAC, 3Ø
39 Amperes Starting
4.6 Amperes Running

At 460 VAC, 3Ø
35 Amperes Starting
4.1 Amperes Running

Booster Pump Electric Motor

1/2 H.P. Electric Motor Single Phase:

At 115 VAC, 1Ø
34 Amperes Starting
7.4 Amperes Running

At 220 - 230 VAC, 1Ø
17 Amperes Starting
3.7 Amperes Running

1/2 H.P. Electric Motor Three Phase:

At 208 VAC, 3Ø
13 Amperes Starting
2.2 Amperes Running

At 230 VAC, 3Ø
12 Amperes Starting
2 Amperes Running

At 380 VAC, 3Ø
7 Amperes Starting
1.2 Amperes Running

At 460 VAC, 3Ø
6 Amperes Starting
1 Amperes Running

RECOMMENDED CIRCUIT BREAKER:

Aqua Whisper 400 & 800

Aqua Whisper 600 & 1200

and

Aqua Whisper 800 & 1500

Operating Voltage 115 VAC, Single Phase
Circuit Breaker Size 30 Amperes

Operating Voltage 230 VAC, Single Phase
Circuit Breaker Size 15 Amperes

Operating Voltage 208 VAC, Three Phase
Circuit Breaker Size 10 - 15 Amperes

Operating Voltage 230 VAC, Three Phase
Circuit Breaker Size 10 Amperes

Operating Voltage 380 VAC, Three Phase
Circuit Breaker Size 7.5 - 10 Amperes

Operating Voltage 460 VAC, Three Phase
Circuit Breaker Size 5 - 7.5 Amperes

RECOMMENDED COPPER WIRE & SIZE FOR MAIN POWER FEED LINE

Operating Voltage 115 VAC, Single Phase
Minimum Power Line Wire Size 10 AWG

Operating Voltage 230 VAC, Single Phase
Minimum Power Line Wire Size 12 AWG

Operating Voltage 208 VAC, Three Phase
Minimum Power Line Wire Size 12 AWG

Operating Voltage 230 VAC, Three Phase
Minimum Power Line Wire Size 12 AWG

Operating Voltage 380 VAC, Three Phase
Minimum Power Line Wire Size 12 AWG

Operating Voltage 460 VAC, Three Phase
Minimum Power Line Wire Size 12 AWG

MOTOR ROTATION:

Single Phase Systems:

The High Pressure Pump Electric Motor rotation is prewired by Sea Recovery prior to shipment.

The Booster Pump Electric Motor rotation is controlled by interchanging two specific wires at the Electric Motors wiring box connections.

Three Phase Systems

The High Pressure Pump and Booster Pump Electric Motors rotation are controlled by interchanging any two of the three power lines at the Electric Motors wiring box connections.

WIRING CONNECTIONS

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

NOTE: Use the following procedure when changing motor voltage as shown on pages E-42 through E-50. Wire nuts are supplied when system is shipped and are taped inside controller lid for voltage modifications.

1. Cut crimped motor leads as close to the crimped terminal.

2. Wires which need to be jumpered (connected) must be stripped with stripped length not exceeding 1/2".

3. When two wires are jumpered, use the supplied blue wire nuts (SRC P/N 3131210100). When three wires are jumpered, use the supplied yellow wire nuts. (P/N 3131210495)

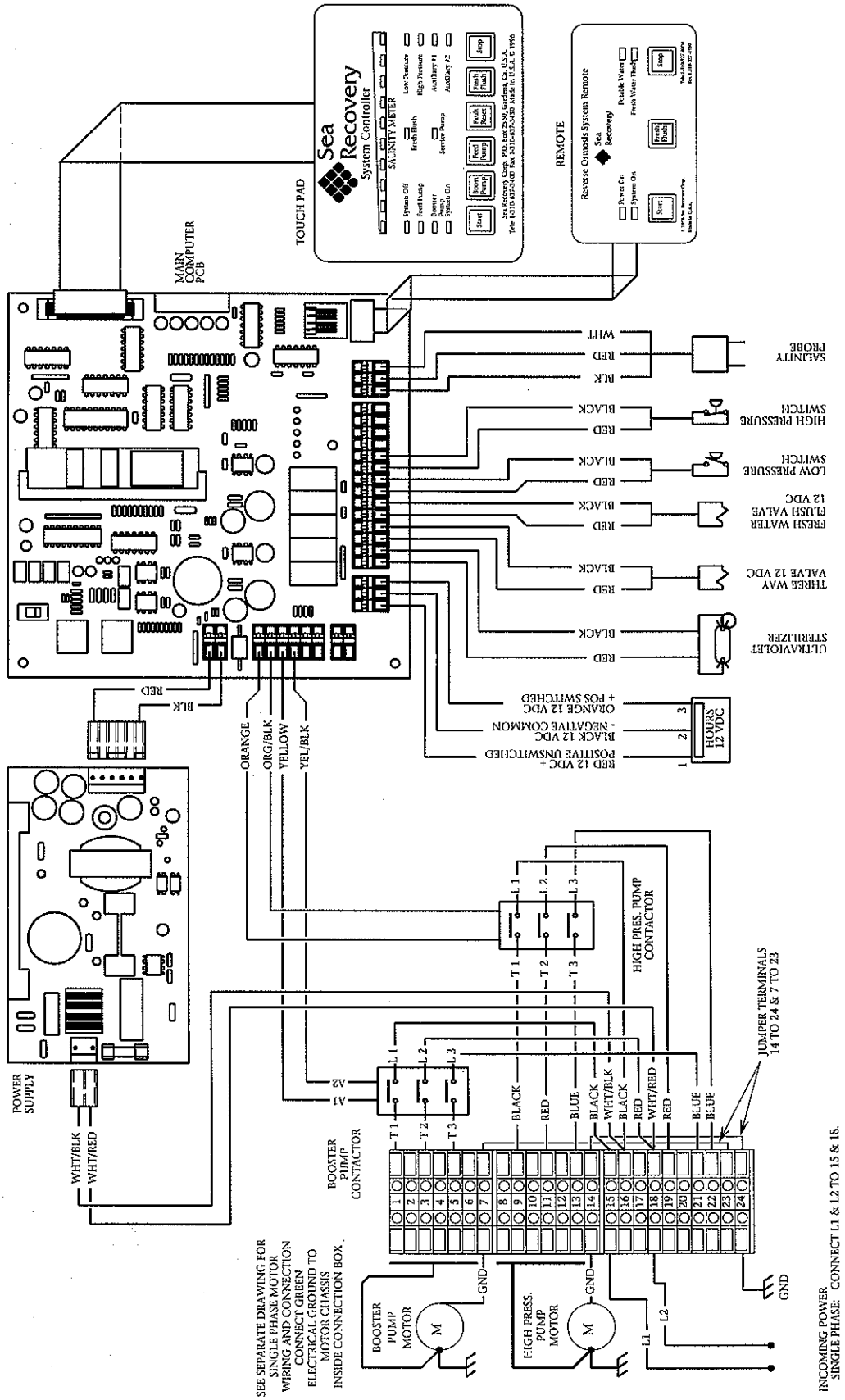
4. Do not overtighten wire nuts.

Single Phase System Rotation:
JOG TO CHECK ROTATION BEFORE OPERATING. TO REVERSE ROTATION INTERCHANGE MOTOR LEADS 5 AND 8 LOCATED INSIDE THE REAR COVER. HOWEVER, WIRING CONNECTIONS LISTED ABOVE ARE PROPER FOR THE SEA RECOVERY SYSTEM.

Three Phase System Rotation:
JOG TO CHECK ROTATION BEFORE OPERATING. THREE PHASE MOTORS ONLY - TO REVERSE ROTATION INTERCHANGE ANY TWO POWER LEADS.

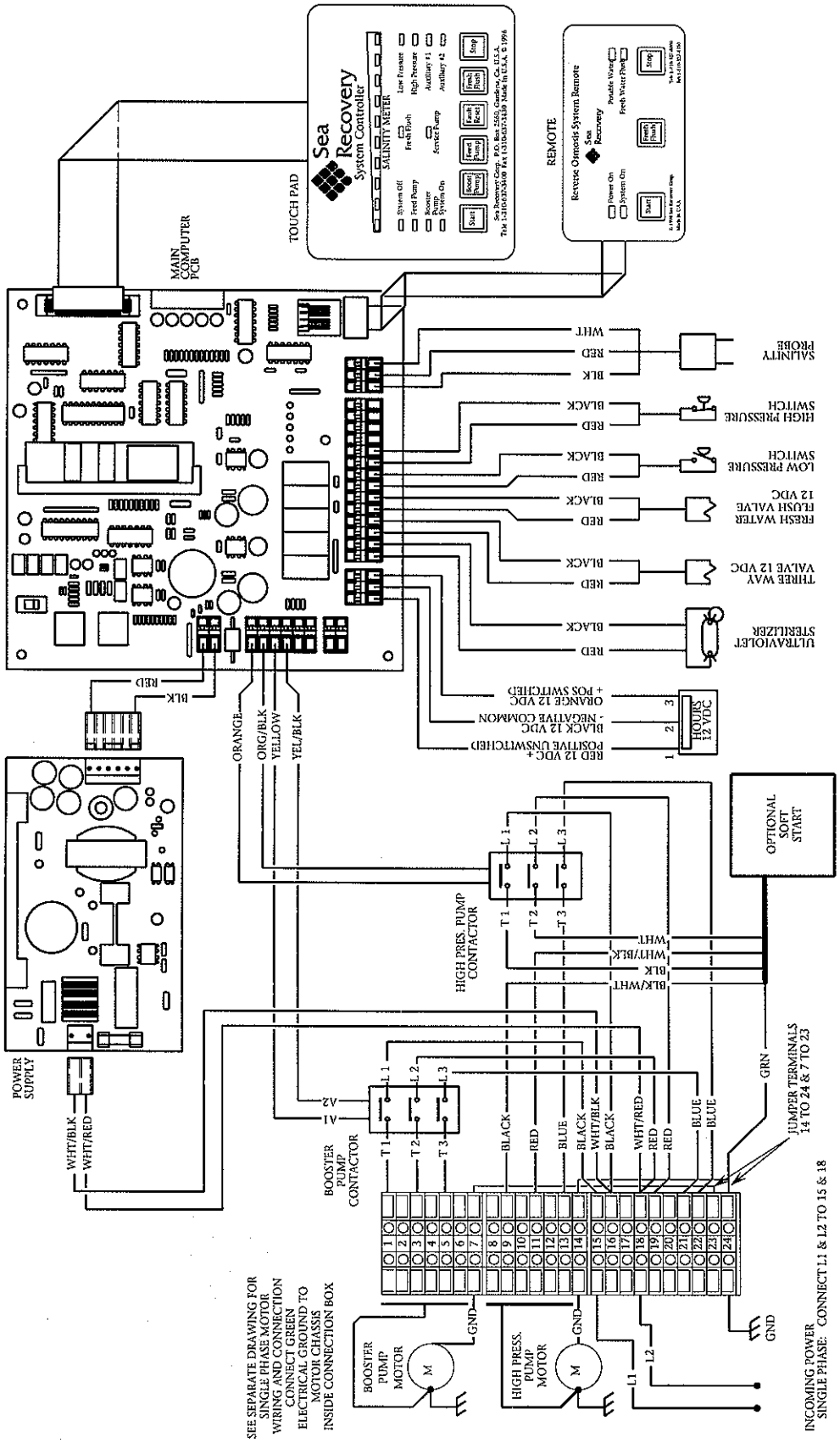
Sea Recovery AquaWhisper Electrical Diagram

110/220 VAC Single Phase Standard Controller



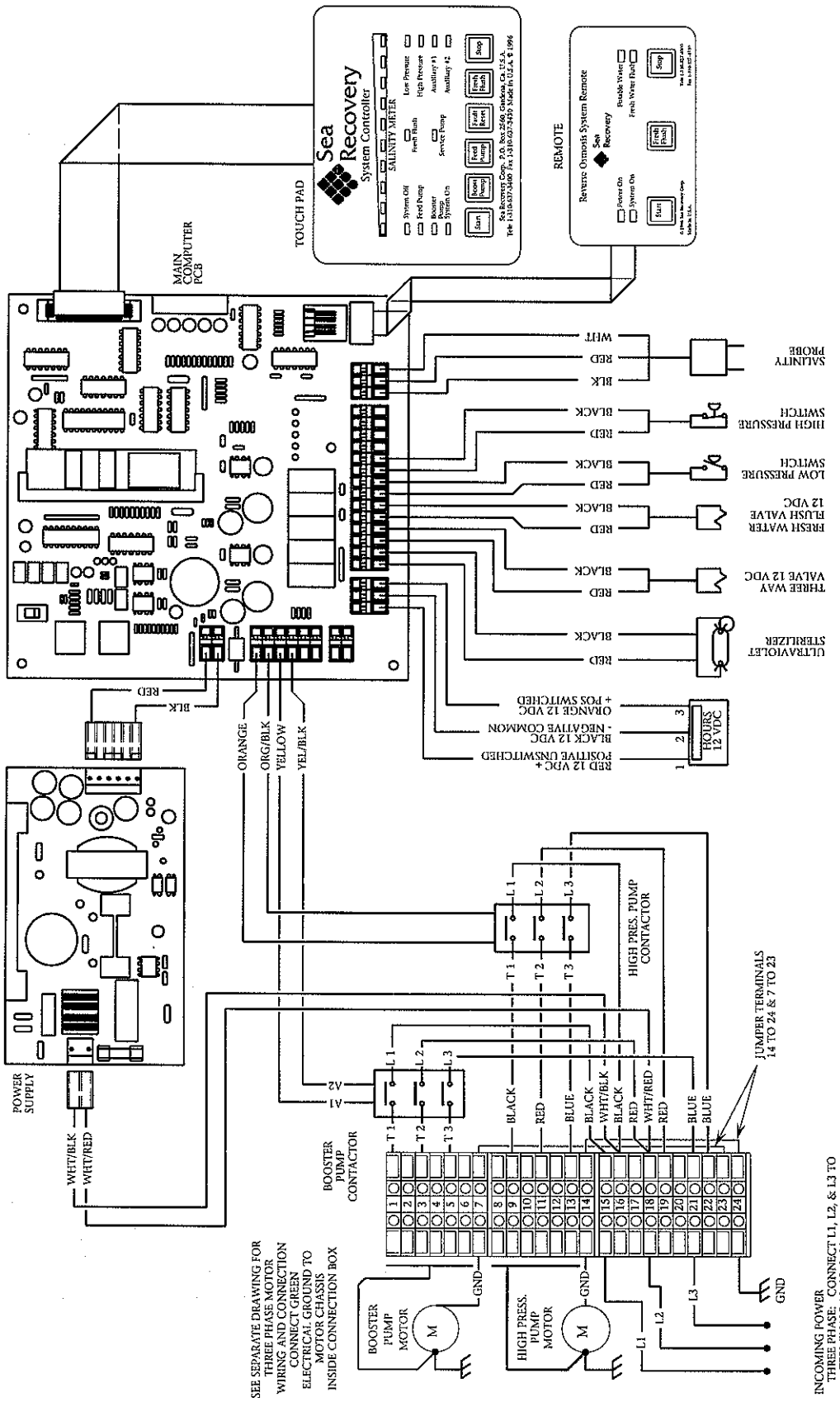
Sea Recovery AquaWhisper Electrical Diagram

110/220 VAC Single Phase Controller With Optional Soft Motor Starter



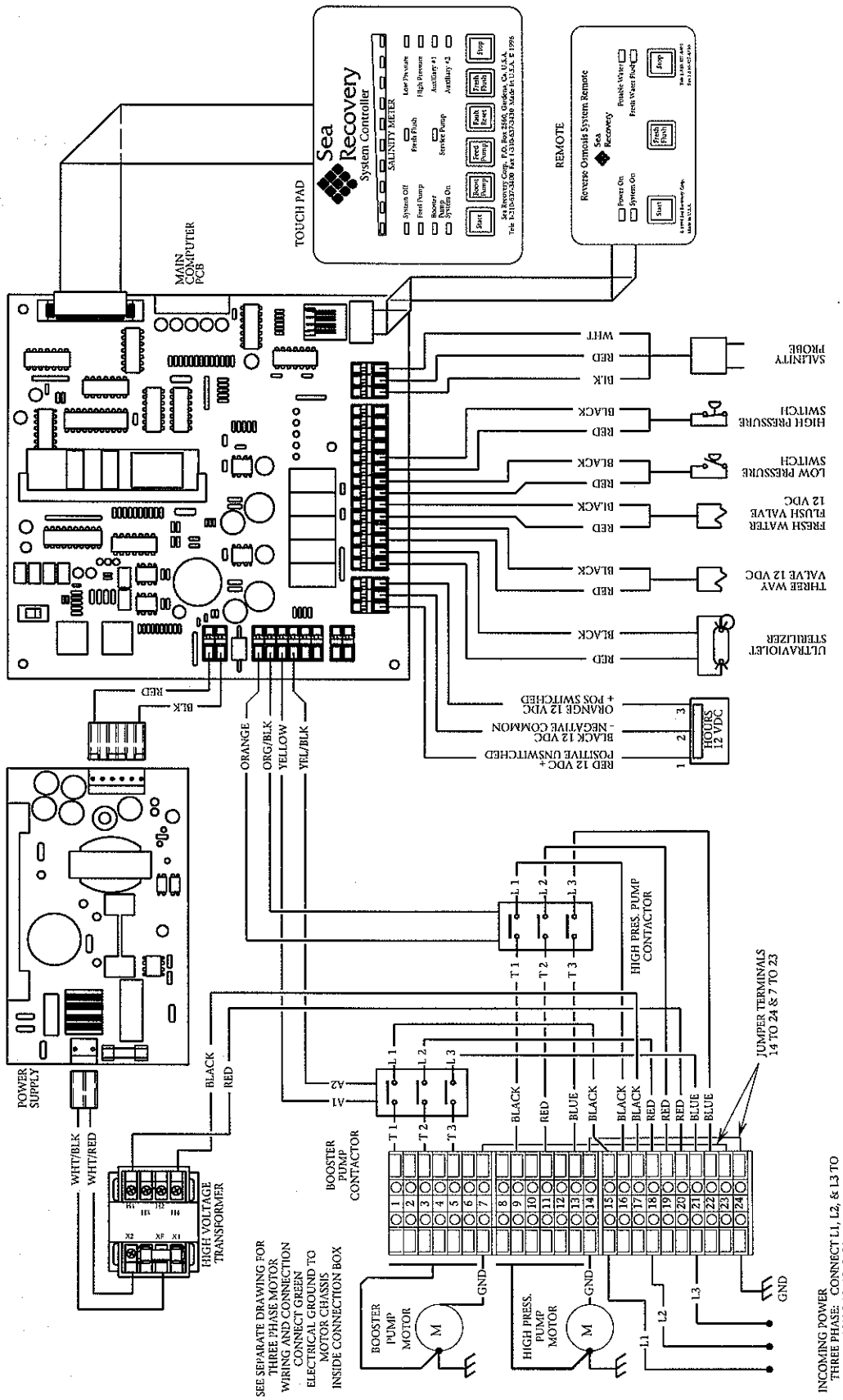
Sea Recovery AquaWhisper Electrical Diagram

220/230 VAC Three Phase Controller



Sea Recovery AquaWhisper Electrical Diagram

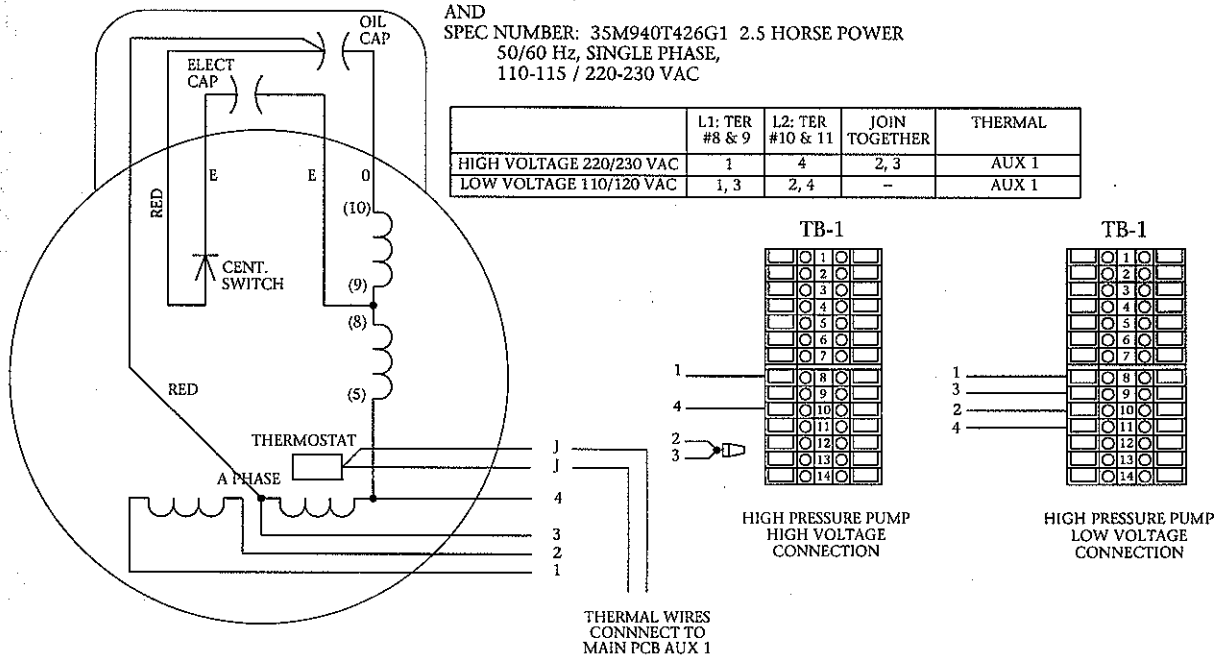
380-460 VAC Three Phase Controller



AquaWhisper Frame Series
Booster Pump and High Pressure Pump
Inside of the Frame. Single Phase, 50/60 Hz

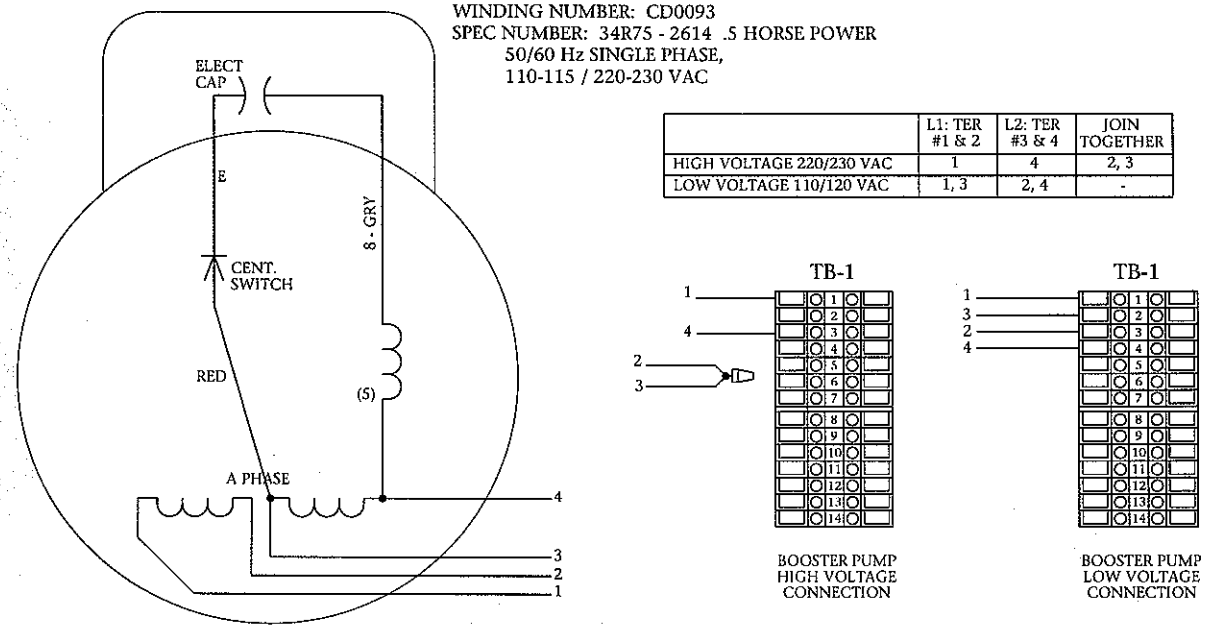
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0615A01
SPEC NUMBER: 35M821T427G1 2.1 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC
AND
SPEC NUMBER: 35M940T426G1 2.5 HORSE POWER
50/60 Hz, SINGLE PHASE,
110-115 / 220-230 VAC

	L1: TER #8 & 9	L2: TER #10 & 11	JOIN TOGETHER	THERMAL
HIGH VOLTAGE 220/230 VAC	1	4	2, 3	AUX 1
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	–	AUX 1



BOOSTER PUMP MOTOR
WINDING NUMBER: CD0093
SPEC NUMBER: 34R75 - 2614 .5 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC

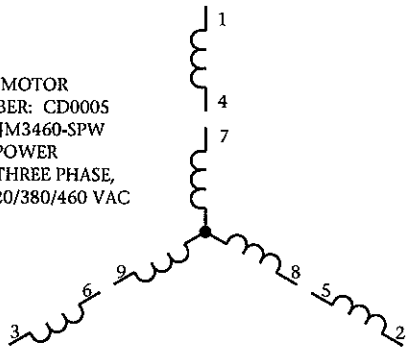
	L1: TER #1 & 2	L2: TER #3 & 4	JOIN TOGETHER
HIGH VOLTAGE 220/230 VAC	1	4	2, 3
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	-



AquaWhisper Frame Series
Booster Pump and High Pressure Pump
Inside of the Frame. Three Phase, 50 Hz

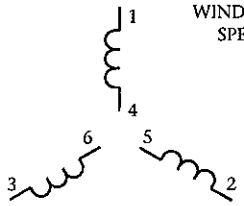
Booster Pump, Three Phase, 50 Hz

BOOSTER PUMP MOTOR
WINDING NUMBER: CD0005
SPEC NUMBER: JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC

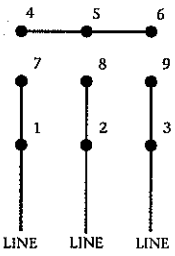


High Pressure Pump, Three Phase, 50 Hz

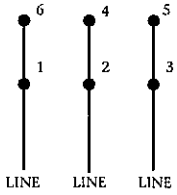
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0022
SPEC NUMBER:
3 HORSE POWER
50 Hz, THREE PHASE,
220/3800 VAC



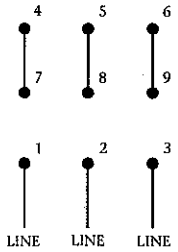
BOOSTER PUMP MOTOR
LOW VOLTAGE
CONNECTION (2Y)
220 VAC
THREE PHASE, 50 Hz



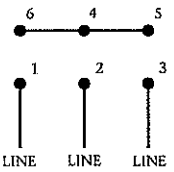
HIGH PRESSURE PUMP MOTOR
LOW VOLTAGE
CONNECTION
220 VAC
THREE PHASE, 50 Hz



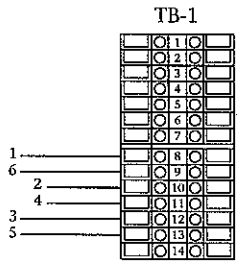
BOOSTER PUMP MOTOR
HIGH VOLTAGE
CONNECTION (1Y)
380 - 415 VAC
THREE PHASE, 50 Hz



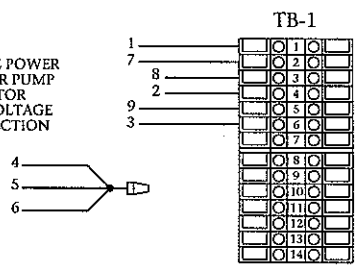
HIGH PRESSURE PUMP MOTOR
HIGH VOLTAGE
CONNECTION
380 - 415 VAC
THREE PHASE, 50 Hz



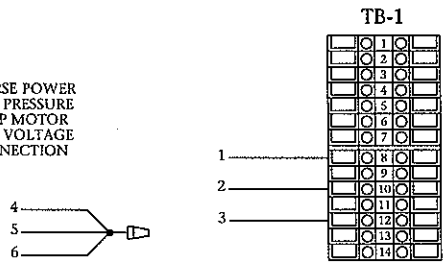
3 HORSE POWER
HIGH PRESSURE
PUMP MOTOR
LOW VOLTAGE
CONNECTION



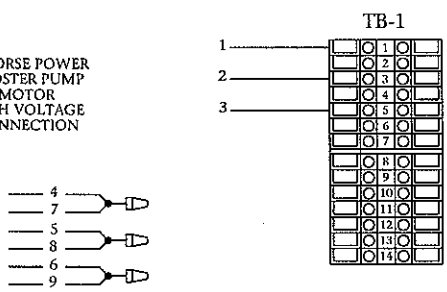
.5 HORSE POWER
BOOSTER PUMP
MOTOR
LOW VOLTAGE
CONNECTION



3 HORSE POWER
HIGH PRESSURE
PUMP MOTOR
HIGH VOLTAGE
CONNECTION

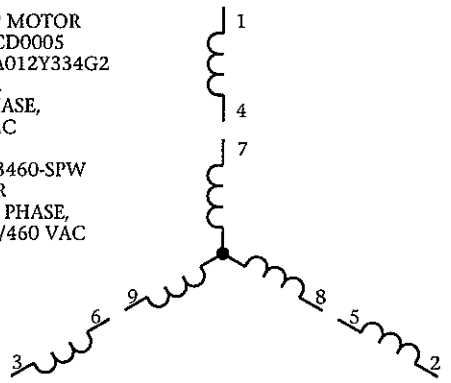


.5 HORSE POWER
BOOSTER PUMP
MOTOR
HIGH VOLTAGE
CONNECTION

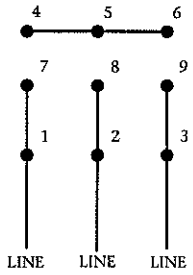


AquaWhisper Frame Series
Booster Pump and High Pressure Pump
Inside of the Frame. Three Phase, 60 Hz

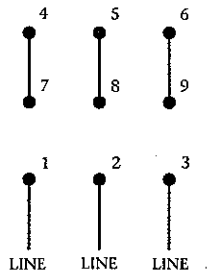
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0005
SPEC NUMBER: 35A012Y334G2
3 HORSE POWER
60 Hz, THREE PHASE,
208 - 230/460 VAC
AND
SPEC NUMBER: JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC



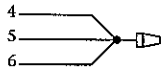
LOW VOLTAGE CONNECTION (2Y)
208 - 230 VAC
THREE PHASE, 60 Hz



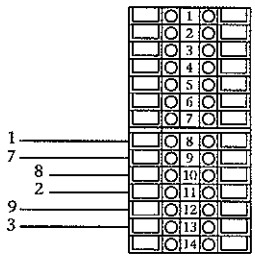
HIGH VOLTAGE CONNECTION (1Y)
460 VAC
THREE PHASE, 60 Hz



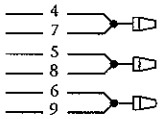
3 HORSE POWER
HIGH PRESSURE
PUMP MOTOR
LOW VOLTAGE
CONNECTION



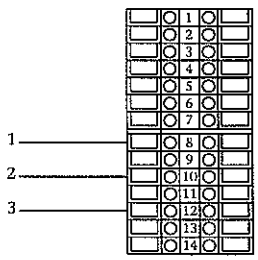
TB-1



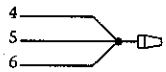
3 HORSE POWER
HIGH PRESSURE
PUMP MOTOR
HIGH VOLTAGE
CONNECTION



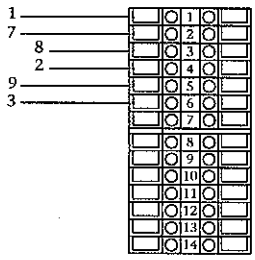
TB-1



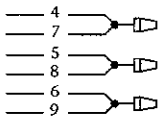
.5 HORSE POWER
BOOSTER PUMP
MOTOR
LOW VOLTAGE
CONNECTION



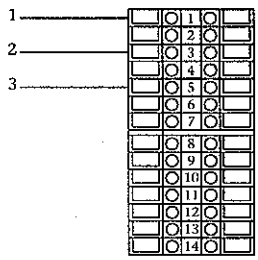
TB-1



.5 HORSE POWER
BOOSTER PUMP
MOTOR
HIGH VOLTAGE
CONNECTION



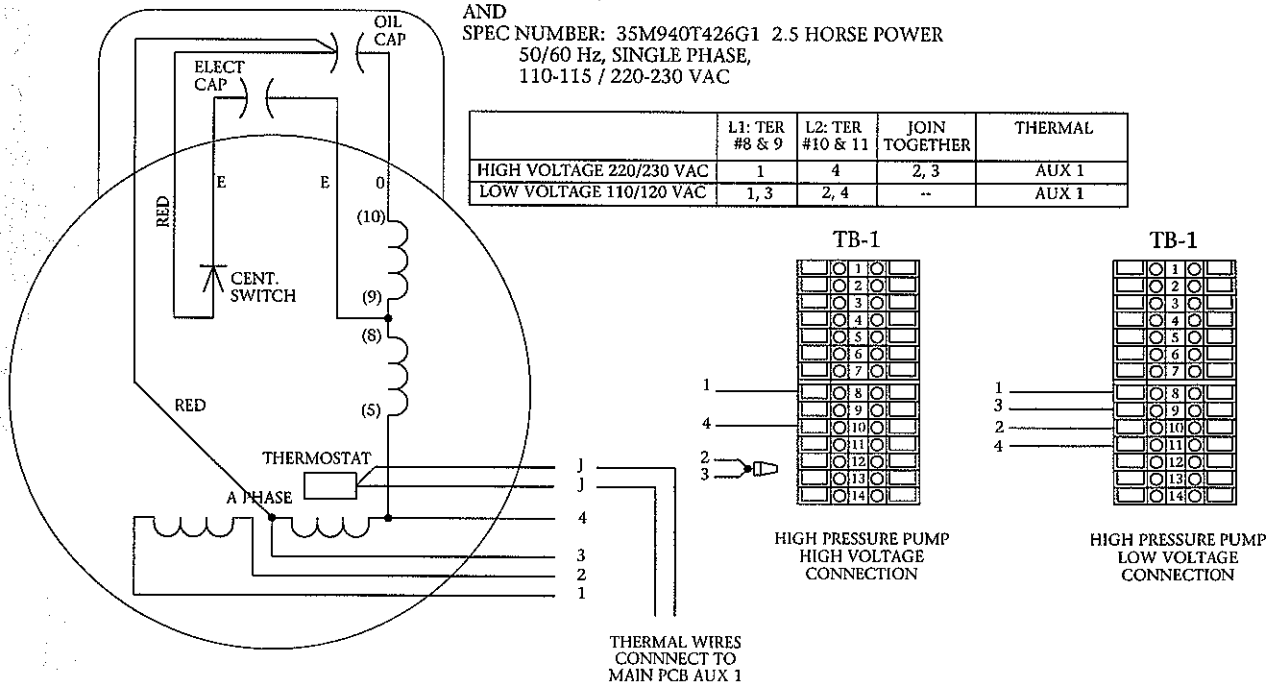
TB-1



AquaWhisper Frame Series
Booster Pump and High Pressure Pump
Inside of the Frame. Single Phase, 50/60 Hz

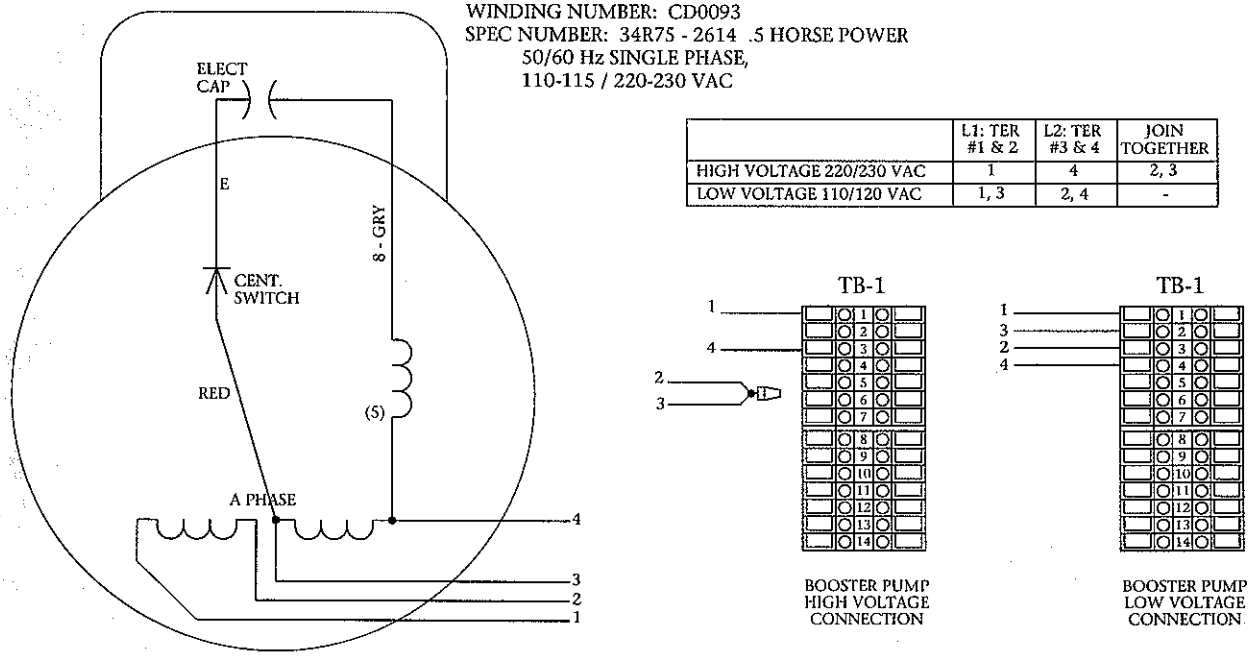
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0615A01
SPEC NUMBER: 35M821T427G1 2.1 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC
AND
SPEC NUMBER: 35M940T426G1 2.5 HORSE POWER
50/60 Hz, SINGLE PHASE,
110-115 / 220-230 VAC

	L1: TER #8 & 9	L2: TER #10 & 11	JOIN TOGETHER	THERMAL
HIGH VOLTAGE 220/230 VAC	1	4	2, 3	AUX 1
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--	AUX 1



BOOSTER PUMP MOTOR
WINDING NUMBER: CD0093
SPEC NUMBER: 34R75 - 2614 .5 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC

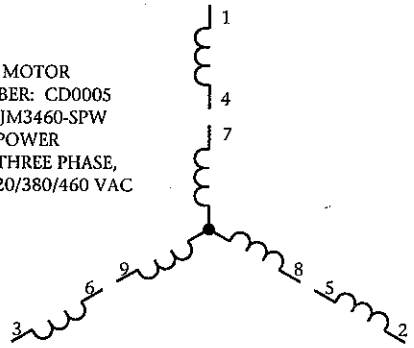
	L1: TER #1 & 2	L2: TER #3 & 4	JOIN TOGETHER
HIGH VOLTAGE 220/230 VAC	1	4	2, 3
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	-



AquaWhisper Compact Series
Booster Pump External of Frame
Three Phase, 50 Hz

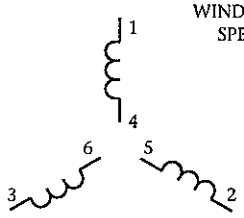
Booster Pump, Three Phase, 50 Hz

BOOSTER PUMP MOTOR
WINDING NUMBER: CD0005
SPEC NUMBER: JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC

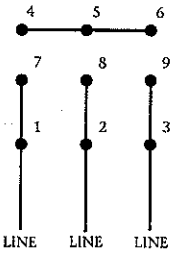


High Pressure Pump, Three Phase, 50 Hz

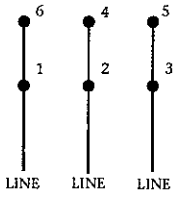
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0022
SPEC NUMBER:
3 HORSE POWER
50 Hz, THREE PHASE,
220/3800 VAC



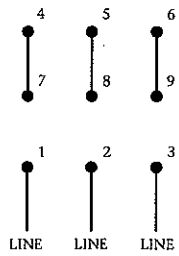
BOOSTER PUMP MOTOR
LOW VOLTAGE
CONNECTION (2Y)
220 VAC
THREE PHASE, 50 Hz



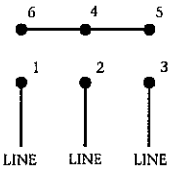
HIGH PRESSURE PUMP MOTOR
LOW VOLTAGE
CONNECTION
220 VAC
THREE PHASE, 50 Hz



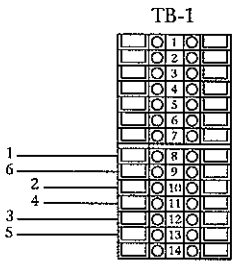
BOOSTER PUMP MOTOR
HIGH VOLTAGE
CONNECTION (1Y)
380 - 415 VAC
THREE PHASE, 50 Hz

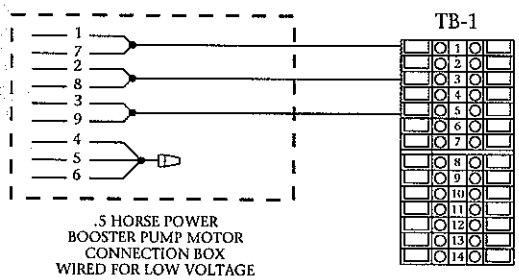


HIGH PRESSURE PUMP MOTOR
HIGH VOLTAGE
CONNECTION
380 - 415 VAC
THREE PHASE, 50 Hz



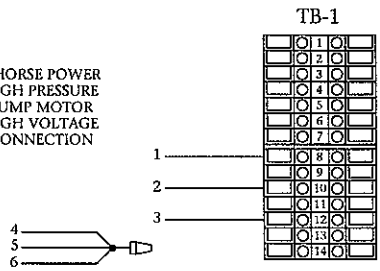
3 HORSE POWER
HIGH PRESSURE
PUMP MOTOR
LOW VOLTAGE
CONNECTION

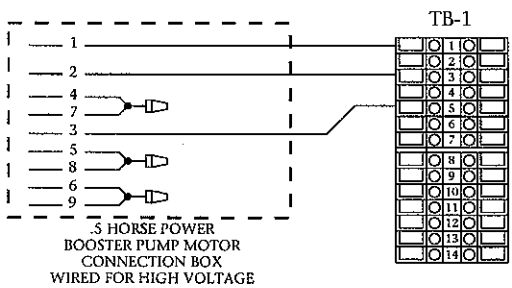




.5 HORSE POWER
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE

3 HORSE POWER
HIGH PRESSURE
PUMP MOTOR
HIGH VOLTAGE
CONNECTION

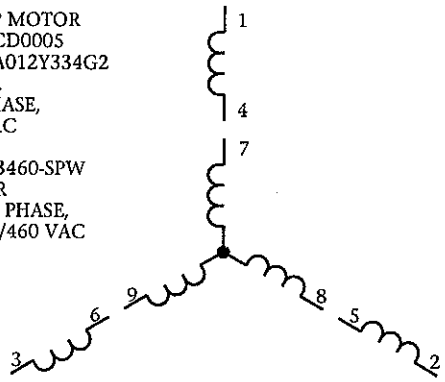




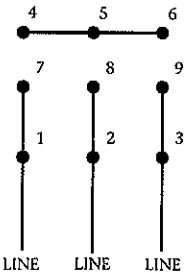
.5 HORSE POWER
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE

AquaWhisper Compact Series
Booster Pump External of Frame
Three Phase, 60 Hz

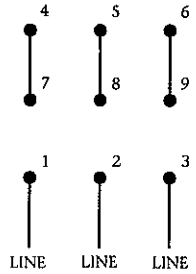
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0005
SPEC NUMBER: 35A012Y334G2
3 HORSE POWER
60 Hz, THREE PHASE,
208 - 230/460 VAC
AND
SPEC NUMBER: JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC

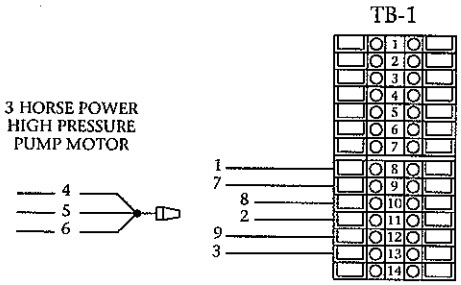


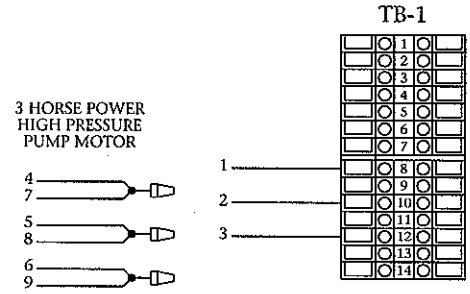
LOW VOLTAGE CONNECTION (2Y)
208 - 230 VAC
THREE PHASE, 60 Hz

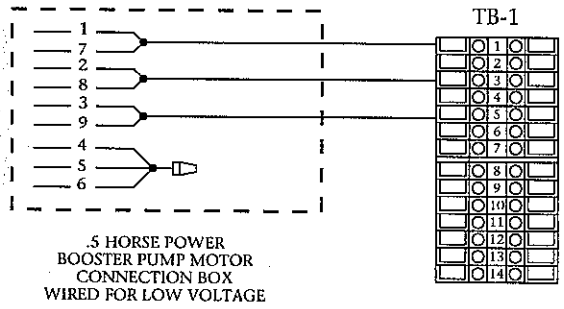


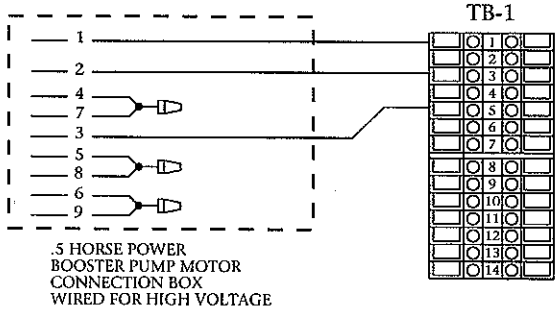
HIGH VOLTAGE CONNECTION (1Y)
460 VAC
THREE PHASE, 60 Hz







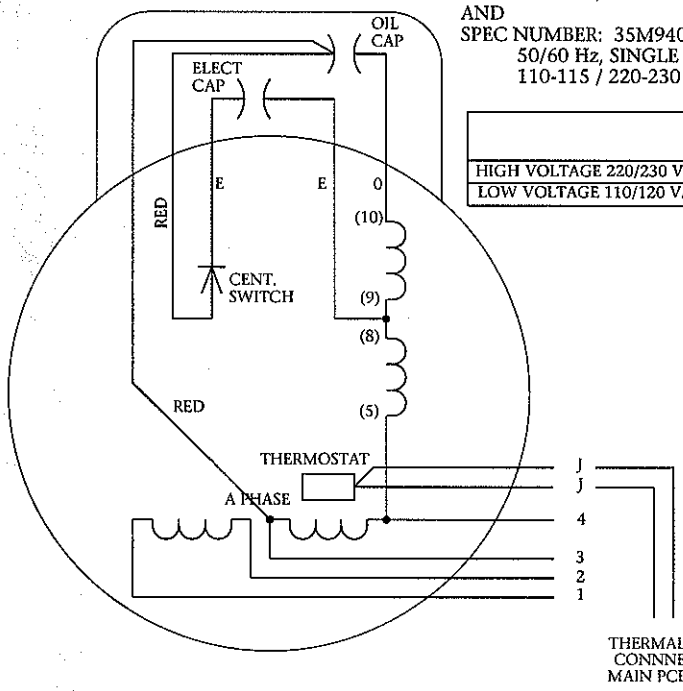




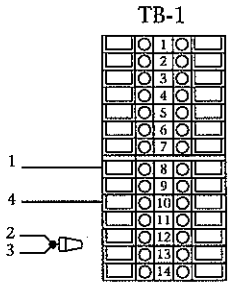
AquaWhisper Frame Series
Booster Pump and High Pressure Pump
Inside of the Frame. Single Phase, 50/60 Hz

HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0615A01
SPEC NUMBER: 35M821T427G1 2.1 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC
AND
SPEC NUMBER: 35M940T426G1 2.5 HORSE POWER
50/60 Hz, SINGLE PHASE,
110-115 / 220-230 VAC

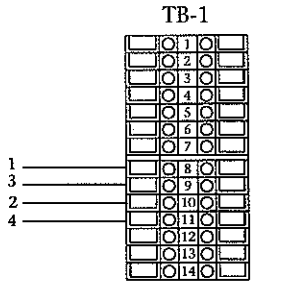
	L1: TER #8 & 9	L2: TER #10 & 11	JOIN TOGETHER	THERMAL
HIGH VOLTAGE 220/230 VAC	1	4	2, 3	AUX 1
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	--	AUX 1



THERMAL WIRES CONNNECT TO MAIN PCB AUX 1



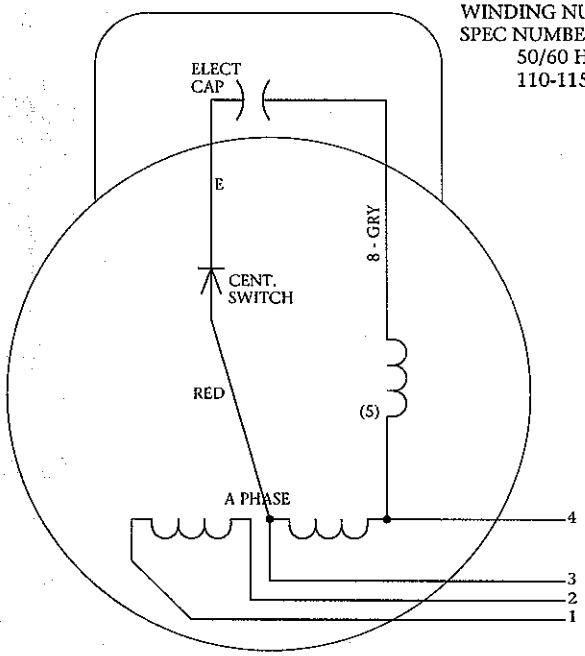
HIGH PRESSURE PUMP HIGH VOLTAGE CONNECTION

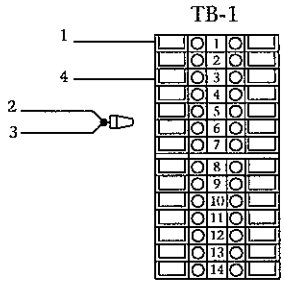


HIGH PRESSURE PUMP LOW VOLTAGE CONNECTION

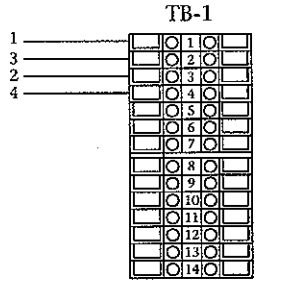
BOOSTER PUMP MOTOR
WINDING NUMBER: CD0093
SPEC NUMBER: 34R75 - 2614 .5 HORSE POWER
50/60 Hz SINGLE PHASE,
110-115 / 220-230 VAC

	L1: TER #1 & 2	L2: TER #3 & 4	JOIN TOGETHER
HIGH VOLTAGE 220/230 VAC	1	4	2, 3
LOW VOLTAGE 110/120 VAC	1, 3	2, 4	-





BOOSTER PUMP HIGH VOLTAGE CONNECTION

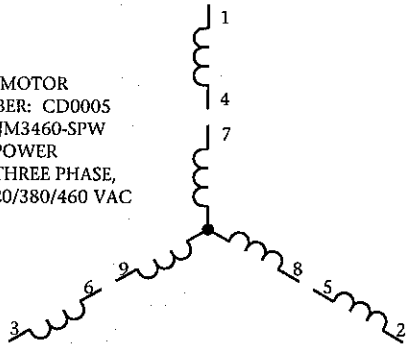


BOOSTER PUMP LOW VOLTAGE CONNECTION

AquaWhisper Modular Series
Three Phase, 50 Hz

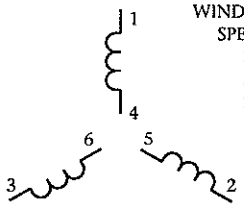
Booster Pump, Three Phase, 50 Hz

BOOSTER PUMP MOTOR
WINDING NUMBER: CD0005
SPEC NUMBER: JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC

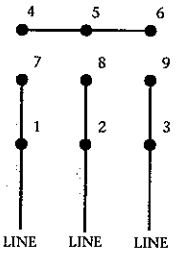


High Pressure Pump, Three Phase, 50 Hz

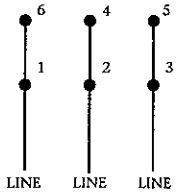
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0022
SPEC NUMBER:
3 HORSE POWER
50 Hz, THREE PHASE,
220/3800 VAC



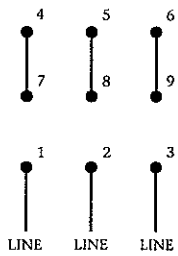
BOOSTER PUMP MOTOR
LOW VOLTAGE
CONNECTION (2Y)
220 VAC
THREE PHASE, 50 Hz



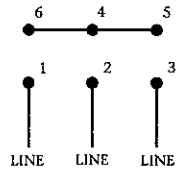
HIGH PRESSURE PUMP MOTOR
LOW VOLTAGE
CONNECTION
220 VAC
THREE PHASE, 50 Hz



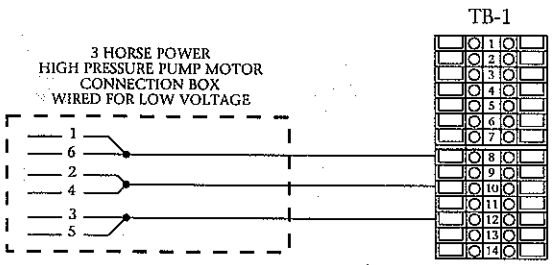
BOOSTER PUMP MOTOR
HIGH VOLTAGE
CONNECTION (1Y)
380 - 415 VAC
THREE PHASE, 50 Hz



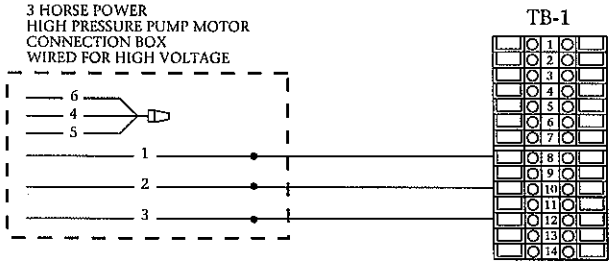
HIGH PRESSURE PUMP MOTOR
HIGH VOLTAGE
CONNECTION
380 - 415 VAC
THREE PHASE, 50 Hz



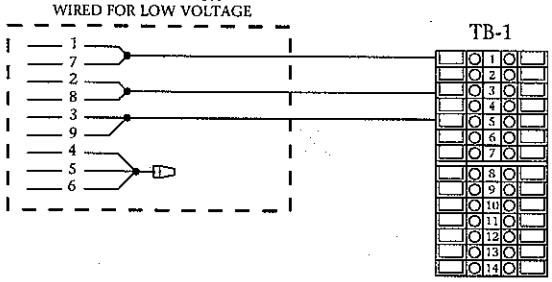
3 HORSE POWER
HIGH PRESSURE PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE



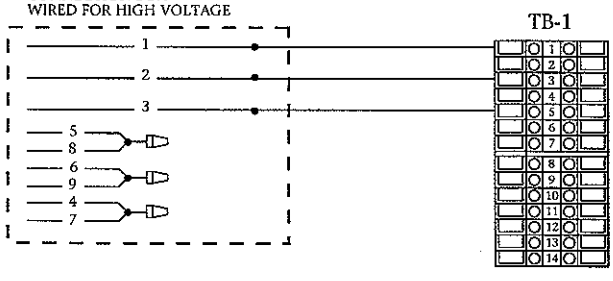
3 HORSE POWER
HIGH PRESSURE PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE



.5 HORSE POWER
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE

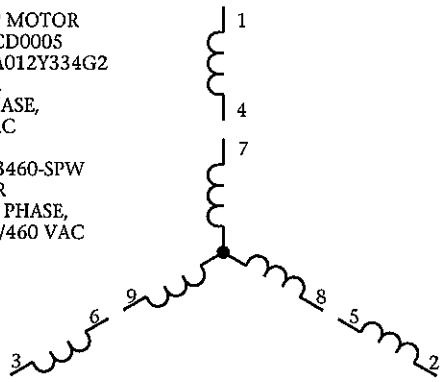


.5 HORSE POWER
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE

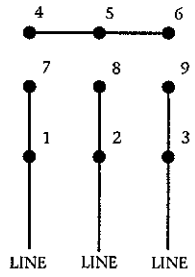


AquaWhisper Modular Series
Three Phase, 60 Hz

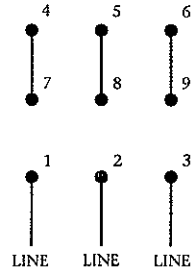
HIGH PRESSURE PUMP MOTOR
WINDING NUMBER: CD0005
SPEC NUMBER: 35A012Y334G2
3 HORSE POWER
60 Hz, THREE PHASE,
208 - 230/460 VAC
AND
SPEC NUMBER: JM3460-SPW
.5 HORSE POWER
50/60 Hz, THREE PHASE,
208-230/220/380/460 VAC



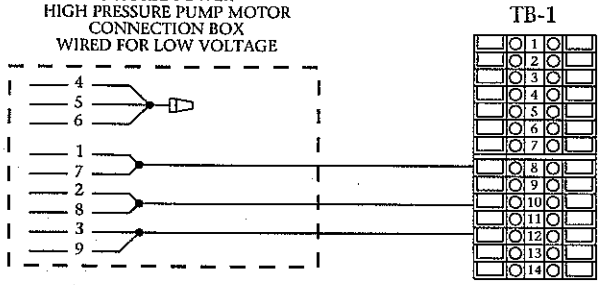
LOW VOLTAGE CONNECTION (2Y)
208 - 230 VAC
THREE PHASE, 60 Hz



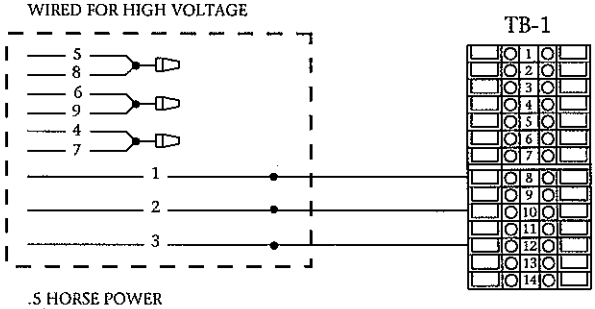
HIGH VOLTAGE CONNECTION (1Y)
460 VAC
THREE PHASE, 60 Hz



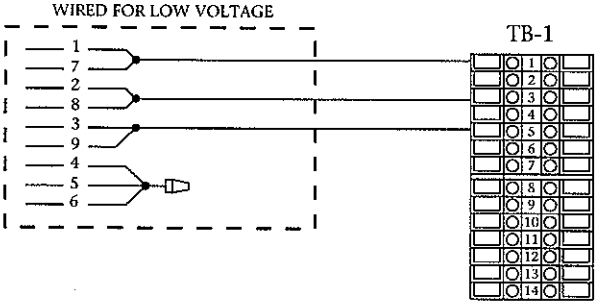
3 HORSE POWER
HIGH PRESSURE PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE



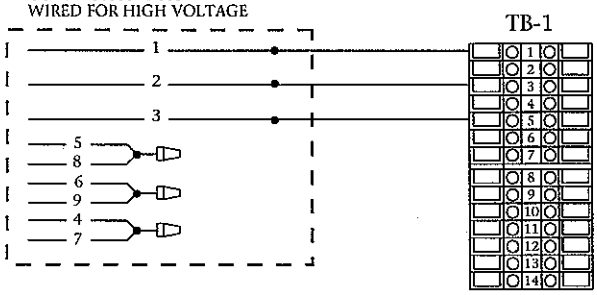
3 HORSE POWER
HIGH PRESSURE PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE

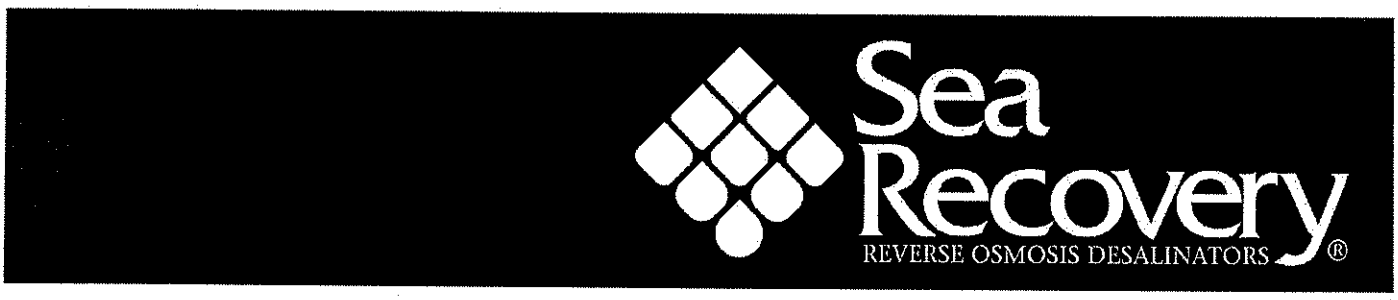


.5 HORSE POWER
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR LOW VOLTAGE



.5 HORSE POWER
BOOSTER PUMP MOTOR
CONNECTION BOX
WIRED FOR HIGH VOLTAGE





SECTION F

System Commissioning
&
Initial Start Up Of A New
Aqua Whisper R.O. Desalination System
with
Initial New System Readings Form

NOTES:

AVOID CHEMICAL ATTACK TO THE SYSTEM:

CAUTION: Do not expose the Sea Recovery R.O. System to intake Feed Water that contains:

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

or any other specific chemical not approved in writing by Sea Recovery Corp.
Use of non authorized or misuse of authorized chemicals voids any warranty.

Do not connect any water line to the Sea Recovery R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Sea Recovery R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the co-polymer components within the system. Do not connect the Sea Recovery R.O. System to any line that may contain chlorine or other oxidants as they also damage the R.O. Membrane Element.

INITIAL START-UP PROCEDURE OF A NEW Sea Recovery AquaWhisper System:

Throughout this Manual, Numbers in [brackets] refer to the I.D. numbers illustrated on page F - 4.

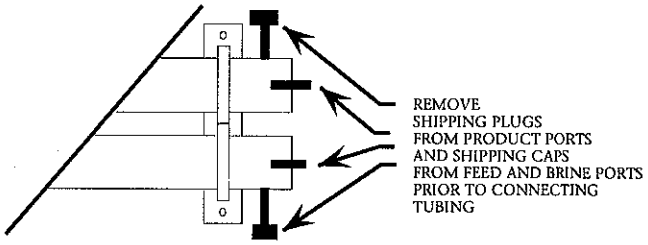
The following instructions must be carried out for initial start-up of a NEW system. For every day use starting routines refer to Section "G" "Start-Up Procedure" of this manual. These instructions are written either to ensure that all connections are properly made, or because the system is new at the initial start-up and therefore requires special precautions, considerations and procedures.

Failure to follow these procedures exactly leads to system failure, and cause 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.

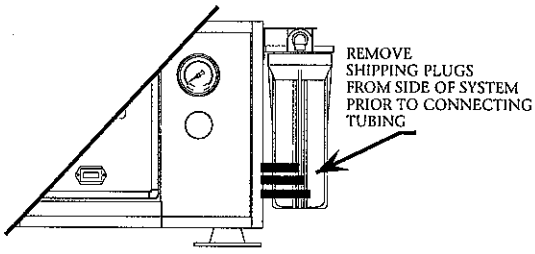
1. ***WARNING:*** **Ensure that all *TUBE SHIPPING PLUGS* from the side of the AquaWhisper Frame or Compact System and all *TUBE SHIPPING PLUGS and TUBE SHIPPING CAPS* from the AquaWhisper Modular R.O. Membrane Vessel Assembly have been removed whether the corresponding port is used in the installation and operation or not.**

   If the installer has failed to remove all of these plugs and if the System is operated with these plugs or caps in place then System damage results. Sea Recovery is not liable for resulting damage to the System due to the installers neglect or operators failure to remove these plugs and caps prior to System operation.

AquaWhisper Modular System
R.O. MEMBRANE VESSEL ASSEMBLY
Shipped with feed/brine port caps
and product port plugs

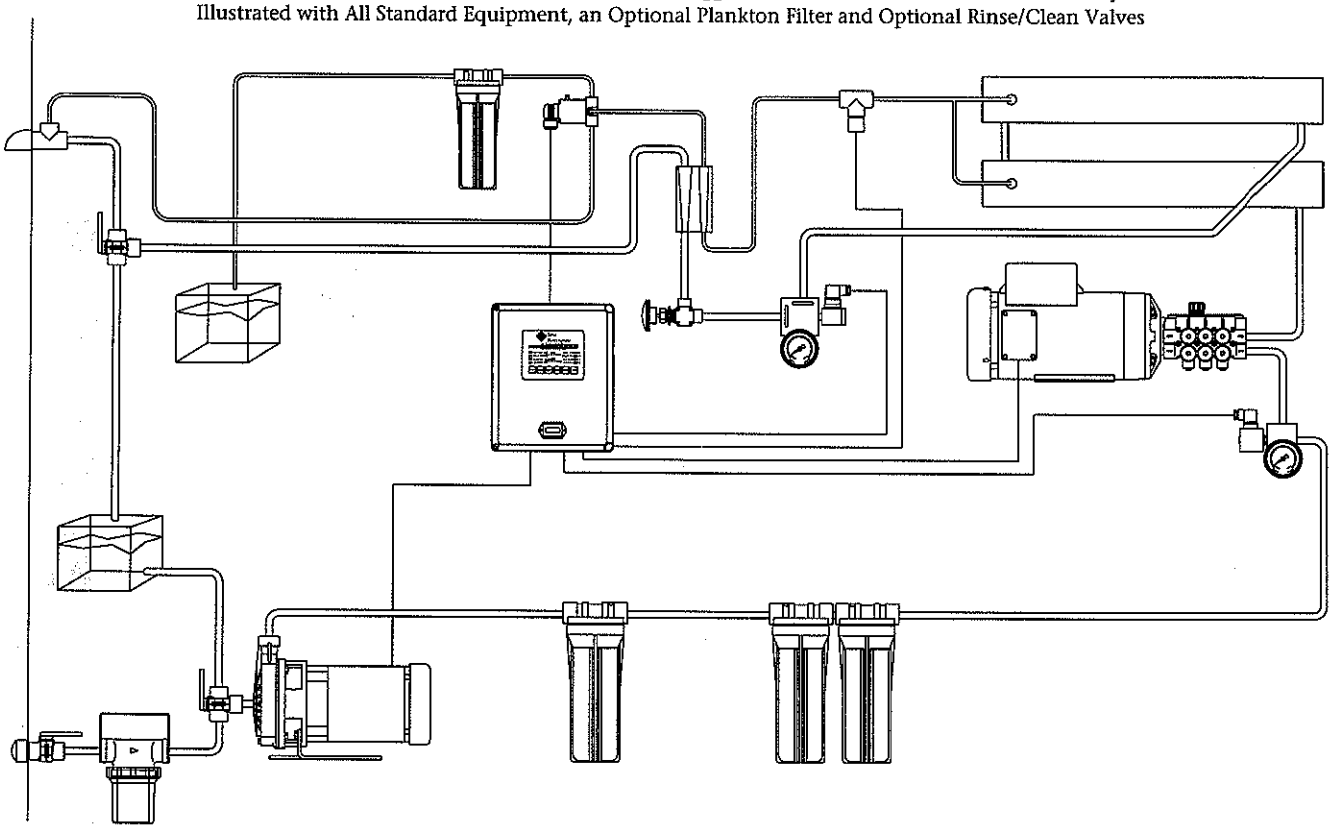


AquaWhisper Frame and Compact System
Shipped with
feed/brine port plugs
and product port plugs



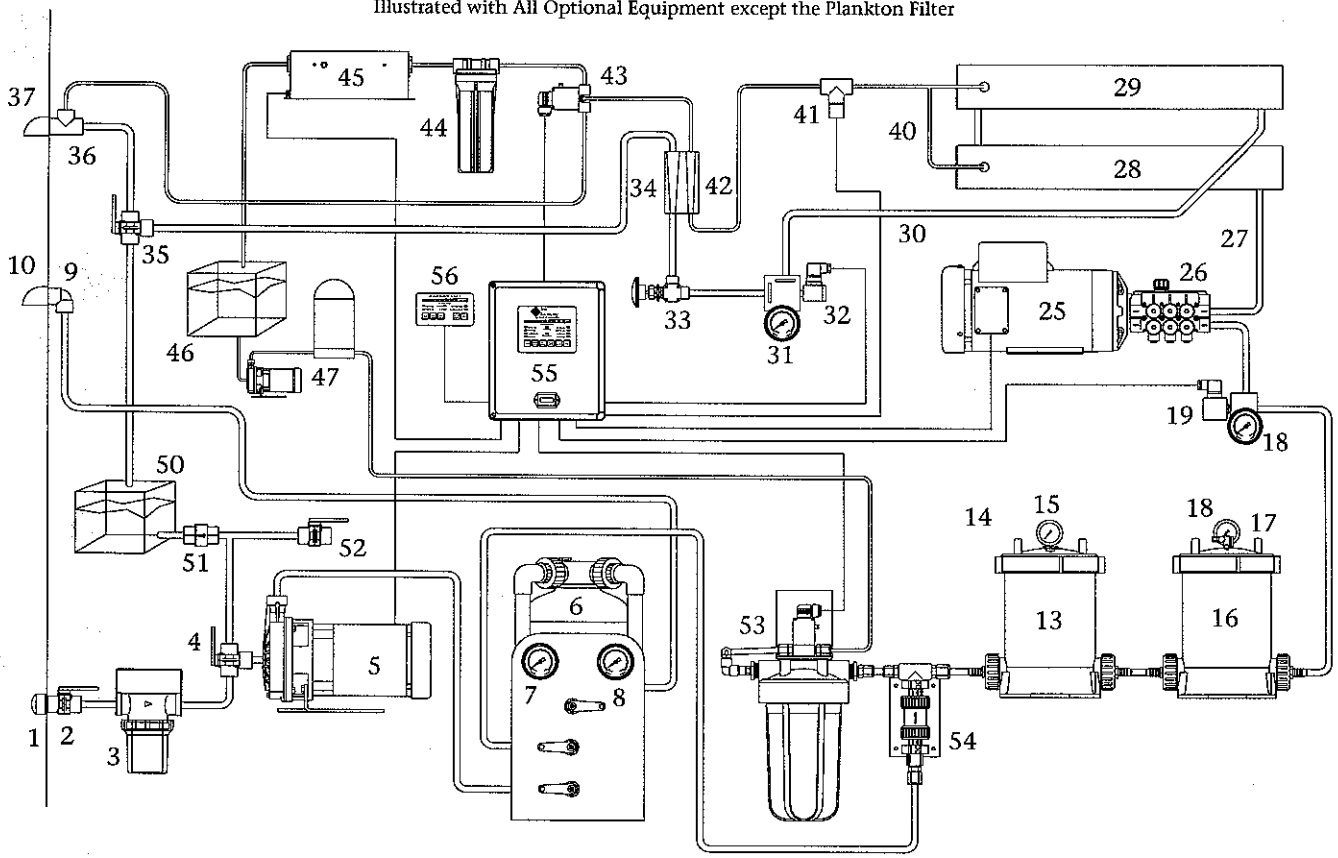
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System

Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves

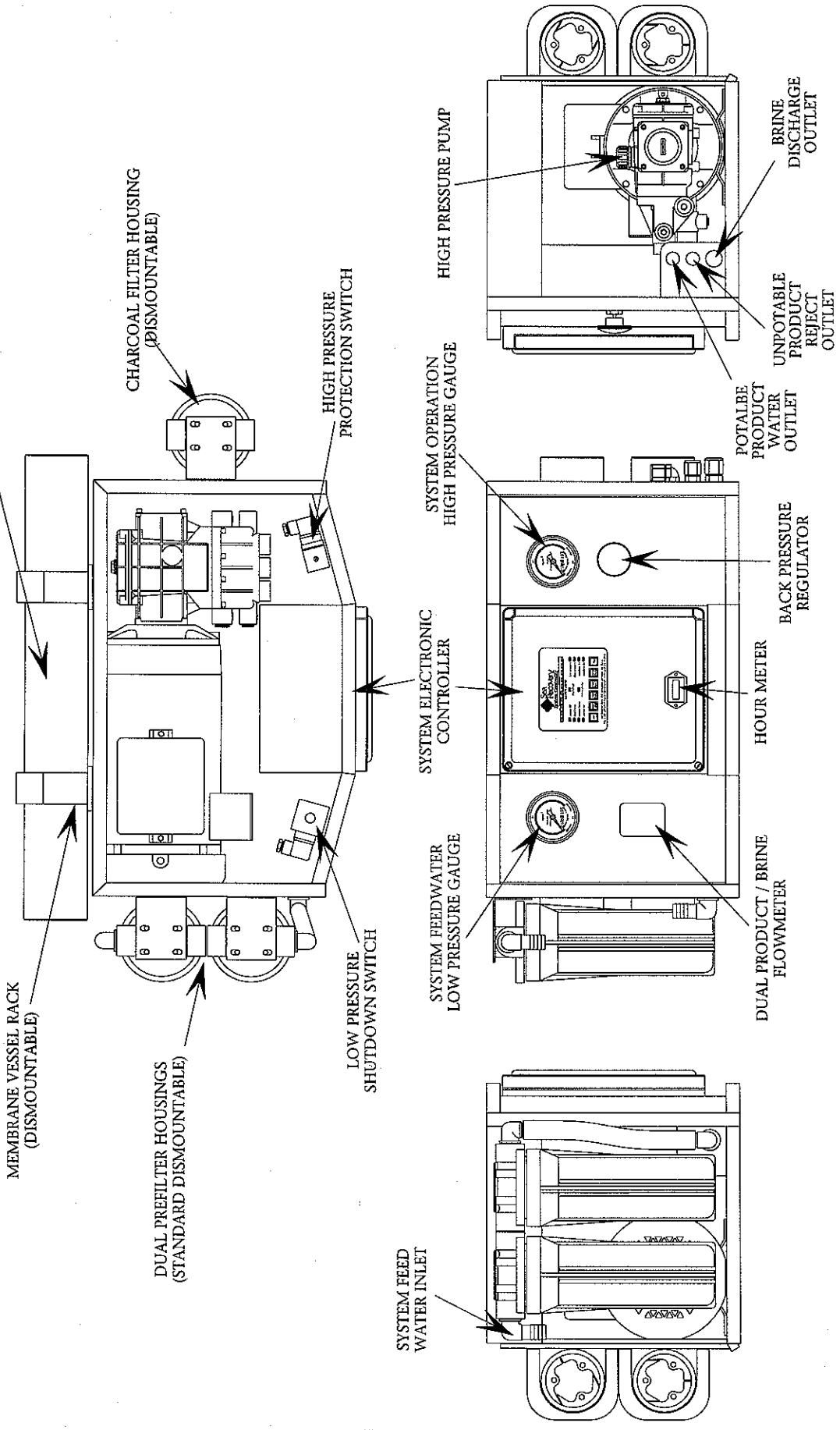


Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System

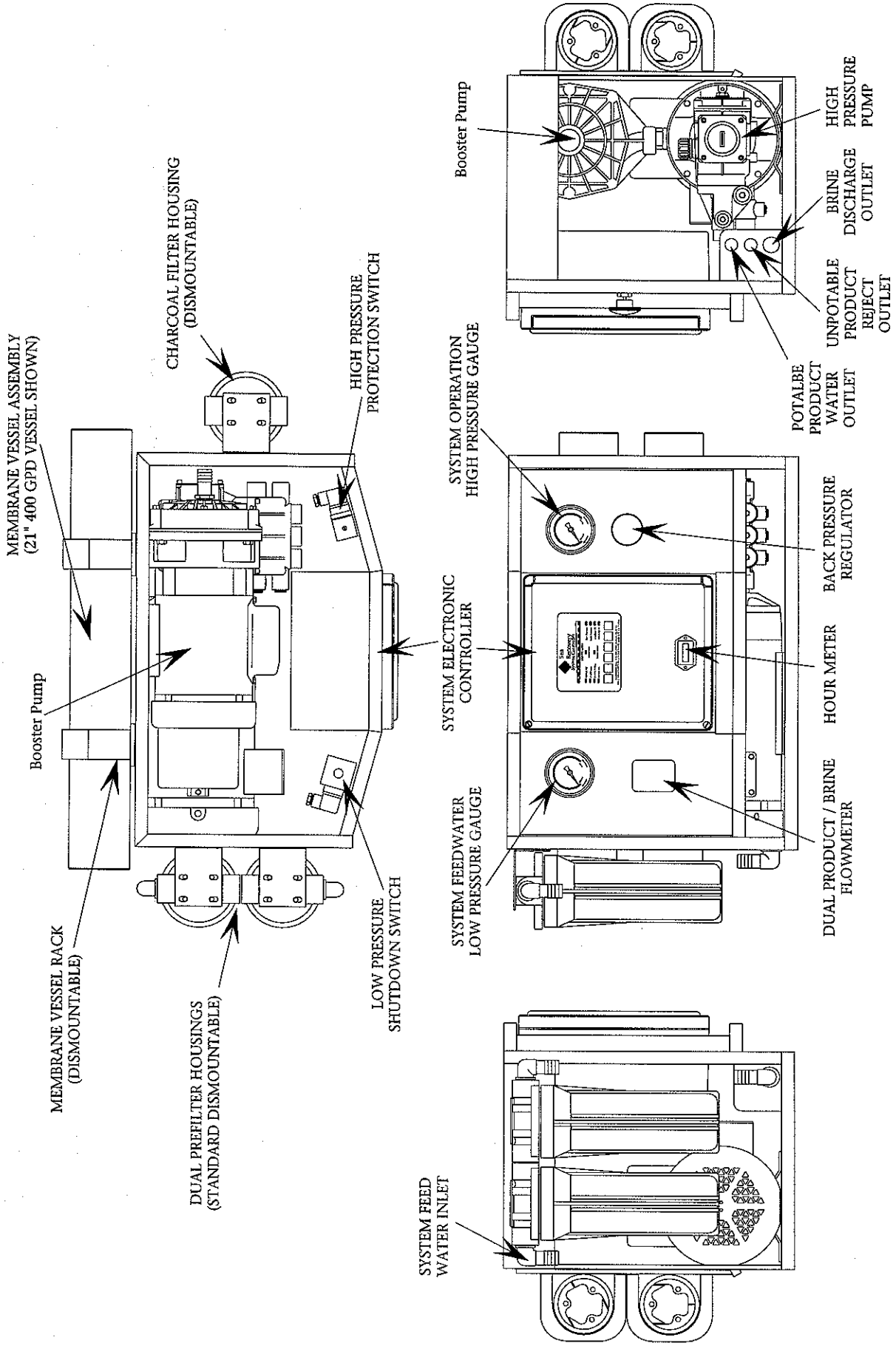
Illustrated with All Optional Equipment except the Plankton Filter



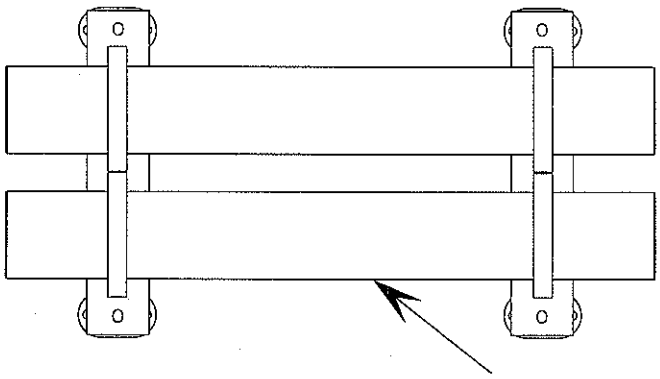
AquaWhisper Compact Style Major System Components Identification



AquaWhisper Frame Style Major System Components Identification



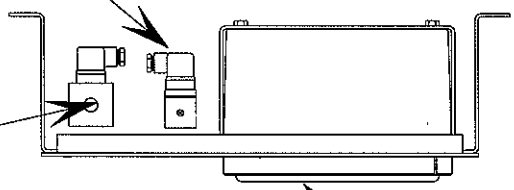
AquaWhisper Modular Style Components Identification



MEMBRANE VESSEL ASSEMBLY
WITH RUBBER ISOLATION MOUNTS
(21" 400 GPD VESSEL SHOWN)

HIGH PRESSURE
PROTECTION SWITCH

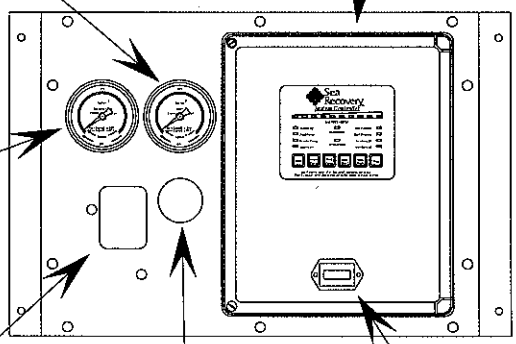
LOW PRESSURE
SHUTDOWN SWITCH



SYSTEM ELECTRONIC
CONTROLLER

SYSTEM OPERATION
HIGH PRESSURE GAUGE

SYSTEM FEEDWATER
LOW PRESSURE GAUGE



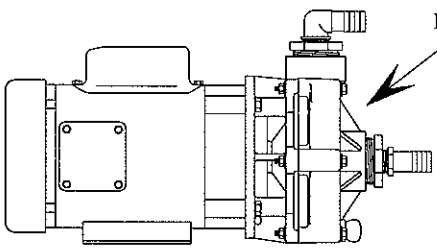
DUAL PRODUCT / BRINE
FLOWMETER

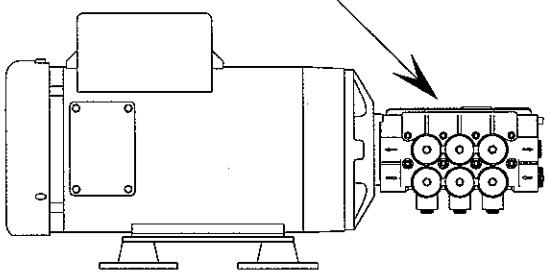
BACK PRESSURE
REGULATOR

HOUR METER

HIGH PRESSURE PUMP

BOOSTER PUMP





2. Check the level of the oil in the High Pressure Pump crankcase. Oil level is viewed through the rear Oil Level Sight Glass located at the back of the High Pressure Pump crankcase section. Ensure that the oil level is higher than the center of the sight glass. Under filling of oil causes overheating and damage to the rear crankcase section. Over filling does not cause damage. Over filling keeps the crankcase section cooler and properly lubricated.

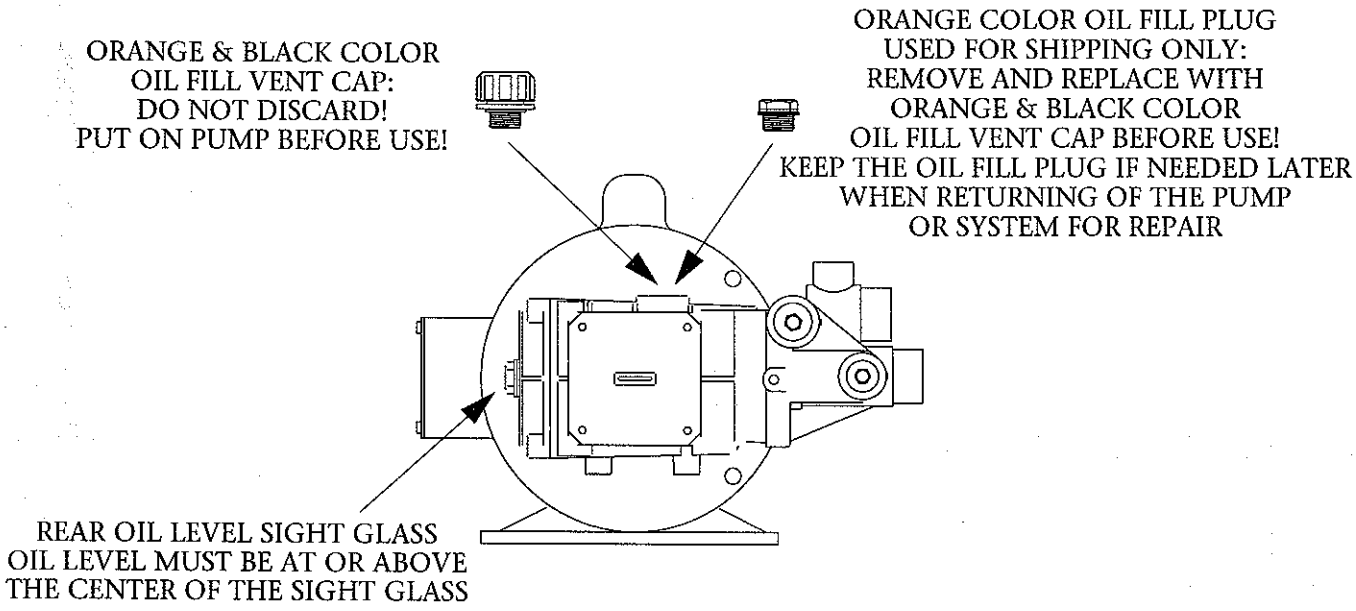
However, if too much oil is placed into the crankcase the excess oil percolates out the vented oil fill cap until the oil finds it's own level. Filling just to the top of the sight glass is ideal and best.

Use only Sea Recovery supplied pump oil as the Sea Recovery oil is a special hydraulic oil which contains anti rust and wear inhibitors which are essential to the high pressure pump crankcase section.

HIGH PRESSURE PUMP PREPARATION:

In Section E of this manual, the installer was cautioned that the High Pressure Pump is shipped with a <u>Non Vented Plug</u> so that oil does not spill from the High Pressure Pump during shipment. This orange color Non Vented Plug (located on top of the black color rear crankcase section) <u>must be removed and replaced</u> with the supplied orange and black color <u>Vented Oil Fill Cap</u>.

If the crankcase is not vented with the proper cap, pressure builds within the crankcase and causes oil seal failure, loss of crankcase oil and, in turn, damage to the High Pressure Pump due to lack of lubricating oil. <u>Such a failure due to the installers neglect voids all warranty of the High Pressure Pump</u>. Sea Recovery Corp. is not liable for the installers neglect. The Installer is held totally responsible for any damages due to neglect and failure to install the supplied <u>High Pressure Pump Oil Fill Vented Cap</u>.



3. Check each tube connection at the side panel of the System to ensure that the installer has properly connected and properly routed each tube. Follow each tube from the side panel to the final termination point in the boat. Improper routing and any blockage in any line causes damage to the system. ***Do not rely on the installers word, check it yourself.*** If you are the installer, check these lines again. Any damage due to improper installation is not covered under warranty by Sea Recovery.

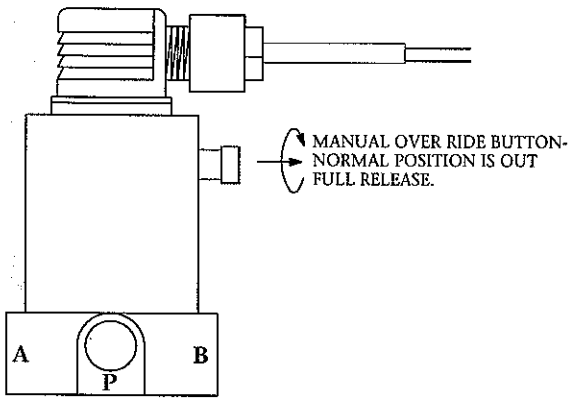
4. Make sure that the Electrical Power Source to the System is switched "OFF". When the Electrical Power Source is turned off, no power should be present at the System.

5. Open the front panel of the Salinity Controller. While the front panel of the controller is open, check all connections for good electrical attachment and proper wiring. Refer to the proper wiring diagram in Section "E" of this manual.

6. Close the Salinity Controller front panel.

7. Ensure that the manual By-Pass lever (gray color button) located on the side of the 3-Way Product Diversion Valve [43] is positioned outward (away from the coil body).

8. Close the Commercial Prefilter [13] Drain



PLUMBING CONNECTIONS
"P" = INLET (COMMON)
"B" = NORMALLY OPEN -TO DISCHARGE (BAD WATER)
"A" = NORMALLY CLOSED -TO CHARCOAL FILTER INLET (GOOD WATER)

Valve, if installed.

9. Close the Oil/Water Separator [16] Drain Valve, if installed.

10. Close the air bleed valve located on top of the Commercial Prefilter [14], if installed.

11. Close the air bleed valve located on top of the Oil/Water Separator [17], if installed.

12. Open the Inlet Sea Cock Valve [2] fully.

13. Position the Clean/Rinse Inlet Valve [4], if installed, to the normal operating position towards the Sea Strainer Outlet [3].

14. Position the Clean/Rinse Outlet Valve [35], if installed, to the normal operating position towards the Brine Discharge Tee [36].

15. Open any auxiliary Valve within the incoming Feed Line from the Inlet Thru Hull Fitting [1] to the System; Outgoing Brine Discharge Line from the System to the Brine Thru Hull Fitting [37]; and Outgoing Product Water Line from the System to the Ships Potable Water Storage Tank [46].

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

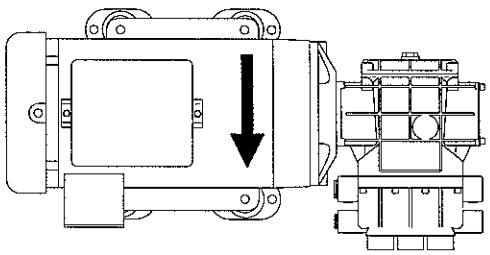
16. Open the Back Pressure Regulator Valve [33] FULL OPEN by turning the valve handle counter clockwise.

CAUTION: The Back Pressure Regulator Valve [33] must be full open when starting the Sea Recovery R.O. System. If this valve is left closed extensive damage to the Sea Recovery R.O. System results.

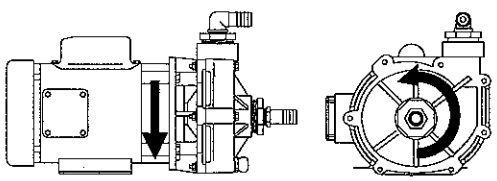
17. Switch the Electrical Power Source to the Salinity Controller "ON". The Power Source should be switched "ON" at a Circuit Breaker between the Power Source and the Salinity Controller.

18. ELECTRIC MOTOR ROTATIONAL CHECK: Ask an assistant to view the fan section of the Electric Motors, (High Pressure Pump Electric Motor [25] and Booster Pump Electric Motor [5]) while you ***Jog*** the System.

HIGH PRESSURE PUMP & MOTOR:



BOOSTER PUMP & MOTOR:



CAUTION: The Back Pressure Regulator Valve must be full open when starting or jogging the Sea Recovery R.O. System. Briefly press and release the Booster Pump Start Switch then immediately press the System Stop Switch. Ensure that the Booster Pump Electric Motor turned in the proper rotation.

Press the Booster Pump Start Switch then Press the System Start Switch then press the System Stop Switch. Ensure that the High Pressure Pump Electric Motor turned in the proper rotation. If either or both motors turned in the wrong direction refer to Section E of this manual for rotation correction.

19. Multi Media Filter Preparation.

The Multi Media Filter should have been loaded with gravel and #20 silica sand during the installation of the system. When new, as is the case with this system, the gravel and sand contain contaminates which must be back washed then rinsed to waste prior to use. This back washing procedure fluffs the silica sand and dislodges the suspended solids, fines and contaminates from the sand base. During back washing the suspended solids are discharged to waste through the Multi Media Filter Waste outlet [10].

Refer to the illustrations on page F-11 and the diagram to the right. To backwash the Multi Media Filter: Open the Inlet Sea Cock Valve [2]. Position the Inlet Clean Rinse Valve, if installed, to the normal operating position towards the Sea Strainer [3].

Position the Multi Media Filter Valves (3 each valves) as shown in the diagram to the right for Multi Media Filter Back Wash.

Press the Booster Pump Start Switch. The Booster Pump [5] is now back washing the Multi Media Filter [6] to waste [10] as illustrated at the top of page F-11. Allow this back washing to continue for 10 minutes.

After 10 minutes of back washing press the Booster Pump Stop Switch to Stop the Booster Pump.

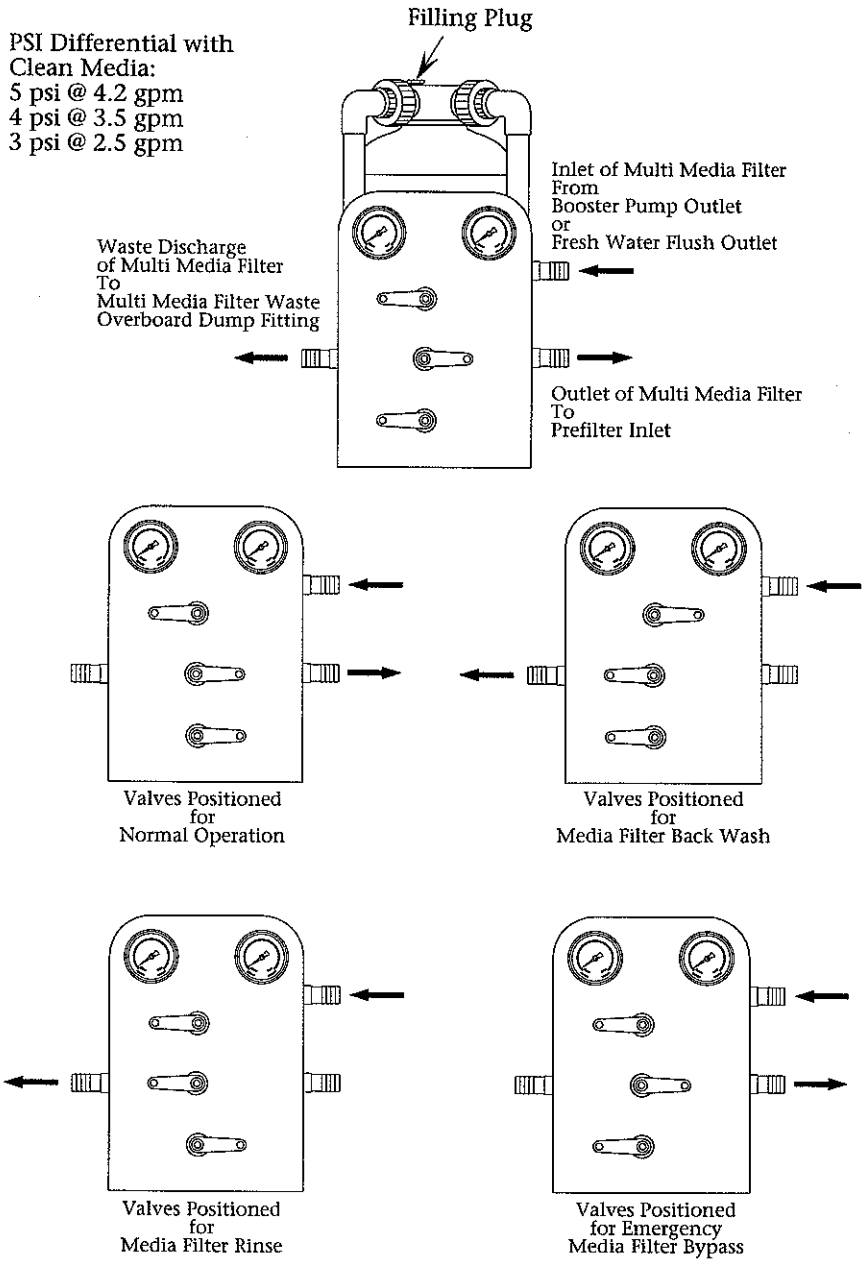
Position the Multi Media Filter Valves as shown in the diagram below for Multi Media Filter Rinse.

Press the Booster Pump Start Switch. The Booster Pump [5] is now rinsing the Multi Media Filter [6] to waste [10] as shown at the bottom of page F-11. Allow this rinsing to continue for 5 min.

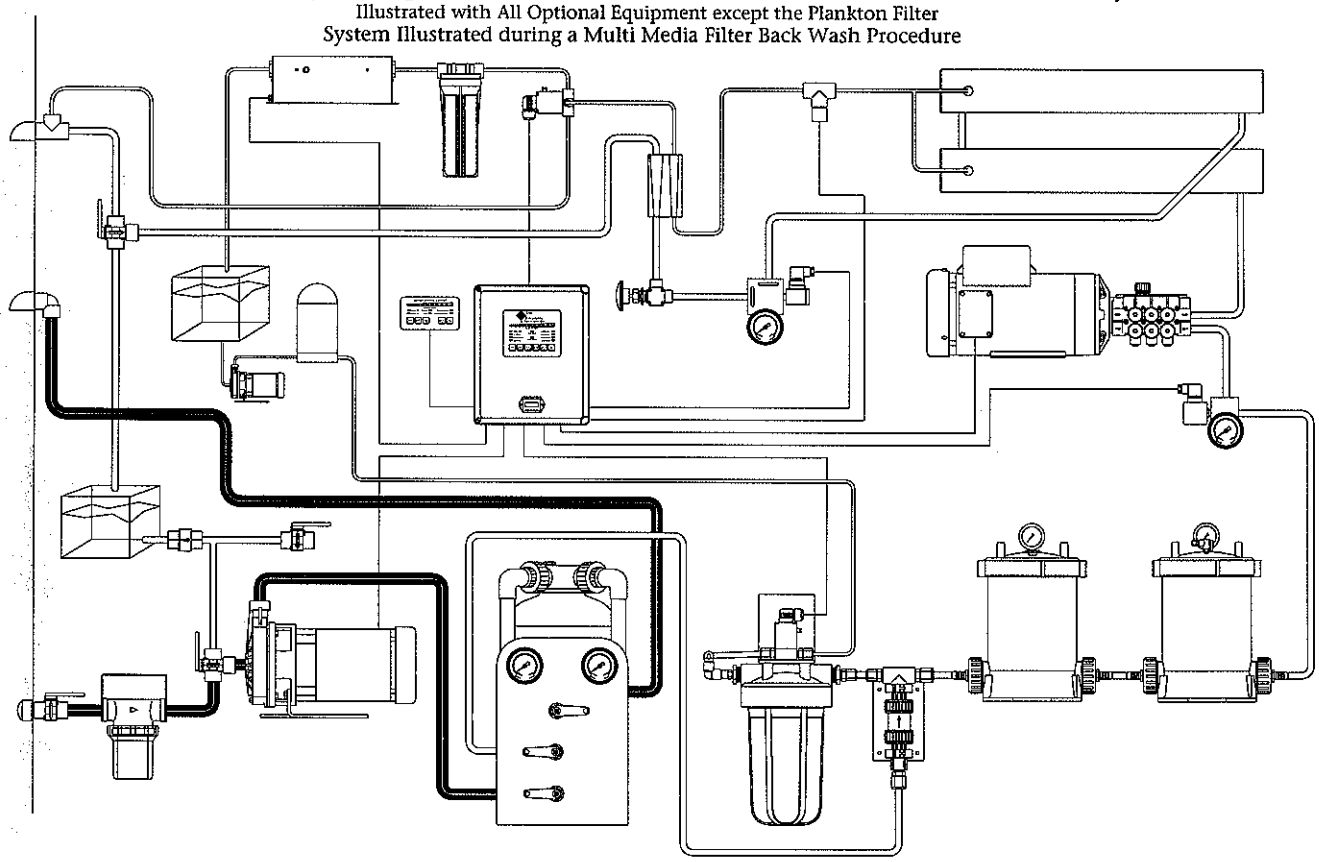
After 5 minutes of rinsing press the Booster Pump Stop Switch to Stop the Booster Pump.

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

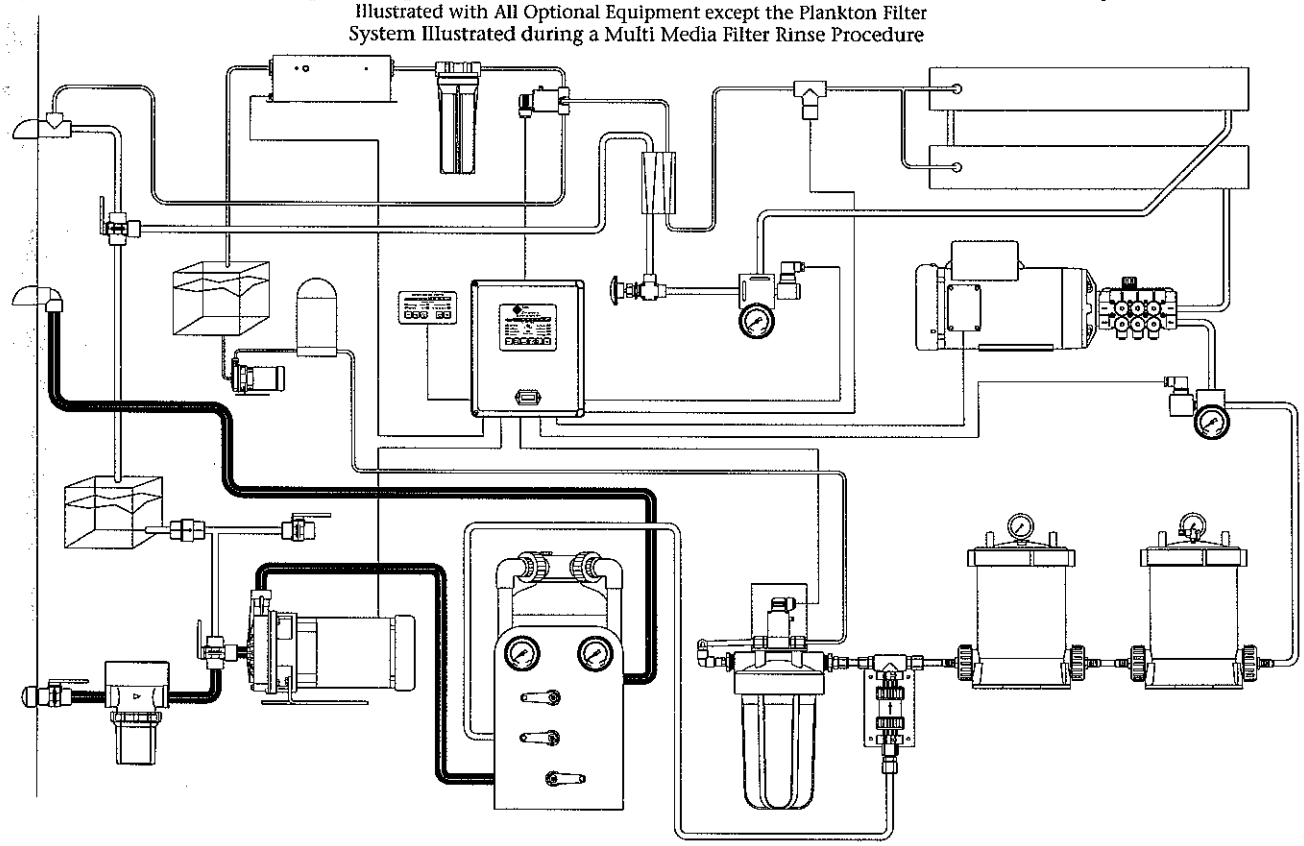
VALVE POSITIONING OF THE MULTI MEDIA FILTER
DURING 4 SEPARATE MODES OF OPERATION



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated during a Multi Media Filter Back Wash Procedure



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated during a Multi Media Filter Rinse Procedure



The following 4 pages, F-12 through F-15 contain illustrations showing the water flow of the System during the three stages of the start up process. These three stages are

1) The System is operating without pressure applied at the R.O. Membrane Elements.

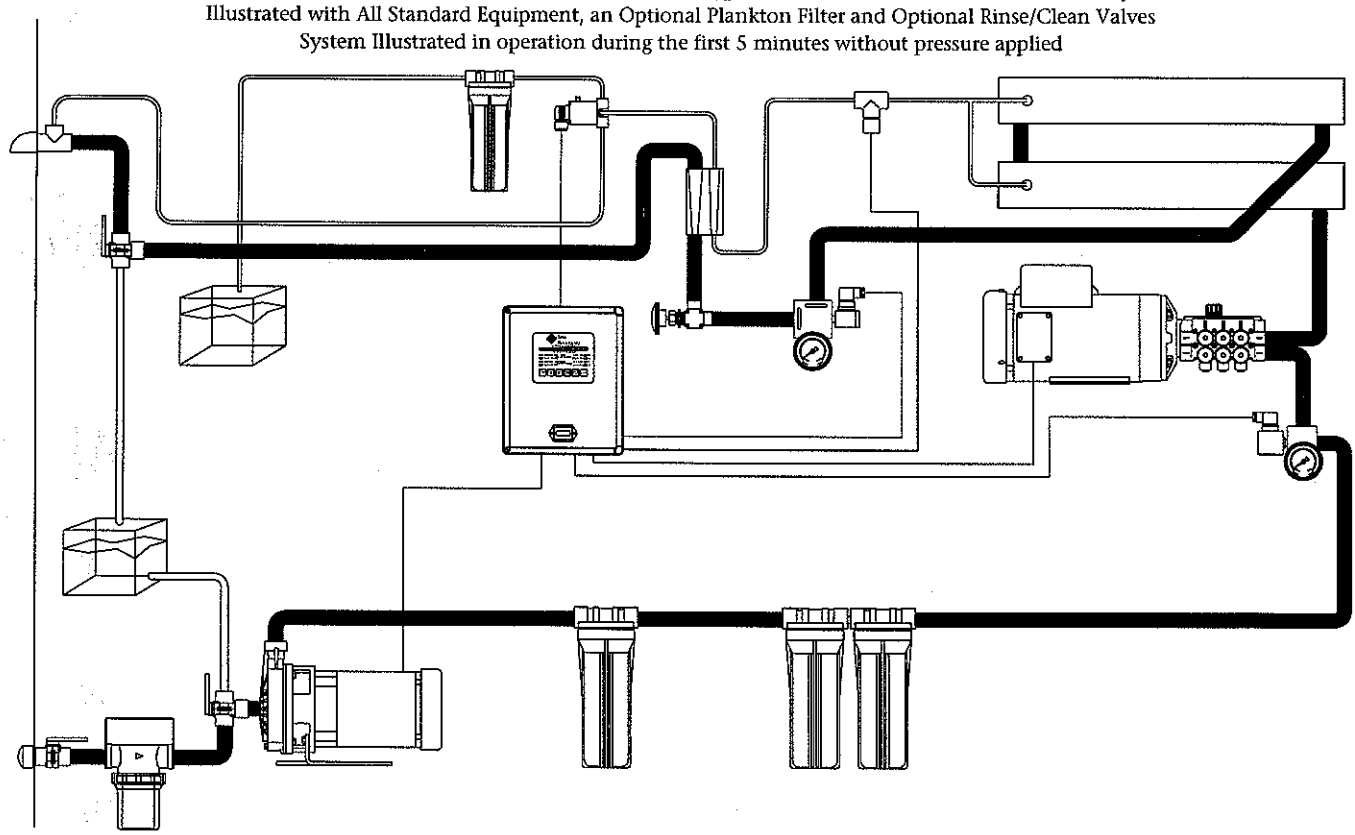
2) The System is operating with pressure applied at the R.O. Membrane Elements, the R.O. Membrane Elements are producing product water, however the product water is not yet potable.

3) The System is operating with pressure applied at the R.O. Membrane Elements and the product water being produced is potable.

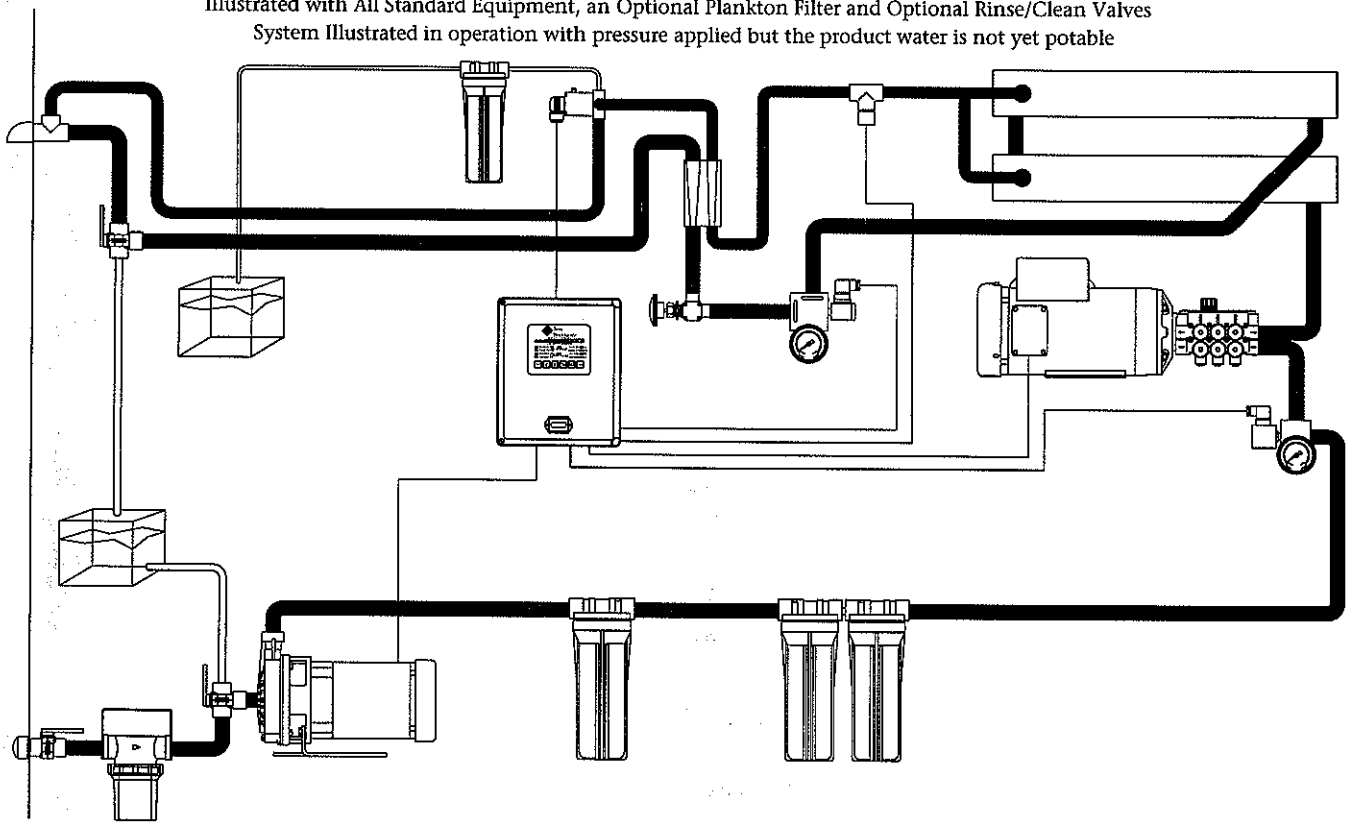
Pages F-12 and F-13 illustrate the System with the Rinse/Clean Valves and Plankton Filter Options.

The F-14 and F-15 illustrate the System with all optional equipment except the Plankton Filter.

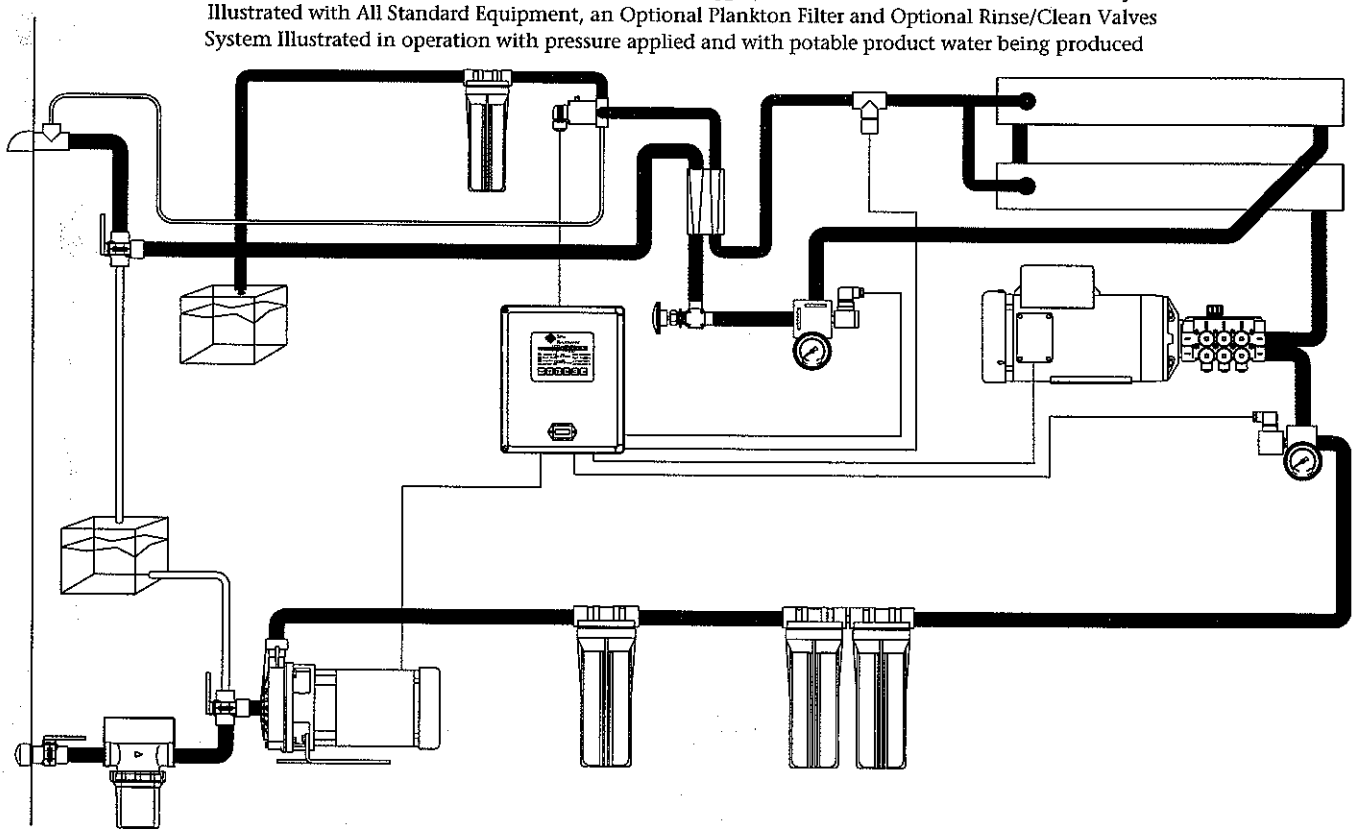
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated in operation during the first 5 minutes without pressure applied



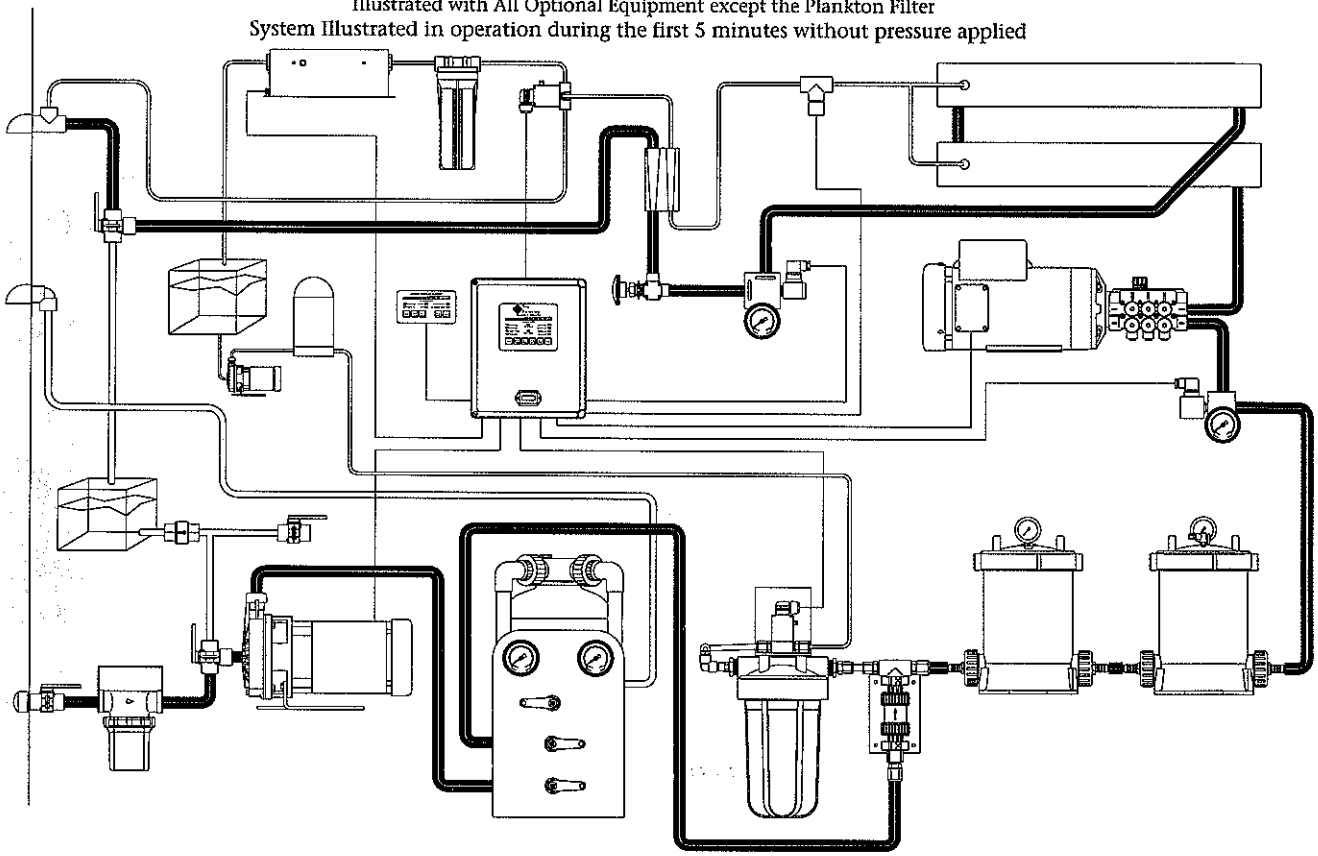
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated in operation with pressure applied but the product water is not yet potable



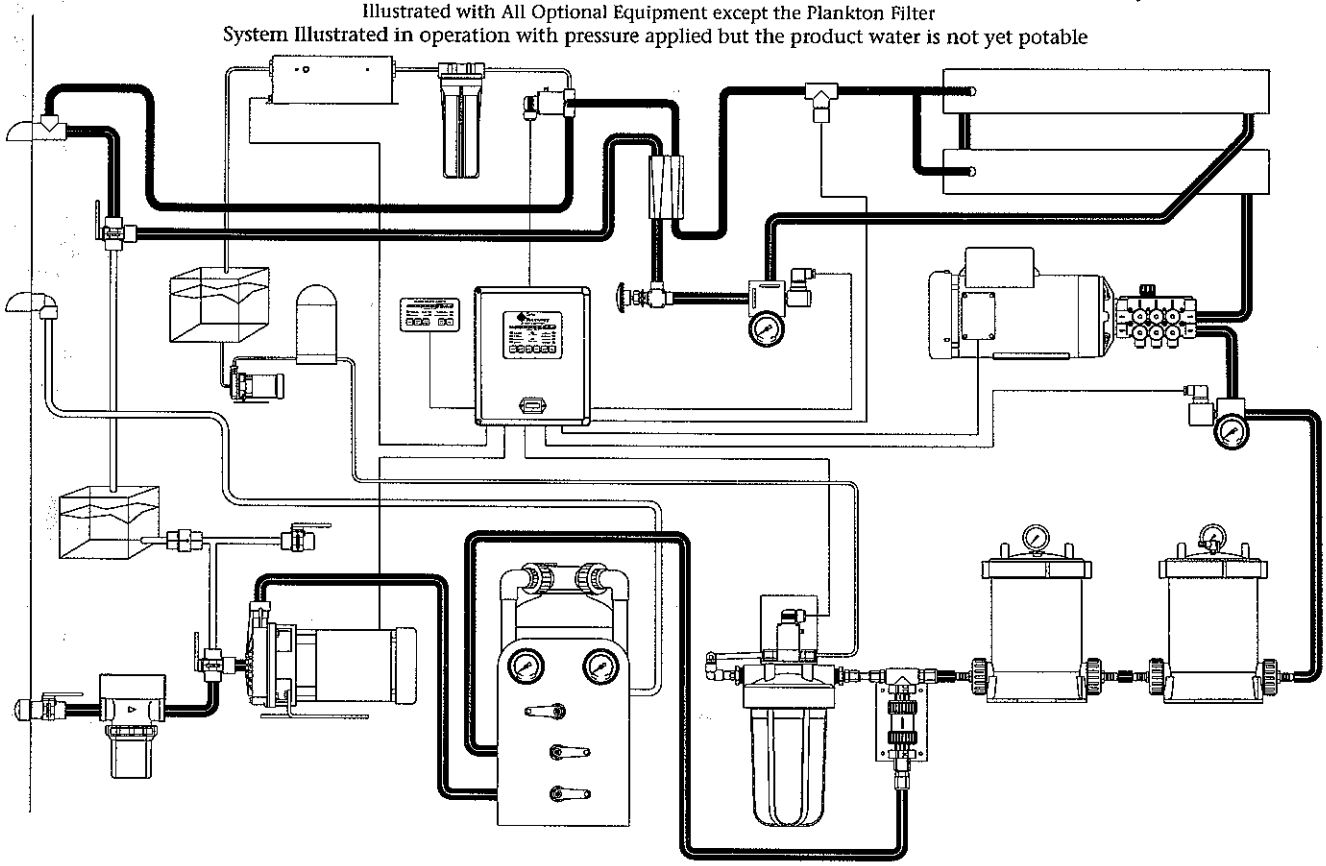
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated in operation with pressure applied and with potable product water being produced



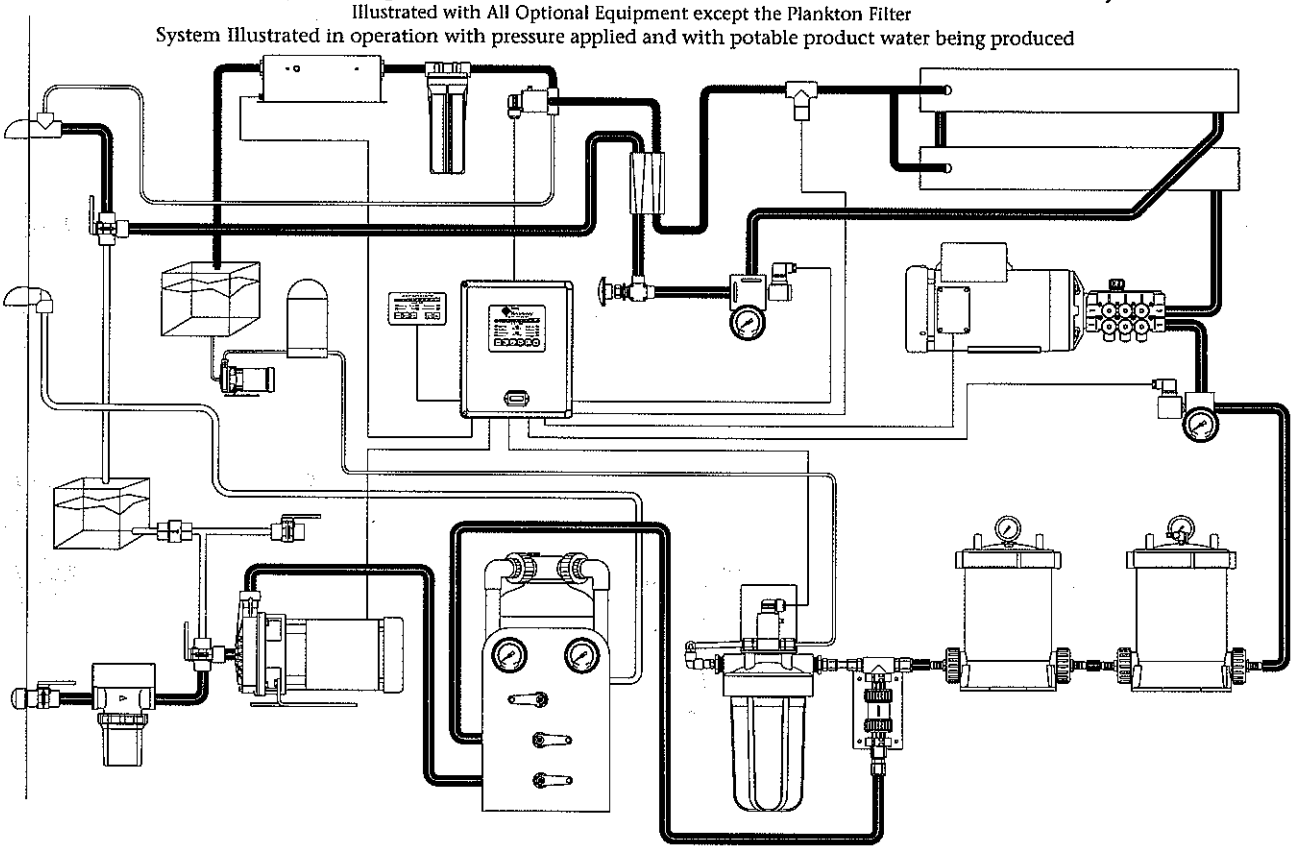
Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated in operation during the first 5 minutes without pressure applied



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated in operation with pressure applied but the product water is not yet potable



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated in operation with pressure applied and with potable product water being produced



20. **CAUTION:** The Back Pressure Regulator Valve must be full open when starting the Sea Recovery R.O. System. Open fully, counter clockwise the Back Pressure Regulator.

    CAUTION: ***Starting an SRC system equipped with an optional soft-start without opening the Back Pressure Regulator Valve fully causes damage to the high pressure motor. This step must be strictly adhered to.***

    The Booster Pump and High Pressure Pump may be started manually or automatically. If Started Automatically the booster pump Starts then after approximately 3 seconds the High Pressure Pump Starts.

    To Start the System press the System Start Switch, in which case the Booster Pump Starts first and then after approximately 3 seconds the High Pressure Pump automatically Starts.

    or

    You may Start the Booster Pump and High Pressure Pump manually by first pressing the Booster Pump Start Switch and then the High Pressure Pump Start Switch.

    In either case, the Booster Pump [5] and High Pressure Pump [25] are in operation at this time as illustrated on page F-12 & at the top of F-14.

    If the System remains operating then go on to step 21. If the System shuts off after several seconds of operation then read on here.
    If the System automatically shuts off after several seconds of operation look at the Touch Pad. If one of the 4 fault lamps is illuminated this is the cause of shut down. Reset the Fault Lamp by pressing the Fault Reset Switch at the Touch Pad then determine what caused the Fault Lamp to illuminate.

    Fault Lamp explanation and correction procedure:

    a. **Low Pressure Fault Lamp:** The System is equipped with a Low Pressure Switch which functions as a Normally Open Switch.

    With no pressure applied to the Low Pressure Switch it remains in an open position and not allow the System to remain in operation. With pressure above 6 psi applied to the Low Pressure Switch it closes and allows the System to operate.

    In other words, there must be at least 6 psi present at the Low Pressure Switch in order for the System to continue operating. This is confirmed by viewing the Low Pressure Gauge located on the System Control Panel.

This Low Pressure Gauge must read above 6 psi in order for the Low Pressure Switch to close and maintain System operation.

With the assumption that the Booster Pump is functioning and rotating in the proper direction, the Inlet Sea Cock Valve is Open and if the Inlet Clean / Rinse Valve is installed and positioned properly towards the Sea Strainer, and all hose connections are tight and not allowing air to suck into the feed line, then it is likely that this New System simply needs priming.

To prime the System fill the prefiltration housings with feed or dock water and pour water into the feed line hose to get some water into the Booster Pump.

Once water is introduced into the Booster Pump it picks up new feed water and is able to maintain pressure at the Low Pressure Switch.

b. High Pressure Fault Lamp: The System is equipped with a High Pressure Switch which functions as a Normally Closed Switch. With System Operating Pressure below 900 to 1000 psi the High Pressure Switch remains Closed and allows the System to operate. If the High Pressure Fault Lamp Illuminated when attempting to start the System this indicates a blockage or restriction in the Brine Discharge Line or High Pressure Side of the System. Never operate the System above 1000 psi.

Ensure that the Back Pressure Regulator is full open counter clockwise. Follow the Brine Discharge Line and if there is a Valve in this line ensure that it is in the full Open position. Ensure that there are no kinks or blockages in the Brine Discharge Line.

c. Auxiliary #1 Fault Lamp: Some Systems are equipped with a thermal protection switch inside the High Pressure Pump Electric Motor, other Systems are not. This depends upon the exact configuration of the System and the specific electric motor utilized. When Auxiliary #1 Fault Lamp is illuminated this indicates that the Electric Motor Thermal Switch has opened due to excessive heat (amperage draw) inside the High Pressure Pump Electric Motor.

or

The installer may not have connected the thermal switch wires at the High Pressure Pump Motor, if the motor has a thermal switch, to the Auxiliary #1 connection point within the Controller.
If the Auxiliary #1 Fault Lamp illuminates, and if the High Pressure Pump has a thermal switch that is properly connected, check the electric motor wiring to ensure that it is properly wired for the operating supply voltage. Ensure that the power supply, generator or shore power, is the proper line voltage, cycles and phase for the System. Ensure the power source is sufficient to maintain full voltage and cycles to the System during Startup.

If Voltage and/or Cycles drop at any time, the High Pressure Pump Electric Motor draws excessive amperage and over heats.

d. Auxiliary #2 Fault Lamp: This connection is an optional protection circuit which is utilized by SRC when the system is equipped with an optional Soft Start. This circuit is connected to the temperature sensor of the Soft Start. When a system is equipped with a Soft Start and the Auxiliary 2 lights this means the Soft Start has overheated. Allow the system to cool down and proceed with the following:
Reset the Fault and switch the main power off and then on. This resets the Soft Start's logic.

In other systems it is not utilized by Sea Recovery. If the Installer connected a switch to this circuit then check with the installer to trouble shoot the circuit and reason for shut down.

After a fault has been corrected and the Fault Reset Switch has been pressed go back to the beginning of Step 20.

21. While the System is in operation, the GPM Brine Flow Meter [34] allows observation of the water passing through it. Any air passing through the meter is visible and causes the flow reading to fluctuate. Once all air is bled and eliminated from the System, the meter may be read reliably.

22. Bleed all air from the Commercial Prefilter [13] and or Oil/Water Separator [16], if the system is equipped with these options. Open the air bleed valve located at the top of the respective housing [14 & 17] until water displaces all of the air then close the air bleed valve(s).

23. Check for air suction leaks or water leaks throughout the entire system. Refer to Section "I" Troubleshooting and Section "K" Maintenance & Repair, in this manual to correct any leaks.

24. A new Charcoal Filter Element transfers carbon fines into the storage tank if not rinsed before use. Prior to applying pressure to the System disconnect the product water line from the Charcoal Filter Outlet Port. Discard the first few liters of product water.

25. After a minimum of 15 minutes running time, with proper feed flow in progress, slowly adjust the Back Pressure Regulator Valve [33] by turning the valve handle clockwise to increase the System operating pressure up to 800 PSI if the feed water source is full salinity sea water.

    Flow is progressing as illustrated at the top of page G-13 & bottom of page G-14.

    When the feed water source is BRACKISH WATER (not full salinity sea water) adjust the Back Pressure Regulator Valve from 100 PSI to 800 PSI. Decrease or increase pressure so that the product water output, as registered on the Product Water Flow Meter [42], is within system specifications. Product water output specifications to be considered when in Brackish Feed Water Feed Sources are:

	Hourly Production Gallons / Liters
SRC AW 400	16 / 63
SRC AW 600	25 / 94
SRC AW 800	33 / 126
SRC AW 1200	50 / 189
SRC AW 1600	66 / 252

    DO NOT EXCEED PRODUCT WATER FLOW SPECIFICATIONS. PERMANENT FOULING TO THE R.O. MEMBRANE ELEMENT RESULTS IF PRODUCT WATER FLOW SPECIFICATIONS ARE EXCEEDED.

    If leaks develop, decrease pressure by adjusting the Back Pressure Regulator Valve [33] full open, counter clockwise, then depress the system STOP switch. Correct any problems, then refer to step 21 above.

25. Determine that product water is being produced. This is assured by a noticeable flow through the Product Water Flow Meter [42]. The system operating, properly interconnected and pressurized, may not produce "potable" water for up to 30 minutes. The salinity of the Product Water diminishes gradually, until the quality of the product water reaches the factory micromho setting at which time the unpotable (red) water light turns off, and the 3-Way Product Diversion Valve [43] energizes and direct flow to the "potable" (good water) position. This allows product water to pass into the Post Filtration components, and in turn, into the Ship's Potable Water Storage Tank [46].

    When the product water clears of carbon fines then reconnect the product water line to the outlet of the Charcoal Filter so that the product water may continue on to the storage tank.The normal pressurized flow is illustrated at the bottom of page G-13 and on page G-15.

Motor Temperature Note: The Electric Motors used in the AquaWhisper Systems are rated for high temperature operation. They do not contain cooling case fins because the windings are rated for high temperature operation and external fins are not necessary. Therefore, the case of the motor is hot to touch. Do not be alarmed if the external case of the electric motor is too hot to touch. Check motor line amperage if it is suspected that the motor is overheating.

26. Recheck for:

    a. A constant and proper feed water flow.

    b. A constant appropriate system pressure.

    c. Leaks in the system: air, water or oil.

    d. Unusual noises or other occurrences.

27. Refer to Section "H" of this manual for shut down procedures.

NOTES:

The person commissioning the New Sea Recovery AquaWhisper System should, at this time, fill out the two INITIAL NEW SYSTEM READINGS forms located on pages F-20 and F-21.

Retain in this Manual the form on page F-20 for the owner and future operators reference. This information is valuable to the servicing technicians in providing technical support to the owner and future operators of the Sea Recovery AquaWhisper System.

The form on page F-21 should be retained by the person or company that performed the commissioning of the New Sea Recovery System. This information is valuable to the servicing technicians in providing technical support to the owner and future operators of the Sea Recovery AquaWhisper System.

Sea Recovery Aqua Whisper Reverse Osmosis Desalination System

"AquaWhisper" INITIAL NEW SYSTEM READINGS
KEEP THIS COPY IN THE OWNERS MANUAL

The following information must be determined and recorded at the time of system commissioning (initial new system start up). The readings should correlate closely with normal operation specifications. By making a record of the initial new system readings the operator can correlate these with subsequent daily log readings.

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

Serial Number: _____ Model Number: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ °Fahrenheit or _____ ° Celsius

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Control Panel Low Pressure Gauge Reading: _____ PSI

High Pressure Gauge Reading: _____ PSI

WATER FLOW METER READINGS:

Brine Water Flow Meter: _____ U.S. GPM or _____Liters Per Minute

Product Water Flow Meter: _____ U.S. GPH or _____Liters Per Hour

WATER QUALITY:

Feed Water Salinity: _____ PPM or Location: _____

Product Water Salinity: _____ PPM

Number of LED Indication on Salinity Controller: _____ LED's

Unusual occurrences or special comments: _____

_____

_____

Sea Recovery AquaWhisper Reverse Osmosis Desalination System

"AquaWhisper" INITIAL NEW SYSTEM READINGS
THIS COPY IS FOR THE INSTALLER, DEALER OR COMMISSIONER

The following information must be determined and recorded at the time of system commissioning (initial new system start up). The readings should correlate closely with normal operation specifications. By making a record of the initial new system readings the service technician can correlate these with subsequent daily log readings.

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

Serial Number: _____ Model Number: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ °Fahrenheit or _____° Celsius

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Control Panel Low Pressure Gauge Reading: _____ PSI

High Pressure Gauge Reading: _____ PSI

WATER FLOW METER READINGS:

Brine Water Flow Meter: _____ U.S. GPM or _____Liters Per Minute

Product Water Flow Meter: _____ U.S. GPH or _____Liters Per Hour

WATER QUALITY:

Feed Water Salinity: _____ PPM or Location: _____

Product Water Salinity: _____ PPM

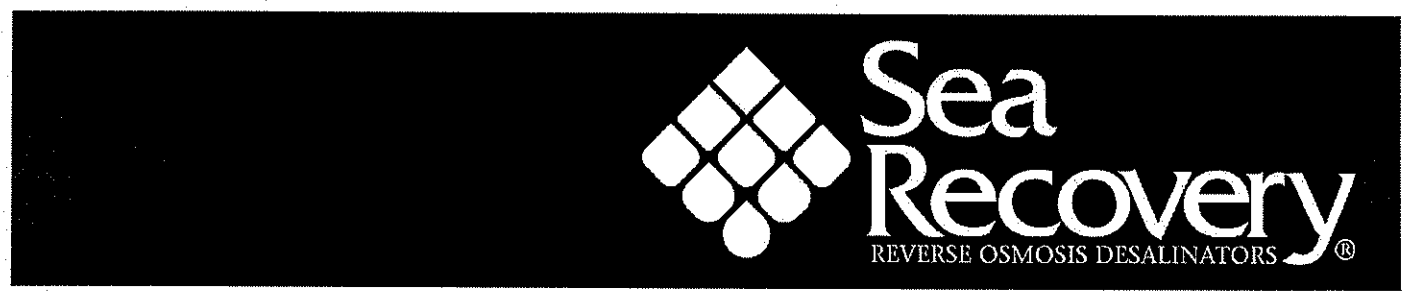
Number of LED Indication on Salinity Controller: _____ LED's

Unusual occurrences or special comments: _____

_____

_____

NOTES:



SECTION G

System Start Up Procedure

NOTES:

AVOID CHEMICAL ATTACK TO THE SYSTEM:

CAUTION: Do not expose the Sea Recovery R.O. System to intake Feed Water that contains:

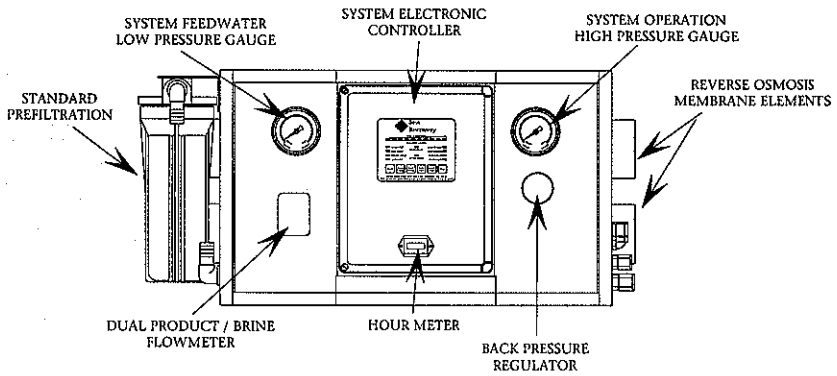
hydrogen peroxide	chloramine	chloramine-T	N-chloroisocyanurates
chlorine dioxide	hypochlorite	chlorine	iodine
bromine	bromide	phenolic disinfectants	petroleum products

or any other specific chemical not approved in writing by Sea Recovery Corp.
Use of non authorized or misuse of authorized chemicals voids any warranty.

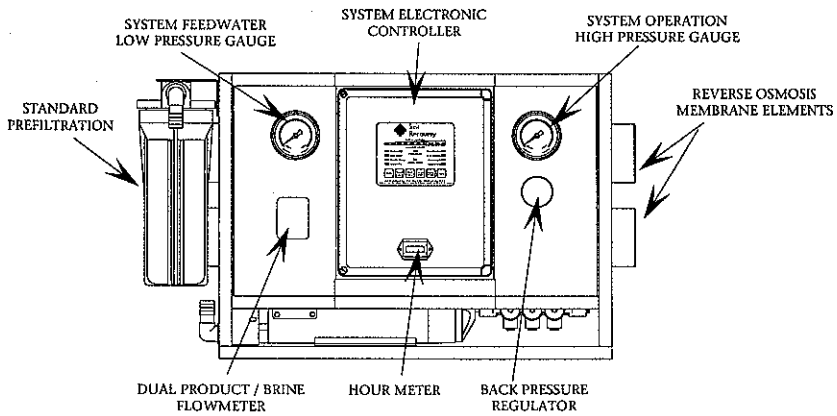
Do not connect any water line to the Sea Recovery R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Sea Recovery R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the co-polymer components within the system. Do not connect the Sea Recovery R.O. System to any line that may contain chlorine or other oxidants as they also damage the R.O. Membrane Element.

Throughout this Manual, Numbers in [brackets] refer to the I.D. numbers illustrated on page D-3 and F-4.

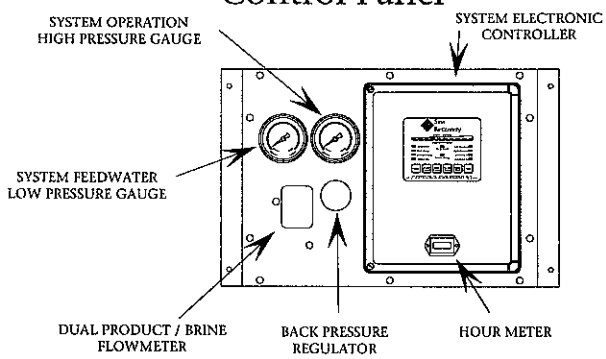
AquaWhisper Compact Style System Control Panel



AquaWhisper Frame Style System Control Panel



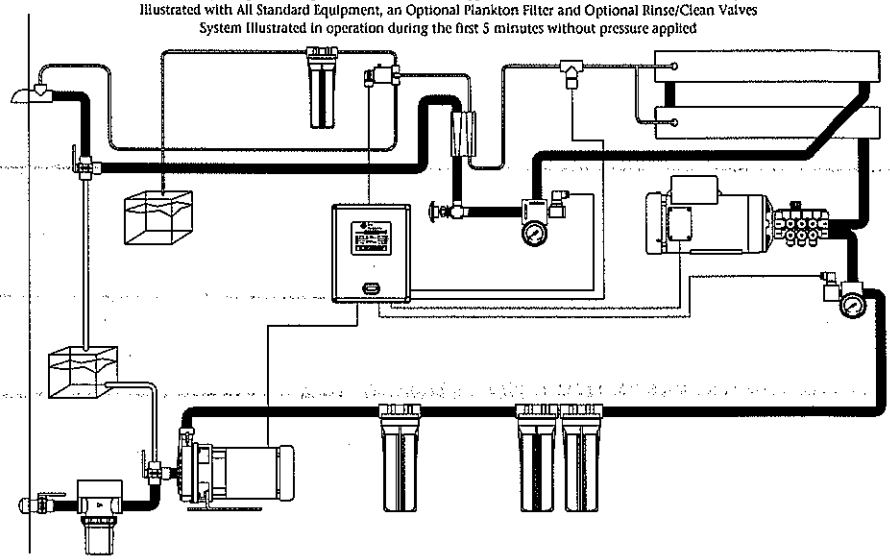
AquaWhisper Modular Style System Control Panel



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

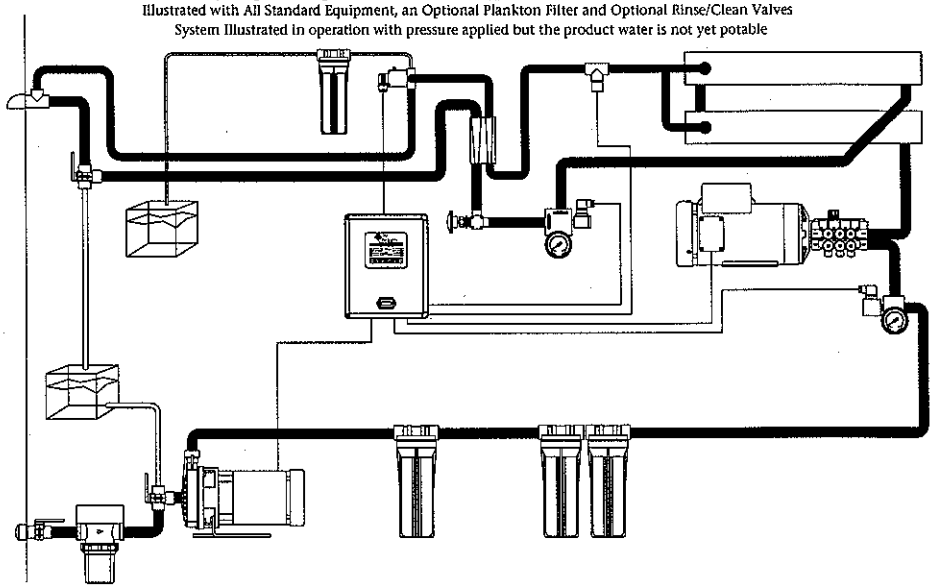
In operation without pressure applied to the R.O. Membrane Elements.

Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated in operation during the first 5 minutes without pressure applied



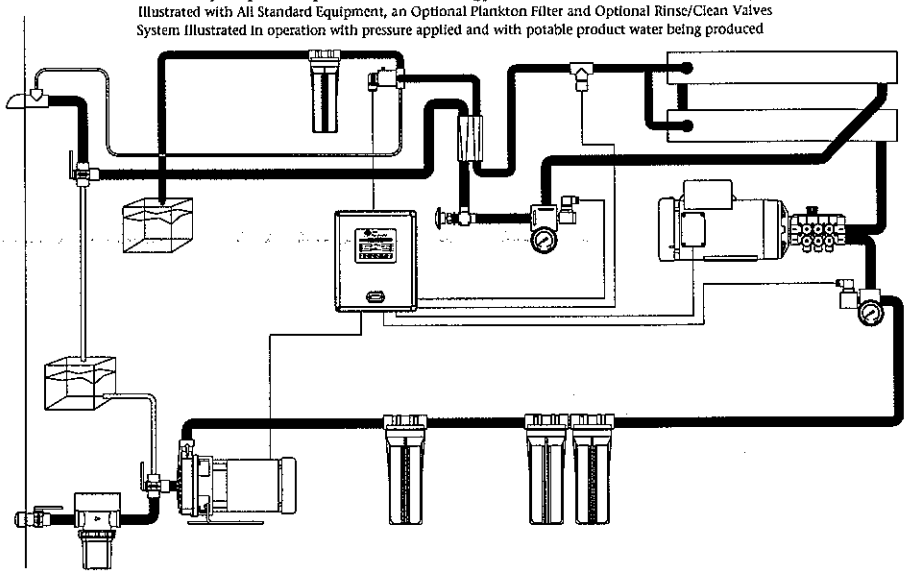
In operation with pressure applied to the R.O. Membrane Elements. Product Water is being produced, however the Product Water is not yet Potable.

Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated in operation with pressure applied but the product water is not yet potable



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

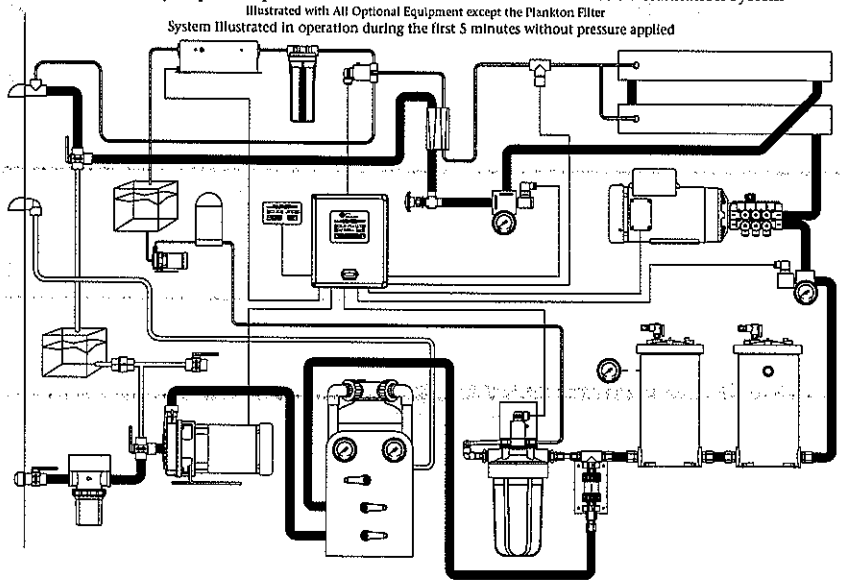
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated in operation with pressure applied and with potable product water being produced



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

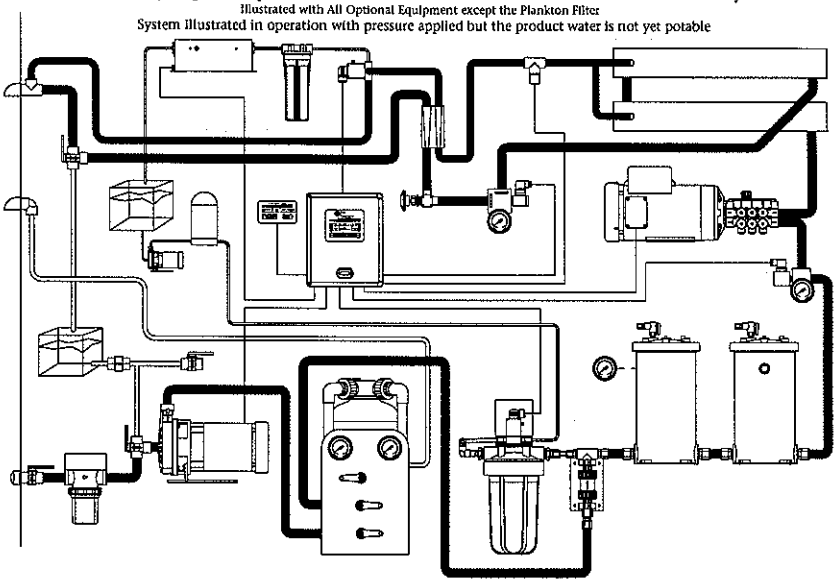
In operation without pressure applied to the R.O. Membrane Elements.

Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated in operation during the first 5 minutes without pressure applied



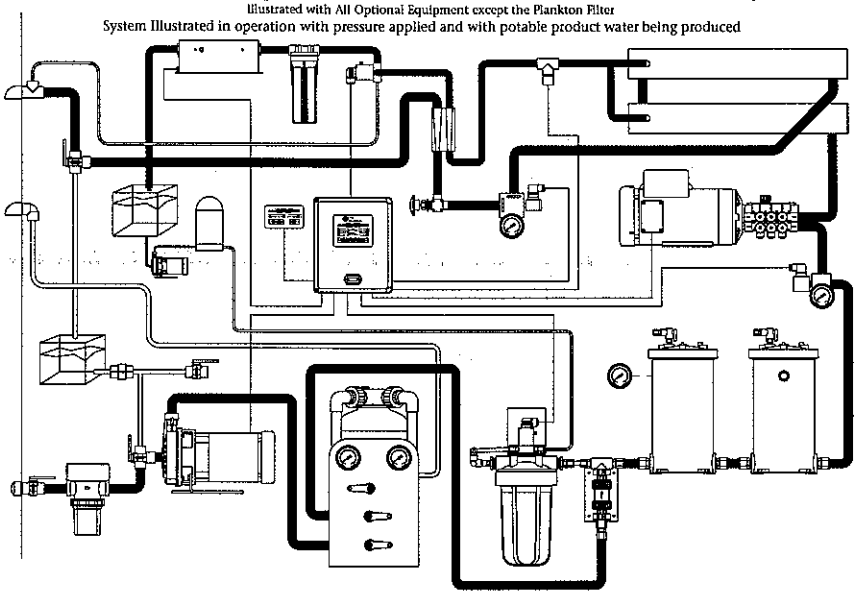
In operation with pressure applied to the R.O. Membrane Elements. Product Water is being produced, however the Product Water is not yet Potable.

Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated in operation with pressure applied but the product water is not yet potable



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

Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System
Illustrated with All Optional Equipment except the Plankton Filter
System Illustrated in operation with pressure applied and with potable product water being produced



1. Check the level of the oil in the High Pressure Pump crankcase. Oil level is viewed through the rear Oil Level Sight Glass located at the back of the High Pressure Pump crankcase section. Ensure that the oil level is higher than the center of the sight glass.

2. Check each tube and hose connection into, within and from the System to ensure that no hose or tube has been kinked or removed from it's fitting.

3. Open the Inlet Sea Cock Valve [2] fully.

4. Position the Clean/Rinse Inlet Valve [4], if installed, to the normal operating position towards the Sea Strainer Outlet [3].

5. Position the Clean/Rinse Outlet Valve [35], if installed, to the normal operating position towards the Brine Discharge Tee [36].

6. Open any auxiliary Valve within the incoming Feed Line from the Inlet Thru Hull Fitting [1] to the System;

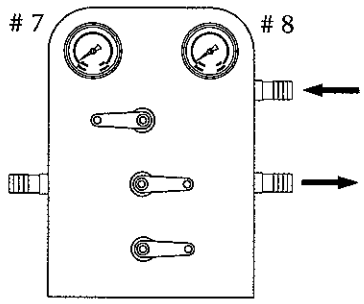
7. Open any auxiliary Valve in the Outgoing Brine Discharge Line from the System to the Brine Thru Hull Fitting [37];

8. Open any auxiliary Valve in the Outgoing Product Water Line from the System to the Ships Potable Water Storage Tank [46].

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

9. Set the Multi Media Filter Valves, if installed, for the Normal Operating Position.

VALVE POSITIONING
OF THE MULTI MEDIA FILTER
DURING NORMAL OPERATION



PSI Differential with Clean Media:
#7 - #8 = 5 psi @ 4.2 gpm
#7 - #8 = 4 psi @ 3.5 gpm
#7 - #8 = 3 psi @ 2.5 gpm

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

    CAUTION: ***Starting an SRC system equipped with an optional soft-start without opening the Back Pressure Regulator Valve fully causes damage to the high pressure motor. This step must be strictly adhered to.***

11. Switch the Electrical Power Source to the Salinity Controller "ON". The Power Source should be switched "ON" at a Circuit Breaker between the Power Source and the Salinity Controller.

12. To Start the System press the System Start Switch, in which case the Booster Pump Starts first and then after approximately 5 seconds the High Pressure Pump automatically Starts.

    or

    You may Start the Booster Pump and High Pressure Pump manually by first pressing the Booster Pump Start Switch and then the High Pressure Pump Start Switch.

    In either case, the Booster Pump [5] and High Pressure Pump [25] should be in operation at this time and the flow progress is illustrated in the diagrams at the top of pages G-4 & G-5.

    If the System is operating then go on to step 13.

    If the System automatically shuts off after several seconds of operation look at the Touch Pad. If one of the 4 fault lamps is illuminated this is the cause of shut down. Reset the Fault Lamp by pressing the Fault Reset Switch at the Touch Pad then determine what caused the Fault Lamp to illuminate.

    Fault Lamp explanation and correction procedure:

    a. **Low Pressure Fault Lamp:** The System is equipped with a Low Pressure Switch which functions as a Normally Open Switch.

       With no pressure applied to the Low Pressure Switch it remains in an open position and not allow the System to remain in operation. With pressure above 6 psi applied to the Low Pressure Switch it closes and allows the System to operate.

       In other words, there must be at least 6 psi present at the Low Pressure Switch in order for the System to continue operating. This is confirmed by viewing the Low Pressure Gauge located on the System Control Panel.

This Low Pressure Gauge must read above 6 psi in order for the Low Pressure Switch to close and maintain System operation.

With the assumption that the Booster Pump is functioning and rotating in the proper direction, the Inlet Sea Cock Valve is Open and if the Inlet Clean / Rinse Valve is installed and positioned properly towards the Sea Strainer, and all hose connections are tight and not allowing air to suck into the feed line, then it is likely that this New System simply needs priming.

To prime the System fill the prefiltration housings with feed or dock water and pour water into the feed line hose to fill the Booster Pump.

Once water is introduced into the Booster Pump, it is able to maintain pressure at the Low Pressure Switch.

b. High Pressure Fault Lamp: The System is equipped with a High Pressure Switch which functions as a Normally Closed Switch. With System Operating Pressure below 900 to 1000 psi the High Pressure Switch remains Closed and allows the System to operate. If the High Pressure Fault Lamp Illuminated when attempting to start the System this indicates a blockage or restriction in the Brine Discharge Line or High Pressure Side of the System. Never operate the System above 1000 psi.

Ensure that the Back Pressure Regulator is full open counter clockwise. Follow the Brine Discharge Line and if there is a Valve in this line ensure that it is in the full Open position. Ensure that there are no kinks or blockages in the Brine Discharge Line.

c. Auxiliary #1 Fault Lamp: Some Systems are equipped with a thermal protection switch inside the High Pressure Pump Electric Motor, other Systems are not. This depends upon the exact configuration of the System and the specific electric motor utilized. When Auxiliary #1 Fault Lamp is illuminated this indicates that the Electric Motor Thermal Switch has opened due to excessive heat (amperage draw) inside the High Pressure Pump Electric Motor.

or

The installer may not have connected the thermal switch wires at the High Pressure Pump Motor, if the motor has a thermal switch, to the Auxiliary #1 connection point within the Controller.

If the Auxiliary #1 Fault Lamp illuminates, and if the High Pressure Pump has a thermal switch that is properly connected, check the electric motor wiring to ensure that it is properly wired for the operating supply voltage. Ensure that the power supply, generator or shore power, is the proper line voltage, cycles and phase for the System. Ensure the power source is sufficient to maintain full voltage and cycles to the System during Startup.

If Voltage and/or Cycles drop at any time, the High Pressure Pump Electric Motor draws excessive amperage and over heats.

d. Auxiliary #2 Fault Lamp: This connection is not utilized by Sea Recovery. If the Installer connected a switch to this circuit then check with the installer to trouble shoot the circuit and reason for shut down.

Reset the Fault by pressing **FAULT RESET** .

After a fault has been corrected and the Fault Reset Switch has been pressed go back to the beginning of Step 12.

13. While the System is in operation, the GPM Brine Flow Meter [34] allows observation of the water passing through it. Once all air is bled from the System, the meter reads reliably.

14. Bleed all air from the Commercial Prefilter [13] and or Oil/Water Separator [16]. If the system is so equipped, open the air bleed valve located at the top of the respective housing [14 & 17] until water displaces all of the air then close the air bleed valve(s).

15. Check for air suction leaks or water leaks throughout the entire system. Refer to Section "I" Troubleshooting and Section "K" Maintenance & Repair, to correct any leaks.

16. After a minimum of 5 minutes running time, with proper feed flow in progress, slowly adjust the Back Pressure Regulator Valve [33] by turning the valve handle clockwise to increase the System operating pressure up to 820 PSI if the feed water source is full salinity sea water. Flow progresses as illustrated in the center drawings on pages G-4 & G-5.

If the feed water source is BRACKISH WATER (not full salinity sea water) adjust the Back Pressure Regulator Valve from 100 PSI to 800 so the product water output, as registered on the Product Water Flow Meter [42], is within system specifications. Product water output specs. are:

	Hourly Production Gallons / Liters
SRC AW 400	16 / 63
SRC AW 600	25 / 94
SRC AW 800	33 / 126
SRC AW 1200	50 / 189
SRC AW 1600	66 / 252

DO NOT EXCEED PRODUCT WATER FLOW SPECIFICATIONS. FOULING OF THE R.O. MEMBRANE ELEMENT RESULTS.

17. If any abnormality develops, stop the System and correct the problem.

18. Verify product water flow by viewing the Product Water Flow Meter [42]. 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 the factory salinity setting at which time the 3-Way Product Diversion Valve [43] energizes and directs flow to the "potable" (good water) position. This allows product water to pass into the Post Filtration components, & onto the Ship's Storage Tank [46] as shown on pages G-4-5.

Motor Temperature Note: The Electric Motors used in the AquaWhisper Systems are rated for high temperature operation. They do not contain cooling case fins because the windings are rated for high temperature operation and external fins are not necessary. Therefore, the case of the motor is hot to touch. Do not be alarmed if the external case of the electric motor is too hot to touch. Check motor line amperage if it is suspected that the motor is overheating.

19. Recheck for:

    a. A constant and proper feed water flow.

    b. A constant appropriate system pressure.

    c. Leaks in the system: air, water or oil.

    d. Unusual noises or other occurrences.

SOFT START OPERATION

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

Never start the system without the Back Pressure Regulator Valve open fully. The reduced torque available to the motor is not sufficient to turn the high pressure pump when the Back Pressure Regulator Valve is adjusted to 820 psi. Starting while the Back Pressure Regulator is not fully open causes damage to the motor.

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

When the **START** switch is pressed, power is present at the Soft Start.

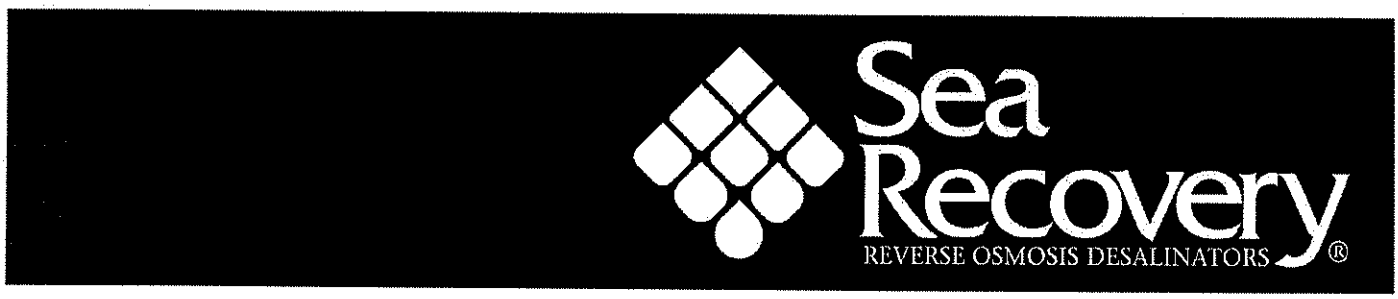
The Soft Start immediately begins its starting cycle.

After a delay, the motor reaches full speed and the High Pressure Pump contactor makes an audible click and is switched on.

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

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

20. Refer to Section "H" of this manual for shut down procedures.



SECTION H

Shutdown Procedure

NOTES:

Sea Recovery "AquaWhisper" DAILY OPERATIONAL LOG RECORD
KEEP THIS COPY IN THE OWNERS MANUAL UNTOUCHED AS A MASTER FOR ADDITIONAL COPIES

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the System Owners Manual for future reference and troubleshooting. This information should be given to the Sea Recovery Technical Service Technician when requesting assistance from Sea Recovery.

Serial Number: _____ Model Number: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ °Fahrenheit or _____ ° Celsius

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Commercial Prefilter (if used) Low Pressure Gauge Reading: _____ PSI

Control Panel Low Pressure Gauge Reading: _____ PSI

High Pressure Gauge Reading: _____ PSI

WATER FLOW METER READINGS:

Feed Water Flow Meter: _____ U.S. GPM or _____Liters Per Minute

Product Water Flow Meter: _____ U.S. GPH or _____Liters Per Hour

WATER QUALITY:

Feed Water Salinity: _____ PPM or Location of use _____

Product Water Salinity: _____ PPM

Number of LED Indication on Salinity Controller: _____ LED's

Unusual occurrences: _____

_____

_____

_____

_____

Sea Recovery "AquaWhisper" DAILY OPERATIONAL LOG RECORD
KEEP THIS COPY IN THE OWNERS MANUAL UNTOUCHED AS A MASTER FOR ADDITIONAL COPIES

Record the following information at the time of system shutdown. Maintain a log of the completed forms with the System Owners Manual for future reference and troubleshooting. This information should be given to the Sea Recovery Technical Service Technician when requesting assistance from Sea Recovery.

Serial Number: _____ Model Number: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VAC, _____ Hz, _____ Phase

Feed Water Temperature: _____ °Fahrenheit or _____ ° Celsius

Hour Meter Reading: _____ Hours

PRESSURE GAUGE READINGS:

Commercial Prefilter (if used) Low Pressure Gauge Reading: _____ PSI

Control Panel Low Pressure Gauge Reading: _____ PSI

High Pressure Gauge Reading: _____ PSI

WATER FLOW METER READINGS:

Feed Water Flow Meter: _____ U.S. GPM or _____Liters Per Minute

Product Water Flow Meter: _____ U.S. GPH or _____Liters Per Hour

WATER QUALITY:

Feed Water Salinity: _____ PPM or Location of use _____

Product Water Salinity: _____ PPM

Number of LED Indication on Salinity Controller: _____ LED's

Unusual occurrences: _____

_____

_____

_____

_____

SHUTDOWN CAUTIONS

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

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

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

Frequently Asked Questions about the Optional FWF:

1. What is FWF Mode?

Fresh Water Flush Mode is a fresh rinsing process that lasts 10 minutes and repeats every 7 days.

2. What do the LED lights indicate after the FWF rinse?

After the FWF finishes rinsing, seven LED's will illuminate indicating that the FWF is in the "7 Day Mode". Every day that passes, one less LED will be lit. Every day there will be one less LED lit unless the Stop button is pressed or the circuit breaker is switched off. During the 7-day countdown the "Fresh Flush" LED blinks.

3. How is the Fresh Water Flush stopped?

The Fresh Water Flush is aborted when the Stop Button is pressed. If the circuit breaker is switched off during FWF Mode, the FWF mode ***WILL CONTINUE*** when power to the system is restored.

4. When can I use the Fresh Water Flush?

It can be used any time after running the system.

SHUTDOWN PROCEDURES:

1. Record the Sea Recovery System readings onto a blank copy of the "DAILY OPERATIONAL LOG RECORD" form (page H-3 & H-4 of this manual).

2. Decrease the pressure on the System by adjusting the Back Pressure Regulator Valve [33] full open counter clockwise.

3. Momentarily depress the STOP Switch on the System's front panel Touch Pad to shut down the System.

   Check to make sure that the Booster Pump & High Pressure Pump have stopped rotating, and that the System On lamp is OFF and the System Off Lamp is ON.

4. Immediately after stopping the system, close the Inlet Sea Cock Valve [2]. This is a safeguard for vessel installations, as explained below:

   a. If a water line develops a leak while the system is shut down, and the Inlet Sea Cock Valve is open, the incoming feed water fills the bilge.

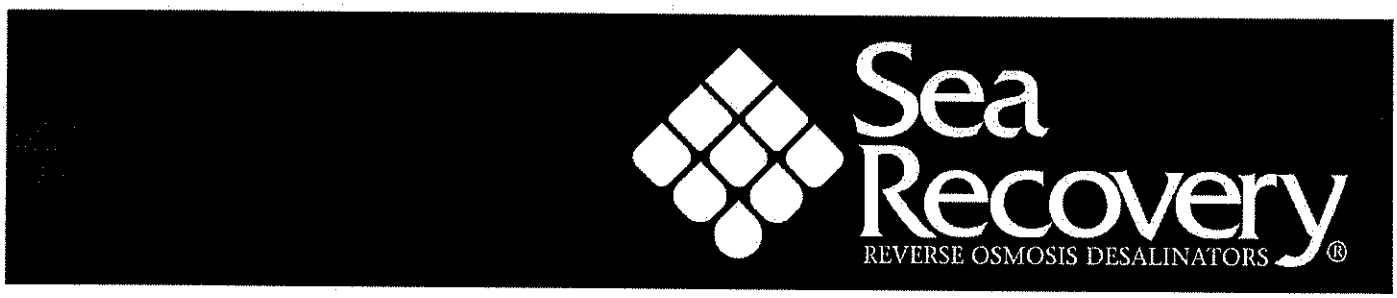
   b. By closing the Inlet Sea Cock Valve immediately after system shutdown, siphoning does not occur prior to the next start-up. Holding water in the system ensures immediate water to the High Pressure Pump at the next start-up.

5. If installed, the Fresh Water Flush (FWF) system may be operated at this time. Start the Fresh Water Flush by pressing FRESH FLUSH on the Touch Pad. The fresh water flush rinse lasts for 10 minutes unless adjusted (for FWF duration adjustment see page K-17). After 10 minutes, the fresh water flush stops but remains in FWF mode. In this mode, the fresh water flush repeats every 7 days until the stop switch is pressed on the Touch Pad, or power is interrupted.

6. Turn off the electrical power source (circuit breaker) to the system. This eliminates the chance of accidentally starting the system should an electrical short develop, or if someone unintentionally presses the START switch.

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

NOTES:



SECTION I

System Troubleshooting Guide

NOTES:

SRC SYSTEM TROUBLESHOOTING GUIDE

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

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

View the Touch Pad Fault Indication Lamps.

If the Low Pressure Fault Lamp is Illuminated: This is the most common fault reported. This is due to loss of pressure at the Low Pressure Switch. Low Pressure may be caused by Dirty Prefilters, Air entering the System intake, or by a non functioning Booster Pump. The Low Pressure Fault Lamp illuminates immediately when the Low Pressure Switch is OPEN and after several seconds of illumination the System shuts off. In other words, this is a delayed circuit.

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

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

   Correct any air suction leaks.

2. If the Low Pressure Gauge needle moves and registers below 6 psi or draws a vacuum (negative pressure) this indicates that one or more of the Prefiltration components is dirty and requires cleaning or changing.

   Clean the Sea Strainer Mesh Screen.

   Back Wash the Multi Media Filter.

   Clean the Plankton Mesh Screen(s).

   Change the Prefilter Element(s).

   Change the Oil/Water Separator Filter Element.

Note: Diagnosing of the Low Pressure Fault takes some patience and time. One or more prefiltration components may be dirty and causing the low pressure condition. However, after the last shutdown and after the System has sat for awhile, the debris clogging the particular filter element becomes loose, without the presence of flow and pressure during shut down, and that loose debris falls to the filter bowl. Then when the System is restarted, the pressure rises for awhile until the debris within the filter housing stirs up and packs back onto the filter element. Therefore, upon restarting of the System you may see sufficient pressure at the Low Pressure Gauge, thinking all is well, but within 30 to 60 minutes the System shuts down again because as the system is in operation that debris slowly packs back onto the filter element. Unless you take the patience and time to watch the Low pressure Gauge for awhile, after restarting, you do not see the drop in pressure and you may think that the problem is elsewhere.

If the High Pressure Fault Lamp is Illuminated: This is due to over pressurizing the System above 900 to 1000 psi. The High Pressure Switch is set for 950 psi and has a +- 50 psi range. Over pressure, high enough to cause the High Pressure Switch to open and shut the System off, is caused by debris at the Back Pressure Regulator Valve, over adjustment of the Back Pressure Regulator Valve, a Kink or blockage in the Brine Discharge Line, or a kink or blockage in the Product Water Line. The High Pressure Fault Lamp illuminates immediately when the High Pressure Switch is OPEN and the System shuts off immediately. In other words, this is a priority non delayed circuit.

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

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

Open the Back Pressure Regulator Valve FULL OPEN counter clockwise.

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

Adjust the Back Pressure Regulator to 820 psi, if in sea water, as explained in the Start Up section G of this manual.

If the Auxiliary #1 Fault Lamp is Illuminated: The Auxiliary #1 circuit is utilized in some Systems and not in others. It is primarily used in Single Phase Systems to protect the Single Phase High Pressure Pump Electric Motor, if that particular motor is equipped with a thermal switch. If your System is equipped with a Single Phase standard High Pressure Pump Electric Motor that has the incorporated thermal switch then there are two thin wires from the Electric Motor to the Auxiliary #1 connection point within the Controller. The Auxiliary #1 Fault Lamp illuminates immediately when the High Pressure Pump Electric Motor Thermal Switch is OPEN and the System shuts off immediately. In other words, this is a priority non delayed circuit.

Allow the High Pressure Pump Electric Motor to cool down for 60 minutes or more.

Check the Power Source Line Voltage, Cycles and Phase to ensure that it is proper for your system (refer to the specification Section B and the Installation Section E of this manual).

Ensure that the Power Source, Generator or Shore Power, is of sufficient capacity to provide constant full line Voltage, Cycles and Phase to the Sea Recovery System.

Remove all other power consumption auxiliary equipment from the Power Source to ensure that only the Sea Recovery System is drawing power from the Power Source during starting of the Sea Recovery System.

Restart the Sea Recovery System and immediately check the Power Source Line Voltage, Cycles and Phase at the Sea Recovery System. Bring the Sea Recovery System up to normal operating pressure while continuing to check the Power Source Line Voltage, Cycles and Phase as well as the current, amperage draw, of the Sea Recovery System. Ensure that the Power Source Line provides the required Voltage, Cycles and Phase and ensure that the Sea Recovery System does not consume amperage in excess of that specified in this Manual and or that which is listed on the Electric Motor Nameplate.

If the Auxiliary #2 Fault Lamp is Illuminated: The Auxiliary #2 circuit is a delayed circuit, similar to that of the Low Pressure Switch. When a switch connected to the Auxiliary #2 Circuit opens the Auxiliary #2 Fault Lamp illuminates and after several seconds the System turns off and the Auxiliary #2 Fault Lamp continues to illuminate until the Fault Reset Switch is pressed.

The Auxiliary #2 circuit is not utilized by Sea Recovery. The two Auxiliary terminals are closed with a jumper at the terminal strip inside the Electronic Controller. The installer may have utilized this circuit for High Water Level (full storage tank) shut down, Leak Detection, Timing Shut Down, or a multitude of other functions. If the Auxiliary #2 circuit is connected to a switch then check with the installer for understanding of its functionality.

The Auxiliary #2 circuit must be closed in order to allow reset and restarting of the System.

If the Service Pump Fault Lamp is Illuminated: This is a timed circuit that counts down from 500 hours, displaying the remaining hours on the Salinity Indicator in 50 hour increments. The Service Pump Fault Lamp illuminates when the 500 hours has elapsed. This is a reminder that the crankcase oil in the High Pressure Pump requires changing. After four such shutdowns, indicating 2000 hours of usage, the High Pressure Pump Seals, Packings and Valves must be changed as a normal wear maintenance procedure. Press the Fault Reset Switch to clear this fault and reset the time to change the pump oil, only after the respective maintenance to the High Pressure Pump is complete.

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

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

Power loss caused the System to shut down.

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

Reset the Circuit Breaker and check the circuit breaker to ensure that it passes full voltage across all legs when the System is in full pressurized operation. Replace the Circuit Breaker if it is not passing full voltage.

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

The Shore Power or Generator (Line Power to the System) had a temporary drop out or voltage fluctuation. This is caused by other auxiliary equipment starting and pulling current in excess of the permissible load on the Shore Power or Generator.

There is a loose wire from the Power Source to the System or within the System Electronic Controller which is intermittently opening the power to the System. This may be a main power lead or an electronic lead wire.

C. VACUUM / LOW PRESSURE GAUGE READINGS:

The System is equipped with one or more Low Pressure Gauges depending upon the optional Prefiltration equipment installed. When ever there is more than one Low Pressure Gauge installed always correlate each of these Low Pressure Gauges to determine which Prefiltration component is dirty and requires maintenance. A high pressure reading prior to a prefiltration component and low pressure reading after that component indicates that that particular component is dirty and requires maintenance. The pressure prior to less the pressure after the component is referred to as the pressure differential.

The pressure gauges used through the System contain a small orifice at the pressure port stem. This orifice can become plugged up with debris or corrosion. If the gauge fails to register then clean the pressure pick up orifice with a thin stiff wire or small drill bit. Use caution when inserting the cleaning wire or drill bit into the orifice. Do not enter the orifice too deeply else damage to the inner movements occurs and renders the gauge unrepairable.

D. HIGH PRESSURE GAUGE READING:

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

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

   Back Pressure Regulator requires adjustment up to normal System operating pressure.

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

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

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

   High Pressure Pump has a problem within the manifold

   Worn Seals are allowing internal by-passing

   Broken or stuck valve or valve spring or debris in the valve chamber is allowing internal by-passing

4. High Pressure Gauge reading is low with low Brine Discharge Flow Meter reading with very high product water flow meter reading and the Salinity Meter Red LED is illuminated:

   R.O. Membrane Vessel Assembly is allowing by-passing of Feed Water into the Product Water.

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

   A cracked or broken product water tube is caused by a blockage in the Product Water line. Check all Product Water Lines from the System to ensure that there are no blockages, valves or kinks in this line.

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

   A worn or cut product water O-ring allows Feed Water to enter into the Product Water.

E. FLOW METER READINGS:

In diagnosing flow meter readings always correlate the reading with both the Brine Discharge Water Flow Meter reading and the Product Water Flow Meter reading as well as consideration to the Pressure Gauge readings. Prior to diagnosing flow meter readings, always check first to ensure that the pressure gauge readings are normal. The symptoms and causes listed below assume that all pressure gauge readings are normal. For "normal" readings refer to the "INITIAL NEW SYSTEM READINGS" in section "F" of this manual.

Brine Discharge Water Flow Meter

Without High Pressure applied the Brine Discharge Water Flow Meter registers the amount of Feed Water entering the system and, in turn, accepted by and discharged by the High Pressure Pump; with High Pressure applied the Brine Discharge Flow Meter registers the amount of Feed Water less the amount of Product Water being produced (thus this is then the Brine Discharge Flow Rate [feed water less product water]).

The High Pressure Pump is a positive displacement pump. This means that it always draws a pre-defined amount of water unless there is a problem at the High Pressure Pump. Therefore, a drop from normal reading on the Brine Discharge Water Flow Meter indicates that the High Pressure Pump is not functioning properly.

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

R.O. Membrane Vessel Assembly is allowing by-passing of Feed Water into the Product Water.

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

A cracked or broken product water tube is caused by a blockage in the Product Water line. Check all Product Water Lines from the System to ensure that there are no blockages, valves or kinks in this line.The End Cap Product Water O-Ring is cut or worn.

A worn or cut product water O-ring allows Feed Water to enter into the Product Water.

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

High Pressure Pump has a problem within the manifold

Worn Seals are allowing internal by-passing

Broken or stuck valve or valve spring or debris in the valve chamber is allowing internal by-passing

Brine Discharge Water Flow Meter reading is normal with no pressure applied to the system but the bobbin is pulsating up and down and as pressure is applied to the system the bobbin pulsates more radically.

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

Product Water Flow Meter

The Product Water Flow Meter registers the amount of Product Water being produced by the R.O. Membrane Element. In Sea Water applications the Product Water Flow Meter does not register until the System Pressure exceeds 420 PSI. For each 100 PSI applied over 420 PSI the Product Water Flow Meter registers about 25% of normal production (ie: at 520 PSI 25% production is achieved; at 620 PSI 50% production is achieved; at 720 PSI 75% production is achieved; and at approximately 820 PSI full production is achieved). Therefore, if full production registers on the Product Water Flow Meter, if the Feed Water is normal full salinity Sea Water, when the system is at or below 420 PSI operating pressure this indicates that the R.O. Membrane Vessel Assembly has a problem, such as a defective "O" ring, defective Membrane Element, broken product water tube, cracked end plug or damaged High Pressure Vessel.

If full operating pressure of 820 PSI produces a Product Water Flow Meter reading below normal this indicates that:

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

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

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

A cracked or broken product water tube is caused by a blockage in the Product Water line. Check all Product Water Lines from the System to ensure that there are no blockages, valves or kinks in this line.

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

A worn or cut product water O-ring allows Feed Water to enter into the Product Water. After compensating for Temperature of the Feed Water, the Product Water Flow Meter registers lower than normal flow when the system operating pressure is 820 PSI and the system is operating in Sea Water.

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

There is a restriction in the Product Water Line from the R.O. Membrane Vessel Assembly to the ship's Product Water Storage Tank, such as a closed valve, line kink or debris clogging a component port.

Temperature and Pressure correction has not been properly calculated, refer to Section "M" of this manual.

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

F. PRODUCT WATER QUANTITY AND QUALITY:

The R.O. Membrane Element requires a specified amount of Feed Water flow in order to reject impurities. Less than required Feed Water flow causes the R.O. Membrane Element to recover a high percentage of Product Water (ratio of Feed Water to Product Water) and causes the R.O. Membrane Element to foul quickly resulting in poor quality and loss of productivity. It is, therefore, important to maintain the proper amount of Feed Water Flow into the R.O. Membrane Element. This proper Feed Water Flow must be maintained in order for the R.O. Membrane Element to properly reject impurities and remain free and clear of mineral build up fouling. If the Feed Water Flow drops below normal, due to a damaged High Pressure Pump, then do not operate the system until the Feed Flow problem is corrected.

The clarity of the Feed Water effects the ability of the R.O. Membrane Element to remain clean and, in turn, reject the impurities of the Feed Water. If the Prefiltration Section of the System is not working properly and not trapping the suspended solids, contained in the Feed Water, the R.O. Membrane Element quickly becomes fouled, lose productivity and lose it's ability to reject the dissolved solids or impurities in the Feed Water. Always ensure that there are clean Prefilter Elements within the Prefilter Housings. Change the Prefilter Elements frequently.

Never use Prefilter Elements that are not Sea Recovery supplied. Non Sea Recovery supplied Prefilter Elements can be of the wrong micron rating, wrong material, wrong size or wrong type. Non Sea Recovery Prefilter Elements plug up quickly causing more frequent changing and unnecessary cost. Non Sea Recovery Prefilter Elements enhances the growth of bacteria. Non Sea Recovery supplied Prefilter Elements do not have FDA approval. Use of non Sea Recovery Prefilter Elements also leads to rapid fouling of the R.O. Membrane Element and render them unusable in a short period of time.

Sea Water (35,000 ppm TDS typical Sea Water) applications require that the System be operated at 820 PSI in order to gain optimal performance of the R.O. Membrane Element. Pressures below 820 PSI cause low Product Water Production as well as poor Product Water Quality. The Operating Pressure must be correlated to the Feed Water Temperature, production rate and Feed Water salinity.

When operating from typical, 35,000 ppm TDS, Sea Water and with a Feed Water Temperature below 77°F / 25°C the system may be operated at higher pressures, not to exceed 1000 psi, in order to gain optimal performance. With a Feed Water Temperature above 77°F / 25°C the system must be operated at lower pressures in order to prevent excessive Product Water recovery and prevent fouling

of the R.O. Membrane Element. However, during System operation with Feed Water Temperature above 77°F / 25°C there is a decline in Product Water Quality. This is a natural and predicted occurrence with Reverse Osmosis. Therefore, when operating the System with Feed Water Temperature above 77°F / 25°C a decline in Product Water Quality is not a concern. As this does not indicate a problem. This condition corrects itself as the Feed Water Temperature decreases.

Salinity Meter reads higher than normal or the red light does not go out.

The system operating pressure is below normal, adjust it accordingly.

The Feed Water Temperature is above 77°F / 25°C
The Feed Water Salinity is above 35,000 ppm TDS due to operation in a high salinity sea

Mediterranean Sea is 38,000 to 40,000 ppm TDS

Red Sea is 40,000 to 45,000 ppm TDS

Arabian Gulf is 45,000 to 60,000 ppm TDS

The Brine Discharge Water Flow Meter reading is lower than normal, refer to the Brine Discharge Water Flow Meter troubleshooting.

A product water "O" ring within the R.O. Membrane Element Vessel is defective and requires replacement. However, this would normally show as very high product water flow and the Product Water would be very salty tasting.

The R.O. Membrane Element has developed a hole or cracked product water tube. However, this normally shows as very high product water flow and the Product Water is very salty tasting.

G. HIGH PRESSURE PUMP:

The high pressure pump is a positive displacement triplex plunger pump. The pump always delivers the normal amount of water flow unless a problem develops within the pump, the pump is being starved and subjected to an extreme vacuum at it's inlet, or the RPM from the Electric Motor has changed due to low or high Cycles from the Power Source.

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

Worn High Pressure Pump seals are allowing internal by-passing and require replacement.

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

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

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

The Electric Motor RPM has lowered due to improper Cycles from the Power Source to the System.

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

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

High Pressure Pump flow is erratic and pulsating with no pressure applied and as pressure to the system is applied the pulsations become more erratic:

Worn or broken High Pressure Pump Inlet Valves, Inlet Valve seats, Inlet Valve springs and or debris is trapped within a High Pressure Pump Inlet Valve chamber. High Pressure Pump flow is normal (at the Brine Discharge Flow Meter) when the system operating pressure is at zero, but the High Pressure Gauge does not register pressure as the the Back Pressure Regulator Valve is adjusted clockwise yet the Feed Water Flow Meter reads normal and normal Product Water Flow registers on the Product Water Flow Meter as the Back Pressure Regulator Valve is adjusted clockwise:

The High Pressure Gauge orifice is plugged up with debris. Clean the debris from the High Pressure Gauge orifice or replace the gauge.

High Pressure Pump leaks oil:

Locate the leak source and repair as required.

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

Worn low pressure inlet packings due to operating the High Pressure Pump dry or continued operation of the System with a vacuum at the Low Pressure Gauge, simply worn seals from normal wear, or degraded from age. Replace the High and Low Pressure Seals and associated O-Rings together as a set. The High Pressure Pump must not be allowed to operate when there is no feed water present in the High Pressure Pump manifold. The Prefilters must be changed when the Low Pressure Gauge registers below 6 psi. The High Pressure Pump Seals require changing every 2,000 to 4,000 hours depending upon age, use, and feed water conditions.

H. PRESSURE SWITCHES:

High Pressure Switch

The High Pressure Switch is a normally closed switch and it is set to open and shut the System down as the System Pressure into the Back Pressure Regulator reaches 950 psi +- 50 psi (900 to 1000 psi setting is acceptable)

The System shuts down and the High Pressure Fault Lamp is illuminated when applying pressure to the system but operating pressure does not exceed 900 psi

The High Pressure Switch has drifted from it's factory setting, is opening prematurely and requires adjustment upward to minimum 900 psi and a maximum of 1000 psi. Ensure that the High Pressure Gauge is reading accurately prior to adjusting the High Pressure Switch.

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

The High Pressure Switch has drifted from it's factory setting, is not opening and requires adjustment downward to minimum 900 psi and a maximum of 1000 psi. Ensure that the High Pressure Gauge is reading accurately prior to adjusting the High Pressure Switch.

Low Pressure Switch

The Low Pressure Switch is a normally open switch and it is set to close as the Prefiltration pressure, from the Booster Pump, rises above 6 psi (+- 2 psi) in order to maintain the System in operation. The Low Pressure Switch opens and shuts the System off as the Prefiltration pressure drops, due to dirty prefiltration, below 4 psi (+- 2 psi).

Note: Diagnosing of the Low Pressure Switch may take some patience and time. One or more prefiltration components may be dirty and causing the low pressure condition. However, after the last shutdown and after the System has sat for awhile, the debris clogging the particular filter element becomes loose, without the presence of flow and pressure during shut down. Then when the System is restarted, the pressure rises for awhile until the debris packs back onto the filter element. Therefore, upon restarting of the System there is sufficient pressure at the Low Pressure Gauge, but within 30 to 60 minutes the System shuts down again because the debris slowly packs back onto the filter element. Unless you watch the Low pressure Gauge for awhile, after restarting, you do not see the drop in pressure and think that the problem is elsewhere. Therefore, you must physically check the Low Pressure Switch Setting and not assume that the Low Pressure Switch has a problem.

In order to check the Low Pressure Switch Setting:

While the System is in operation and with at least 6 psi or greater registered at the Low Pressure Gauge at the System Control Panel, slowly close the Inlet Sea Cock Valve. While slowly closing the Inlet Sea Cock Valve view the Low Pressure Gauge at the System Control Panel while simultaneously viewing the Low Pressure Fault Lamp. If the Low Pressure Switch is properly adjusted the Low Pressure Fault Lamp illuminates as the Feed Water Pressure drops to 6 to 2 psi. If the Low Pressure Fault Lamp illuminates prior to 6 psi then the Low Pressure Switch is set too high. If the Low Pressure Fault Lamp illuminates only after pressure drops below 2 psi or does not illuminate at all then the Low Pressure Switch is set too low.

Adjust or replace the Low Pressure Switch but first refer to:

A. SYSTEM SHUTS DOWN BY ITSELF AND A FAULT LAMP IS ILLUMINATED: / View the Touch Pad Fault Indication Lamps. / If the Low Pressure Fault Lamp is Illuminated above in order to ensure that the Low Pressure Switch is in fact out of adjustment. One of the most frequently misdiagnosed problems is the Low Pressure Switch because the operator confuses dirty prefiltration with a defective Low Pressure Switch or Gauge. Maintenance to the Prefiltration Section normally clears the problem of shut down with the Low Pressure Fault Lamp illuminated.

I. POST FILTRATION SUBSYSTEM:

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

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

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

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

The system has sat for an extended period of time without operation and the biological slimes trapped within the Prefilter have decayed and are producing hydrogen sulfite. Replace the Prefilters and clean their respective housings.

Saturated Charcoal Filter Element, replace the element.

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

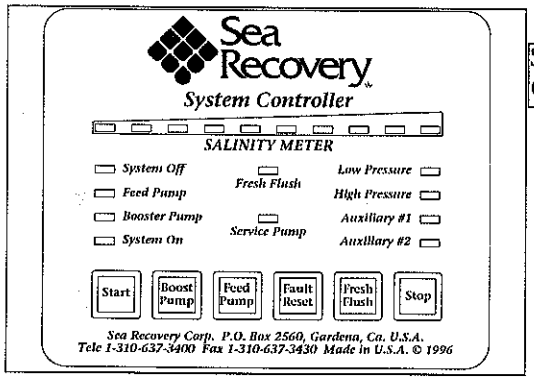
In existing plumbing or filters not included as part of the SRC system, isolate the origin & correct.

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

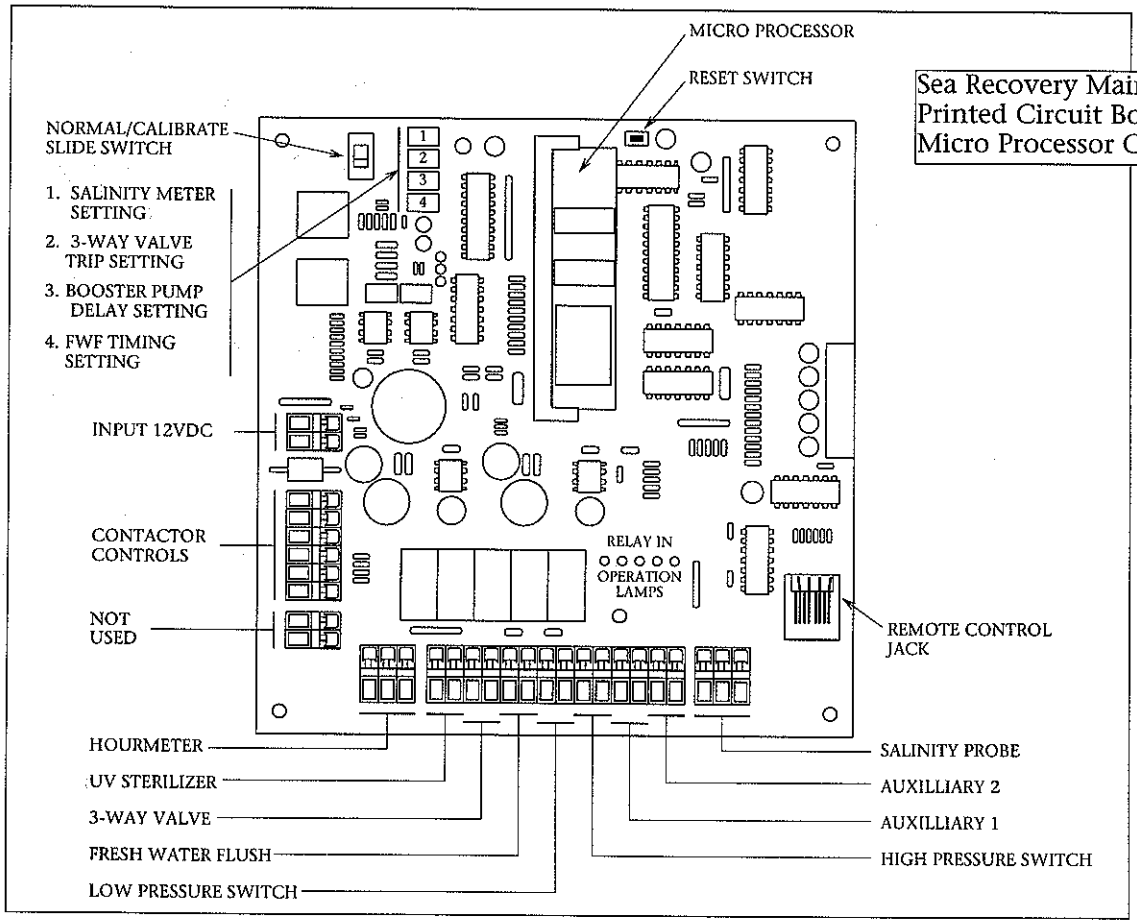
Change the U.V. Lamp.

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

G. ELECTRONIC SUBSYSTEM:



Sea Recovery Touch Pad and
6 Function Switches



Sea Recovery Main
Printed Circuit Board
Micro Processor Controlled

Salinity Meter registers full scale, red light on, continuously.

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

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

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

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

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

Salinity Meter registers low scale, green or yellow light on, but the product water has a definite salt taste.

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

The Salinity Probe may be dirty and require cleaning

The Salinity Meter may require calibration.

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

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

Power Source Line is switched off, reset the Power Source Circuit Breaker.
Blown fuse in the controller, check fuse condition.

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

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

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

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

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

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

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

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

Fuse in controller blows at start up:

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

Defective component that relies on the fuse for power:

3-way solenoid valve

U.V. Sterilizer

Printed Circuit Boards

Touch Pad

Shorted wire, locate shorted wire and repair it.

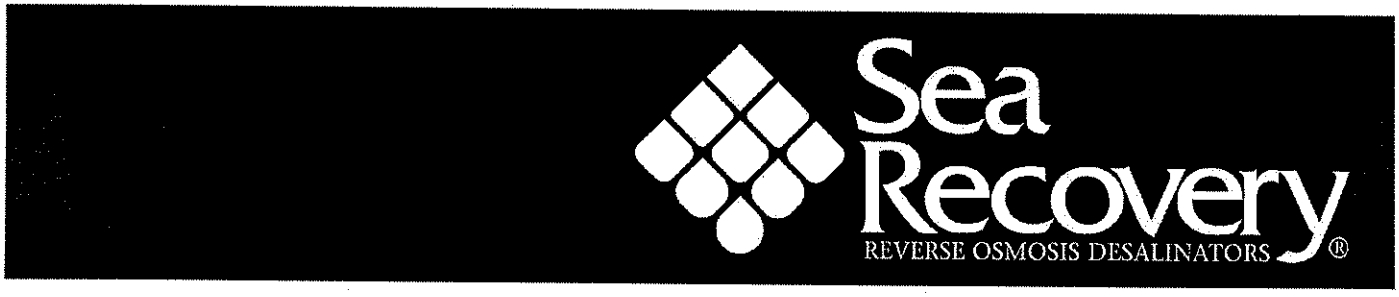
3 Way Product Diversion Valve does not switch from bad water dump position to good product water position when the Unsafe water (red) LED is off:

Loose or corroded connections, clean and tighten the connections at the 3-way Diversion Valve.

Port orifice adjustment screw, located under the two outlet fittings, have been improperly adjusted. This can lead to solenoid coil over heating and failure.Dysfunctional valve coil.

Dysfunctional PCB Main.

NOTES:



SECTION J

System & R.O. Membrane Element Storage Procedure

Winterizing & Freezing Temperature Storage & Cleaning Procedure

NOTES:

1. SYSTEM STORAGE:

AVOID CHEMICAL ATTACK TO THE SYSTEM:

CAUTION: Do not use for storage and do not expose the Sea Recovery R.O. System to:

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

or any other specific chemical not approved in writing by Sea Recovery Corp. Use of non authorized or misuse of authorized chemicals voids any warranty.

Do not connect any water line to the Sea Recovery R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Sea Recovery R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the co-polymer components within the system. Do not connect the Sea Recovery R.O. System to any line that may contain chlorine or other oxidants as they damage the R.O. Membrane Element.

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

TEMPERATURE CAUTION: As pointed out in other sections of this manual, never expose the SRC R.O. membrane(s) to storage temperatures above 122˚/F 50˚C or below 32˚F / 0˚C. Never store the R.O. membrane assembly in direct sunlight. High temperature causes up to 40% flux loss (loss of production) of the R.O. membrane element(s). This damage is irreversible to the R.O. membrane element. Freezing temperatures cause mechanical damage to the SRC system due to the expansion of water as it freezes. This damage is irreversible to the R.O. membrane element.

DRYING OUT CAUTION: Never allow the R.O. membrane element to dry out. If the R.O. membrane element is allowed to dry out up to 40% flux loss (loss of production) occurs. This damage may be irreversible to the R.O. membrane element. The R.O. membrane element(s) must remain wet at all times.

BIOLOGICAL FOULING CAUTION: Protect the R.O. membrane element from biological fouling. Up to 40% flux loss (loss of production) occurs if the element is allowed to become extensively fouled by biological slimes. Some, but not all, flux may be regained after thorough cleaning.

CHEMICAL FOULING CAUTION: Protect the R.O. membrane element from chemical attack or 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 recovery or repair. Chemical attack of the R.O. Membrane Element is not covered by warranty.

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

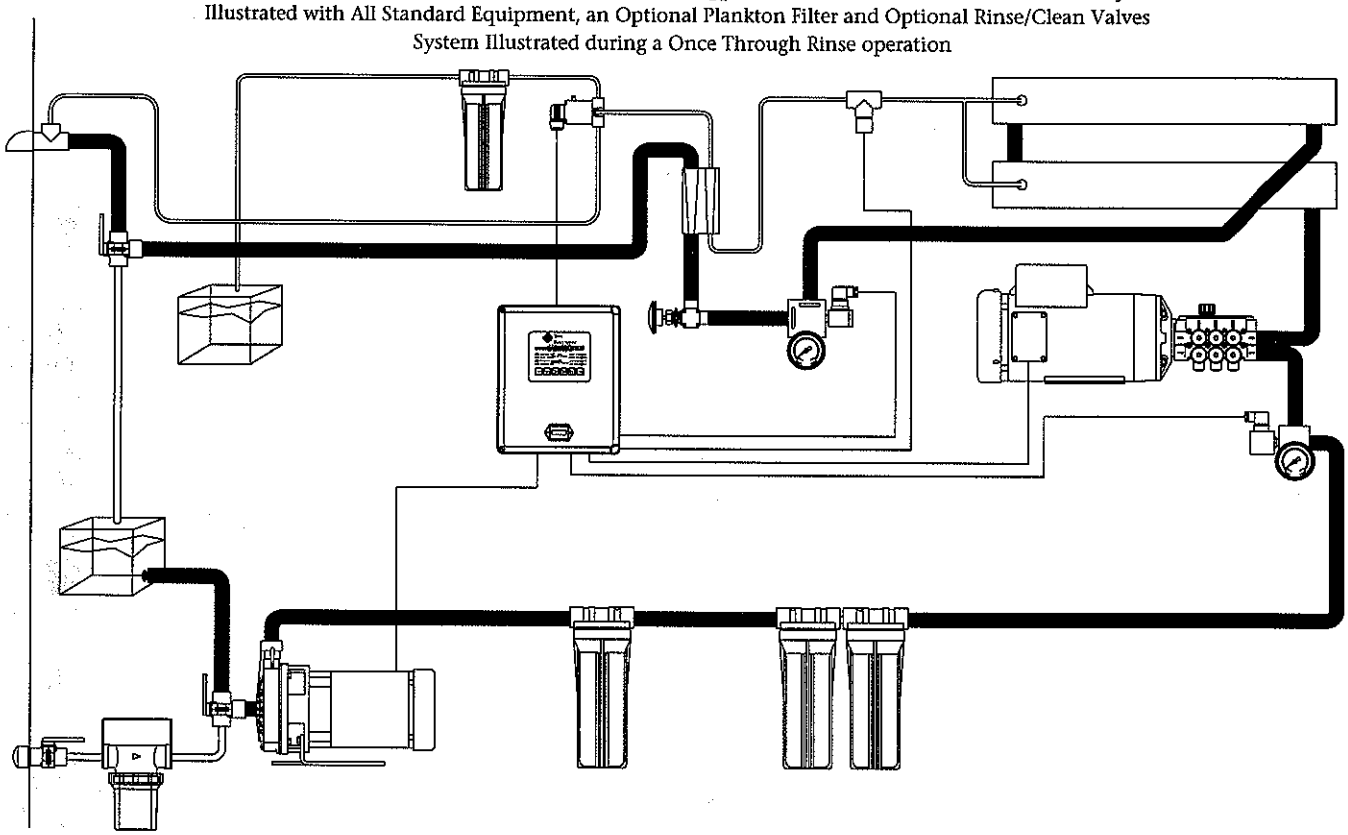
NEW SYSTEM STORAGE CAUTION: The Sea Recovery AquaWhisper System has been tested at the factory and rinsed with a mild mixture of storage chemical. This allows the system to be stored for up to 3 months if kept in a cool place. Do not store the system for longer than 3 months prior to actual use. If storage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

Illustrations on Page J - 4
show the
AquaWhisper System
With
Rinse/Clean Valves and Plankton Filter Options
in a Once Through Rinse and a Closed Loop Cleaning Mode.

Illustrations on Page J - 5
show the
AquaWhisper System
With
All Options except the Plankton Filter
in a Once Through Rinse and a Closed Loop Cleaning Mode.

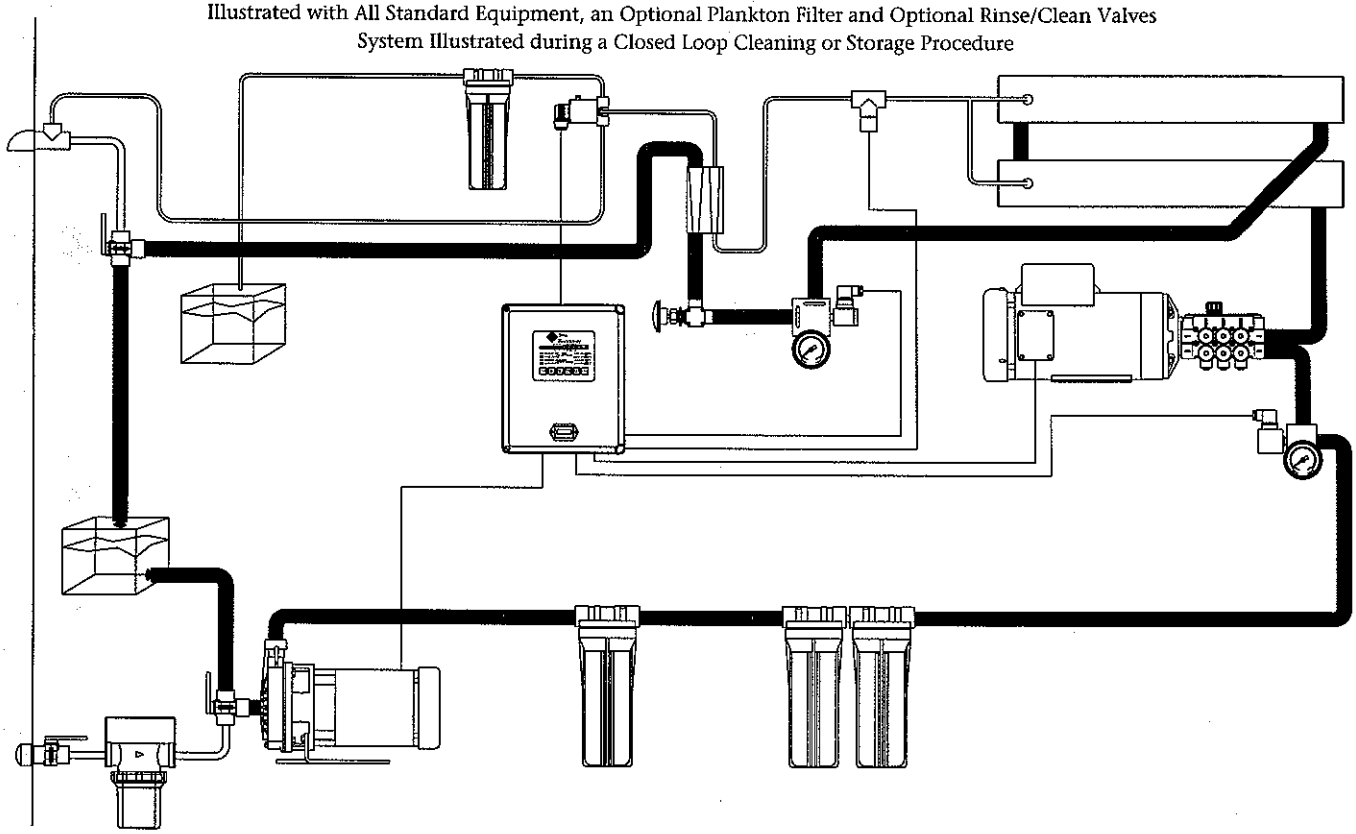
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System

Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated during a Once Through Rinse operation



Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System

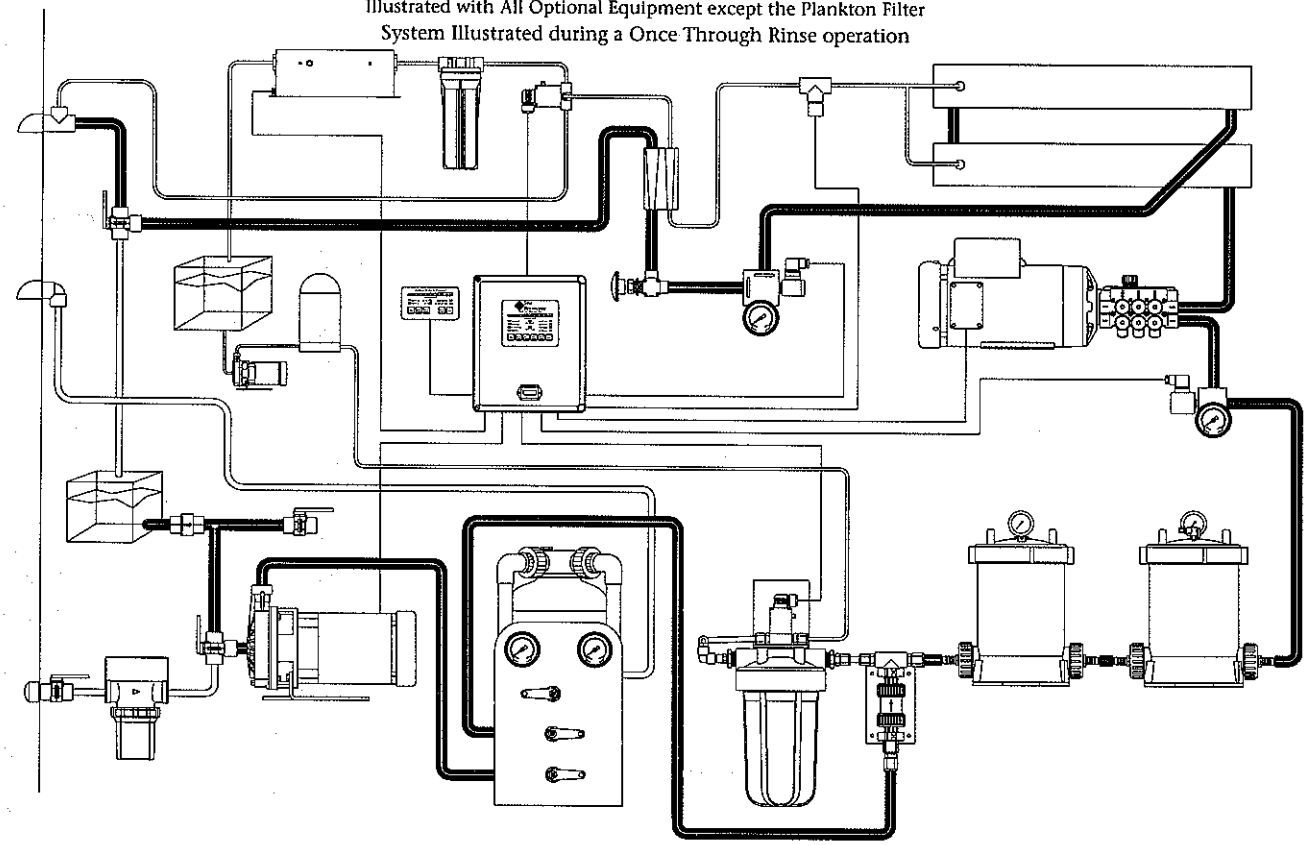
Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves
System Illustrated during a Closed Loop Cleaning or Storage Procedure



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System

Illustrated with All Optional Equipment except the Plankton Filter

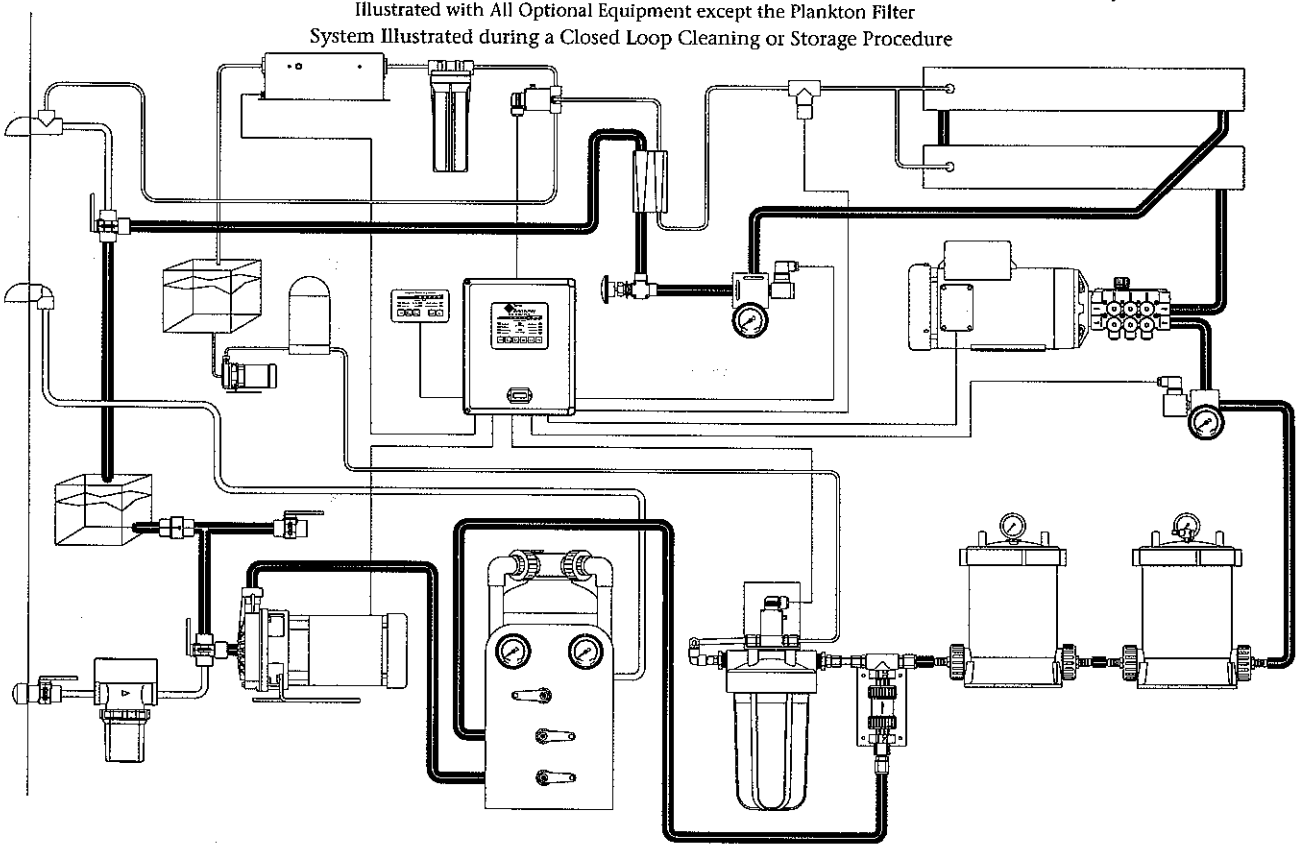
System Illustrated during a Once Through Rinse operation



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System

Illustrated with All Optional Equipment except the Plankton Filter

System Illustrated during a Closed Loop Cleaning or Storage Procedure



A. SHORT TERM SHUTDOWN:

A short term shutdown may be defined as a period of time in which the SRC system is not utilized for a period of two days to two weeks. An excellent inexpensive short term method of protecting the SRC system and R.O. membrane element is to perform a "once through" Fresh Water Rinse of the entire system with fresh water (product water from the system). This prolongs the system life by hindering the possibility of any electrolysis and also retarding biological growth. During a short term shutdown, this simple procedure, known as a "Fresh Water Rinse", is performed as follows:

ONE TIME THROUGH FRESH WATER RINSE PROCEDURE: Follow the directions below. This procedure displaces the system feed water with fresh water and thus renders the system suitable for a short term shutdown for up to two weeks. 10 to 20 gallons (38 to 75 liters) of fresh product or potable water is required for this process. The amount of fresh water required depends upon the Optional Prefiltration included with your particular System. Refer to the Once Through Rinse diagram on page J-4 or J-5. Numbers in brackets [ ] correspond to the identification numbers within the diagram on page D-3.

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

   WINTERIZING AND FREEZING TEMPERATURE STORAGE NOTE: If the system is exposed to freezing temperatures add twenty percent (2 to 4 gallons / 8 to 15 liters) food grade glycerin (propylene glycol) to the rinse water. This prevents the water in the system from freezing.
4. Position the Rinse/Clean Inlet Valve [4] to the Rinse/Clean Tank position [50].
5. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position [37].
6. Open the Back Pressure Regulating Valve [33] full open counter clockwise.
7. Operate the system by pressing the System Start Switch. The rinse water is now rinsing the entire Sea Recovery R.O. system and discharging out to waste.
8. Apply 200 psi of pressure to the System by turning the Back Pressure Regulator Clockwise. This allows the system to produce a minimal amount of product water which ensures that the product water line remains wet.
9. Just prior to depleting the rinse water from the tank, Stop the System.
10. Position the Rinse/Clean Inlet Valve [4] to the Normal Operating Position towards the Sea Strainer [3]. The system is now exposed to fresh rinse water and may be left unattended for up to two weeks. This procedure should be repeated every two weeks if the System is not in use.

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

B. LONG TERM SHUTDOWN:

A Long Term or Prolonged Shutdown is defined as a period of time in which the SRC system is not operated for longer than three months. For a prolonged shut down, longer than three months, the Sea Recovery R.O. system should first be rinsed with fresh water then stored with SRC SC System and Membrane Element Storage Chemical. This chemical inhibits bacterial growth while maintaining the high flux and salt rejection of the SRC R.O. Membrane Element. Follow the directions listed below.

The AquaWhisper Long Term Shutdown procedure requires a total of 20 to 40 gallons / 75 to 150 liters of potable water.

1. Close the Inlet Sea Cock Valve [2].
2. Back Wash and rinse the Multi Media Filter, if installed.
3. Remove all Prefiltration Cartridge Elements and clean their respective Bowl or Housing. Replace all of the Prefiltration Cartridges with new Sea Recovery supplied Prefiltration Elements.
4. If not already connected, connect the "RINSE/CLEAN INLET" line from the Rinse/Clean Inlet Valve [4] to the pick

up point of the Rinse/Clean Tank [50].

5. Fill the Rinse/Clean Tank [50] full with non-chlorinated (chlorine free) product water. The cleaning tank must contain enough non-chlorinated product water to sustain rinsing of the system until all of the feed water is displaced. This process requires approximately 10 to 20 gallons (38 to 75 liters).

6. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position [37].

7. Open the Back Pressure Regulating Valve [33] full open counter clockwise.

8. Operate the system by pressing the System Start Switch. The rinse water is now rinsing the entire Sea Recovery R.O. system and discharging out to waste.

9. Apply 200 psi of pressure to the System by turning the Back Pressure Regulator Clockwise. The system produces a minimal amount of product water which ensures the product water line remains wet.

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

11. Open the Back Pressure Regulating Valve [33] full open counter clockwise.

12. Add 10 to 20 gallons / 8 to 15 liters of product water to the Rinse/Clean Tank [50].

13. Fill a separate plastic bucket or container (1/2 to 2 gallons) 1/2 full with product water. Add to the water in the plastic bucket or container SRC SC Storage Chemical as follows:

    If the Rinse/Clean Tank [50] contains 10 gallons of product water then add to the plastic bucket or container 1/4 bottle (.375 lb., or 6 ounces, or .17 kg) of the SRC SC Storage Chemical.

    If the Rinse/Clean Tank [50] contains 20 gallons of product water then add to the plastic bucket or container 1/2 bottle (.75 lb., or 12 ounces, or .34 kg) of the SRC SC Storage Chemical.

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

WINTERIZING AND FREEZING TEMPERATURE STORAGE NOTE: If the system is exposed to freezing temperatures 2 to 4 gallons / 8 to 15 liters of food grade glycerin (propylene glycol) is also be required for addition to the final storage chemical mixture. This prevents the water in the system from freezing.

14. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] return for a Closed Loop recirculation out from and back into the Clean/Rinse Tank [50].

15. Operate the system by pressing the System Start Switch. The Storage Chemical Solution is now flowing from the Clean/Rinse Tank, through the System and back into the Clean/Rinse Tank in a Closed Loop configuration.

16. After approximately 20 minutes of recirculation, Stop the System by pressing the Stop Switch.

17. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge [37] normal operating position.

18. Operate the system by pressing System Start. The Storage Chemical Mixture discharges through the Brine Discharge Thru Hull Fitting [37].

19. Stop the system just before depleting the Storage Chemical Mixture water from the tank

20. Position the Rinse/Clean Inlet Valve [4] to the Sea Strainer [3] normal operating position.

The system is now exposed to Storage Chemical and may be left unattended for up to 3 to 6 months. The length of time allowed for storage varies and is dependent upon conditions. With ideal conditions including a relatively new R.O. Membrane Element, a clean system prior to storage, cool temperatures and no loss of storage chemical within the system it provides protection for up to 6 months. On the other hand, adverse conditions such as a fouled R.O. Membrane Element prior to storage, warm or hot temperatures and or leakage of the storage chemical from the system provides only a month or less of safe storage. Evaluate these factors before determining the proper interval between repeated rinsing and storage periods.

2. SRC R.O. MEMBRANE ELEMENT CLEANING PROCEDURES

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

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

When determining the percentage of performance changes, Feed Water Temperature, Feed Water Salinity, and System Operating Pressure must be taken into consideration (Refer to the Salinity, Temperature, and Pressure Effects Charts in section "M") and compensate for those variables. After compensations, a 10% decline in productivity (GPH Flow) and/or a 10% increase in salt passage (indicated by the Salinity Controller LED Meter) indicate that the R.O. Membrane Element requires cleaning.

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

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

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

The Sea Recovery R.O. system must be rinsed with fresh water then the R.O. Membrane Element(s) may be cleaned with the SRC MCC R.O. Membrane Element Cleaning Chemical as follows. Refer to the diagrams on page J-4 when rinsing and closed loop cleaning the system.

The process of rinsing and cleaning the R.O. Membrane Elements takes from 40 to to 200 gallons / 151 to 757 liters of combined fresh non chlorinated product water. The amount of fresh water required depends upon which cleaning chemicals are used and the different Prefiltration options installed.

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

If the System Includes only the Standard Prefiltration:

Chemical	Rinse	Clean	Recirc Rinse	Final Final	Total Water Used
SRC MCC 1	10	10	10	10	40
SRC MCC2	--	10	10	10	70
SRC MCC3	--	10	10	10	100

If the System Includes Commercial Prefiltration and Oil Water Separator:

Chemical	Rinse	Clean	Recirc Rinse	Final Final	Total Water Used
SRC MCC 1	20	20	20	20	80
SRC MCC2	--	20	20	20	140
SRC MCC3	--	20	20	20	200

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

SRC MCC1, 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, including the R.O. Membrane Element, is constantly exposed to Sea Water and therefore fouling by biological growth occurs from the first day the System is exposed to the Sea Water, just like the bottom of the boat. Conceivably, once exposed to Sea Water and if left to sit, the R.O. Membrane Elements become unusable and uncleanable even with no actual System use. This fouling can not be stopped, however it is minimized with fresh water rinsing whenever the System is not in use.

SRC MCC2, Membrane Cleaning Compound "# 2" is an acid cleaner designed to clean calcium carbonate and other mineral build up from the R.O. Membrane Element. Mineral fouling is usually a very slow process which takes place over many hours of use. Therefore, if the System has relatively few hours of use yet shows signs of R.O. Membrane Element fouling then that fouling is likely biological fouling. If the System has in excess of 1000 hours of use then there may be some mineral fouling combined with biological fouling.

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

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

B. R.O. MEMBRANE ELEMENT CLEANING INSTRUCTIONS:

1. Close the Inlet Sea Cock Valve [2].
2. Back Wash and rinse the Multi Media Filter, if installed.
3. Remove all Prefiltration Cartridge Elements and clean their respective Bowl or Housing. Replace all of the Prefiltration Cartridges with new Sea Recovery supplied Prefiltration Elements. DO NOT REPLACE THE OIL/WATER SEPARATOR ELEMENT (IF USED) AT THIS TIME. LEAVE THE OIL/WATER SEPARATOR ELEMENT HOUSING EMPTY.
4. If not already connected, connect the "RINSE/CLEAN INLET" line from the Rinse/Clean Inlet Valve [4] to the pick up point of the Rinse/Clean Tank [50].

   The Rinse/Clean Tank should be minimum 10 to maximum 20 gallons in size.
5. Fill the Rinse/Clean Tank [50] full with non-chlorinated (chlorine free) product water. The cleaning tank must contain enough non-chlorinated product water to sustain rinsing of the system until all of the feed water is displaced.
6. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge (normal operation) position [37].
7. Open the Back Pressure Regulating Valve [33] full open counter clockwise.
8. Operate the system by pressing the System Start Switch. The rinse water is now rinsing the entire Sea Recovery R.O. system and discharging out to waste.
9. Just prior to depleting the rinse water from the tank stop the system.
10. Fill again the Rinse/Clean Tank [50] full with non-chlorinated (chlorine free) product water, minimum 10 to maximum 20 gallons (38 to 75 liters).
11. Fill a separate plastic bucket or container (1/2 to 2 gallons) 1/2 full with product water. Add to the water in the plastic bucket or container the full contents of the Sea Recovery SRC MCC 1, ***OR*** MCC 2, ***OR*** MCC 3 Membrane Cleaning Chemical. USE ONLY ONE CHEMICAL AT A TIME.

    Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution contents of the bucket or container into the Rinse/Clean Tank [50].
12. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] return for a Closed Loop recirculation out from and back into the Clean/Rinse Tank [50].

13. Operate the system by pressing the System Start Switch. The Storage Chemical Solution is now flowing from the Clean/Rinse Tank, through the System and back into the Clean/Rinse Tank in a Closed Loop configuration.

14. After approximately 60 minutes of recirculation, Stop the System by pressing the Stop Switch.

15. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge [37] normal operating position.

16. Operate the system by pressing the System Start Switch. The used Cleaning Chemical Mixture is now discharging out the Brine Discharge Thru Hull Fitting [37].

17. Just prior to depleting the Cleaning Chemical Mixture water from the tank stop the system.

18. Fill again the Rinse/Clean Tank [50] full with non-chlorinated (chlorine free) product water.

19. Position the Rinse/Clean Outlet Valve [35] to the Clean/Rinse Tank [50] for Rinse Recirculation.

20. Operate the system by pressing the System Start Switch. The rinse water is now recirculating out of the Rinse/Clean Tank through the System and back into the Rinse/Clean Tank. Allow this rinsing to continue for 20 minutes.

21. After approximately 20 minutes of recirculation, Stop the System by pressing the Stop Switch.

22. In order to empty the Clean/Rinse Tank, position the Rinse/Clean Outlet Valve [35] to the Brine Discharge [37] normal operating position.

23. Operate the system by pressing the System Start Switch. The used rinse water is now discharging out the Brine Discharge Thru Hull Fitting [37].

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

25. Fill again the Rinse/Clean Tank [50] full with non-chlorinated (chlorine free) product water.

26. Position the Rinse/Clean Outlet Valve [35] to the Brine Discharge [37] normal operating position.

27. Operate the system by pressing the System Start Switch. The final rinse water is now rinsing the System and discharging out the Brine Discharge Thru Hull Fitting to waste.

28. Just prior to depleting the Final Rinse Water from the tank stop the system.

The System is now rinsed, cleaned, recirculation rinsed and final rinsed. The System is now ready for additional cleaning with the same or different cleaning chemicals, or the System is ready for Storage, or the System is ready for use.

If further cleaning is necessary, then go back and repeat steps 10 through 28 for each additional cleaning.

If no further cleaning is necessary and if the System is stored, not used, then go to the beginning of this section and review the Storage Procedures and Cautions.

If no further cleaning is necessary and if the System is operated in a short period of time then go to step 29 below.

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

Sea Recovery SRC SC Storage Chemical

WARNING: CONTAINS SODIUM METABISULFITE. HARMFUL IF SWALLOWED, AVOID BREATHING DUST & FUMES. CAUSES IRRITATION TO EYES & MUCOUS MEMBRANES. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, GIVE TAP WATER & INDUCE VOMITING. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT.

MEDICAL PERSONNEL FAMILIAR WITH Sea Recovery "SRC SC", SYSTEM & MEMBRANE STORAGE CHEMICAL, ARE AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK, U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER:
1-800-228-5635. (Outside the U.S.A. 612-221-2113)

FOR INDUSTRIAL USE ONLY. Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly wash contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Adding small amounts of water to power may liberate irritating sulfur dioxide gas. Add powder to above specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN
NET CONTENTS 1.5 POUNDS (.68 Kg)

Sea Recovery SRC MCC1 Membrane Cleaning Chemical

WARNING: CONTAINS SODIUM METASILICATE. HARMFUL IF SWALLOWED. MAY CAUSE BURNS. AVOID CONTACT WITH EYES. AVOID PROLONGED CONTACT WITH SKIN. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, DO NOT INDUCE VOMITING, GIVE ONE GLASS OF TAP WATER OR MILK. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT. CONTACT A PHYSICIAN IF IRRITATION PERSISTS.

MEDICAL PERSONNEL FAMILIAR WITH Sea Recovery "SRC MCC1", R.O. MEMBRANE ELEMENT ALKALINE DETERGENT CLEANING CHEMICAL, ARE AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK, U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER:
1-800-228-5635. (Outside the U.S.A. 612-221-2113)

FOR INDUSTRIAL USE ONLY. Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly wash contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Add powder to above specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN
NET CONTENTS 1.5 POUNDS (.68 Kg)

Sea Recovery SRC MCC2 Membrane Cleaning Chemical

DANGER: CONTAINS SULFAMIC ACID. CAUSES BURNS, EYE & SKIN IRRITATION. HARMFUL IF SWALLOWED. AVOID BREATHING DUST. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, DO NOT INDUCE VOMITING, GIVE ONE GLASS OF TAP WATER OR MILK. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT. CONTACT A PHYSICIAN IF IRRITATION PERSISTS.

MEDICAL PERSONNEL FAMILIAR WITH Sea Recovery "SRC MCC2", R.O. MEMBRANE ELEMENT ACID CLEANING CHEMICAL, ARE AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK, U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER:
1-800-228-5635. (Outside the U.S.A. 612-221-2113)

FOR INDUSTRIAL USE ONLY. DO NOT MIX WITH CHLORINATED SOLUTIONS OR COMPOUNDS. Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly wash contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Add powder to above specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN
NET CONTENTS 1.5 POUNDS (.68 Kg)

Sea Recovery SRC MCC3 Membrane Cleaning Chemical

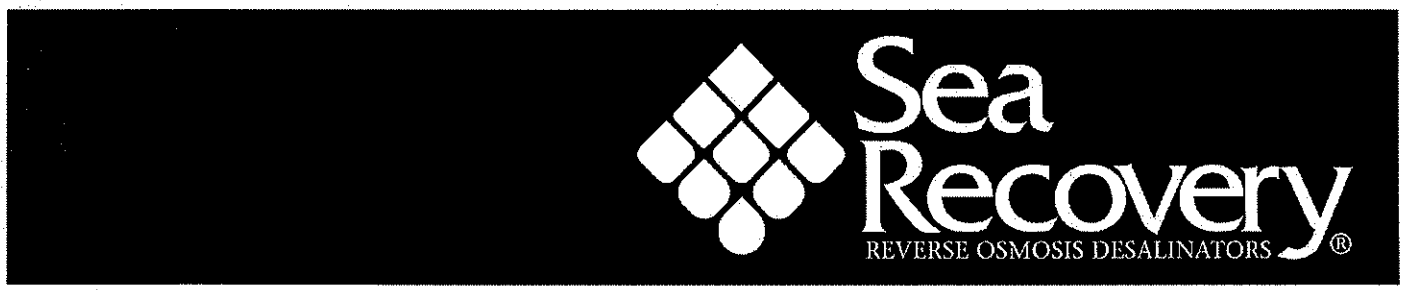
WARNING: CONTAINS SODIUM METABISULFITE. HARMFUL IF SWALLOWED. AVOID BREATHING DUST AND FUMES. CAUSES IRRITATION TO EYES AND MUCOUS MEMBRANES. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, GIVE TAP WATER AND INDUCE VOMITING. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT. CONTACT A PHYSICIAN IF IRRITATION PERSISTS.

MEDICAL PERSONNEL FAMILIAR WITH Sea Recovery "SRC MCC3", R.O. MEMBRANE ELEMENT RUST REMOVER CLEANING CHEMICAL, ARE AVAILABLE 24 HOURS A DAY, 7 DAYS A WEEK, U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER: 1-800-228-5635. (Outside the U.S.A. 612-221-2113)

FOR INDUSTRIAL USE ONLY. Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly wash contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Adding small amounts of water to powder may liberate irritating sulfur dioxide gas. Add powder to above specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN
NET CONTENTS 1.5 POUNDS (.68 Kg)



SECTION K

Maintenance & Repair

Maintenance Time Chart

Operator's Preventive Maintenance

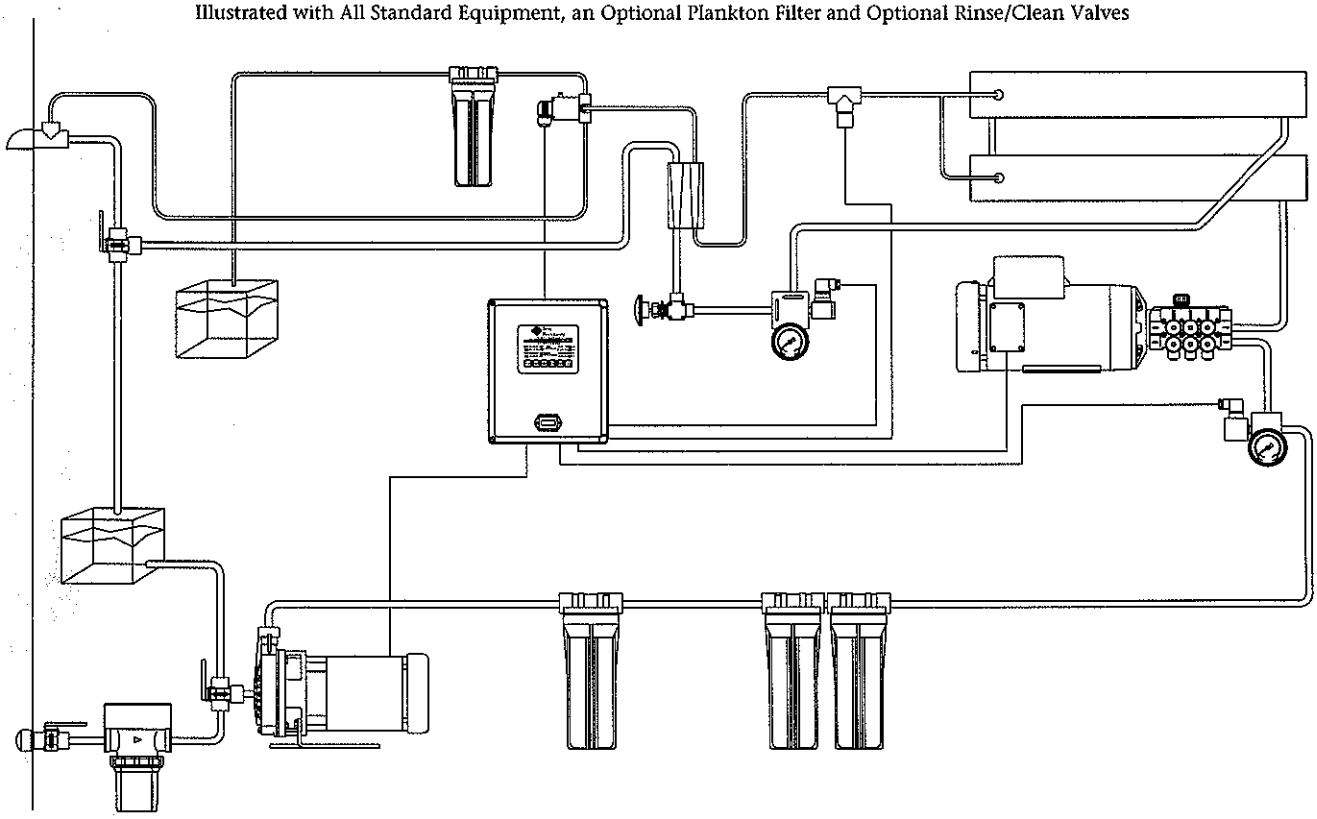
Component Maintenance & Repair

System Upgrading

NOTES:

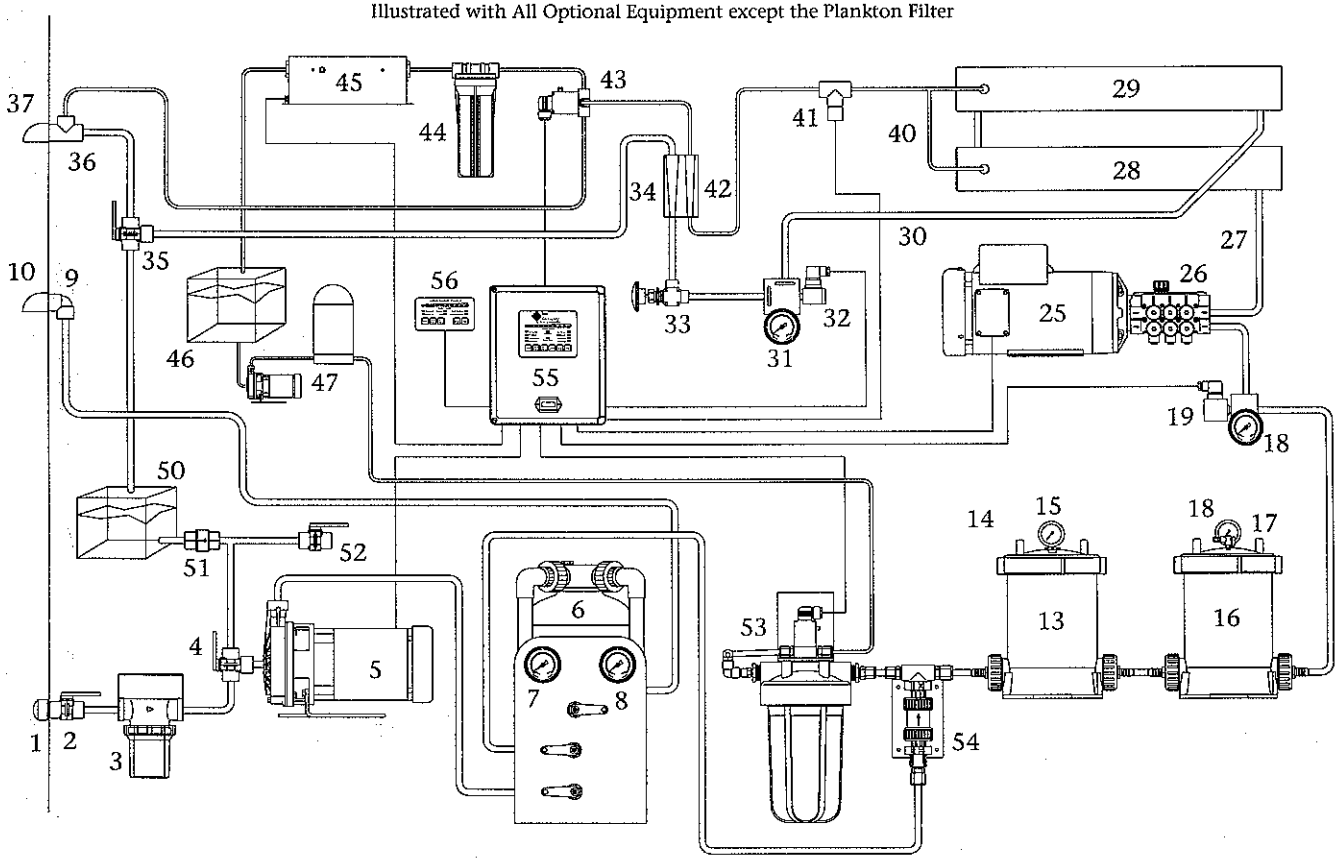
Sea Recovery "AquaWhisper" Series 400-1500gpd Reverse Osmosis Desalinator System

Illustrated with All Standard Equipment, an Optional Plankton Filter and Optional Rinse/Clean Valves



Sea Recovery "AquaWhisper" Series 400-1500 U.S. GPD Reverse Osmosis Desalination System

Illustrated with All Optional Equipment except the Plankton Filter



OPERATOR MAINTENANCE TIMETABLE

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

COMPONENT	MAINTENANCE REQUIRED	TIME INTERVAL INTERMITTENT DUTY	TIME INTERVAL CONTINUAL DUTY
Sea Strainer	Inspect & clean screen & housing	weekly	100 hrs
Booster Pump	Replace Seal	1000 hrs or if seal leaks	2000 hrs or if seal leaks
Media Filter	Back Wash Media	weekly	> 20 psi differential
Plankton Filter	Inspect & clean screen & housing	weekly	100 hrs
Prefilter	Replace elements & clean housings	Low Pressure Gauge is < 10 psi	Low Pressure Gauge is < 10 psi
Flow Meters	Clean inside of the clear tube	As Required When Dirty	As Required When Dirty
High Pressure Pump	Change oil Replace Seal Kit Replace Valve Kit	500 hrs 2000 hrs 2000 hrs	500 hrs 2000 hrs 2000 hrs
Electric Motors	Lubricate Bearing	6 months	4000 hrs
R.O. Membrane	Clean Element	When production or salt rejection decreases by 10%	
Salinity Probe	Clean Probes	Annually	Annually
Charcoal Filter	Replace Element	3 months	3 months
U.V. Sterilizer	Replace lamp & clean quartz sleeve	2000 Hours	4000 Hours

Other _____

Other _____

Other _____

Other _____

Other _____

Other _____

Other _____

OPERATORS PREVENTIVE MAINTENANCE

Weekly or approximately every 50 hours of use, the SRC system needs inspection as part of a regular preventive maintenance program. The following steps ensure that potential problems are resolved preventing major repairs. Any electro mechanical pumping system requires similar preventive maintenance. Numbers in brackets [ ] correspond to the identification numbers on the SRC R.O. System Schematic illustrated throughout this manual.

1. Mounting Hardware: Because the system is subjected to vibrations, all mounting hardware requires inspection for tightness. Inspect all screws, brackets, nuts and bolts. Pay special attention to the the High Pressure Pump [26] and Electric Motor [25] since they are subject to increased vibration.

2. High Pressure Pump [26]: Whenever power is initially switched on, or **SYSTEM STOP** is pressed, the LED meter indicates the remaining hours until the HP pump oil needs to be changed. Nine lamps indicates that more than 450 hours remain. When the system has operated for 450 hours between oil changes, the last red LED lights indicating that less than 50 hours remain before the system shuts down and the Service Pump is lit. Change Pump oil and press **FAULT RESET** to repeat 500 hour countdown. Regularly check the level of the crankcase oil. When the pump is horizontal, the minimum oil level is the center of the sight glass, located at the rear of the High Pressure Pump. The maximum oil level is the top of the sight glass and this level does not harm the pump. Use only Sea Recovery SRC PO High Pressure Pump oil. The Sea Recovery SRC PO High Pressure Pump crankcase oil contains special additives to minimize wear and corrosion. DO NOT USE MOTOR OIL OR OTHER HYDRAULIC OIL.

3. Regularly clean any salt water or salt deposits from the system with a wetted rag. Dry all parts to protect against the salt environments.

4. Check regularly for fluid leaks; either oil from the High Pressure Pump or water from anywhere in the system. Do not arbitrarily tighten water fittings unless they are obviously loose or leaking. Be sure to tighten the black tube fittings by hand only. Use caution in tightening the gray PVC fittings.

5. Regularly check all tubing and high pressure hoses for wear and friction against abrasive surfaces. Do not allow hoses to come in contact with heated or abrasive surfaces.

COMPONENT MAINTENANCE & REPAIR

CAUTION AVOID CHEMICAL ATTACK TO THE SYSTEM: Do not use for storage and do not expose the Sea Recovery R.O. System to:

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

or any other specific chemical not approved in writing by Sea Recovery Corp. Use of non authorized or misuse of authorized chemicals voids warranty.

Do not connect any water line to the Sea Recovery R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Sea Recovery R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the co-polymer components within the system. Do not connect the Sea Recovery R.O. System to any line that may contain chlorine or other oxidants as they destroys the R.O. Membrane Element.

If you use detergents to clean the internal wetted parts of the system ensure that they are rinsed thoroughly, wiped and dried prior to reassembly. After the components have been reassembled, product water can be used to remove any feed water residue from the exterior surfaces of the components.

WARNING: Use of non Sea Recovery parts causes damage to the Sea Recovery System and void all Warranty. USE ONLY SEA RECOVERY SUPPLIED PARTS.

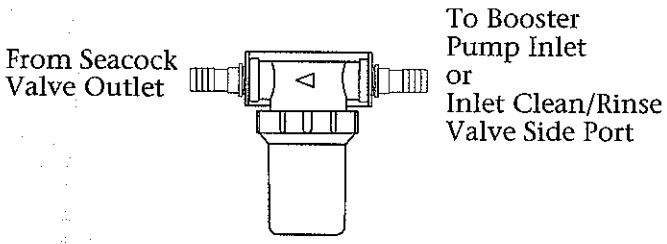
CAUTION: Make sure that the System Feed Water Sea Cock Valve [2] is closed prior to performing maintenance on the Sea Recovery R.O. System. Additionally, make sure that the system main electrical disconnect switch is switched "OFF", LOCKED and TAGGED FOR MAINTENANCE prior to performing maintenance or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

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

1. **Inlet Thru Hull Fitting [1]:** Keep the Inlet Thru Hull Fitting free and clear of debris and marine growth. The Sea Recovery R.O. System must receive an uninterrupted supply of feed water. If the Inlet Thru Hull Fitting is clogged this restricts the feed water and results in a low feed pressure condition which causes the System to shut off.

2. **Inlet Sea Cock Valve [2]:** The packings and connections of the Inlet Sea Cock Valve must be tight and must properly seal. If the connections or packings at the Inlet Sea Cock Valve are loose, air may enter the feed line and result in a low feed pressure condition which causes the System to shut off. Clean the valve cavity of debris or replace the seal and seat, or the entire valve, as required.

3. **Sea Strainer [3]:**



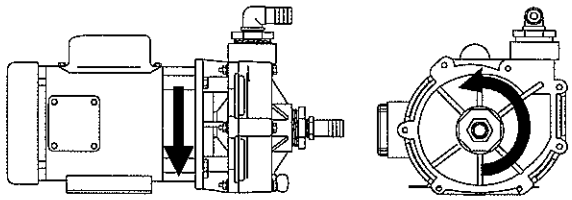
Keep the mesh screen free and clear of debris. The supplied Sea Strainer contains a very fine mesh (40 mesh) monel screen. This fine mesh screen is designed to trap marine debris prior to entering the Booster Pump and Prefilters. If the mesh screen becomes clogged it results in a low feed pressure condition which causes the System to shut off.

To clean or replace the mesh screen remove the bowl from the Coarse strainer by turning the bowl counter clockwise. Remove the Sea Strainer Mesh Screen from the bowl. Remove the flat sealing gasket from the bowl and take care to not damage it. Clean the mesh screen. Ensure that the screen is intact. If the brazed seam is ruptured or if the mesh screen remains plugged after cleaning, replace it with a new Sea Recovery supplied Mesh Screen Element.

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

CAUTION: If the sealing gasket is missing, not properly seated or if the bowl is over tightened then air enters the feed line and causes the system to shut off due to low feed pressure. Excess tightening causes the gasket to pinch and cause an air suction leak.

4. **Booster Pump [2]:** (centrifugal; <u>counter clockwise</u> rotation as viewed from volute end {front end} of pump)



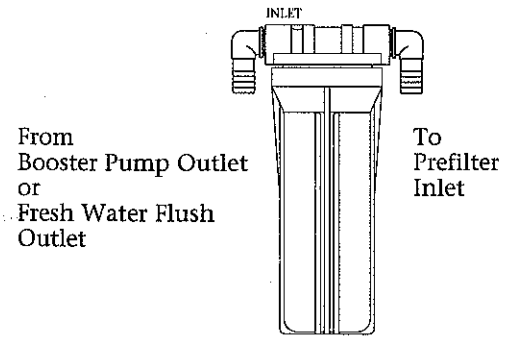
Replace the ceramic seal approximately every 2000 hours, or at the sign of leakage P/N SRC B655800009:

DISASSEMBLY: Remove the seven 3/8-16 Bolts holding the volute to the motor bracket. To remove the impeller, remove the bearing cap on the motor to expose the screwdriver slot on the motor shaft. Hold the motor shaft with a large screwdriver and remove the impeller by grasping it with your hand and turning the impeller counter clockwise. Remove the Seal. Two screwdrivers wedged into the seal at 180 degrees apart serve as tools to wedge the seal out. The ceramic seat is removed by removing the end bell gasket.

REASSEMBLY: Clean the motor shaft and the bracket of any corrosion or salt deposits. Replace the end bell gasket and the tap seat portion into the bracket cavity. Use a new gasket. Place the ceramic seat into the cavity over the shaft. Make sure that the polished side is toward the end of the shaft. Tap into place evenly using a hollow piece of wood or plastic tool. If a metal tool is used to tap it into place, protect the seat with cardboard or a clean cloth. Lubricate the shaft with water, water and soap or a light oil and slip the rotating portion of the seal over the shaft with the carbon element toward the ceramic. Slide it down onto the shaft as far as possible. Apply blue Loctite to the motor shaft threads. Hold the Motor shaft and reinstall the impeller. Tighten the impeller by turning it clockwise until it is snug. Reinstall the volute. Tighten the bolts evenly. Thoroughly prime the pump.

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

5. Plankton Filter [11] Element Cleaning:



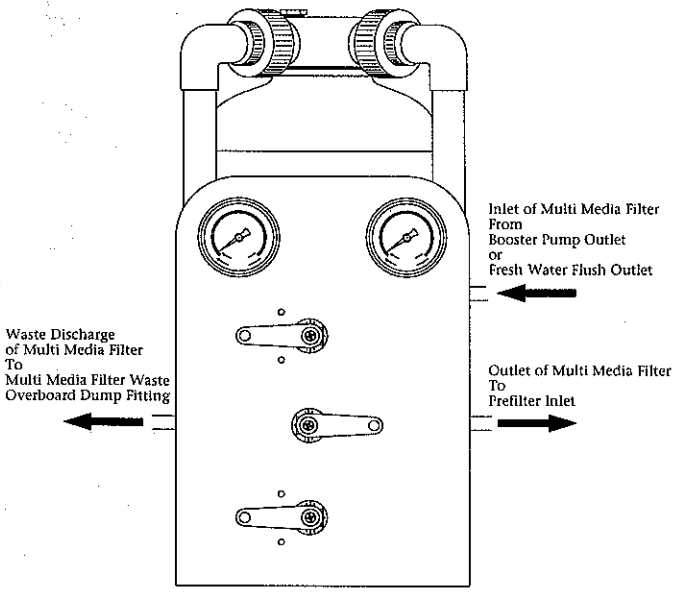
The plankton filter element is cleanable. When it is no longer cleanable or is otherwise damaged, it must be replaced.

To clean the element, unscrew the blue bowl counter clockwise by hand. Take care not to spill the feed water from the bowl. Remove the Plankton Filter Element from the bowl. Remove the "O" Ring from the top of the bowl and take care to not damage it. Clean the mesh screen filter element with a bristle brush and water spray. Clean the bowl with a mild detergent and rinse out thoroughly.

Wipe the "O" ring with a damp cloth. Lubricate it sparingly with Silicon Base "O" ring lubricant. Place the "O" ring back onto the bowl. Insert the cleaned, or a new, plankton filter element into the bowl. Screw the bowl on clockwise. Hand tighten only enough to seat the "O" ring.

CAUTION: If the "O" ring is missing, not properly seated or if the bowl is over tightened water leaks from the bowl.

6. Multi Media Filter [6] Back washing :



The Multi Media Filter contains fine gravel and #20 silica sand. This silica sand traps suspended solids larger than 20 micron. The top layer of the silica sand within the Multi Media Filter becomes packed with suspended solids and restricts flow through it. When the silica sand becomes packed with suspended solids, as indicated by a loss of pressure across it, it must then be "back washed" to waste. This back washing procedure fluffs the silica sand and dislodges the suspended solids from the sand base. During back washing the suspended solids are discharged to waste through the Multi Media Filter Waste outlet [10].

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

To replace the media: disconnect the union joints from the multi port valve. Unscrew the Multi Media Filter lid counter clockwise. Remove the Multi Media with a wet-dry vacuum cleaner or other means. Thoroughly clean the inside of the Multi Media Filter. Thoroughly clean the exposed threads at the top opening of the Multi Media Filter.

Place the lid over the opening while aligning the pick up pipe into its corresponding hole in the lid. Screw the lid onto the Multi Media Filter clockwise snugly. DO NOT over tighten. Reconnect the multi port union joints

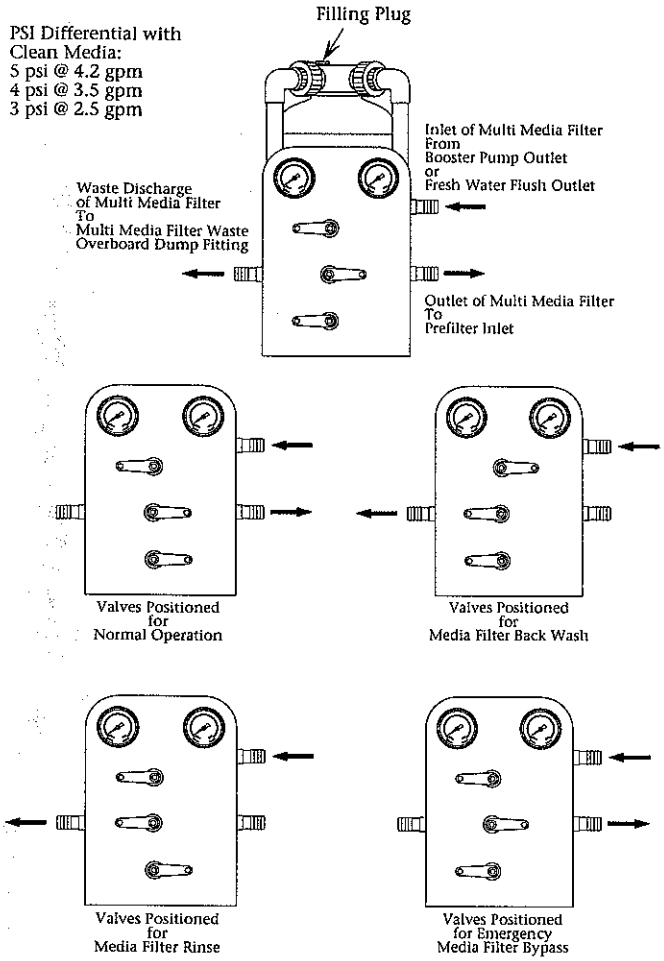
Open the Fill Plug located on the top of the lid. Pour approximately 15 lbs (7 kg) of small gravel (1/8 x 1/4 inch) first (on the bottom). Gently shake the Multi Media Filter to level the small gravel. Add approximately 26 lbs (12 kg) of #20 silica sand last (on top of the small gravel).

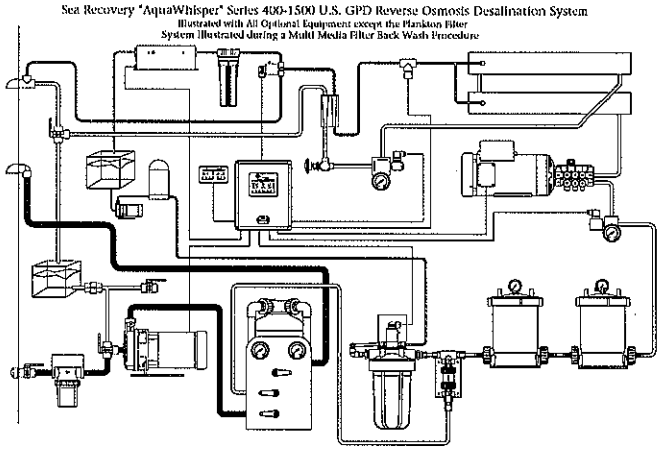
NOTE: the new gravel and sand contain fines and contaminates. The Multi Media Filter must be back washed prior to use.

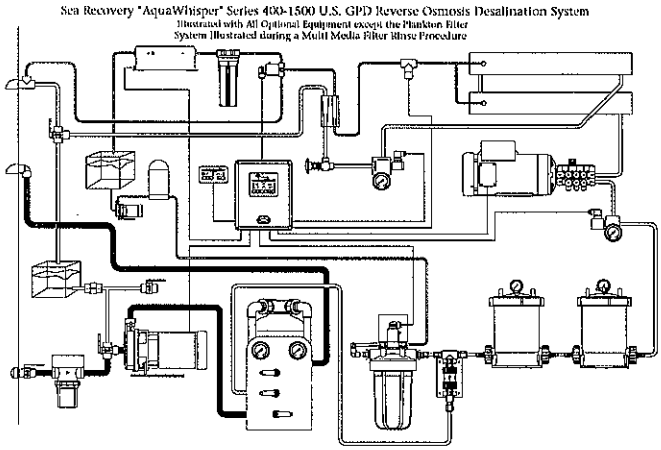
To backwash the Multi Media Filter: Refer to the illustrations on page K-7 and K-8. To backwash the Multi Media Filter: Open the Inlet Sea Cock Valve [2]. Position the Inlet Clean/Rinse Valve [4], if installed, to the normal operating position towards the Sea Strainer [3].

Position the Multi Media Filter Valves (3 each valves) as shown in the diagram on the left hand side of page K-8 for Multi Media Filter Back Wash.

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







Press the Booster Pump Start Switch. The Booster Pump [5] is now back washing the Multi Media Filter [6] to waste [10] as illustrated at the top right hand side of this page K-8. Allow this back washing to continue for 10 minutes.

After 10 minutes of back washing press the Booster Pump Stop Switch to Stop the Booster Pump.

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

Press the Booster Pump Start Switch. The Booster Pump [5] is now rinsing the Multi Media Filter [6] to waste [10] as illustrated in the second diagram from the top right side of this page K-8. Allow this rinsing to continue for 5 min.

After 5 minutes of rinsing press the Booster Pump Stop Switch to Stop the Booster Pump.

Position the Multi Media Filter Valves as shown in the diagram to the left on this page K-8 for Normal Operation.

7. **Prefilter Element Replacement:** The prefilter elements must be cleaned, or replaced, when plugged to the extent that the Low Pressure Gauge at the control panel reads below 10 PSI. At or slightly below 6 PSI the Low Pressure Switch shuts the System off. The standard dual 10 inch prefilter and the commercial prefilter are both discussed below.

CAUTION: NON SEA RECOVERY filter elements do not properly fit and allow by-passing and suspended solids to enter the R.O. Membrane Element(s), foul them quickly and render them uncleanable. USE ONLY SEA RECOVERY FILTER ELEMENTS. The Sea Recovery Prefilter Element can appear to be similar to commercially available elements. However, Sea Recovery manufactures their own unique filter elements to specific stringent specifications designed to withstand unique Sea Water applications and simultaneously protect the SRC R.O. Membrane Element. Only Sea Recovery filter elements, supplied by Sea Recovery, can be used as replacements.

a. 10 inch Prefilters [12]:

The standard prefilter consists of two individual filter housings connected in series. The first in line contains a 25 micron Prefilter Element (SRC PFE 10/25) and the second in line contains a 5 micron Prefilter Element (SRC PFE 10/05).

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

Lubricate the "O" Ring sparingly with silicon base "O" ring lubricant. Place the "O" ring back onto the bowl. Place new Sea Recovery Supplied Prefilter Elements into the appropriate bows. The first Prefilter receives an SRC PFE 10/25 Prefilter Element. The second Prefilter receives an SRC PFE 10/05 Prefilter Element.

Screw the bowl on clockwise. Hand tighten only enough to seat the "O" ring.

CAUTION: If the "O" ring is missing, not properly seated or if the bowl is over tightened air enters the feed line or water leaks from the bowl.

b. Commercial Prefilter [13] Element Replacement:

CAUTION: NON SEA RECOVERY filter elements do not properly fit, and allow by-passing and suspended solids to enter the R.O. Membrane Element(s), foul them quickly and render them uncleanable. USE ONLY SEA RECOVERY FILTER ELEMENTS. The Sea Recovery Prefilter Element may appear to be similar to commercially available elements. However, Sea Recovery manufactures their own unique filter elements to specific stringent specifications designed to withstand unique Sea Water applications and simultaneously protect the SRC R.O. Membrane Element. Only Sea Recovery filter elements, supplied by Sea Recovery, can be used as replacements.

Open the air release valve on top of the housing. Open the drain valve located near the bottom of the base, if a drain valve is installed. After the water and residue have drained from the housing, unscrew the lid clamp counter clockwise. Lift and remove the lid. Remove the prefilter element and discard it. Clean the assembly with product water and a cloth. Insert a new Sea Recovery supplied Prefilter Element SRC CPFE-AW into the housing. Lubricate sparingly the "O" ring with Parker "O" ring lubricant and replace the lid carefully.

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

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

8. Oil/Water Separator [16] Element Replacement:

CAUTION: NON SEA RECOVERY filter elements do not properly fit, and allow by-passing and suspended solids to enter the R.O. Membrane Element(s), foul them quickly and render them uncleanable. USE ONLY SEA RECOVERY FILTER ELEMENTS. The Sea Recovery Oil/Water Separator Element may appear to be similar to commercially available elements. However, Sea Recovery manufactures their own unique filter elements to specific stringent specifications designed to withstand unique Sea Water applications and simultaneously protect the SRC R.O. Membrane Element. Only Sea Recovery filter elements, supplied by Sea Recovery, can be used as replacements.

Open the air release valve on top of the housing. Open the drain valve located near the bottom of the base, if a drain valve is installed. After the water and residue have drained from the housing, unscrew the lid clamp counter clockwise. Lift and remove the lid. Remove the Oil/Water Separator Element and discard it. Clean the assembly with product water and a cloth. Insert a new Sea Recovery supplied Oil/Water Separator Element SRC OWSE-AW into the housing. Lubricate sparingly the "O" ring with Parker "O" ring lubricant and replace the lid carefully.

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

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

9. **Low Pressure Gauge [18] :** If the pressure gauge fails to register the orifice may be corroded with debris. Use a thin wire to dislodge any debris trapped within the pressure port orifice.

10. **Low Pressure Switch [19]:** The Low Pressure Switch contains one N.O. (Normally Open) contact. As the Booster Pump builds pressure on the Prefiltration Section the Low Pressure Switch closes at 6 PSI (+- 2 psi). After the Low Pressure Switch closes, the system then remains in operation. The Low Pressure Switch opens and shuts the system off, as pressure decreases below 6 PSI (+-2 PSI).

The internal switching mechanism is very sensitive and improper adjustment may damage the switch and render it inoperable. In field, on site, adjustment of the Low Pressure Switch is, therefore, not recommended.

However, if in field adjustment is necessary: Stop the Sea Recovery system. Remove the calibration sealing cap located in the center top of the pressure switch canister to expose the calibration hole and calibration screw. Insert a medium size flat blade screwdriver into the calibration hole. Gently adjust the calibration screw, maximum 1/8 th turn (45 degrees) at a time, clockwise to increase the set point or counter clockwise to decrease the set point as appropriate to adjust the switch. Restart the system and check the Low Pressure Switch setting by slowly closing the Inlet Sea cock Valve while observing the Low Pressure Gauge at the point of shut down. Repeat this procedure as necessary to properly calibrate the switch.

11. **High Pressure Pump [26] refer to page L-23:**

Problem or Failure Signs and possible causes (troubleshooting):

Problem: Pulsations at the low pressure gauge, at the High Pressure Gauge and or at the Brine Discharge Flow Meter:
Possible Cause: Worn or broken Valve. Worn or broken Valve Spring, Worn or Broken Valve Seat. Debris in Valve Chamber. Check Valve Chambers for debris and inspect Valves. Replace Valve assemblies as necessary

Problem: Water Leak between the High Pressure Pump Manifold and Rear Crankcase Section.
Possible Cause: Worn Seals or Seals damaged due to running dry. Inspect Seals and change if necessary.

Problem: Normal flow when not pressurized but flow drops dramatically when attempting to pressurize and there is no flow at the Product Flow Meter.
Possible Cause: Worn Seals or Seals damaged due to running dry, broken Valve, Broken Valve Spring or debris in Valve Chamber. Check Seals and Valve Chambers.

TORQUE SPECIFICATIONS:

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

High Pressure Pump Drive End Disassembly for Servicing & Trouble Shooting

a. **Servicing The Valves:**

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

1) Only one valve kit is required to repair all of the valves in one pump. The Valve Kit (SRC HPP VK 4.2/SS) includes new valve o-rings, valve seats, valves, springs, and cages, all preassembled.

2) All of the inlet and discharge valves can be serviced without disrupting the inlet or discharge plumbing.

3) To service any valve, remove the valve plug.

4) Examine the valve plug O-rings and replace them if there is any evidence of cuts, abrasions or distortion.

5) Remove the valve assemblies (cage, spring & valve seat) by pushing the valve cage in any direction to unseat it then lift the valve cage assembly out with needle noise pliers.

6) Clean the Valve Seat Chamber of all debris, deposit build up and corrosion.

7) Inspect the manifold for wear or damage.

8) Insert a new valve assembly and squarely push it into place in the valve cavity.

9) Replace the valve plug and tighten it to the proper torque specification.

b. Removing The Manifold & Seals:

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

1) Remove the manifold bolts and locking washers

2) To separate the manifold from the crankcase, grasp the manifold with both hands and pull **straight** off. **Do Not** apply any side, upward, or downward pressure on the manifold, this damages the plungers.

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

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

4) Thoroughly clean the seal cavity of all corrosion, debris or accumulation.

5) Inspect the seal cavity for any signs of damage, cavitation, erosion or etching.

c. Packing Installation:

Tools Required: Seal Insertion Tool

1) Ensure that the seal cavities are clean and dry. Do Not use any lubricant.

2) Place a seal insertion tool in the seal cavity, and place one high pressure seal squarely into the tool. The high pressure seal consists of two pieces, the inner seal and the outer retainer. These parts are fragile so handle them with care.

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

3) Install the o-ring in the outside groove on the low pressure seal retainer. Next, install the low pressure seal into the retainer with the closed portion of the seal being placed into the retainer, and push into place. Install the entire housing into the seal cavity with the seal opening in first.

4) Finally, install the seal retainer with the smooth side against the low pressure seal retainer. The manifold is now fitted with new seals.

d. Plunger Inspection and removal:

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

1) Inspect the plunger for any sign of damage (Surface scuffing/ scoring, cracks, or pitting). The surface must be absolutely smooth.

2) Remove the plunger retaining nut and stainless steel washer (Note: This is the only area in the pump where a thread locker is used. The washer may be stuck to the plunger. Use the o-ring pick to clean off the thread locker and free the washer.

3) To remove the plunger twist either direction and pull straight off. DO NOT use any type of pliers or metal tools on the plunger as they are ceramic and can be damaged easily. Inspect the plunger again for any sign of damage, also look into the bore of the plunger for any sign of rust Rust here indicates that the plunger retainer o-rings have failed, allowing water to leak between the manifold and crankcase and allowing for water to enter the crankcase section. Check the Crankcase Section for signs of water intrusion.

4) Remove the plunger o-ring and anti-extrusion ring (Note: The anti-extrusion ring is cut at an angle) with the o-ring pick. Once these are off, remove the slinger using needle nose pliers.

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

e. Plunger Installation:

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

1) Clean the old thread lock off the plunger rods. Note: Do Not use assembly lubricant.

2) Push the new slingers into place at the bottom of the plunger rods.

3) Carefully slide the new o-ring into the groove on the plunger rods

4) Slide the anti-extrusion ring into the groove behind the o-rings

5) Push the plungers on to the rods with a twisting motion until they are seated completely on the rods.

6) Place a new washer on the rod and apply a small amount of thread locker. Install the plunger retaining nut and torque to specification.

f. Manifold Installation:

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

1) Place the manifold squarely on the plungers and push with even tension until the manifold is seated against the crankcase (Note: Do Not use any assembly lubricant. If the manifold is hard to seat, tap lightly with a soft faced hammer making sure that the manifold is moving evenly.)

2) Replace the manifold bolts and washers. Torque to specification.

Torque sequence for tightening the manifold:

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

g. Drive End (Crankcase Section) Disassembly:

Tools Required: 3/8" Drive Ratchet; 5mm Hex Socket; 8mm Socket; 1/2 X 6 Brass Punch; 10 X 1.50 X 40mm Bolt; #1 Flat Blade Screw Driver; Needle Nose Pliers; Ball Peen Hammer; Soft Paced Hammer; Crankshaft Oil Seal Installation Tool; Plunger Rod Oil Seal Installation Tool; Bearing Removal and Installation Tool

1) Remove the manifold, plungers, and slingers (see previous instructions)

2) Drain the oil

3) Remove the drive side mounting flange

4) Remove the rear crankcase cover

5) Remove the non-drive side cover plate

6) Remove the non-drive side cover by inserting o-ring picks into the o-ring groove (Place one on each side)

7) Using an 8mm socket remove the crankshaft bushing bolt and washer (Note: The crankshaft must be wedged to keep from turning)

8) Screw a 10 X 1.50 mm bolt into the crankshaft bushing and tighten until the crankshaft separates from the bushing. The Crankshaft oil seal is pushed out. At this point the crankshaft may be removed.

9) Remove the connecting and plunger rods by pulling straight back (Note: Make sure to keep each rod in order. Mark the top of the rod and location). To separate the plunger rod from the connecting rod push out the rod pin.

NOTE: DO NOT remove the bearings if you are only changing the plunger rod.

10) Remove the non-drive side bearing and bushing, set the bearing removal tool on the bearing inside the crankcase and drive it out using a punch and hammer. Set the bearing in a partially open vise, install a 10 X 1.50 mm bolt and drive out the bushing by tapping the bolt.

11) To remove the drive side bearing first remove the spring steel retaining clip by popping it out of the seating groove with the o-ring pick. (Note: Partially cover the opening with one hand in order to keep the clip from flying out). Place the bearing removal tool on the bearing inside the crankcase and drive it out using a punch and hammer.

12) The final items in the crankcase are the plunger rod oil seals. Stand the crankcase on end and slide a #1 flat head screw driver under the oil seal lip, push down on the screwdriver and the seal pops out.

h. Drive End Assembly:

Tools Required: 3/8" Drive Ratchet; 5mm Hex Socket; 8mm Socket; 1/2 X 6 Brass Punch; 10 X 1.50 X 40mm Bolt; #1 Flat Blade Screw Driver; "O" Ring Picks; Torque Wrench; Needle Nose Pliers; Ball Peen Hammer; Soft Faced Hammer; Crankshaft Oil Seal Installation Tool; Plunger Rod Oil Seal Installation Tool; Bearing Removal and Installation Tool; Medium Strength Thread Locker; Plunger Rod Oil Seal Insertion Tool

1) Place the plunger rod oil seal squarely into position with the garder spring pointed toward the crankcase. Place the oil seal insertion tool on the oil seal and seat.

2) Install the drive side bearing. Squarely set the bearing into position. Set the bearing insertion tool on the bearing and drive it into position (The bearing should rest on the bottom shoulder of the crankcase).

3) Install the crankshaft bushing into the non-drive side bearing (take care to not damage the bore where the crankshaft fits). Install the non-drive side bearing into the crankcase. Place the bearing installation tool on the squarely seated bearing and drive into position (The bearing should be resting on the bottom shoulder of the crankcase.)

4) Install the connecting/plunger rods (lightly lubricate the plunger rods with oil), replace the rod assemblies in the same location and direction they were originally removed from. (Make sure there are no burrs on the end of the plunger rods that would damage the oil seal).

When installing the rod you meet some resistance at the oil seals, slightly twist the rod from side to side and push gently (This way you do not dislodge the garder spring in the seal).

5) Now install the crankshaft (lightly lubricate the wrist pin drive side bearing and crankshaft). Carefully slide the crankshaft through the bearing and connecting rods (Note: work the rods back and forth while turning the crankshaft to achieve proper alignment). The crankshaft stops as soon as it reaches the bushing in the other bearing. At this point the bearing tool should be stood up on that side on a hard smooth surface. Make sure that everything is aligned. Place the punch in the hollow portion of the crankshaft and drive the crankshaft into the bushing. (Note: After each hit make sure the connecting rods are not binding, if they are and you continue a rod may be damaged. The crankshaft is properly seated when the searing portion of the shaft is just below the snap ring groove.

6) Next install the bearing snap ring (Note: It must be installed so the steepest corner of the snap ring is at 90 degrees to the groove), make sure that it is fully set into position.

7) Install the crankshaft bearing bushing bolt and washer. Apply a medium strength thread locker and torque to specifications.

8) The oil seal must now be installed. Seat it squarely in position on the shaft and seat it flush with the crankcase.

9) Replace the o-ring on the non-drive cover. Lightly lubricate and push the cover into place (It should be flush with the crankcase). Install the side cover plate and torque to specification

10) Replace the rear cover. Ensure the gasket is in good condition and properly seated on the cover. Torque to specifications.

11) The motor adapter flange is the last piece to be installed and torqued to specifications.

12) Turn the pump crankshaft by hand, ensure that it turns free and smooth

13) Fill the crankcase to the top of the sight glass with SRC Pump Oil (SRC PO).

14) Finish assembling the wet end of the pump according to the previous instructions.

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

13. **High Pressure Hose [27 & 30]:** The High Pressure Hoses have no adjustment or repairable parts. Refer to page L-26 for an exploded parts view of the High Pressure Hoses. For removal and replacement of a High Pressure Hose continue here.

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

b. **Replacement:** When replacing a High Pressure Hose use two open end wrenches. Hold the male flare fitting with one wrench while tightening the female flare swivel nut clock wise. Snug finger tight then, with the open end wrench, tighten 1/4 turn (90˚) to obtain a "metal-on-metal" seal. Never use Teflon tape or pipe sealant on the flare surface or on the swivel nut threads. ***CAUTION: Do Not over tighten the female swivel nut as over tightening cracks the female swivel nut.***

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

a. **Removal of the Reverse Osmosis Membrane Element:** ***NOTE:*** It is highly recommended to replace all "O" rings within the High Pressure Vessel assembly each time the Reverse Osmosis Membrane Element is removed or replaced. Each single High Pressure Vessel assembly contains a total of 6 "O" rings (4 each Brine "O" rings and 2 each Product Water "O" rings). Ensure that you have these "O" rings on hand prior to removing End Plugs from the High Pressure Vessel. If your system has one High Pressure Vessel, one set of 6 "O" rings is needed; if your system has two High Pressure Vessels two sets of 6 "O" rings are needed.

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

Disconnect the High Pressure Hose from both the inlet and discharge end of the High Pressure Vessel Assembly. When removing these Hoses, use two open end wrenches. Hold the male flare fitting with one wrench while loosening the female flare swivel nut counter clock wise.

Disconnect the Plastic Product Water Tube from the Product Port Fitting. Unscrew the hex nut counter clock wise. Pull the Plastic Product Water Tube (with hex nut, grab ring, spacer and O-ring attached) away from the Tube Fitting body.

Using a 5/16 inch Hex allen wrench remove the 3 (six) each Socket Head Cap Screws from the three piece Segment Ring located at the end of the Pressure Vessel.

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

Remove the Port Retainer.

Remove the High Pressure Port.

Unscrew the Product water port.

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

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

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

This outside diameter surface of the Product Water Tube must be scratch free. Never use pliers or other grabbing tools on or near the Reverse Osmosis Membrane Element Product Water Tube.

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

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

b. Inspection and "O" ring replacement: Inspect each End Plug assembly and it's High Pressure Fittings for signs of wear. A High Pressure Fitting that has leaked or shows signs of wear, deformation, stress or cracking must be replaced. Inspect the "O" rings in the High Pressure Port fittings and replace them if they show signs of cuts, cracking, wear, or deformation.

Remove the 2 Brine "O" rings and one Product Water "O" ring from all End Plugs removed from the High Pressure Vessel.

Clean the end plugs with a cloth and sparingly lubricate 2 new Brine "O" rings and one new Product Water "O" ring with Parker "O" ring lubricant. Place them onto the End Plug.

c. Replacement of the Reverse Osmosis Membrane Element: A new Sea Recovery Reverse Osmosis Membrane Element comes from complete with a "U" cup Brine Seal at one end of the Element. This Brine Seal must be at the inlet end of the High Pressure Vessel. Refer to the Cross Sectional View on page C-5 of this manual.

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

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

Ensure that the Ports of the End Plug are aligned with the Port Holes of the High Pressure Vessel.

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

Replace the Port Retainer.

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

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

Reconnect the Plastic Product Water Tube (with hex nut, grab ring, spacer and O-ring attached) to the Tube Fitting body. Screw the hex nut clock wise finger tight.

Connect the High Pressure Hose to both the leading end and discharge end of the High Pressure Vessel Assembly. Use two open end wrenches. Hold the male flare fitting with one wrench while tightening the female flare swivel nut clockwise finger tight then a final 1/4 (90°) turn with the wrenches. Do not over tighten or the female swivel nut cracks.

15. **High Pressure Switch [32]:** The High Pressure Switch contains one N.C. (Normally Closed) contact. The High Pressure switch remains closed and keeps the system in operation when the high pressure is below 950 PSI (±50 PSI). When the high pressure reaches 950 PSI (±50 PSI) the High Pressure Switch opens and the System is shut off.

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

If adjustment is absolutely necessary: Open fully the Back Pressure Regulator [33]. Start the Sea Recovery system. Remove the calibration sealing cap located in the center top of the pressure switch to expose the calibration screw. Insert a 3/16" hex wrench into the calibration screw. Gently adjust the calibration screw, maximum 1/8 th turn (45 degrees) at a time, clockwise to increase and counter clockwise to decrease as appropriate.

Slowly adjust the Back Pressure Regulator Valve

clockwise to increase operating pressure while observing the High Pressure Gauge. The High Pressure Switch should stop the system at 950 PSI (+- 50 PSI). If the system shuts off below 900 PSI or above 1000 PSI, then repeat the adjustment procedure and retest the set point.

Once the High Pressure Switch is properly set replace the adjustment screw cover.

16. **High Pressure Gauge [31] :** If the pressure gauge fails to register, the orifice may be corroded with debris. Use a thin wire to dislodge debris trapped in the orifice.

17. **Back Pressure Regulator [33] :** The Back Pressure Regulator Stem and Packings are replaceable. If the Back Pressure Regulator does not achieve full system pressure, it is due to a worn Valve Stem. If the Back Pressure Regulator leaks from the Valve Stem area then the packings are lose or worn. If a leak develops tighten the Valve Packing Nut 1/8 th turn at a time. If this adjustment fails to stop the leak, replace the packings.

When replacing the Valve Stem or Valve Stem Packings, check the Valve Stem and Valve Stem Packing Seat within the Valve Body for signs of wear, pitting or abrasion. The Valve Stem must be smooth in order for the new packings to properly seal. The Valve Stem Packing Seat must also be smooth in order for the new packings to properly seat and seal.

18. **Flow Meter [34 & 42]:** Since the flow meter body is clear, light penetrates it and supports biological growth. To clean the flow meter body, remove the top access fitting, the guide rod, float and O-ring bumpers and tube stops. clean the interior of the tube using a bottle brush, soft rag, cotton swab or other soft item. Reassemble the unit.

19. **Salinity probe [41]:** The salinity probe requires cleaning once a year. To clean the probe, disconnect the three electrical salinity probe leads from the controller. Unscrew, counter clockwise, the probe from it's tee housing. Using a soft bristle brush scrub the monel probes to remove any built up debris. Remove all old Teflon tape from the male pipe threads of the Salinity Probe and clean the threads of debris.

Place 4 wraps of new Teflon tape to the male threads. Replace the probe assembly hand tight only, do not use a wrench to tighten, and reconnect the electrical wires.

20. **Charcoal Filter [44]:** A sulfurous (rotten egg) smell from the product water requires replacement of the Charcoal Element. The Charcoal Element should be replaced every 3 to 4 months. It is not cleanable.

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

Wipe the "O" ring with a damp cloth and lubricate it sparingly with Parker "O" ring lubricant and place the "O" ring back into the bowl. Rinse a new SRC CFE Charcoal Filter Element with fresh water to remove the Carbon Fines from the Element. Insert it into the bowl. Screw the bowl on clockwise. Hand tighten only enough to seat the "O" ring.

CAUTION: If the "O" ring is missing, not properly seated or if the bowl is over tightened water leaks from the bowl.

21. **Ultraviolet Sterilizer [45]:** Maintenance of the U.V. Sterilizer consists of lamp replacement and quartz sleeve cleaning. Replace the lamp every 2,000 hours for intermittent System use, or every 4,000 hours if the System is used continuously, or if the lamp fails to start, whichever comes first. The lamp becomes progressively weaker over time, so it may be ineffective although it still is emitting light.

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

Disassembly: Remove the three 1/4-20 cap head screws from the Top end (ballast end with electrical cover) of the unit. With your hand, grasp the Top End Plug and pull outward from the vessel. CAUTION: The Quartz tube and Lamp may either stay in the vessel or remain attached to the Top End Plug. Do Not allow the fragile Quartz Tube or Lamp to strike the vessel.

The Quartz Tube is cleaned with water and a bottle brush or soft cloth.

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

22. **Salinity Controller [55]:** The salinity controller does not require any routine maintenance. However, the PCB does have a calibration feature that allows adjustment of the following:

Booster Pump Delay	3-Way Valve Trip Point
Salinity Probe	FWF Duration

Adjustment Procedures: The controller circuit board provides built-in calibration features. To enter the calibration mode, move the Normal/Calibration slide switch from NORMAL to CAL and press the reset switch momentarily. The controller moves into the calibration mode.

a.) **Salinity Probe Calibration:** Press the START switch on the touch pad to proceed to Salinity Probe calibration mode. The LED meter indicates Salinity Level.

1. Adjust SALINITY METER pot to have a full scale illumination (red LED flickering on and off).

2. This is 1000 ppm calibration. Each LED lamp represents 100 ppm.

3. Press STOP to set the Salinity meter and exit Salinity Meter calibration mode.

b.) **Three-Way Valve Trip Point Calibration:** Press the FEED PUMP switch to proceed to the 3-Way Valve Trip Point calibration mode. The LED meter indicates Salinity Level at which the 3-Way Valve diverts product water to the "good" position. Each LED represents 100ppm.

1. Adjust 3-WAY TRIP POINT pot for full scale illumination (red lamp flickering).

2. The default setting for the 3-way valve is 1000 ppm.

3. Press STOP switch to exit the 3-Way Valve Trip Point calibration mode.

c.) **Booster Pump Delay Calibration:** Press the BOOSTER PUMP switch to proceed to Booster Pump delay calibration mode. Each LED represents approximately 2 seconds.

1. Adjust BOOSTER PUMP DELAY pot for desired booster pump operational duration before the High pressure pump activates. The default setting is 5 seconds and is set at the factory.

2. Press STOP to exit the Booster Pump delay calibration mode.

d.) **Fresh Water Flush Duration Setting:** To enter FWF duration calibration mode, press the FRESH FLUSH switch. The default setting is 10 minutes.

1. Adjust FWF DELAY pot to obtain desired FWF duration. Each LED represents approximately 2 minutes.

2. Press STOP to exit the FWF duration calibration mode.

The individual calibration procedures may be done in any order. The CALIBRATION mode may be exited at any time.

To exit the CALIBRATION mode, return the slide switch to NORMAL, then press the reset switch. This completes the adjustments on the controller and system is in normal operation mode.

MEMBRANE VESSEL ASSY (MVA) UPGRADE INSTALLATION INSTRUCTIONS

The following instructions assist the installer in increasing the capacity of the AquaWhisper 400-1, 600-1, or 800-1 systems by adding an additional reverse osmosis membrane.

PLEASE NOTE: The numbers in (parenthesis) refer to the components on page L-30, for those in [brackets] refer to Page L-28. The following tools are required:

1. 5/32" & 3/16" Allen keys
2. Silicone O-ring Lubricant
3. 2 Adjustable Wrenches
4. Needle-nose pliers

INSTALLATION STEPS:

1. Remove the blue high pressure hose leading from the ***OUTLET*** of the original membrane vessel to the back pressure regulator manifold.(This hose may be reused in Modular systems or Compact/Frame systems with remote mounted membranes. For systems with rear mounted MVA rack, refer to page L-26 for the correct upper hose.) When systems have remotely mounted membrane vessel racks, the rack must be removed from the bulkhead. Compact and Frame systems have access holes allowing the MVA upgrade to be mounted with the MVA rack attached to the frame.

2. Remove the socket cap screws [15] from the ***OUTLET*** end plug of the original membrane. Remove the segment ring [14] to expose port retainer [13]. Remove the port retainer. Slowly remove the HP nipple [8 & 9] as it is no longer used.

3. Remove the gray shipping plug from the MVA Upgrade and drain the storage chemical.

4. Locate the MVA interconnect (14) from the MVA Upgrade kit. Lubricate the two O-rings on each side with a moderate amount of O-ring lubricant. Insert the MVA interconnect into the ***INLET*** port of the MVA Upgrade. This interconnect may seem difficult to insert but if properly aligned should slide in easily. ***Forcing the interconnect when inserting causes O-ring damage and leakage.***

5. Reinsert the port retainer into the ***INLET*** end plug of the MVA Upgrade. Replace the segment ring (15) and socket cap screws (16) to secure the MVA interconnect.

6. Place the MVA Upgrade firmly against the MVA rack, whether it is on the rear of the AquaWhisper system or on a flat, level surface. Orient the MVA Upgrade so that the interconnect MVA inserts into the ***OUTLET*** port of the original MVA.

7. Insert the interconnect into the ***OUTLET*** port of the original MVA. Again, use care so that no "O" rings are damaged. Support the MVA upgrade using the MVA brackets (17).

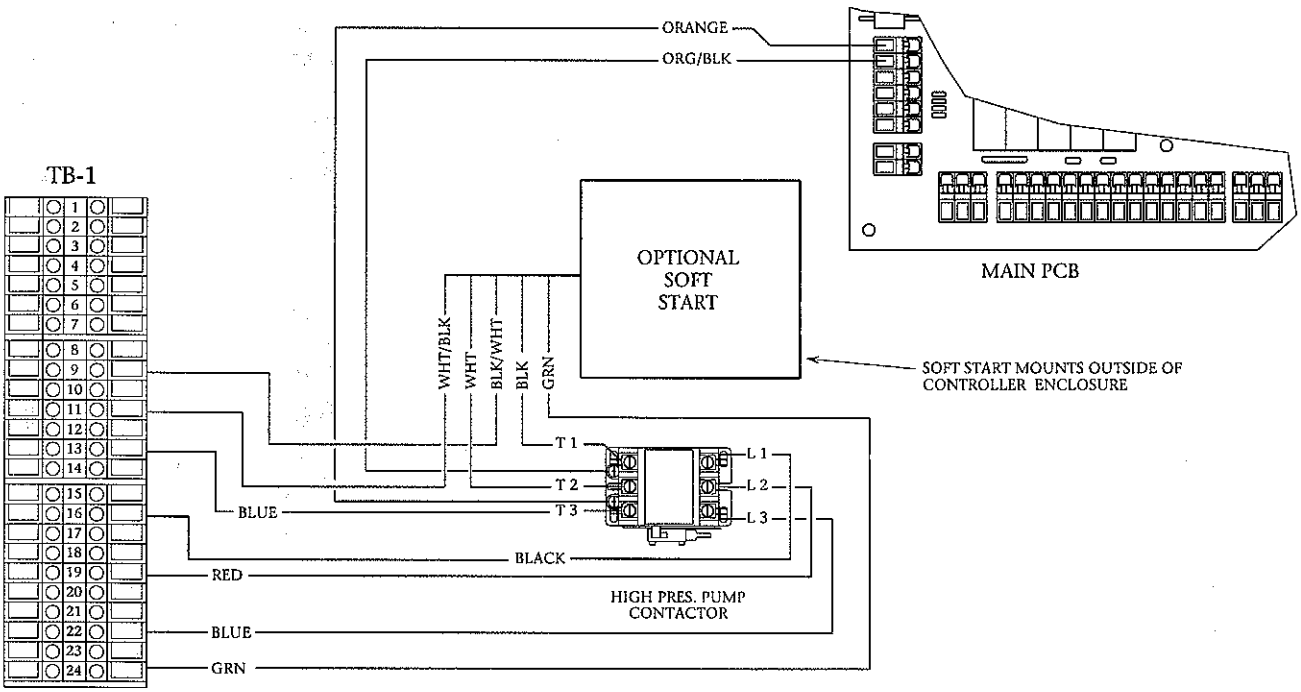
8. Align the MVA upgrade and secure by fastening the MVA bracket to the MVA rack using the allen flat screws (18). After the MVA is secured, reinstall the port retainer removed in Step 2. Reinstall the segment ring on this same end plug.

9. Remove the shipping cap from the ***OUTLET*** port of the MVA Upgrade. Install the correct high pressure hose from this outlet to the high pressure manifold. **Do not bend the high pressure hose smaller than a radius of 5 inches.**

10. Remove the product outlet shipping plug on the MVA Upgrade. Use care in removing this plug so that the metal grab ring and O-ring are not damaged. Now replace the 1/4" plug in the system product tee with the connector (19) fitting. Connect the product hose (12) from the MVA Upgrade product outlet to the product tee, shown on page L-34.

CONGRATULATIONS! The AquaWhisper system now produces up to double its previous capacity. Ensure there are no leaks and leave the watermaking to Sea Recovery!

Sea Recovery Soft Start Electrical Diagram



<u>Installation Steps for Motor Soft Start #B607400001</u> (When ordered Separate from System)

1. Disconnect input power from watermaker (System Off lamp on Touch Pad should be off)
2. Open controller Lid after source power is removed.
3. Connect the Motor Soft Start wires as shown above.

NOTES:

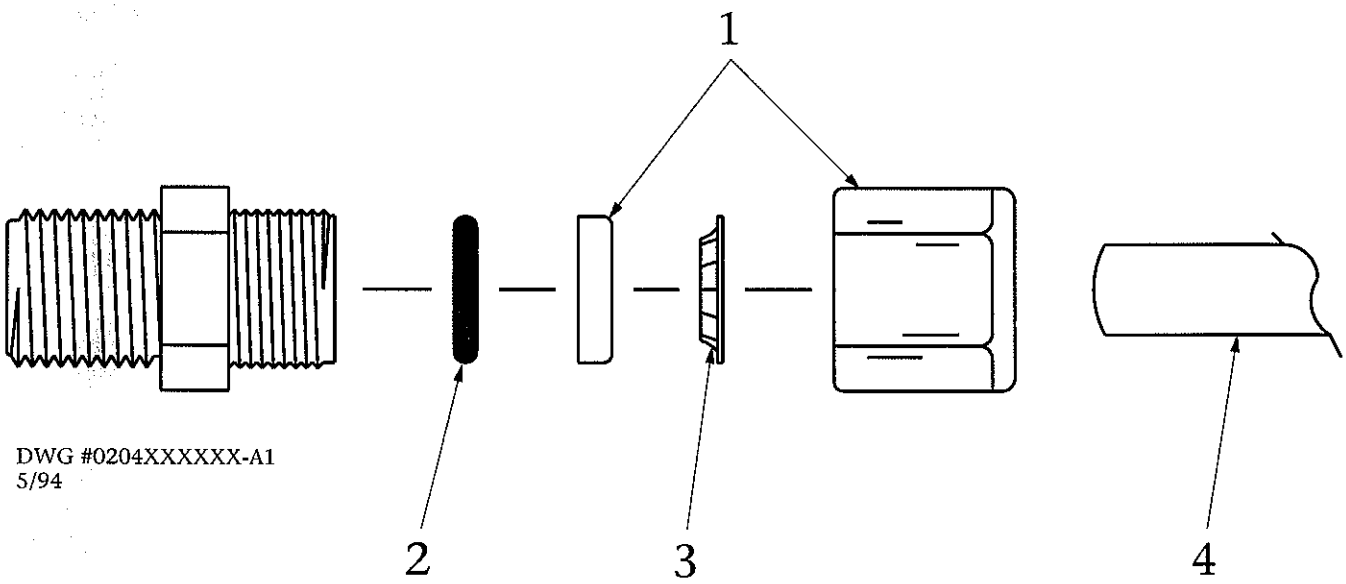
Sea Recovery
REVERSE OSMOSIS DESALINATORS®

SECTION L

Exploded Parts Views With Description & Part Numbers

NOTES:

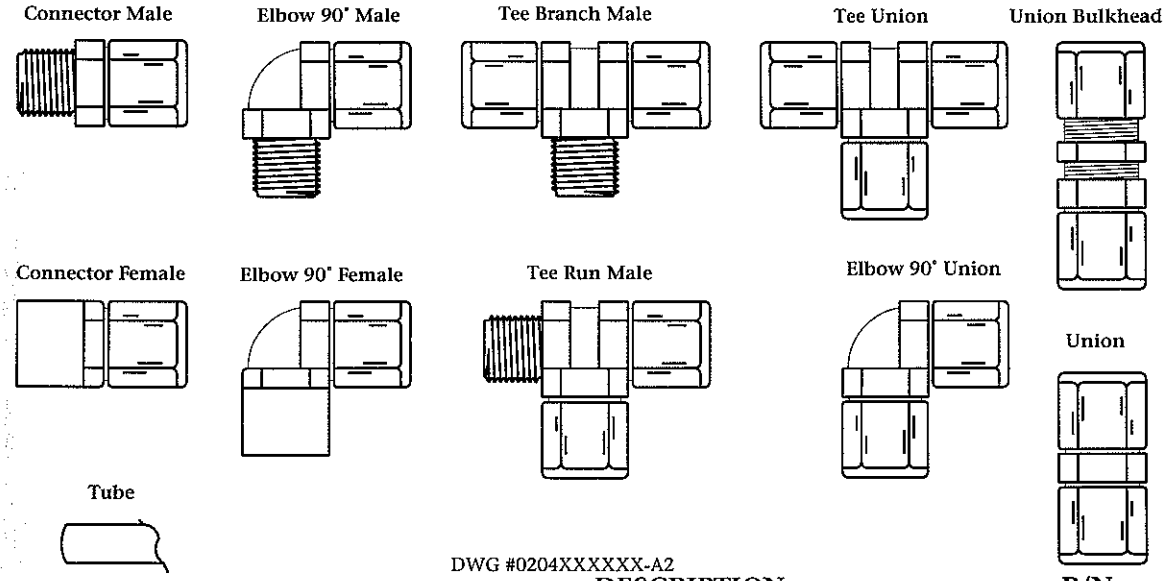
THERMAL PLASTIC FAST-N-TITE TUBE COMPRESSION FITTINGS REPLACEMENT PARTS



DWG #0204XXXXXX-A1
5/94

ITEM	DESCRIPTION	PART NUMBER
FOR 1/4" O.D. TUBE		
1	NUT & SPACER, 1/4" TUBE	0204380869
2	O-RING, 1/4" TUBE	2614011369
3	GRAB RING, 1/4" TUBE	0204360869
4	TUBING, 1/4" O.D., BLACK	0312121969
FOR 3/8" O.D. TUBE		
1	NUT & SPACER, 3/8" TUBE	0204381869
2	O-RING, 3/8" TUBE	2614011569
3	GRAB RING, 3/8" TUBE	0204361869
4	TUBING, 3/8" O.D., BLACK	0312123569
FOR 1/2" O.D. TUBE		
1	NUT & SPACER, 1/2" TUBE	0204382569
2	O-RING, 1/2" TUBE	2614011669
3	GRAB RING, 1/2" TUBE	0204362569
4	TUBING, 1/2" O.D., BLACK	0312124269
FOR 5/8" O.D. TUBE		
1	NUT & SPACER, 5/8" TUBE	0204383069
2	O-RING, 5/8" TUBE	2614011769
3	GRAB RING, 5/8" TUBE	0204363069
4	TUBING, 5/8" O.D., BLACK	0305125169

AVAILABLE THERMAL PLASTIC FAST-N-TITE TUBE COMPRESSION FITTINGS



DWG #0204XXXXXX-A2

DESCRIPTION	P/N
Connector Male	
1/4 inch tube x 1/8 inch mnpt	0204090669
1/4 inch tube x 1/4 inch mnpt	0204090869
3/8 inch tube x 1/8 inch mnpt	0204091669
3/8 inch tube x 1/4 inch mnpt	0204091769
3/8 inch tube x 3/8 inch mnpt	0204091869
3/8 inch tube x 1/2 inch mnpt	0204091969
3/8 inch tube x 3/4 inch mnpt	0204092069
1/2 inch tube x 1/8 inch mnpt	0204092269
1/2 inch tube x 1/4 inch mnpt	0204092369
1/2 inch tube x 3/8 inch mnpt	0204092469
1/2 inch tube x 1/2 inch mnpt	0204092569
1/2 inch tube x 3/4 inch mnpt	0204092669
5/8 inch tube x 1/8 inch mnpt	0204099069
5/8 inch tube x 1/4 inch mnpt	0204099169
5/8 inch tube x 3/8 inch mnpt	0204092869
5/8 inch tube x 1/2 inch mnpt	0204092969
5/8 inch tube x 3/4 inch mnpt	0204093169
Connector Female	
1/4 inch tube x 1/8 inch fnpt	0204120669
1/4 inch tube x 1/4 inch fnpt	0204120869
3/8 inch tube x 1/4 inch fnpt	0204121769
3/8 inch tube x 3/8 inch fnpt	0204121869
3/8 inch tube x 1/2 inch fnpt	0204121969
1/2 inch tube x 1/2 inch fnpt	0204122569
1/2 inch tube x 3/4 inch fnpt	0204122669
5/8 inch tube x 1/2 inch fnpt	0204122969

DESCRIPTION	P/N
Elbow 90° Male	
1/4 inch tube x 1/8 inch mnpt	0204020669
1/4 inch tube x 1/4 inch mnpt	0204020869
1/4 inch tube x 3/8 inch mnpt	0204020969
3/8 inch tube x 1/4 inch mnpt	0204021769
3/8 inch tube x 3/8 inch mnpt	0204021869
3/8 inch tube x 1/2 inch mnpt	0204021969
3/8 inch tube x 3/4 inch mnpt	0204022069
1/2 inch tube x 3/8 inch mnpt	0204022469
1/2 inch tube x 1/2 inch mnpt	0204022569
5/8 inch tube x 1/2 inch mnpt	0204022969
Elbow 90° Female	
1/4 inch tube x 1/8 inch fnpt	0204010669
1/4 inch tube x 1/4 inch fnpt	0204010869
3/8 inch tube x 1/4 inch fnpt	0204011769
3/8 inch tube x 3/8 inch fnpt	0204011869
1/2 inch tube x 3/8 inch fnpt	0204012469
1/2 inch tube x 1/2 inch fnpt	0204012569
5/8 inch tube x 1/2 inch fnpt	0204012969
Branch Tee Male	
1/4 inch tube x 1/8 inch mnpt	0204150669
3/8 inch tube x 1/4 inch mnpt	0204151769
1/2 inch tube x 3/8 inch mnpt	0204152469
5/8 inch tube x 1/2 inch mnpt	0204152969

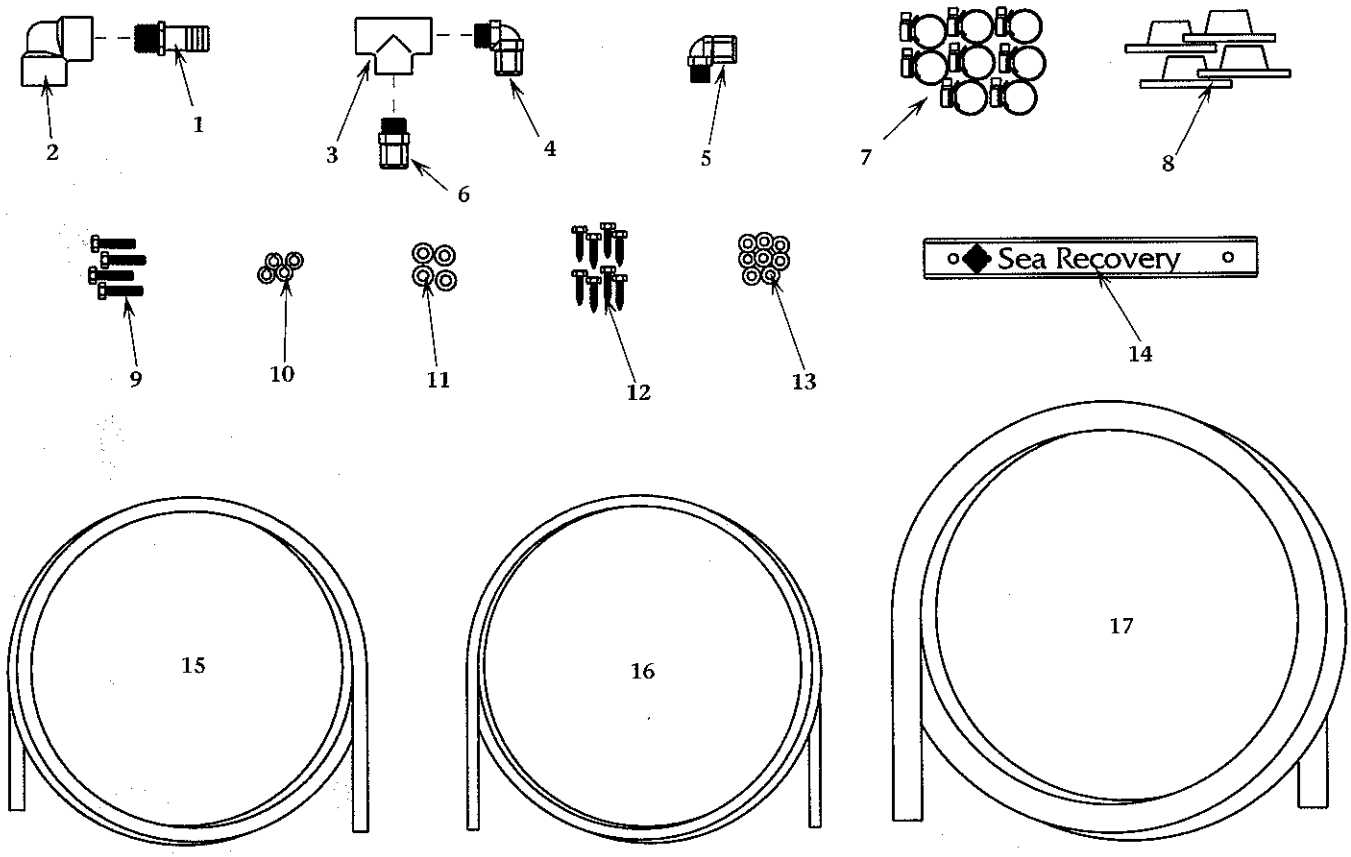
Continued on page L-5

AVAILABLE THERMAL PLASTIC FAST-N-TITE TUBE COMPRESSION FITTINGS CONTINUED

DESCRIPTION	P/N
Run Tee Male	
1/4 inch tube x 1/8 inch mnpt	0204170669
1/4 inch tube x 1/4 inch mnpt	0204170869
3/8 inch tube x 1/4 inch mnpt	0204171769
3/8 inch tube x 3/8 inch mnpt	0204171869
1/2 inch tube x 3/8 inch mnpt	0204172469
1/2 inch tube x 1/2 inch mnpt	0204172569
5/8 inch tube x 1/2 inch mnpt	0204172969
Union Tee	
1/4 inch tube	0204240869
3/8 inch tube	0204241869
1/2 inch tube x 3/8 inch tube	0204242469
1/2 inch tube	0204242569
5/8 inch tube x 3/8 inch tube	0204242869
5/8 inch tube	0204243069
Union	
1/4 inch tube	0204210869
3/8 inch tube x 1/4 inch tube	0204211769
3/8 inch tube	0204211869
1/2 inch tube x 3/8 inch tube	0204212469
1/2 inch tube	0204212569
5/8 inch tube x 3/8 inch tube	0204212869
5/8 inch tube x 1/2 inch tube	0204212969
5/8 inch tube	0204213069
Union Elbow 90°	
1/4 inch tube	0204220869
3/8 inch tube x 1/4 inch tube	0204221769
3/8 inch tube	0204221869
1/2 inch tube	0204222569
5/8 inch tube	0204223069
Union Bulkhead	
1/4 inch tube	0204270869
3/8 inch tube	0204271869
1/2 inch tube	0204272569
Tube	
1/4 inch tube Black Nylon	0312121969
3/8 inch tube Black Nylon	0312123569
1/2 inch tube Black Nylon	0312124269
5/8 inch tube Black Polypropylene	0305125169

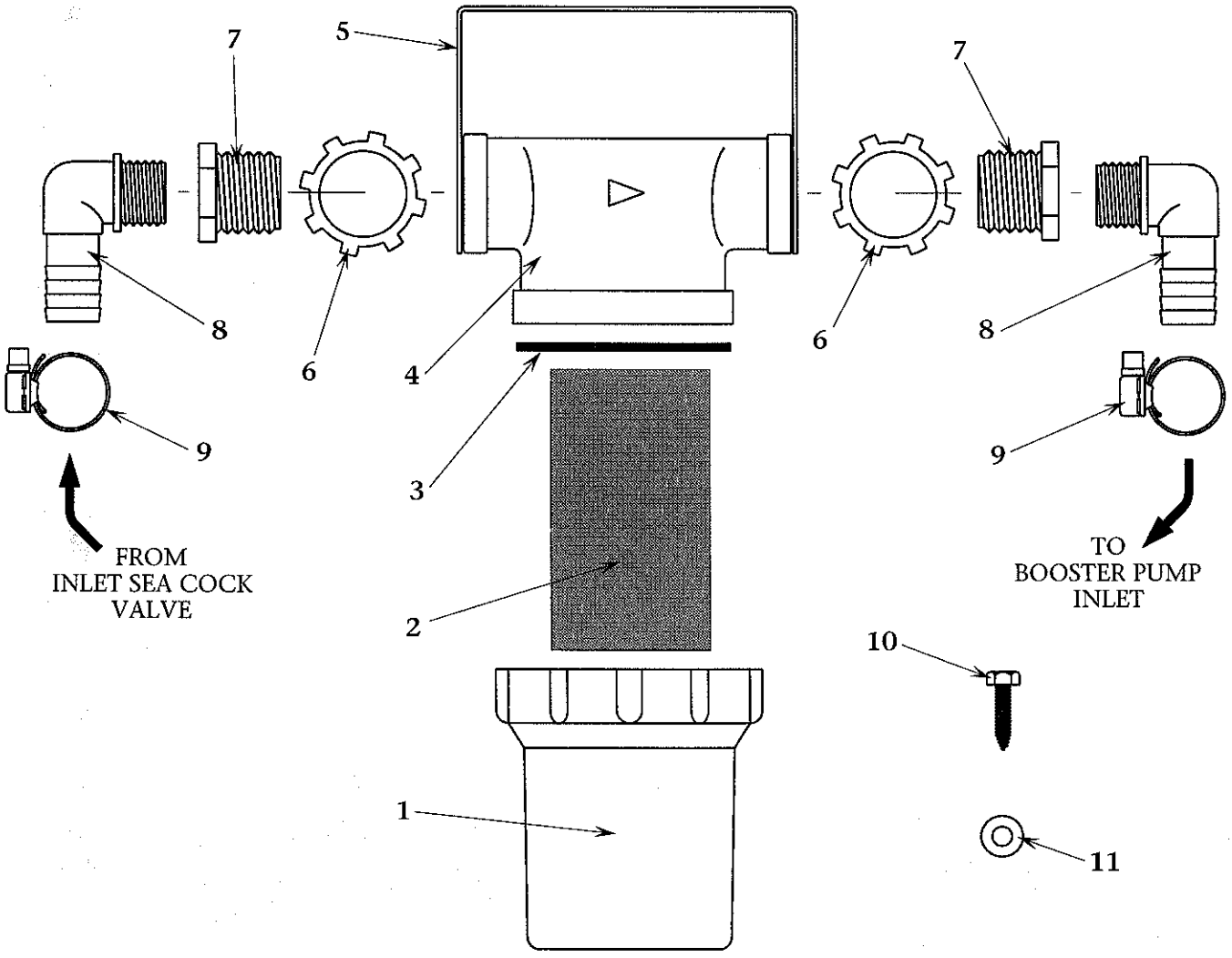
B001800001 INSTALLATION KIT AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-17	B001800001	INSTALLATION KIT AquaWhisper	1
1	0101653783	ADAPTER 3/4" MT x 3/4" BARB PVC	1
2	0101013783	ELBOW 90° 3/4" FT x 3/4" FT PVC	1
3	0101422583	TEE 1/2" FT x 1/2" FT x 1/2" FT PVC	1
4	0204022569	ELBOW MALE 90° 1/2" x 1/2" TUBE PLASTIC	1
5	0204021869	ELBOW MALE 90° 3/8" x 3/8" TUBE PLASTIC	1
6	0204092569	CONNECTOR MALE 1/2" MT x 1/2" TUBE PLASTIC	1
7	05181434AA	HOSE CLAMP 3/4" SS	8
8	2115030120	RUBBER MOUNT RM-55 AQUA SERIES	4
9	061142150020	BOLT HEX 5/16-18 x 1 1/4" SS	4
10	061120049000	WASHER SPLIT LOCK 5/16" SS	4
11	061100049000	WASHER FLAT OS 5/16" SS	4
12	061172143016	SCREW HEX TYPE "A" 1/4" x 1" SS	8
13	061100043000	WASHER FLAT OS 1/4" SS	8
14	B651870001	OWNERS MANUAL AquaWhisper SERIES	1
15	0312124269	TUBE 1/2" BLACK PER FOOT	20
16	0312123569	TUBE 3/8" BLACK PER FOOT	50
17	0328066666	HOSE CLEAR BRAID 3/4" PER FOOT	12



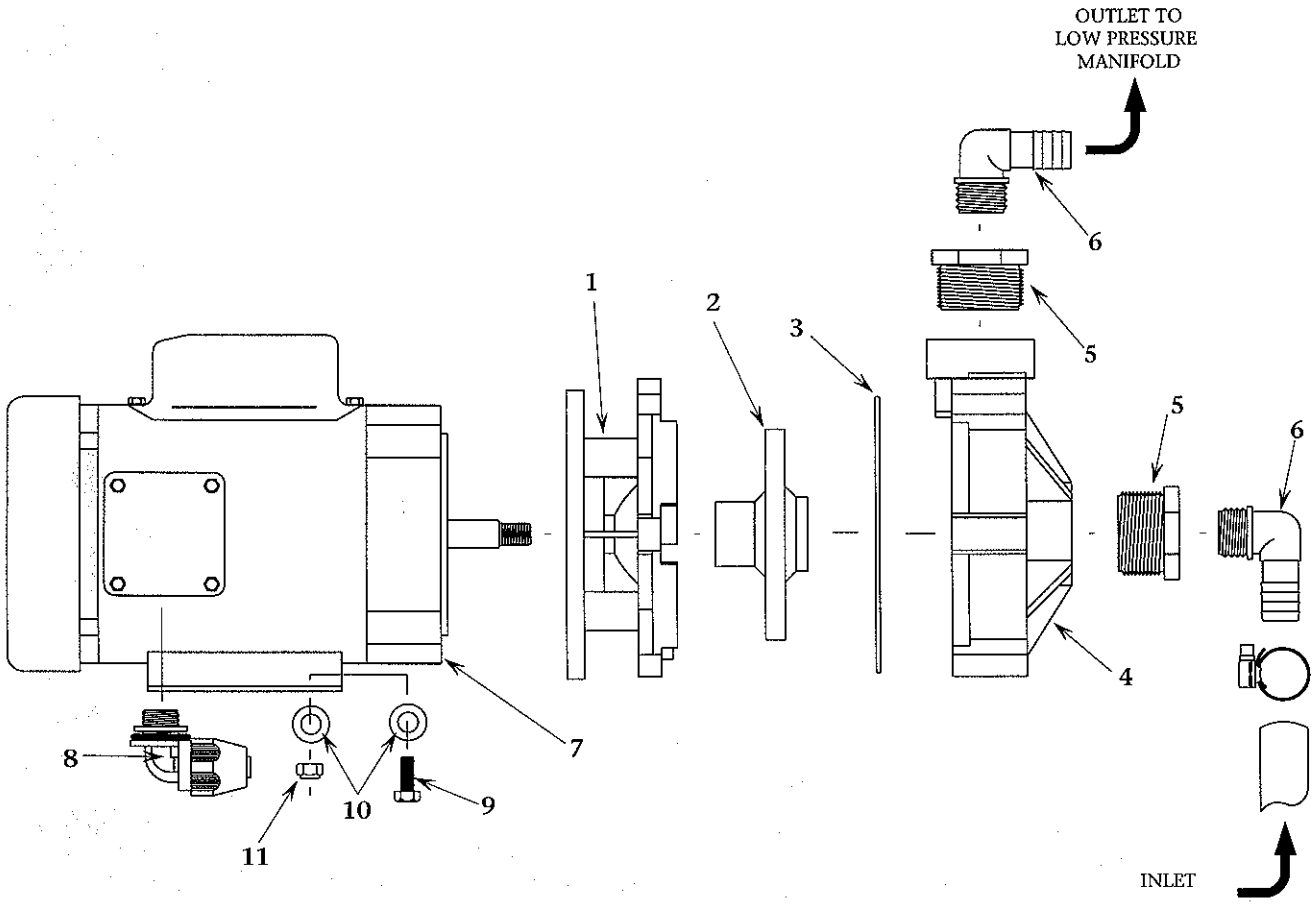
B006080001 RAW WATER SEA STRAINER AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-11	B006080001	SEA STRAINER ASSY AW	1
1	0412061278-5	SEA STRAINER -AS BOWL	1
2	0804702578	MESH SCREEN-3 / AS	1
3	2614100178	O-RING SEA STRAINER MS-3	1
4	0412061278-2	SEA STRAINER -AS LID	1
5	20200402010	BRACKET SEA STRAINER -AS	1
6	063200084000	LOCK NUT 1"	2
7	0101294383	RED BUSH 1" MT x 3/4" FT PVC	2
8	0101073783	ELBOW 90° 3/4" MT x 3/4" BARB PVC	2
9	05181434AA	HOSE CLAMP 3/4" SS	4
10	061172143016	SCREW HEX TYPE "A" 1/4" x 1" SS	3
11	061100043000	WASHER FLAT OS 1/4" SS	3



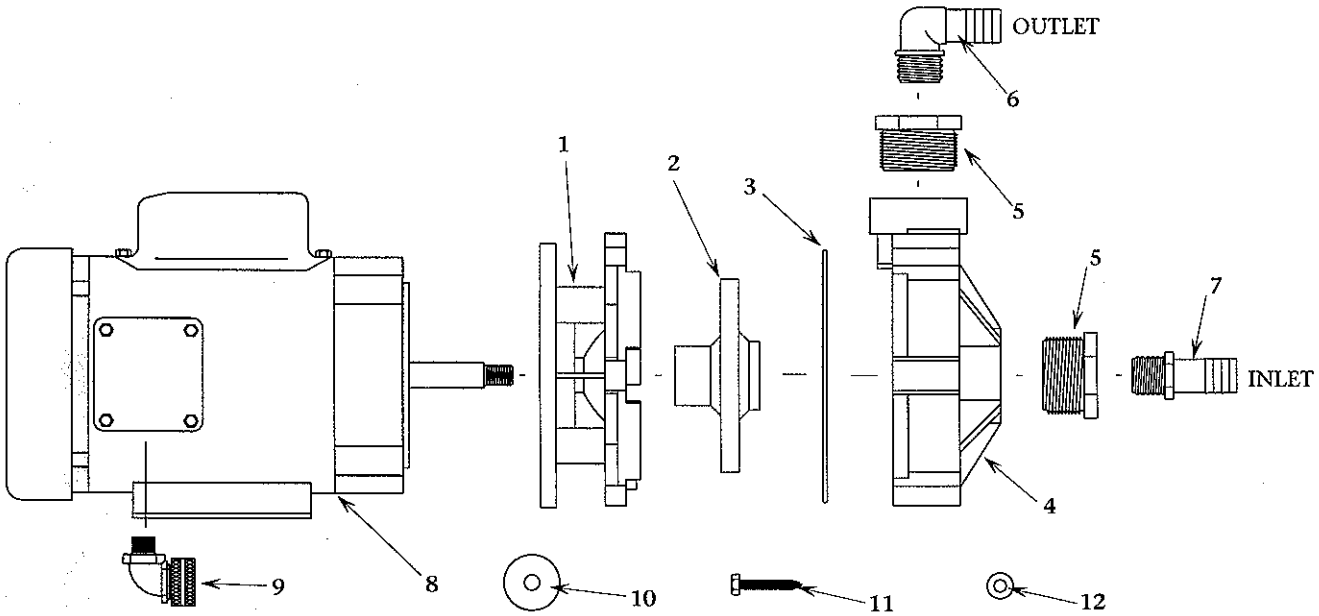
B016080020 BOOSTER PUMP ASSY AquaWhisper 50/60/1
B016080021 BOOSTER PUMP ASSY AquaWhisper 50/3
B016080022 BOOSTER PUMP ASSY AquaWhisper 60/3

ITEM	PART NUMBER	DESCRIPTION	QTY
1-13		BOOSTER PUMP ASSY AW FRAME	1
1	1221515772-2	BRACKET BOOSTER PUMP N200	1
	B655800009	SEAL KIT BOOSTER PUMP N200	1
2	291211181PP	IMPELLER 4.80" N200	1
3	26141260PP	GASKET BOOSTER PUMP N200	1
4	1221515772-1	BOOSTER PUMP VOLUTE N200	1
5	0101295683	REDUCING BUSHING 1 1/2" MT x 3/4 FT PVC	2
6	0101073783	ELBOW 90° 3/4" MT x 3/4" BARB PVC	2
7	1519081110	MOTOR 1/2 HP 110/230 50/60 1PH	1
	1520181110	MOTOR 1/2 HP 208/230/460 50/60 3PH	1
8	1920016590	STRAIN RELIEF LIQ-TITE 90° BLK	1
	063200066000	NUT LOCK 1/2" STEEL	1
9	061142150012	BOLT HEX 5/16-18 x 3/4" SS	4
10	061100049000	WASHER FLAT OS 5/16" SS	8
11	061060050000	NUT HEX 5/16-18 W/INSERT SS	4
12	05181434AA	HOSE CLAMP 3/4" SS	4
13	0328066666	HOSE CLEAR BRAID PER FOOT	4



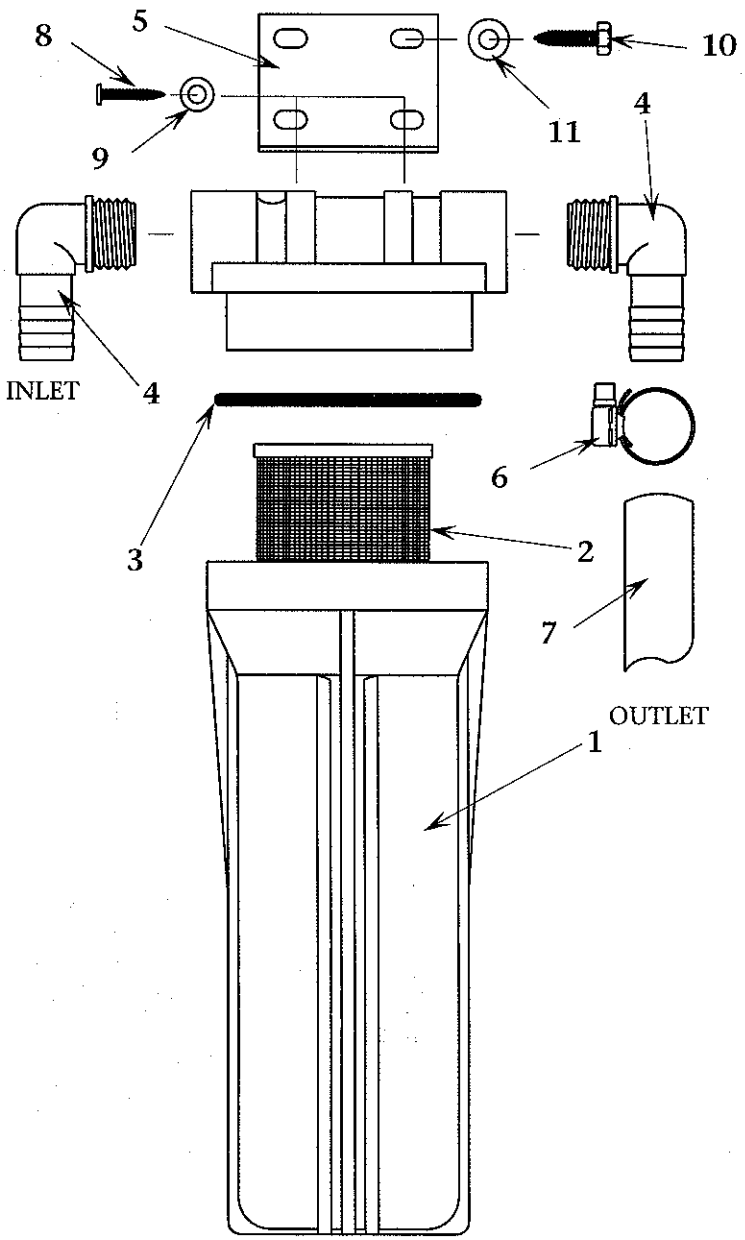
B016080020 BOOSTER PUMP ASSY AquaWhisper 50/60/1
B016080021 BOOSTER PUMP ASSY AquaWhisper 50/3
B016080022 BOOSTER PUMP ASSY AquaWhisper 60/3

ITEM	PART NUMBER	DESCRIPTION	QTY
1-12		BOOSTER PUMP ASSY AW COMPACT/MODULAR	1
1	1221515772-2	BRACKET BOOSTER PUMP N200	1
	B655800009	SEAL KIT BOOSTER PUMP N200	
2	291211481PP	IMPELLER 4.80" N200	
3	26141260PP	GASKET BOOSTER PUMP N200	1
4	1221515772-1	BOOSTER PUMP VOLUTE N200	1
5	0101295683	REDUCING BUSHING 1 1/2" MT x 3/4 FT PVC	2
6	0101073783	ELBOW 90° 3/4" MT x 3/4" BARB PVC	1
7	0101653783	ADAPTER 3/4" MT x 3/4" BARB PVC	1
8	1519081110	MOTOR 1/2 HP 110/220 50/60 1PH	1
	1520181110	MOTOR 1/2 HP 208/230/460 50/60 3PH	1
9	1920023632	STRAIN RELIEF 90° CG90-6250	1
	063200066000	NUT LOCK 1/2" STEEL	1
10	2132020820	VIBRATION ISOLATOR BP	4
11	061182143024	SCREW HEX TYPE "A" 1/4" x 1 1/2" SS	4
12	061100043000	WASHER FLAT OS 1/4" SS	4



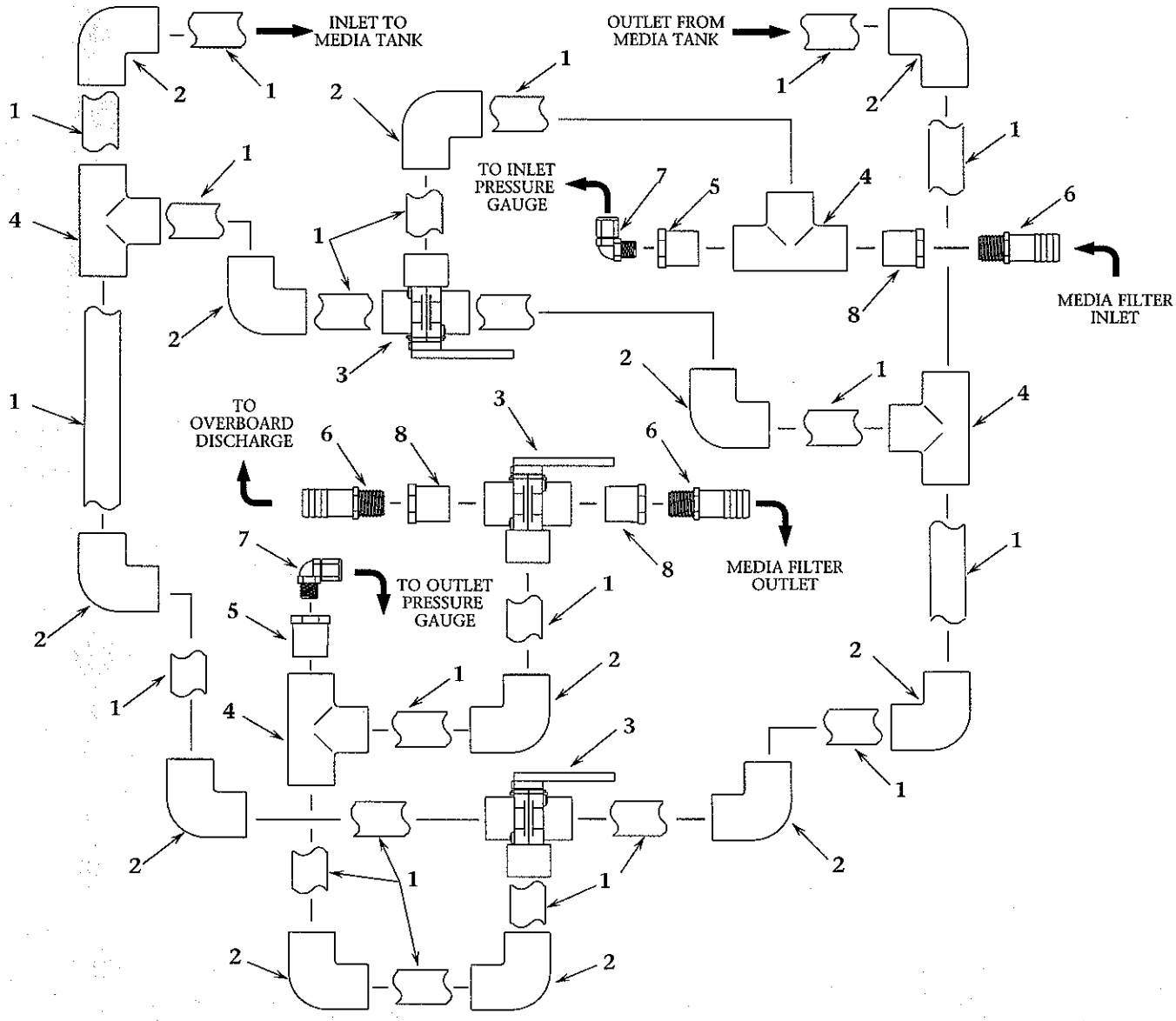
B008800002 PLANKTON FILTER ASSEMBLY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-4	B008800002	PLANKTON FILTER ASSY AW SERIES	1
1	0713020473	FILTER HOUSING W/ LID 3/4" x 10"	1
2	0805823578	ELEMENT PLANKTON FILTER	1
3	2614010473	O-RING BLUE HOUSING	1
4	0101073783	ELBOW 90° 3/4" MPT x 3/4" HOSE BARB PVC	2
ADDED SYSTEM COMPONENTS			
5	20200402100	BRACKET PREFILTER	1
6	05181434AA	HOSE CLAMP 3/4" SS	4
7	0328066666	HOSE CLEAR BRAID 3/4" DIA PER FOOT	1
8	061170628016	SCREW TYPE "A" #10 x 1" SS	4
9	065080028000	WASHER, FLAT #10 NYLON	4
10	061172143016	BOLT HEX TYPE "A" 1/4 x 1" SS	4
11	061100043000	WASHER, FLAT OVERSIZE, 1/4"	4



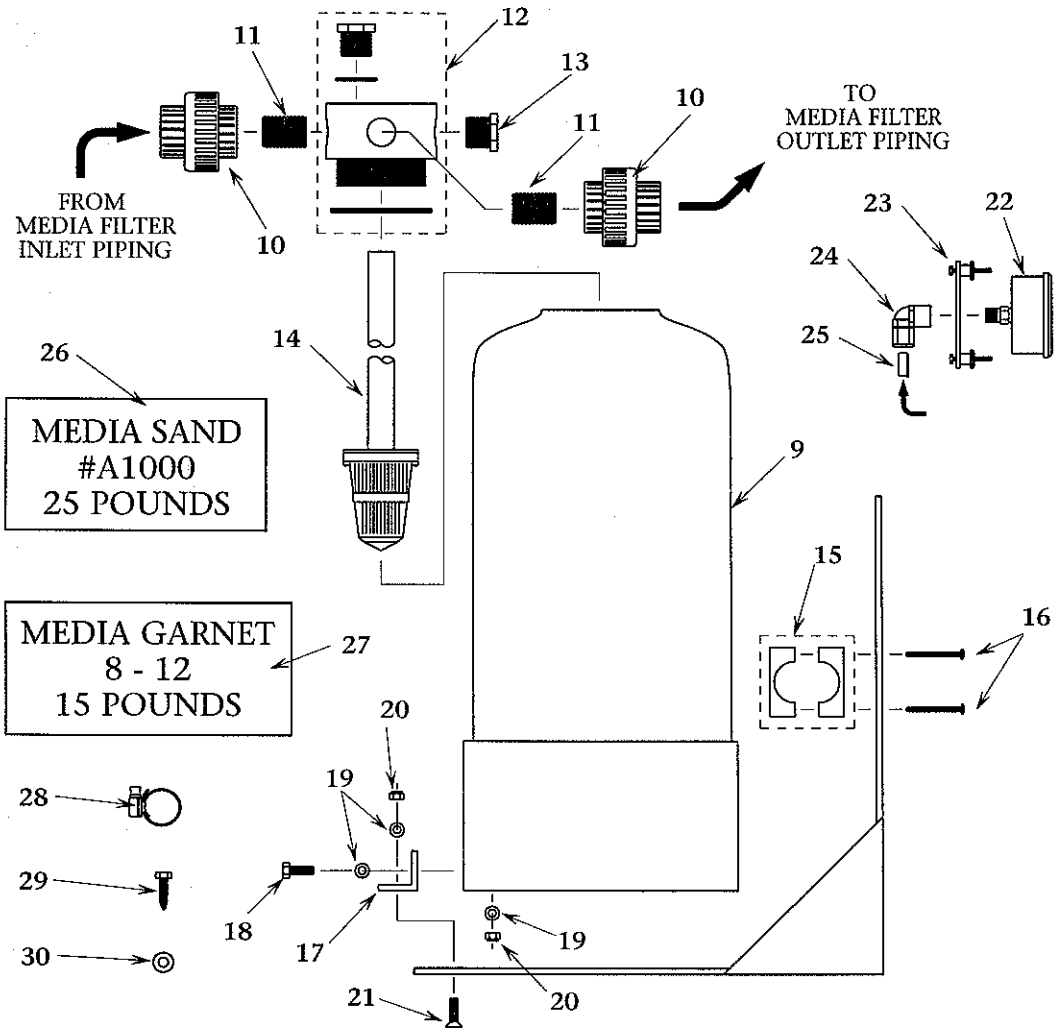
B071080002 MULTI MEDIA FILTER -AW > OCT 98 ASSY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-30	B071080002	MULTI MEDIA FILTER -AW > OCT 98 ASSY	1
1	0301096600	PIPE PVC SCH 80 3/4" PER FOOT	5
2	0101053783	ELBOW 90° 3/4" SL x 3/4" SL PVC	12
3	14011317AR	VALVE 3-WAY BALL 3/4" SLIP	3
4	0101463783	TEE 3/4" SL x 3/4" SL x 3/4" SL	4
5	0101323483	REDUCER BUSHING 3/4" SL x 1/4" FT PVC	2
6	0101652683	ADAPTER 1/2" MT x 3/4" BARB PVC	3
7	0204020869	ELBOW 90° 1/4" MT x TUBE PLASTIC	2
8	0101313683	REDUCER BUSHING 3/4" SLIP x 1/2" FT PVC	3



B071080002 MEDIA FILTER -AS/AW > OCT 98 ASSY CONTINUED

ITEM	PART NUMBER	DESCRIPTION	QTY
9	0708040468-1	MEDIA FILTER HOUSING ALMOND	1
10	0101693783	UNION 3/4" FPT x 3/4" SLIP PVC	2
11	01013737CL	NIPPLE 3/4" NPT x CLOSE PVC	2
12	0708040400-1	MEDIA FILTER TOP	1
13	0101343783	PLUG 3/4" MT PVC	1
14	0708040400-2	MEDIA FILTER RISER	1
15	1453131700-02	VALVE BRACKET 3/4" SLIP	2
16	061160630028	SCREW PHIL PAN 10-24 x 1 3/4"	4
17	20200404010	BRACKET "L" MOUNTING FEET	3
18	061142145012	BOLT HEX 1/4-20 x 3/4" SS	3
19	061080043000	WASHER FLAT 1/4" SS	9
20	061060045000	NUT HEX 1/4-20 W/INSERT SS	6
21	061161845012	SCREW ALLEN FLAT 1/4-20 x 3/4" SS	3
22	10181522CC	GAUGE -30/0/70 PSI CBM TRICOLOR	2
23	05180851CC	BRACKET GAUGE CBM	2
24	0204010869	ELBOW 90° 1/4" FT x TUBE PLASTIC	2
25	0312121969	TUBE 1/4" BLACK PER FOOT	2
26	4643020255	MEDIA SAND #A1000 PER POUND	25
27	4643070155	MEDIA GARNET 8-12 PER POUND	15
28	05181434AA	HOSE CLAMP 3/4" SS	6
29	061172143016	SCREW HEX TYPE "A" 1/4" x 1" SS	4
30	061100043000	WASHER FLAT 1/4" OS SS	4



CAUTIONS REGARDING PREFILTRATION REPLACEMENT ELEMENTS:

Over the years Sea Recovery has seen hundreds of R.O. Membrane Element failures directly resulting from the use of third party, non Sea Recovery, prefiltration elements. Non Sea Recovery filter elements will not properly fit, they allow by-passing and cause suspended solids to enter the R.O. Membrane Element(s), foul them quickly and render them uncleanable. The Sea Recovery Prefilter Element can appear to be similar to commercially available elements. However, Sea Recovery manufactures their own unique filter elements to specific stringent specifications designed to withstand unique Sea Water applications and simultaneously protect the SRC R.O. Membrane Element. Only Sea Recovery filter elements, supplied by Sea Recovery, can be used as replacements.

DIFFERENT TYPES OF PREFILTRATION ELEMENTS:

FIBER SPUN: The Fiber Spun type of element has the appearance and texture of a fine porous sponge. Makers of this type of element claim that it contains hundreds of square feet of surface area for longer filter life. In reality, the life of this type of filter, when filtering Sea Water, is the shortest of the three available types discussed here. Sea Water contains vast amounts of biological matter which must be filtered from the R.O. System Feed Water in order to protect the expensive R.O. Membrane Element from fouling. This biological matter rapidly plugs up the Fiber Spun type of filter element. The average useful life of a Fiber Spun type of filter element is less than 5% of a pleated element. This means that you would have to replace a Fiber Spun type of filter element 20 times more often than the Sea Recovery pleated element. Your effective cost and labor would, therefore, be 20 times greater.

STRING WOUND: The String Wound type of element has the appearance and texture of a knitting yarn ball. It is constructed of string wrapped in a chris cross fashion around a porous tube. Makers of this type of element claim that it costs less than a pleated element. As with the Fiber Spun element, the life of the String Wound type of filter, when filtering Sea Water, is also very short. Because the String Wound element has very little surface area, the average useful life of a String Wound element is less than 10% of a pleated element. This means that you would have to replace a String Wound type of filter element 10 times more often than the Sea Recovery pleated element. Your effective cost and labor would, therefore, be 10 times greater. Also, the String Wound element allows bypassing due to the loose wound manufacturing process. When bypassing occurs this quickly fouls the R.O. Membrane Element.

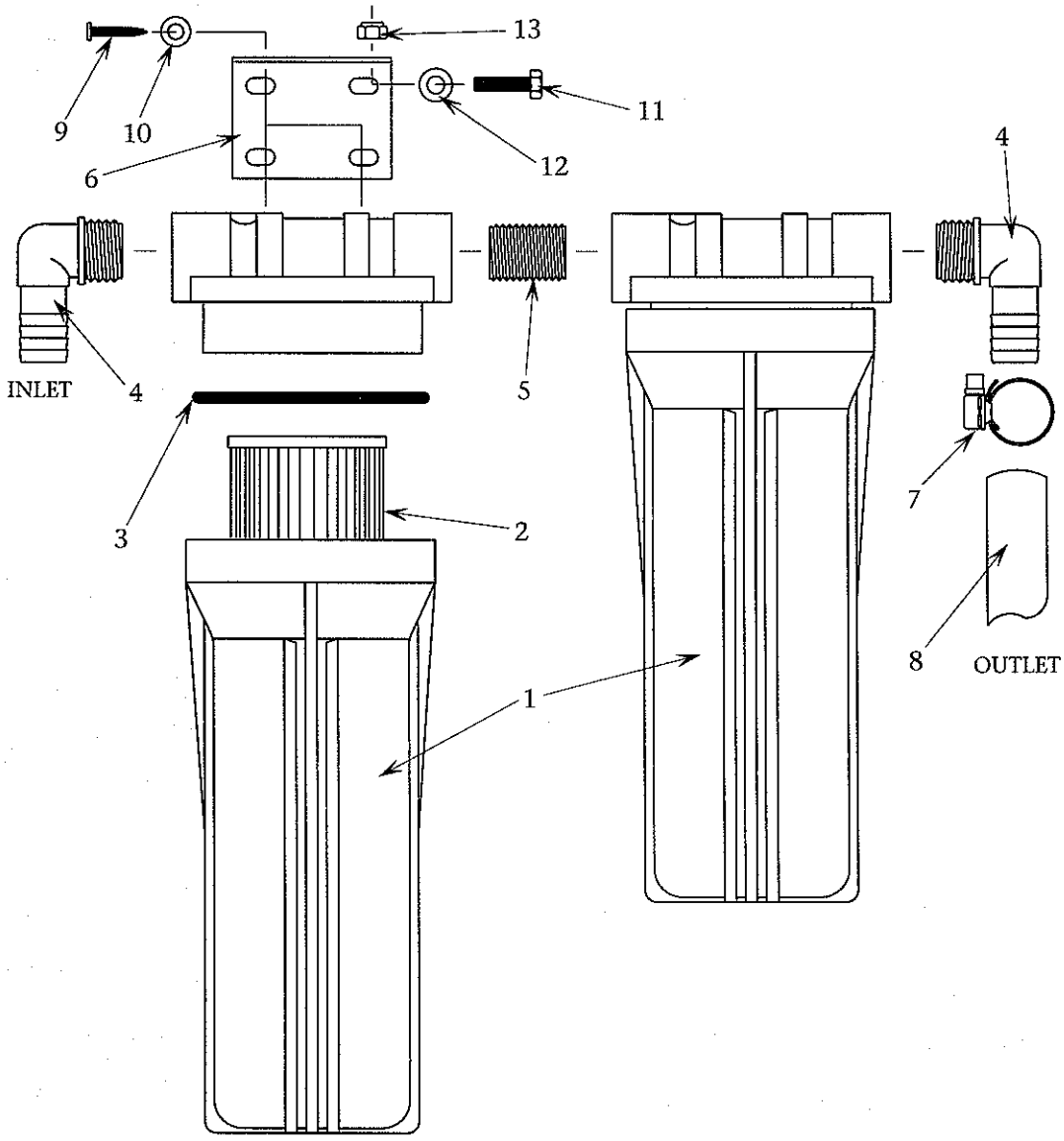
PLEATED: The Pleated type of Prefiltration Element has the appearance of folded pleats molded around a center support tube. The advantage of this type of element is that there is more active surface area in the given physical size. However, there are many different types of Pleated filter elements commercial available. These different available Pleated elements are made from a variety of materials, many of which are not compatible with Sea Water and Reverse Osmosis Feed Water. Many of these third party elements are made from cellulose material which will self destruct in the presence of the biologically rich Sea Water. The manufacturing process, of many third party elements, is not controlled resulting in lose bonding at sealing areas causing bypassing and R.O. Membrane Element fouling. There are many different physical sizes of these commercially available Pleated elements which also results in bypassing and R.O. Membrane failure.

In other words, the use of third party prefiltration elements in the Sea Recovery System will lead to greater maintenance cost, greater maintenance labor and fouled R.O. Membrane Elements. Simply stated, Sea Recovery is not responsible for warranty of R.O. Membrane Elements which have been fouled as a result of the use of Non Sea Recovery Prefiltration Elements.

Save Money,
Save Time,
Protect your Investment,
Minimize R.O. Membrane Fouling,
INSIST ON GENUINE Sea Recovery Replacement Parts!

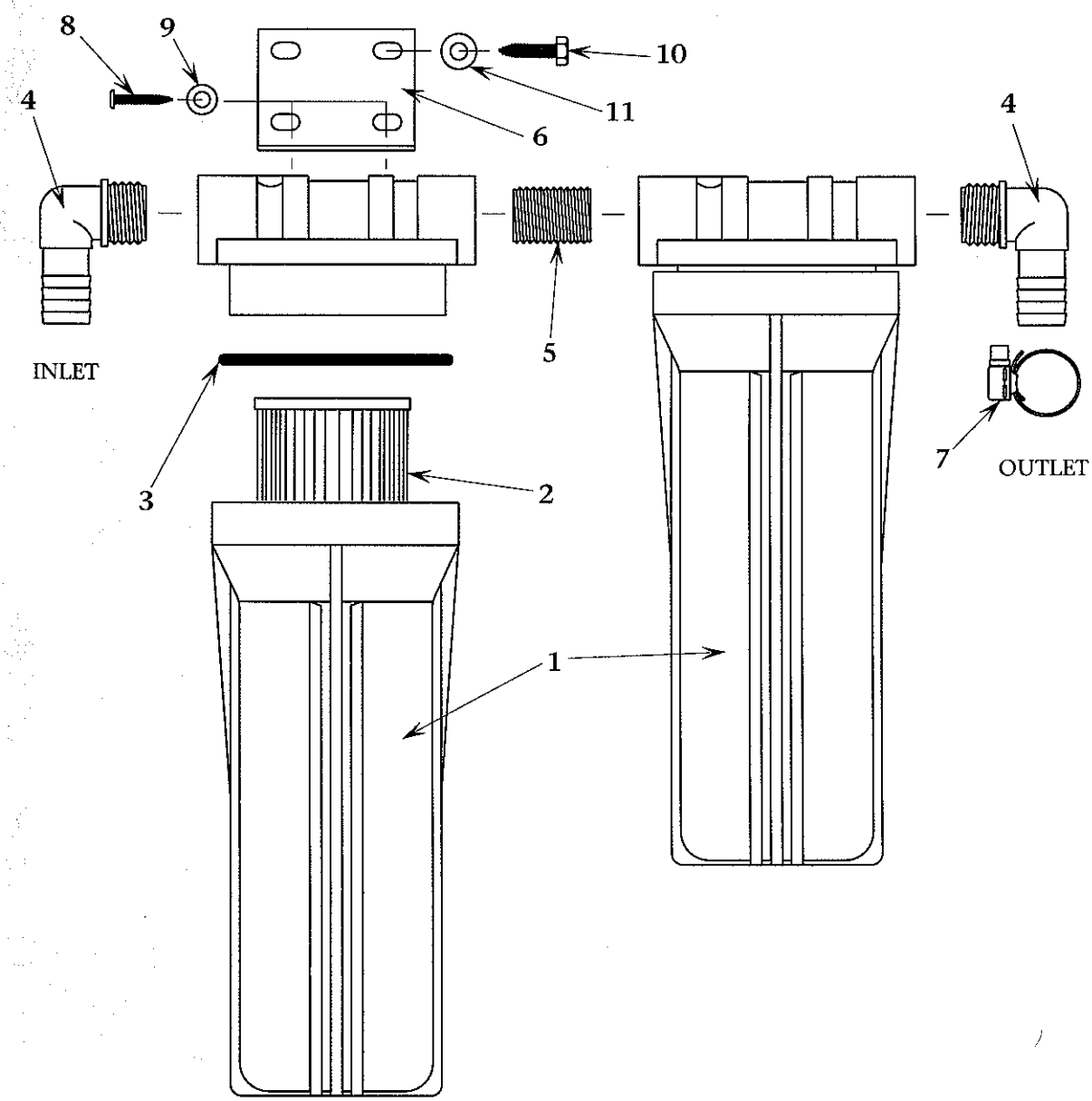
B108800001 PREFILTER ASSY AquaWhisper FRAME & COMPACT SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-13	B108800001	PREFILTER ASSY, AQUA WHISPER SERIES	1
1	0713020473	FILTER HOUSING W/ LID 3/4" x 10"	2
2	0801130257	ELEMENT PREFILTER, 25 MICRON	1
	0801060157	ELEMENT PREFILTER, 5 MICRON	1
3	2614010473	O-RING BLUE HOUSING	2
4	0101073783	ELBOW 90° 3/4" MPT x 3/4" HOSE BARB PVC	2
5	01013737CL	NIPPLE, 3/4" NPT x CLOSE PVC	1
6	20200402100	BRACKET, PREFILTER	2
7	05181434AA	HOSE CLAMP 3/4" SS	4
8	0328066666	HOSE CLEAR BRAID 3/4" DIA PER FOOT	1
9	061170628016	SCREW TYPE "A" #10 x 1" SS	8
10	065080028000	WASHER, FLAT #10 NYLON	8
11	061142145016	BOLT, HEX, 1/4-20 x 1" SS	8
12	061100043000	WASHER, FLAT OVERSIZE, 1/4"	8
13	065070045000	NUT LOCKING 1/4-20 NYLON	8



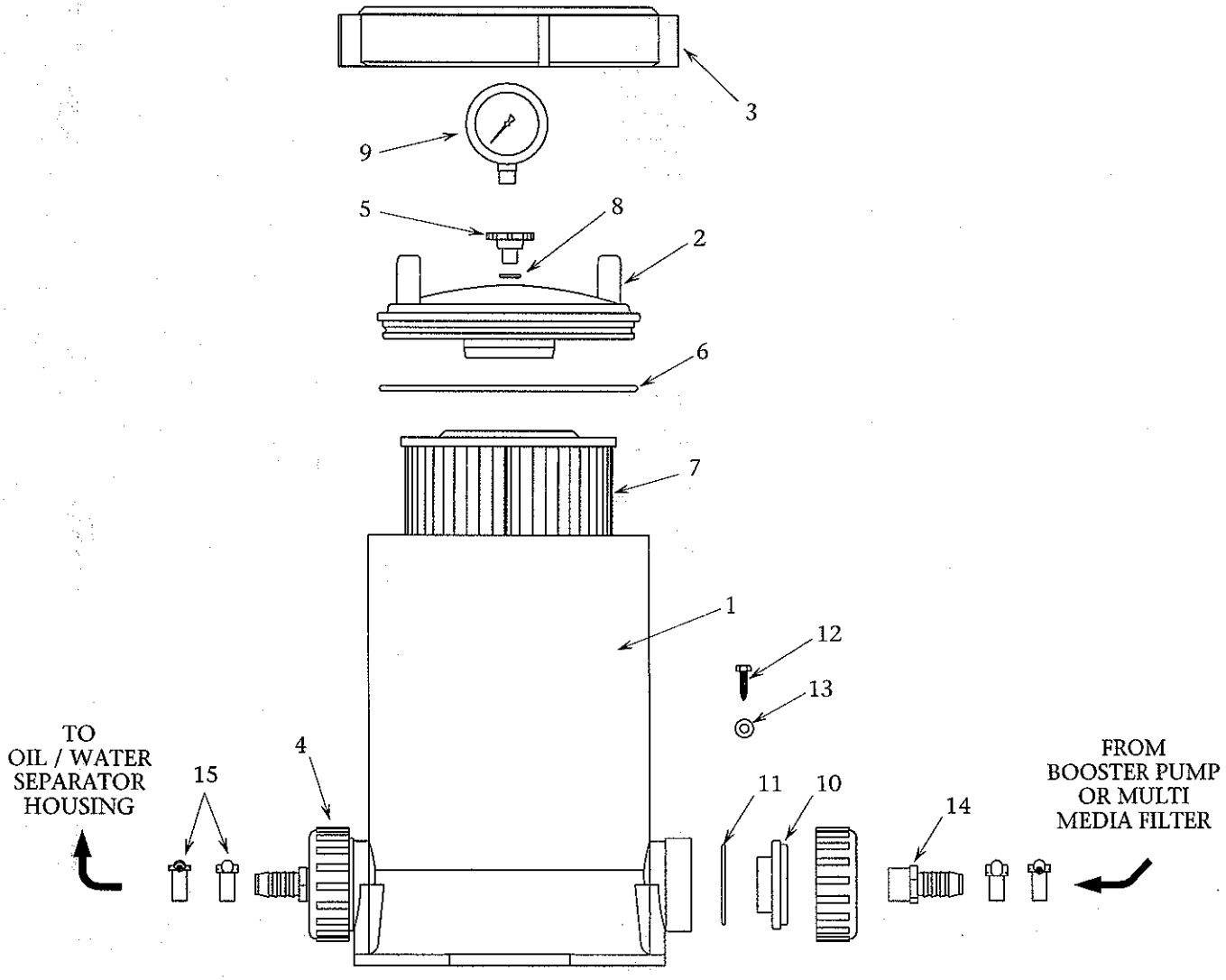
B108800002 PREFILTER ASSY AquaWhisper MODULAR

ITEM	PART NUMBER	DESCRIPTION	QTY
1-11	B108800002	PREFILTER ASSY, AQUA WHISPER MODULAR	1
1	0713020473	FILTER HOUSING W/ LID 3/4" x 10"	2
2	0801130257	ELEMENT PREFILTER, 25 MICRON	1
	0801060157	ELEMENT PREFILTER, 5 MICRON	1
3	2614010473	O-RING BLUE HOUSING	2
4	0101073783	ELBOW 90° 3/4" MPT x 3/4" HOSE BARB PVC	2
5	01013737CL	NIPPLE, 3/4" NPT x CLOSE PVC	1
6	20200402100	BRACKET, PREFILTER	2
7	05181434AA	HOSE CLAMP 3/4" SS	4
8	061170628016	SCREW TYPE "A" #10 x 1" SS	8
9	065080028000	WASHER, FLAT #10 NYLON	8
10	061172143016	SCREW TYPE "A" 1/4" x 1" SS	8
11	061100043000	WASHER FLAT OVERSIZE 1/4"	8



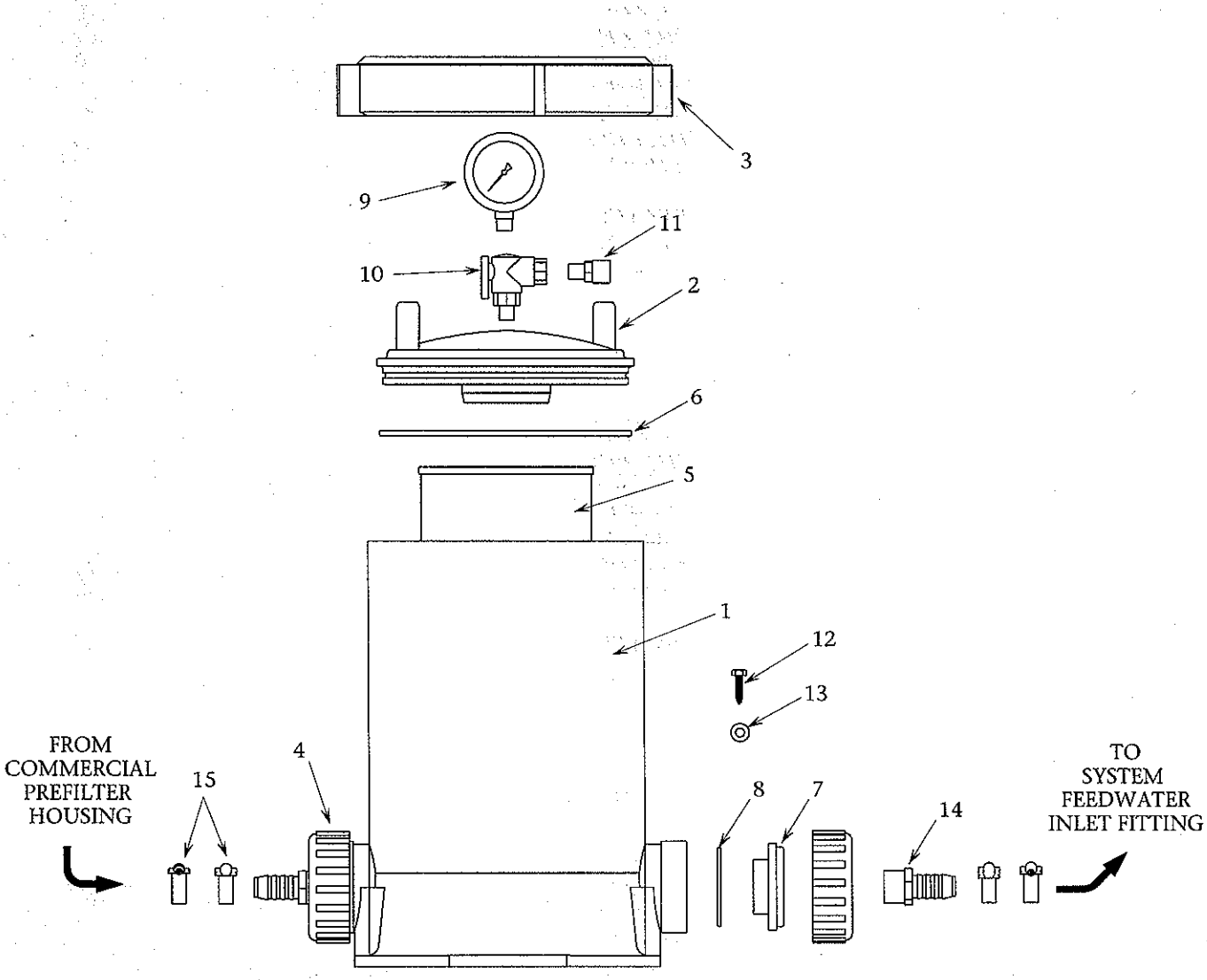
B109800002 COMMERCIAL PREFILTER ASSY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1	07620301WA-01	FILTER BASE CPF/OWS AW	1
2	07620301WA-02	FILTER LID CPF/OWS AW	1
3	07620301WA-03	FILTER CLAMP CPF/OWS AW	1
4	07620301WA-04	FILTER NUT CPF/OWS AW	2
5	07620301WA-05	FILTER AIR BLEED AW	1
6	07620301WA-06	O-RING LID CPF/OWS-AW	1
7	0801063057	ELEMENT CPFE/AW 5 MICRON PP >3/02	1
8	2614011669	O-RING 1/2" TUBE FITTING 2-112	1
9	10180103CC	GAUGE -30/0/70 BPM.NPT	1
10	0901161600	INSERT IN/OUT CPF/OWS AW	2
11	2614014900	O-RING 2-230	2
12	061172143016	SCREW HEX TYPE "A" 1/4" x 1" SS	4
13	061100043000	WASHER FLAT OS 1/4" SS	4
14	0101653783	ADAPTER 3/4 MPT x 3/4 BARB PVC	2
15	05181434AA	HOSE CLAMP 3/4" SS	4



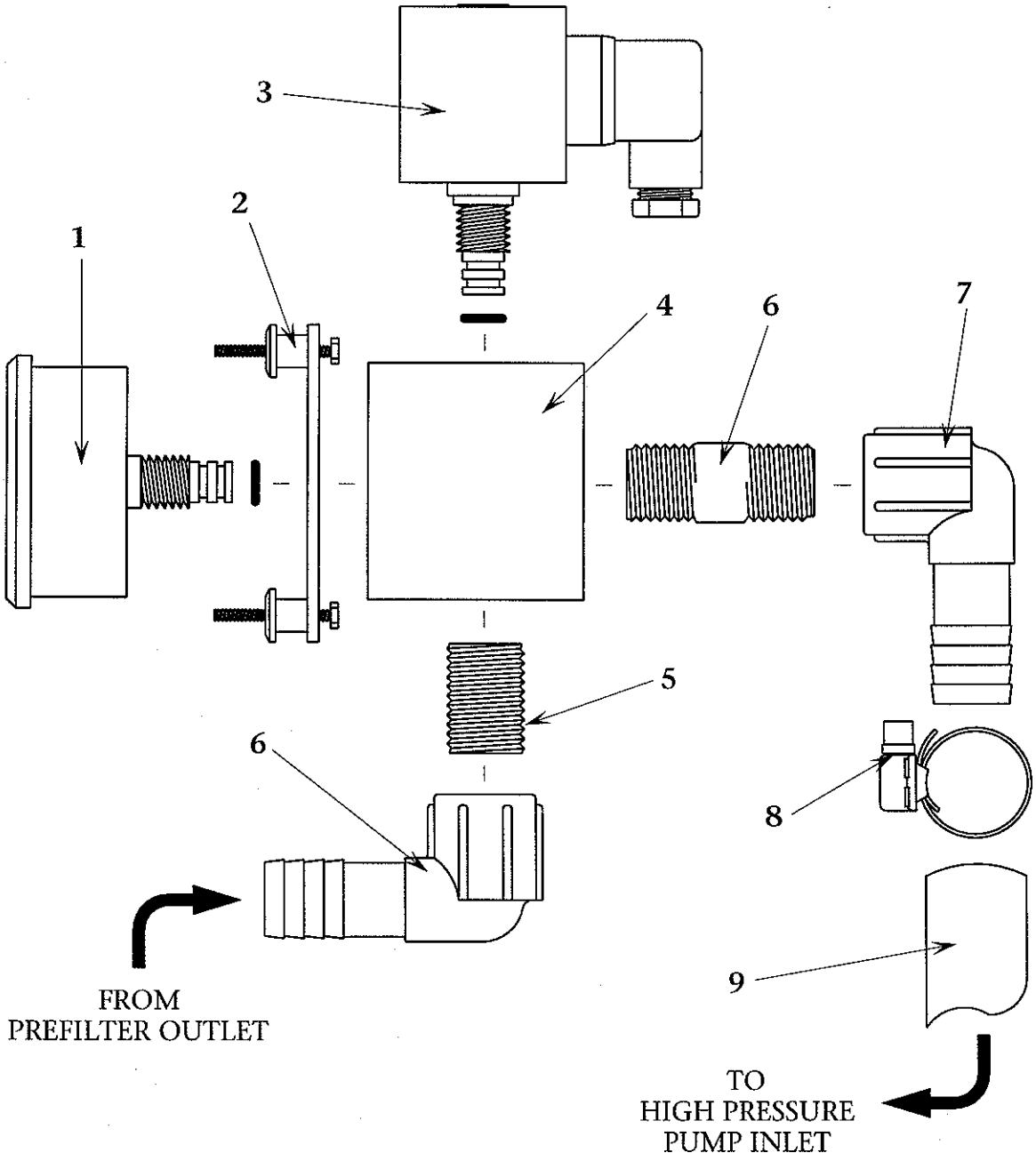
B111800002 OIL/WATER SEPARATOR ASSY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1	07620301WA-01	FILTER BASE CPF/OWS AW	1
2	07620301WA-02	FILTER LID CPF/OWS AW	1
3	07620301WA-03	FILTER CLAMP CPF/OWS AW	1
4	07620301WA-04	FILTER NUT CPF/OWS AW	2
5	08020622KD	ELEMENT OWSE/AW 11"	1
6	07620301WA-06	O-RING LID CPF/OWS-AW	1
7	0901161600	INSERT IN/OUT CPF/OWS AW	2
8	2614014900	O-RING 2-230	2
9	10180103CC	GAUGE -30/0/70 BPM.NPT	1
10	14015506AR-02	VALVE BALL 1/4 FPT X MPT	1
11	0204090869	CONN 1/4 TUBE X 1/4 MPT PLASTIC	1
12	061172143016	SCREW HEX TYPE "A" 1/4" x 1" SS	4
13	061100043000	WASHER FLAT OS 1/4" SS	4
14	0101653783	ADAPTER 3/4 MPT x 3/4 BARB PVC	2
15	05181434AA	HOSE CLAMP 3/4" SS	4



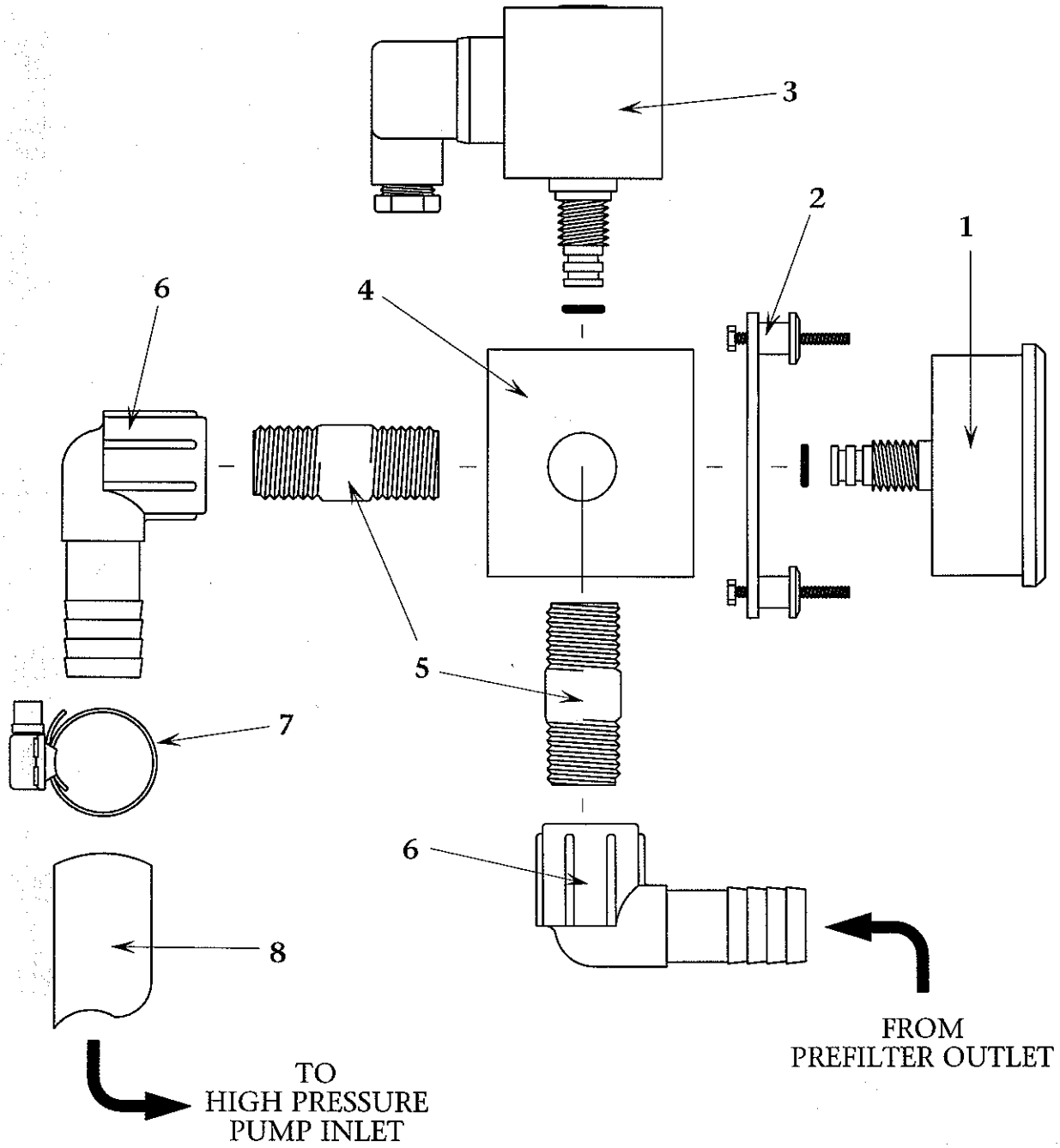
Z502880001 LOW PRESSURE MANIFOLD ASSY AquaWhisper FRAME

ITEM	PART NUMBER	DESCRIPTION	QTY
1-9	Z502880001	LP MANIFOLD ASSY AW FRAME	1
1	10181320CC	GAUGE -30/0/70 PSICBM O-RING SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
2	05180851CC	MOUNTING BRACKET CBM GAUGE	1
3	2301020658	SWITCH LOW PRESSURE 6 PSI O-R SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
4	5353460100	MANIFOLD LOW PRESSURE AW FRAME	1
5	01013725CL	NIPPLE 1/2" NPT x CLOSE PVC	1
6	0101372520	NIPPLE 1/2" NPT x 2" PVC	1
7	0101062683	ELBOW 90° 1/2" FT x 3/4" BARB PVC	2
8	05181434AA	HOSE CLAMP 3/4" SS	4
9	0328066666	HOSE CLEAR BRAID 3/4" PER FOOT	6



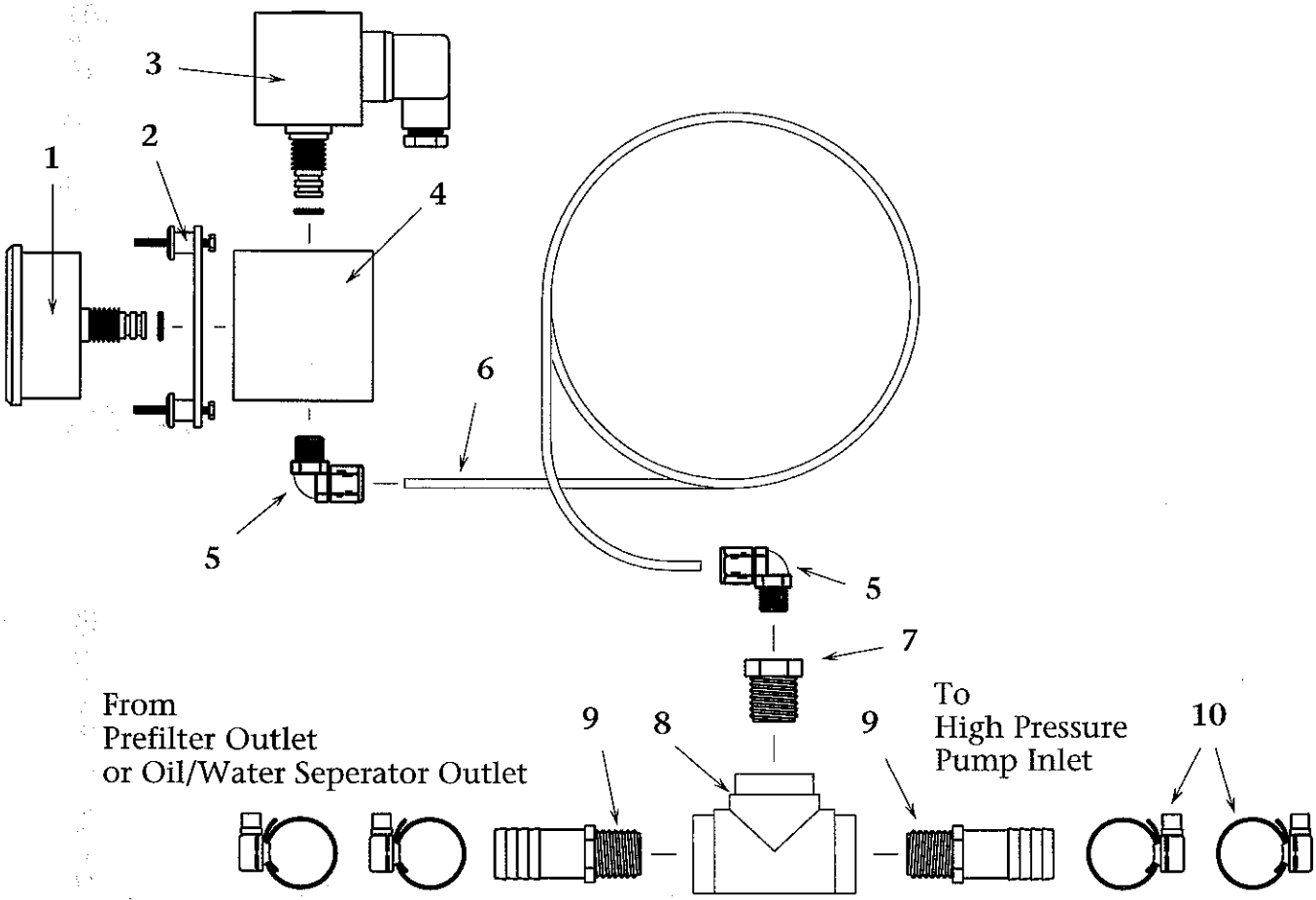
Z502870001 LOW PRESSURE MANIFOLD ASSY AquaWhisper COMPACT

ITEM	PART NUMBER	DESCRIPTION	QTY
1-8	Z502870001	LP MANIFOLD ASSY AW COMPACT	1
1	10181320CC	GAUGE -30/0/70 PSI CBM O-RING SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
2	05180851CC	MOUNTING BRACKET CBM GAUGE	1
3	2301020658	SWITCH LOW PRESSURE 6 PSI O-R SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
4	5301090400	MANIFOLD LOW PRESSURE AW SERIES	1
5	0101372520	NIPPLE 1/2" NPT x 2" PVC	2
6	0101062683	ELBOW 90° 1/2" FT x 3/4" BARB PVC	2
7	05181434AA	HOSE CLAMP 3/4" SS	4
8	0328066666	HOSE CLEAR BRAID 3/4" PER FOOT	4



Z502890001 LOW PRESSURE MANIFOLD ASSY AquaWhisper MODULAR

ITEM	PART NUMBER	DESCRIPTION	QTY
1-10	Z502890001	LP MANIFOLD ASSY AW MODULAR	1
1	10181320CC	GAUGE -30/0/70 PSI CBM O-RING SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
2	05180851CC	MOUNTING BRACKET CBM GAUGE	1
3	2301020658	SWITCH LOW PRESSURE 6 PSI O-R SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
4	5353460100	MANIFOLD LOW PRESSURE AW FRAME	1
5	0204020869	ELBOW 90° 1/4" MT x 1/4" TUBE PLASTIC	2
6	0312121969	TUBE 1/4 BLACK NYLON	20 FT
7	0101323483	RB 3/4 SL X 1/4 FT PVC	1
8	0101423783	TEE 3/4 FT X 3/4 FT X 3/4 FT PVC	1
9	0101653783	ADAP 3/4 MPT X 3/4 BARB PVC	2
10	05181434AA	HOSE CLAMP 3/4" SS	4



HP PUMP/MOTOR ASSEMBLY AquaWhisper SERIES

A LISTING OF WHICH MOTOR AND PUMP TO USE FOR WHICH SYSTEM

AquaWhisper 400-1 & 800-2
115/230 VAC, 60Hz, Single Phase Systems use:

B156870001	HP PMA -AW 2.1HP/50/60/3.0GPM 1PH
15AD062412	MOTOR 2.1 HP 50/60 110/220 1 PH
12180511CO	HP PUMP 3.0 GPM SS

AquaWhisper 400-1 & 800-2
208-230/460 VAC, 60Hz, Three Phase Systems use:

B156870004	HP PMA -AW 3.0HP/60/3.0GPM 3PH
15AE231012	MOTOR 3.0 HP 230/460/60/3
12180511CO	HP PUMP 3.0 GPM SS

AquaWhisper 400-1 & 800-2
110/220 VAC, 50Hz, Single Phase Systems use:

B156870002	HP PMA -AW 2.5HP/50/60/4.2GPM 1PH
15AC062412	MOTOR 2.5 HP 50/60 110/220 1 PH
12180512CO	HP PUMP 4.2 GPM SS

AquaWhisper 400-1 & 800-2
208-220/380 VAC, 50Hz, Three Phase Systems use:

B156870005	HP PMA -AW 3.0HP/50/4.2GPM 3PH
15AF241012	MOTOR 3.0 HP 220/380/50/3
12180512CO	HP PUMP 4.2 GPM SS

AquaWhisper 600-1, 1200-2, 800-1 & 1500-2
110-115/220-230 VAC, 50-60Hz, Single Phase Systems use:

B156870002	HP PMA -AW 2.5HP/50/60/4.2GPM 1PH
15AC062412	MOTOR 2.5 HP 50/60 110/220 1 PH
12180512CO	HP PUMP 4.2 GPM SS

AquaWhisper 600-1, 1200-2, 800-1 & 1500-2
208-220/380 VAC, 50Hz, Three Phase Systems use:

B156870005	HP PMA -AW 3.0HP/50/4.2GPM 3PH
15AF241012	MOTOR 3.0 HP 220/380/50/3
12180512CO	HP PUMP 4.2 GPM SS

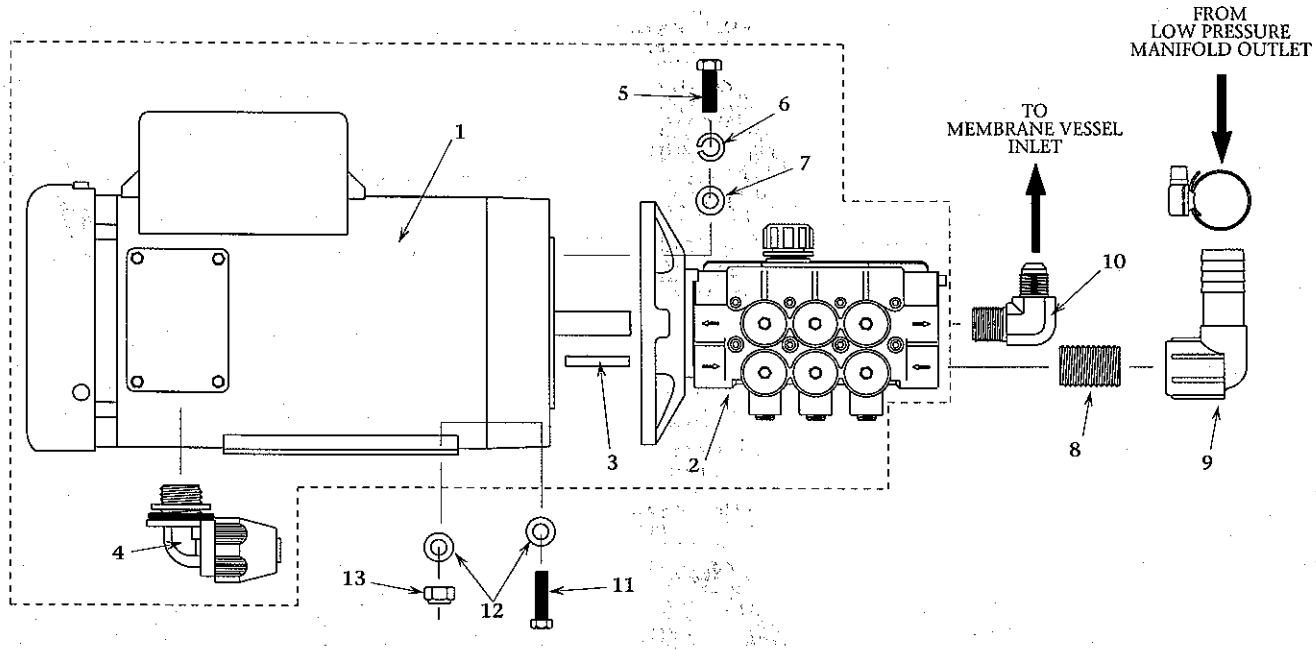
AquaWhisper 600-1, 1200-2, 800-1 & 1500-2
208/230/460 VAC, 60Hz, Three Phase Systems use:

B156870006	HP PMA -AW 3.0HP/60/4.2GPM 3PH
15AE231012	MOTOR 3.0 HP 230/460/60/3
12180512CO	HP PUMP 4.2 GPM SS

HP PUMP/MOTOR ASSEMBLY AquaWhisper FRAME & COMPACT SERIES

REFER TO PAGE L-21 FOR A LISTING OF WHICH MOTOR AND PUMP TO USE

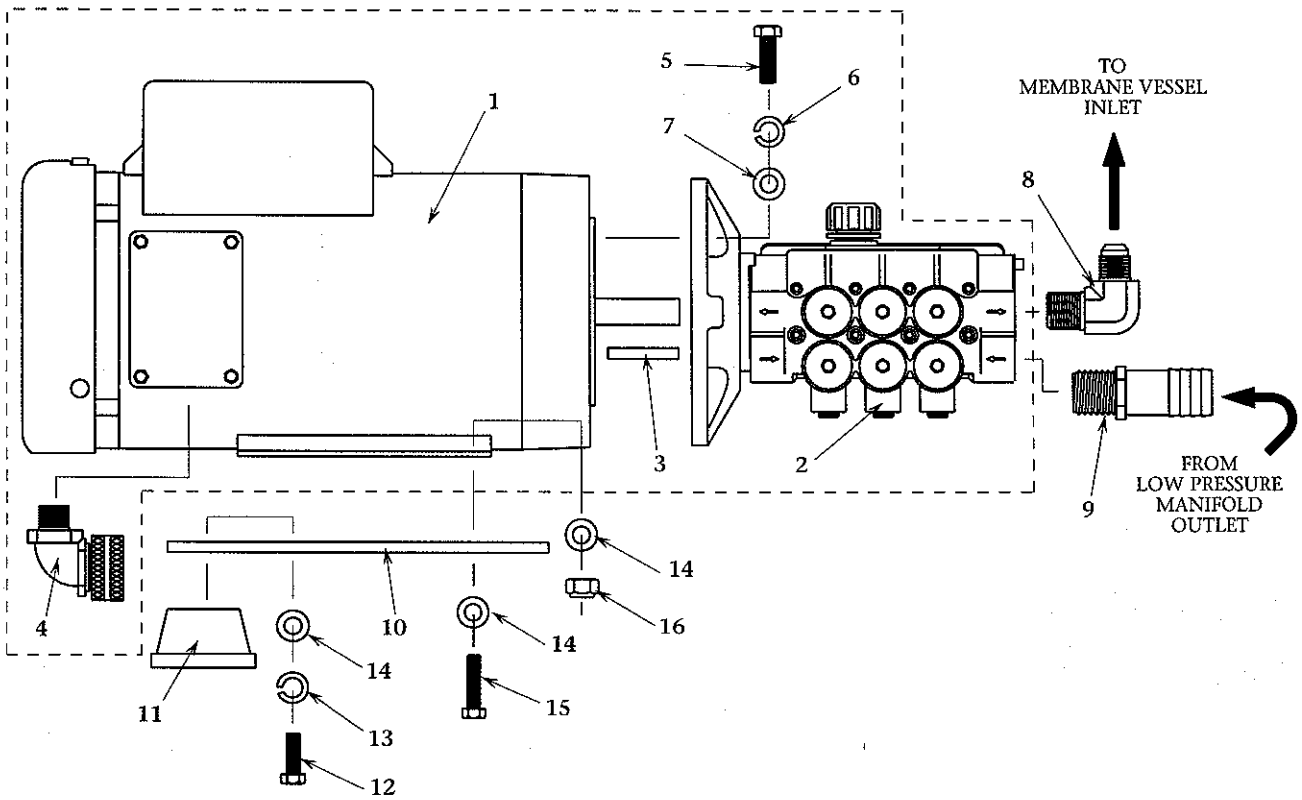
ITEM	PART NUMBER	DESCRIPTION	QTY
1-14		HP PUMP/MOTOR ASSY AW SERIES	1
1-7	B156870001	HP PMA -AW 2.1HP/50/60/3.0GPM 1PH	1
	B156870002	HP PMA -AW 2.5HP/50/60/4.2GPM 1PH	1
	B156870003	HP PMA -AW 3.0HP/50/3.0GPM 3PH	1
	B156870004	HP PMA -AW 3.0HP/60/3.0GPM 3PH	1
	B156870005	HP PMA -AW 3.0HP/50/4.2GPM 3PH	1
	B156870006	HP PMA -AW 3.0HP/60/4.2GPM 3PH	1
1	15AD062412	MOTOR 2.1 HP 50/60 110/220 1 PH	1
	15AC062412	MOTOR 2.5 HP 50/60 110/220 1 PH	1
	15AE231012	MOTOR 3.0 HP 230/460/60/3	1
	15AF241012	MOTOR 3.0 HP 220/380/50/3	1
2	12180511CO	HP PUMP 3.0 GPM SS	1
	12180512CO	HP PUMP 4.2 GPM SS	1
3	4416010300	KEY MOTOR WM SERIES	1
4	1920016590	STRAIN RELIEF LIQ-TITE 90° BLK	1
	063200066000	NUT LOCK 1/2" STEEL	1
5	061142157016	BOLT HEX 3/8-16 x 1" SS	4
6	061120056000	WASHER SPLIT LOCK 3/8" SS	4
7	061100056000	WASHER FLAT OS 3/8" SS	4
8	01013725CL	NIPPLE, 1/2" NPT x CLOSE PVC	1
9	0101062683	ELBOW 90° 1/2" FT x 3/4" BARB PVC	1
10	05181434AA	HOSE CLAMP 3/4" SS	2
11	1317021969	ELBOW 90° -6 FLARE x 3/8" MT SS	1
12	061142150016	BOLT HEX 5/16-18 x 1" SS	4
13	061100049000	WASHER FLAT OS 5/16" SS	8
14	061060050000	NUT HEX 5/16-18 W/INSERT SS	4



HP PUMP/MOTOR ASSY AquaWhisper MODULAR SERIES

REFER TO PAGE L-21 FOR A LISTING OF WHICH MOTOR AND PUMP TO USE

ITEM	PART NUMBER	DESCRIPTION	QTY
1-16		HP PUMP/MOTOR ASSY AW MODULAR	1
1-7	B156870001	HP PMA -AW 2.1HP/50/60/3.0GPM 1PH	1
	B156870002	HP PMA -AW 2.5HP/50/60/4.2GPM 1PH	1
	B156870003	HP PMA -AW 3.0HP/50/3.0GPM 3PH	1
	B156870004	HP PMA -AW 3.0HP/60/3.0GPM 3PH	1
	B156870005	HP PMA -AW 3.0HP/50/4.2GPM 3PH	1
	B156870006	HP PMA -AW 3.0HP/60/4.2GPM 3PH	1
1	15AD062412	MOTOR 2.1 HP 50/60 110/220 1 PH	1
	15AC062412	MOTOR 2.5 HP 50/60 110/220 1 PH	1
	15AE231012	MOTOR 3.0 HP 220/380/440/60/3	1
	15AF241012	MOTOR 3.0 HP 220/380/440/50/3	1
2	12180511CO	HP PUMP 3.0 GPM SS	1
	12180512CO	HP PUMP 4.2 GPM SS	1
3	4416010300	KEY MOTOR WM SERIES	1
4	1920023632	STRAIN RELIEF-90 CG90-6250	1
	063200066000	NUT LOCK 1/2" STEEL	1
5	061142157016	BOLT HEX 3/8-16 x 1" SS	4
6	061120056000	WASHER SPLIT LOCK 3/8" SS	4
7	061100056000	WASHER FLAT OS 3/8" SS	4
8	1317021969	ELBOW 90° -6 FLARE x 3/8" MT SS	1
9	0101652683	ADAPTER 1/2" MT x 3/4" BARB PVC	1
10	20200549030	MOTOR BASE PLATE AW MODULAR	1
11	2115030120	RUBBER MOUNT 55 AW SERIES	4
12	061142150012	BOLT HEX 5/16-18 x 3/4" SS	4
13	061120049000	WASHER SPLIT LOCK 5/16" SS	4
14	061100049000	WASHER FLAT OS 5/16" SS	12
15	061142150016	BOLT HEX 5/16-18 x 1" SS	4
16	061060050000	NUT HEX 5/16-18 W/INSERT SS	4

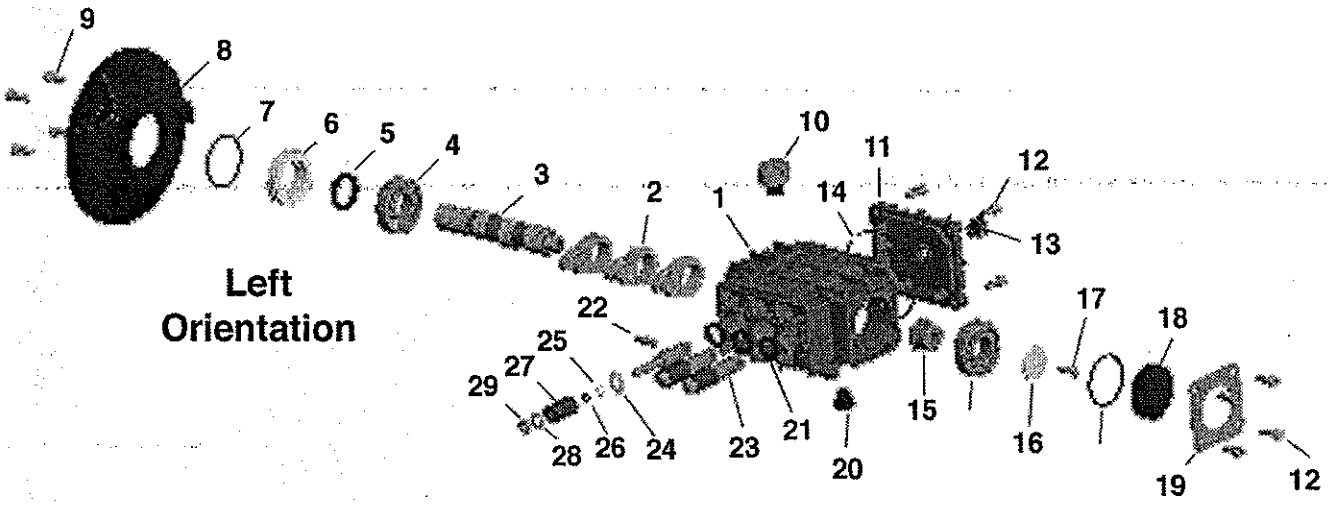


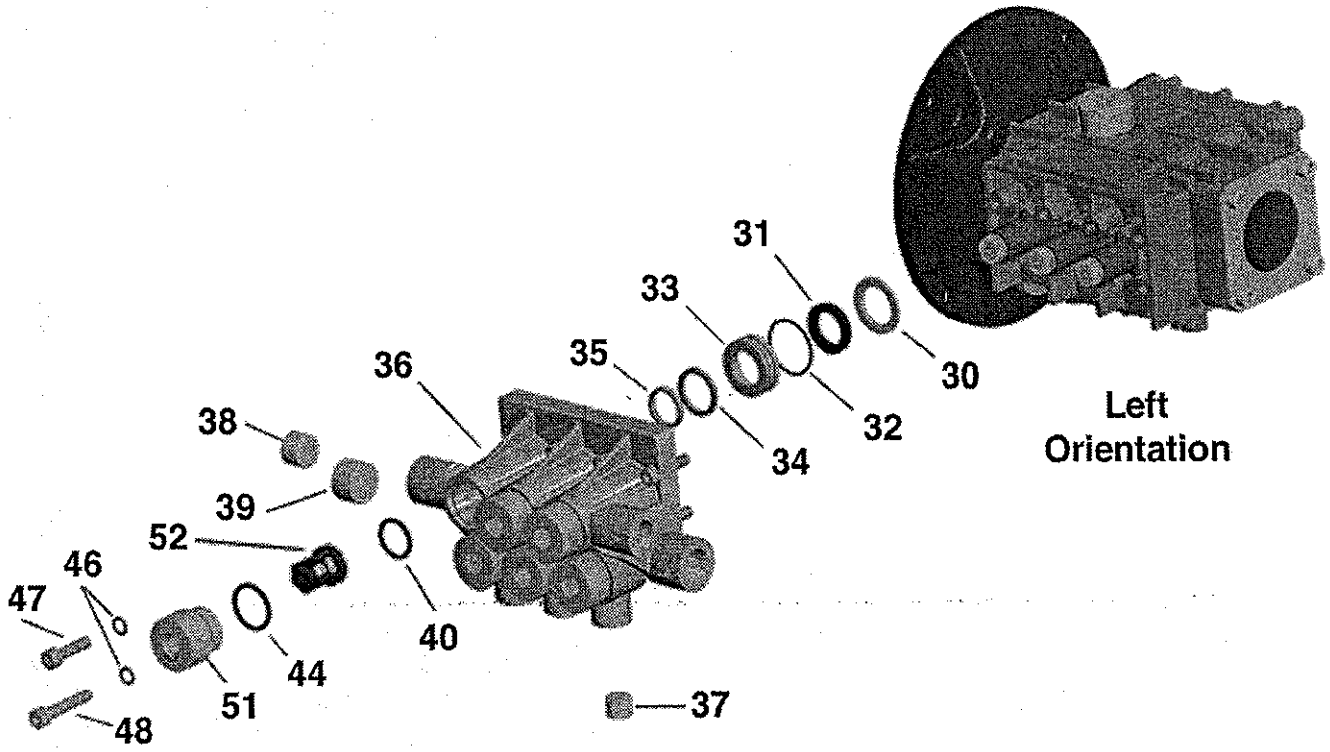
Item	Part #	Description	Qty
1-52	12180511CO-Left	Pump HP 3.0 GPM SS Left (complete high pressure pump)	1
	12180512CO-Left	Pump HP 4.2 GPM SS Left (complete high pressure pump)	
1-29	12180511CO-CCAL	Drive End Pump HP 3.0 GPM SS Left (stuffed crankcase section)	1
	12180512CO-CCAL	Drive End Pump HP 4.2 GPM SS Left (stuffed crankcase section)	
30-52	12180511CO-WE	Wet End Pump HP 3.0 GPM SS (stuffed manifold)	1
	12180512CO-WE	Wet End Pump HP 4.2 GPM SS (stuffed manifold)	
1	12180510CO-01	Crankcase	1
2	12180510CO-02	Connecting Rod	3
3	12180511CO-03	Crankshaft 5/8" Hollow 3.0 GPM	1
	12180512CO-03	Crankshaft 5/8" Hollow 4.2 GPM	
4	12180510CO-04	Bearing	2
5	12180510CO-05	Oil Seal, Crankshaft	1
6	12180510CO-06	Retainer, Oil Seal	1
7	12180510CO-07	O-Ring, Oil Seal Retainer/Side Cover	2
8	12180510CO-08	Flange, NEMA 56C Face	1
9	12180510CO-09	Screw SHCS 18mm Long	4
10	12180510CO-10	Oil Cap Vented	1
11	12180510CO-11	Rear Cover	1
12	12180510CO-12	Screw SHCS 16mm Long	8
13	12180510CO-13	Sight Glass	1
14	12180510CO-14	O-Ring, Rear Cover	1
15	12180510CO-15	Bushing	1
16	12180510CO-16	Washer	1
17	12180510CO-17	Screw HHCS 20mm long	1
18	12180510CO-18	Side Cover	1
19	12180510CO-19	Side Plate	1
20	12180510CO-20	Oil Drain Plug	1
21	12180510CO-21	Oil Seal Plunger	3
22	12180510CO-22	Wrist Pin	3
23	12180510CO-23	Plunger Rod	3
24	12180510CO-24	Slinger	3
25	12180510CO-25	Anti-Extrusion Ring	3
26	12180510CO-26	O-Ring Plunger	3
27	12180510CO-27	Plunger 18mm	3
28	12180510CO-28	Washer, Plunger Rod	3
29	12180510CO-29	Nut, Plunger Rod	3
30	12180510CO-30	Seal Retainer	3
31	12180510CO-31	Low Pressure Seal	3
32	12180510CO-32	O-Ring Seal Case	3
33	12180510CO-33	Seal Case	3
34	12180510CO-34	Square Ring, High Pressure Seal	3
35	12180510CO-35	Glide Ring, High Pressure Seal	3
36	12180510CO-36	Manifold	1
37	12180510CO-37	1/4 NPT Plug	3
38	12180510CO-38	3/8 NPT Plug	1
39	12180510CO-39	1/2 NPT Plug	1
40	12180510CO-40	O-Ring Valve Spacer	6
44	12180510CO-44	O-Ring Valve Plug	6
46	12180510CO-46	Washer, Ribbed Lock	8
47	12180510CO-47	Screw SHCSM5 x 25mm Long	4
48	12180510CO-48	Screw SHCS M5 x 35mm Long	4
51	12180513CO-51	Valve Plug	6
52	12180513CO-52	Valve Assembly 2.3 through 4.2 GPM	6
	B647800003	Pump Oil 16 oz.	

REPAIR KITS P/N:	Model Number	Items in Kit	Per Kit
B653090001	SRC HPP SK 0.50/SS	30, 31, 32, 33, 34 & 35	3
B654080002	SRC HPP VK 2.3 - 4.2/SS	40, 44 & 52	6
B652090002	SRC HPPK 2.3 - 4.2/SS	30, 31, 32, 33, 34, 35, 40, 44 & 52	6

HIGH PRESSURE PUMP AquaWhisper LEFT ORIENTATION

Capacities available in 3.0 GPM and 4.2 GPM





HIGH PRESSURE HOSE ASSY AquaWhisper SERIES

AquaWhisper Compact Style Systems:

AWC	ASSEMBLY LENGTH WITH FITTINGS END TO END LOWER	P/N	ASSEMBLY LENGTH WITH FITTINGS END TO END UPPER	P/N
400	9.75	B390800001	23.125	B390800007
600	12.125	B390800002	27.875	B390800009
800-1	16.875	B390800004	32.125	B390800010
800-2	9.75	B390800001	9.75	B390800001
1200	12.125	B390800002	14.125	B390800003
1500	16.875	B390800004	17.875	B390800005

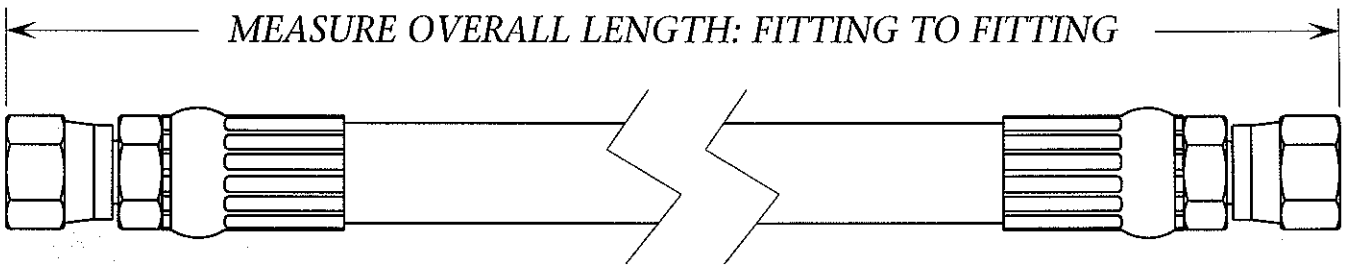
AquaWhisper Frame Style Systems:

AWF	ASSEMBLY LENGTH WITH FITTINGS END TO END LOWER	P/N	ASSEMBLY LENGTH WITH FITTINGS END TO END UPPER	P/N
400	9.625	B390800001	25.625	B390800008
600	12.125	B390800002	32.125	B390800010
800-1	16.875	B390800004	35.125	B390800011
800-2	9.625	B390800001	14.125	B390800003
1200	12.125	B390800002	17.875	B390800005
1500	16.875	B390800004	21.375	B390800006

AquaWhisper Modular Style Systems:

AWM	ASSEMBLY LENGTH WITH FITTINGS END TO END LOWER	P/N	ASSEMBLY LENGTH WITH FITTINGS END TO END UPPER	P/N
	72 +	B390800012	72 +	B390800012

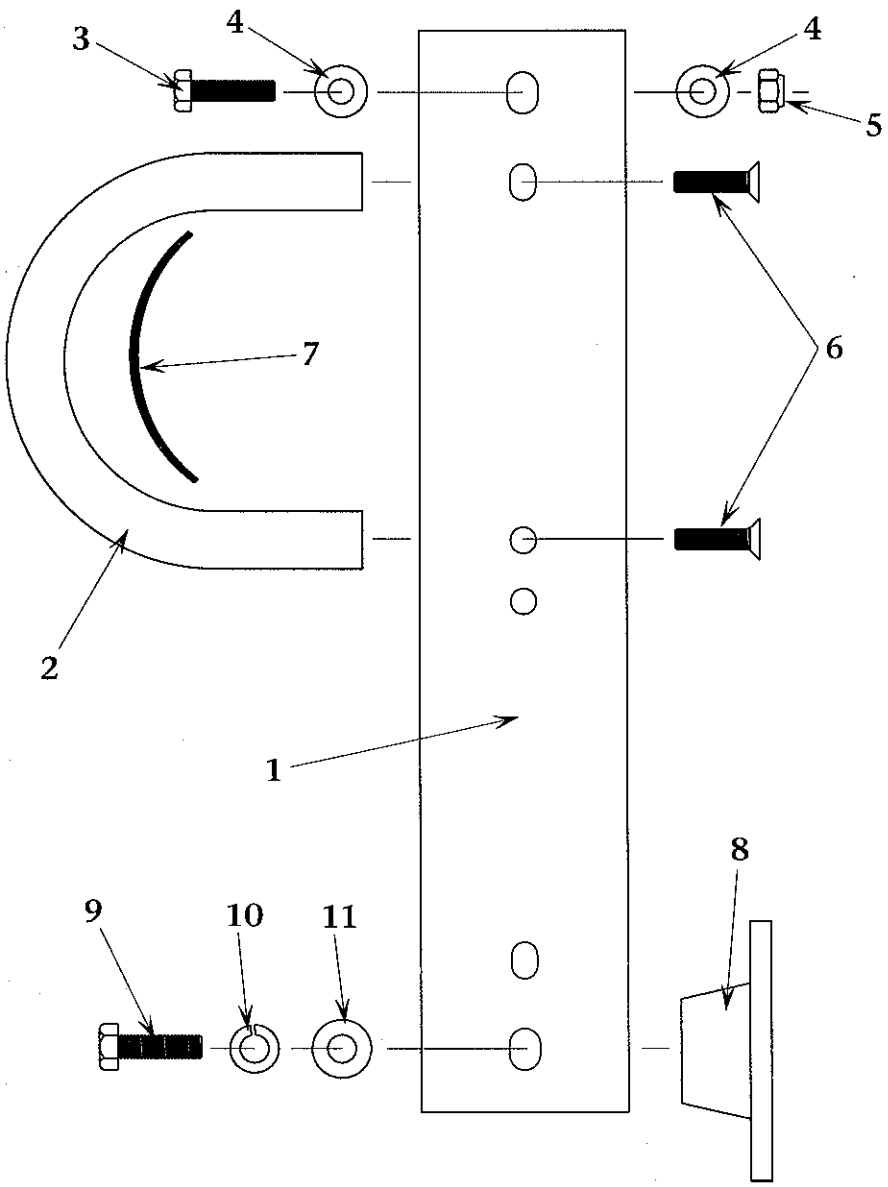
NOTE: LOWER HOSE IS HP PUMP OUTLET TO 1ST MVA, UPPER IS OUTLET OF LAST MVA TO HP MANIFOLD



OVERALL LENGTH IS + / - 1" (2.5cm)

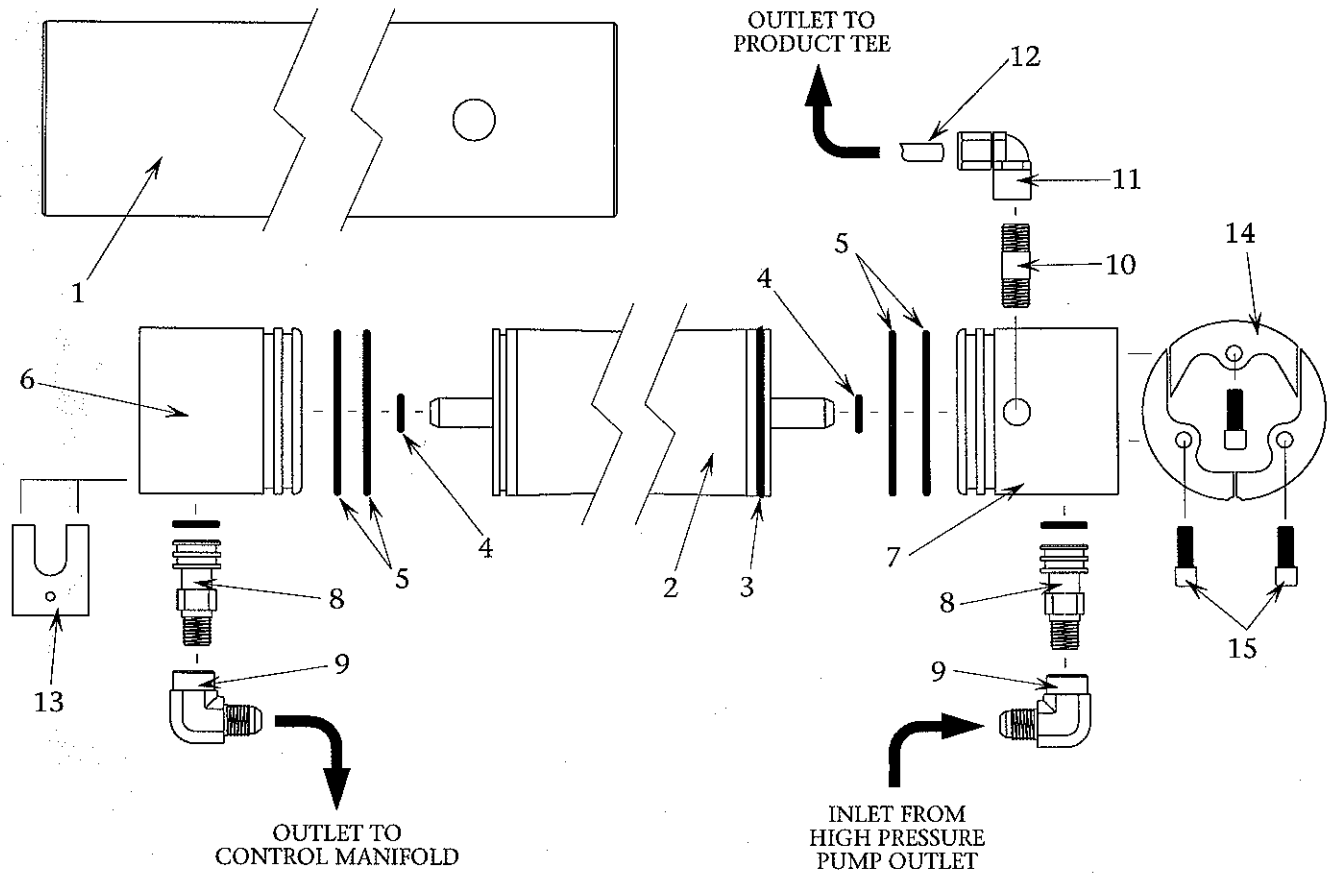
B197900003 SINGLE MEMBRANE VESSEL RACK AquaWhisper SERIES
B197900004 DOUBLE MEMBRANE VESSEL RACK AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-11		MVA RACK AW SERIES	1
1	0520051800	MVA RACK AQUA WHISPER SERIES	2
2	05202401GR	BRACKET MVA (AL) U-CLAMP AquaWhisper SERIES	2 OR 4
3	061142145016	BOLT HEX 1/4-20 x 1" SS	4
4	061100043000	WASHER FLAT O/S 1/4"	8
5	061060045000	NUT HEX 1/4-20 W/INSERT SS	4
6	061161845016	SCREW ALLEN FLAT 1/4-20 x 1" SS	4 OR 8
7	2632180526	DECOFELT 1/16" x 1" BLACK ADHESIVE PER FOOT	1
8	2115030120	RUBBER MOUNT -55 AQUA SERIES (OPTIONAL)	4
9	061142150016	BOLT HEX 5/16-18 x 1" SS (OPTIONAL)	4
10	061120049000	WASHER SPLIT LOCK 5/16" SS (OPTIONAL)	4
11	061100019000	WASHER FLAT O/S 5/16" SS (OPTIONAL)	4



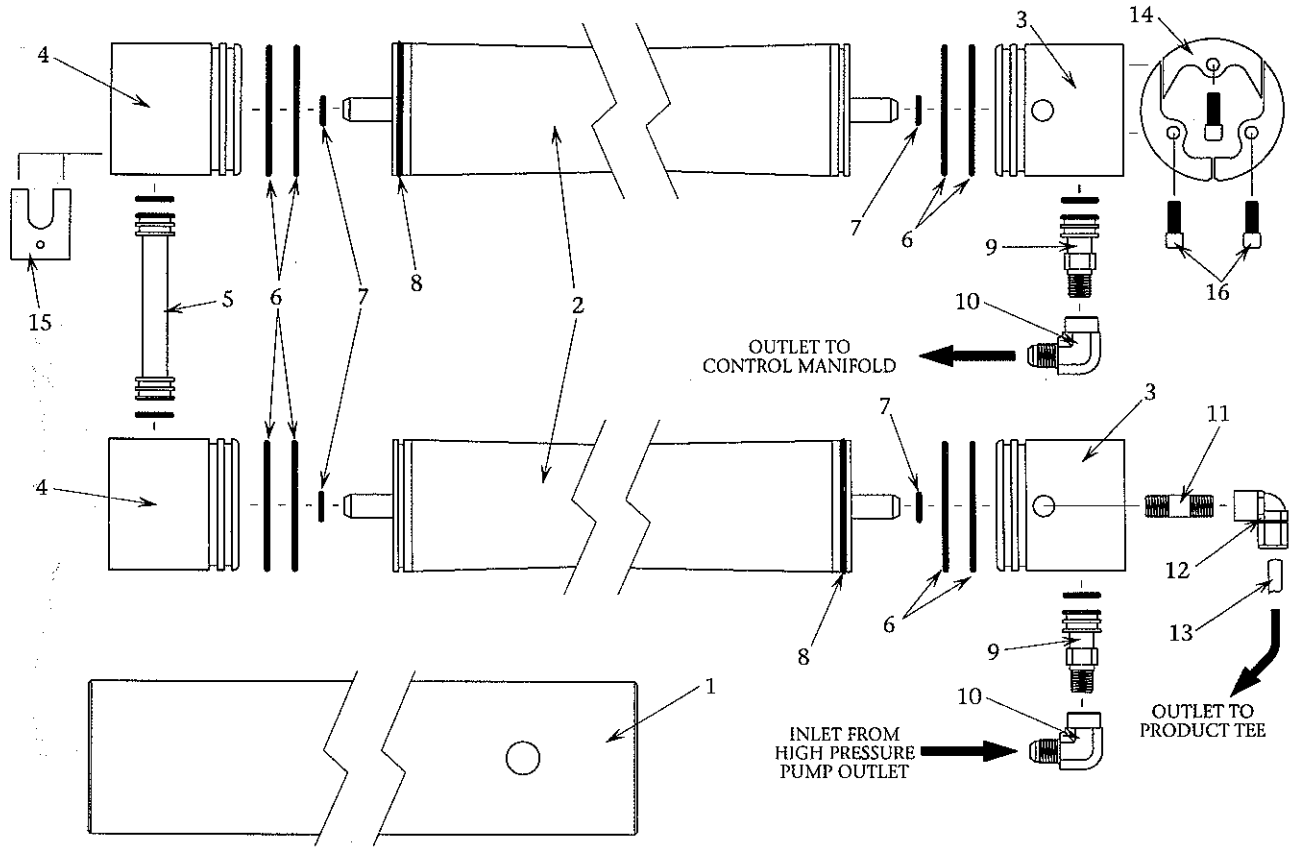
MEMBRANE VESSEL ASSY (SINGLE) AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-15		MVA SINGLE AW SERIES	1
1	2408132500	HIGH PRESSURE VESSEL 20"	1
	2408132500-01	HIGH PRESSURE VESSEL 30"	1
	2408132500-02	HIGH PRESSURE VESSEL 40"	1
2	2724011233	440GPD SW MEMBRANE 20"	1
	2724011333	720GPD SW MEMBRANE 30"	1
	2724011433	900GPD SW MEMBRANE 40"	1
3	2614050433	BRINE SEAL 3"	1
4	2614010100	O-RING PRODUCT	2
5	2614014900	O-RING BRINE 3"	4
6	2453502400	END PLUG SINGLE PORT 3"	1
7	2453512400	END PLUG DUAL PORT 3"	1
8	0117410800	HP NIPPLE MVA AquaWhisper	2
	2614017900	O-RING INTERCONNECT AW	2
9	1317011769	ELBOW 90° -6 FLARE x 1/4" FT SS	2
10	0101370815	NIPPLE 1/4" NPT x 1 1/2" PVC	1
11	0204010869	ELBOW 90° 1/4" FT x 1/4" TUBE PLASTIC	1
12	0312121969	TUBE 1/4" BLACK PER FOOT	2
13	0520210600	PORT RETAINER MVA AquaWhisper	2
14	20201030000	SEGMENT RING MVA AquaWhisper (SET)	2
15	061162345012	SCREW SOC CAP 1/4-20 x 3/4" SS	6



MEMBRANE VESSEL ASSY (DUAL) AquaWhisper SERIES

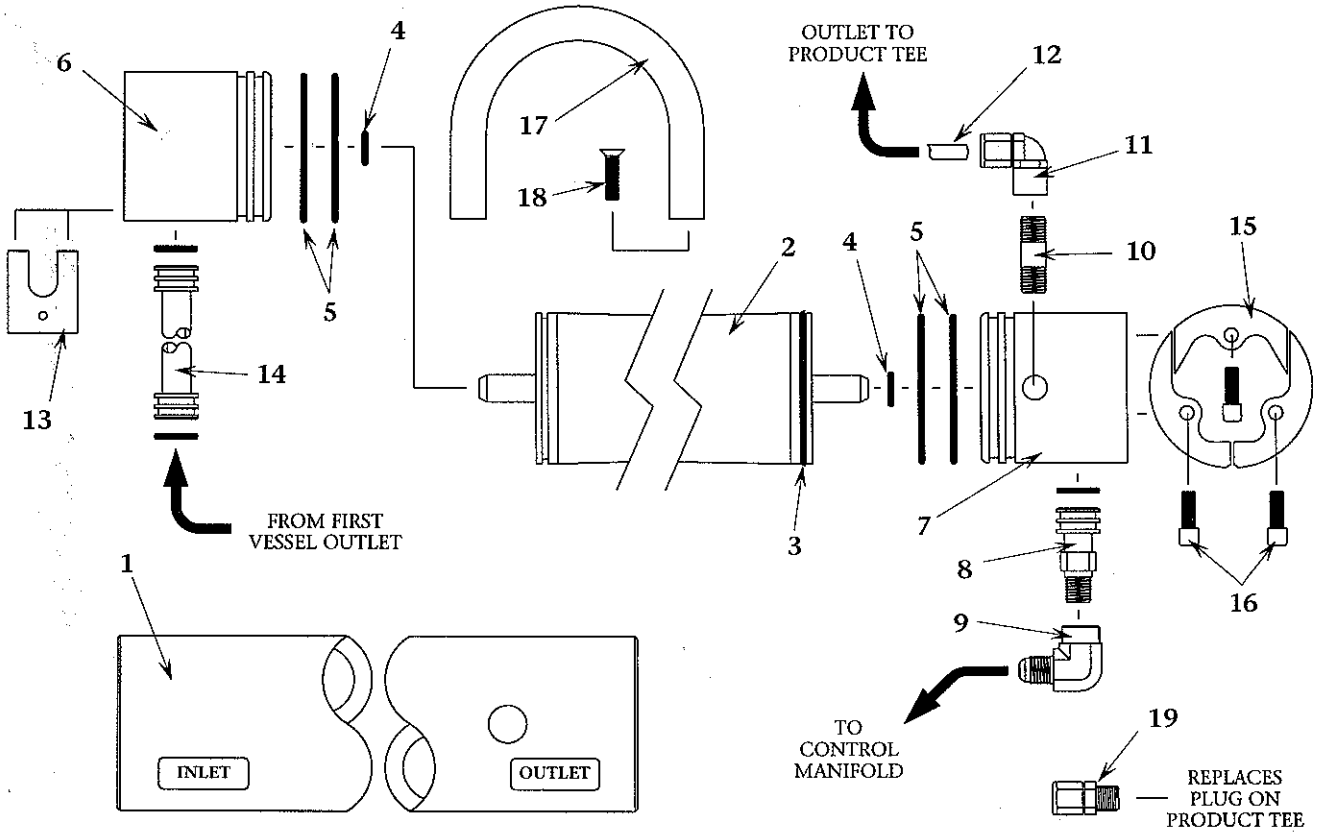
ITEM	PART NUMBER	DESCRIPTION	QTY
1-16		MEMBRANE VESSEL ASSY DUAL AW SERIES	
1	2408132500	HIGH PRESSURE VESSEL 20"	2
	2408132500-01	HIGH PRESSURE VESSEL 30"	2
	2408132500-02	HIGH PRESSURE VESSEL 40"	2
2	2724011233	440GPD SW MEMBRANE 20"	2
	2724011333	720GPD SW MEMBRANE 30"	2
	2724011433	900GPD SW MEMBRANE 40"	2
3	2453512400	END PLUG DUAL 3"	2
4	2453502400	END PLUG SINGLE 3"	2
5	2417430800	INTERCONNECT MVA AquaWhisper	1
	2614017900	O-RING INTERCONNECT AW	4
6	2614014900	O-RING BRINE 3"	8
7	2614010100	O-RING PRODUCT	4
8	2614050433	BRINE SEAL 3"	2
9	0117410800	HP NIPPLE MVA AquaWhisper	2
	2614017900	O-RING INTERCONNECT AW	4
10	1317011769	ELBOW 90° -6 FLARE x 1/4" FT SS	2
11	0101370815	NIPPLE 1/4" NPT x 1 1/2" PVC	2
12	0204010869	ELBOW 90° 1/4" FT x 1/4" TUBE PLASTIC	1
13	0312121969	TUBE 1/4" BLACK PER FOOT	3
14	20201030000	SEGMENT RING MVA AquaWhisper (SET)	4
15	0520210600	PORT RETAINER MVA AquaWhisper	4
16	061162345012	SCREW SOC CAP 1/4-20 x 3/4" SS	12



B2408x0004 MEMBRANE VESSEL ASSY UPGRADE (400 GPD) AquaWhisper
B2408x0005 MEMBRANE VESSEL ASSY UPGRADE (600 GPD) AquaWhisper
B2408x0006 MEMBRANE VESSEL ASSY UPGRADE (800 GPD) AquaWhisper

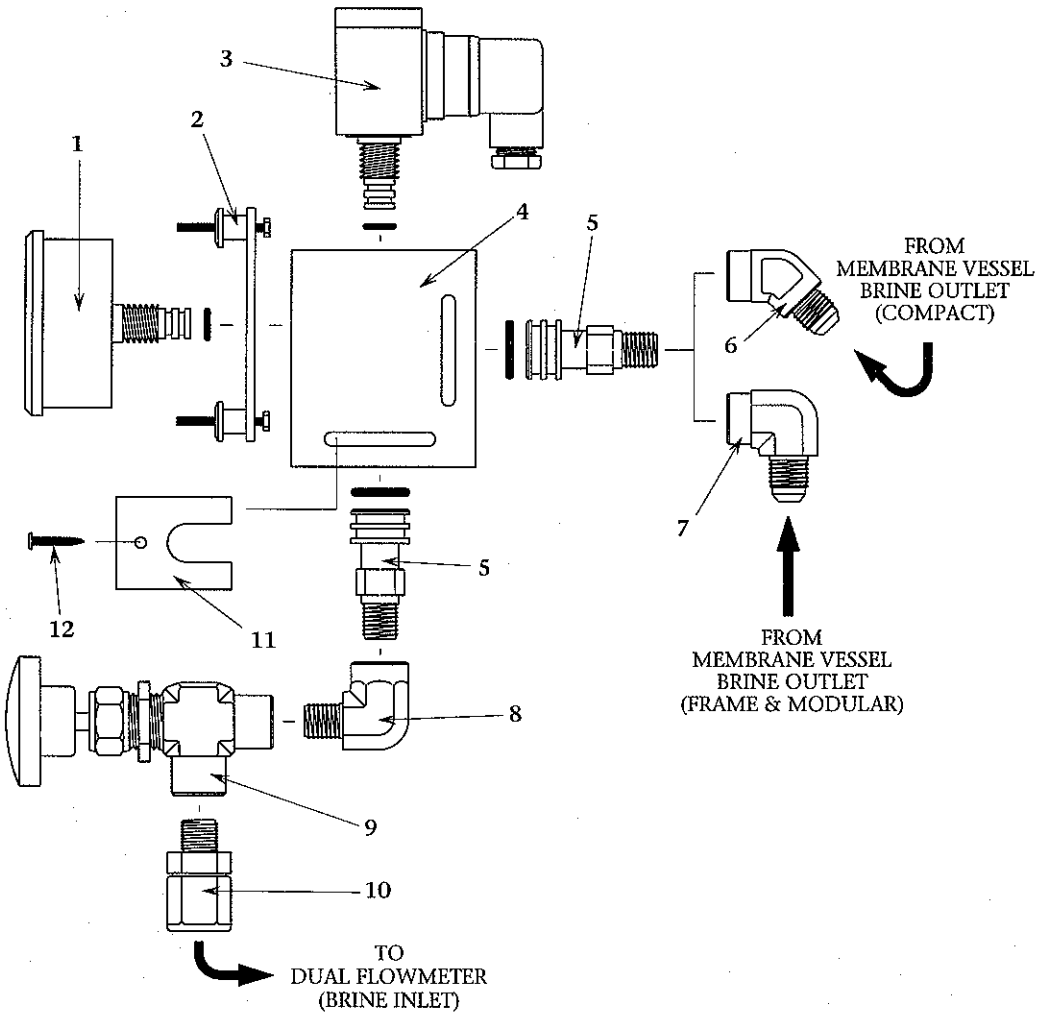
REFER TO PAGE K-18 FOR MVA UPGRADE INSTALLATION INSTRUCTIONS.

ITEM	PART NUMBER	DESCRIPTION	QTY
1-18		MVA UPGRADE AquaWhisper	1
1	2408132500	HIGH PRESSURE VESSEL 20"	1
	2408132500-01	HIGH PRESSURE VESSEL 30"	1
	2408132500-02	HIGH PRESSURE VESSEL 40"	1
2	2724011233	440GPD SW MEMBRANE 20"	1
	2724011333	720GPD SW MEMBRANE 30"	1
	2724011433	900GPD SW MEMBRANE 40"	1
3	2614050433	BRINE SEAL 3"	1
4	2614010100	O-RING PRODUCT	2
5	2614014900	O-RING BRINE 3"	4
6	2453502400	END PLUG SINGLE PORT 3"	1
7	2453512400	END PLUG DUAL PORT 3"	1
8	0117410800	HP NIPPLE MVA AquaWhisper	1
	2614017900	O-RING INTERCONNECT AW	6
9	1317011769	ELBOW 90° -6 FLARE x 1/4" FT SS	2
10	0101370815	NIPPLE 1/4" NPT x 1 1/2" PVC	1
11	0204010869	ELBOW 90° 1/4" FT x 1/4" TUBE PLASTIC	1
12	0312121969	TUBE 1/4" BLACK PER FOOT	10
13	0520210600	PORT RETAINER MVA AquaWhisper	2
14	2417430800	INTERCONNECT MVA AquaWhisper	1
15	20201030000	SEGMENT RING MVA AquaWhisper (SET)	2
16	061162345012	SCREW SOC CAP 1/4-20 x 3/4" SS	6
17	05202401GR	BRACKET MVA (AL) U-CLAMP AquaWhisper	2
18	061161845016	SCREW ALLEN FLAT 1/4-20 x 1" SS	4
19	0204090869	CONNECTOR 1/4" TUBE x 1/4" MPT PLASTIC	1



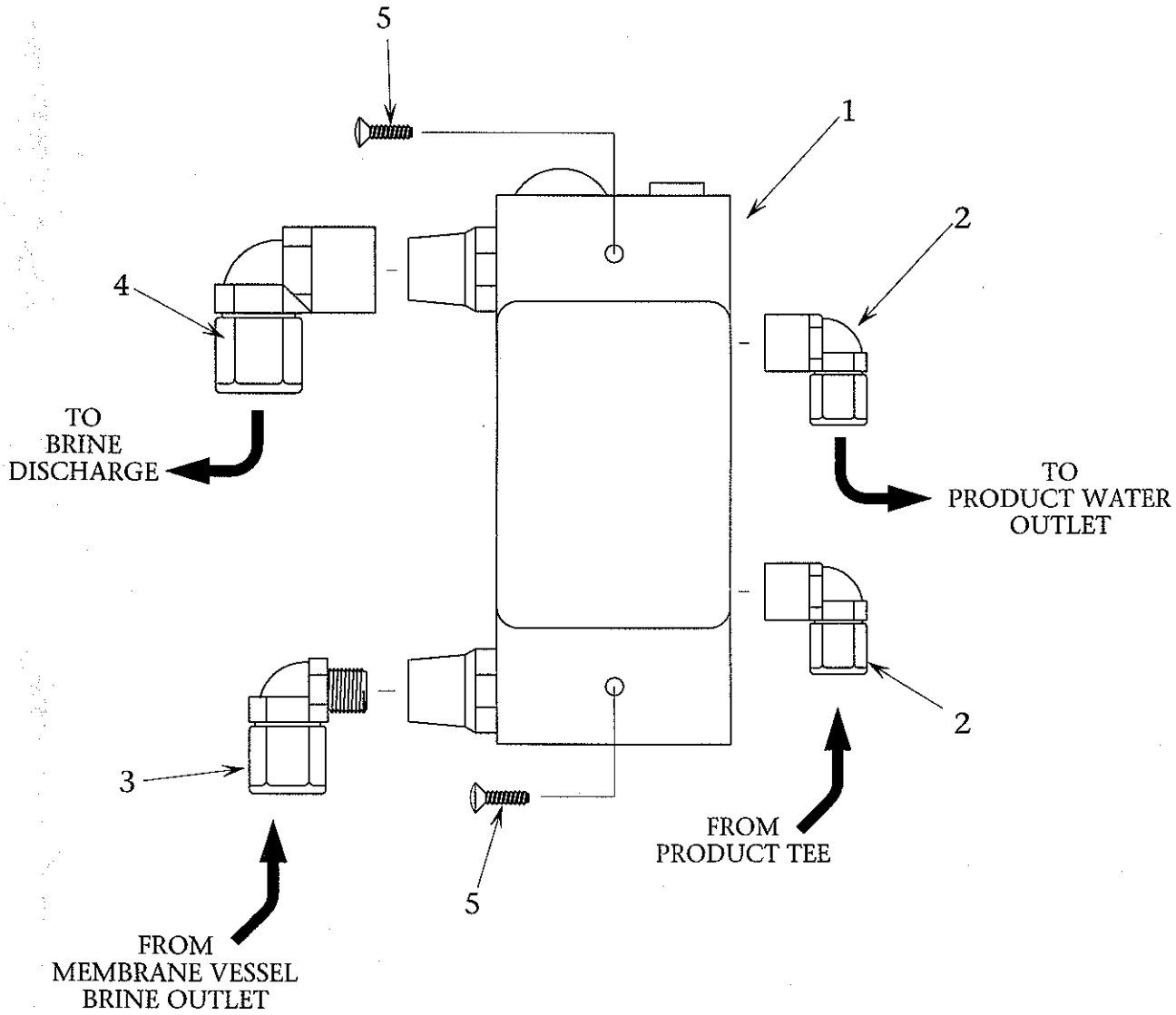
HIGH PRESSURE MANIFOLD ASSY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-12		HP MANIFOLD ASSY AW SERIES	1
1	10181421CC	GAUGE 0/1400 PSI CBM O-RING SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
2	05180851CC	MOUNTING BRACKET CBM GAUGE	1
3	2321020458	SWITCH HIGH PRESSURE 900 PSI O-R SEAL	1
	2614015800	O-RING GAUGE/PRES SWITCH	2
4	5301090500	MANIFOLD HIGH PRESSURE AW SERIES	1
5	0117410800	HP NIPPLE AquaWhisper	2
	2614017900	O-RING INTERCONNECT AW	4
6	1317064800	ELBOW 45° -6 FLARE x 1/4 FT SS	1
7	1317011769	ELBOW 90° -6 FLARE x 1/4" FT SS	1
8	0117230869	ELBOW 90° STREET 1/4" FT x 1/4" MT SS	1
9	1417017896	VALVE PRESSURE REGULATOR -AS	1
	061080081000	WASHER 3/4" FLAT SS	1
10	0204091769	CONNECTOR 1/4" MT x 3/8" TUBE PLASTIC	1
11	0520210600	PORT RETAINER AQUA WHISPER	2
12	061170618109	SCREW PHIL PAN "A" #6 x 3/4" SS	2



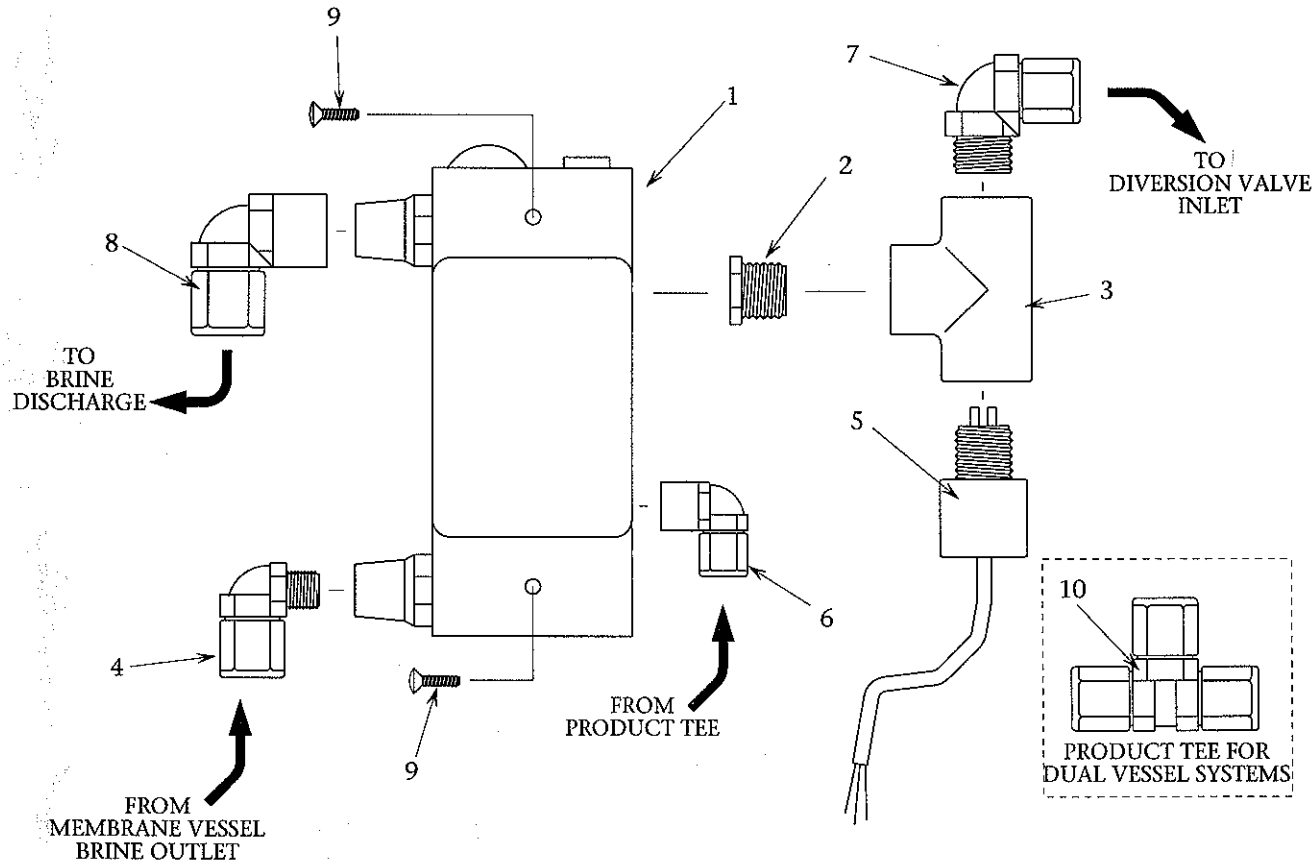
B510900005 DUAL FLOW METER ASSY
AquaWhisper FRAME & COMPACT SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-5	B510900005	DUAL FLOW METER ASSY AW FRAME & COMPACT SERIES	1
1	1109111200	FLOWMETER AW	1
2	0204010869	ELBOW 90° 1/4" TUBE x 1/4" FPT PLASTIC	2
3	0204021769	ELBOW 90° 3/8" TUBE x 1/4" MPT PLASTIC	1
4	0204012569	ELBOW 90° 1/2" TUBE x 1/2" FPT PLASTIC	1
5	061161131006	SCREW PHIL OVAL 10-32 x 3/8" SS	2



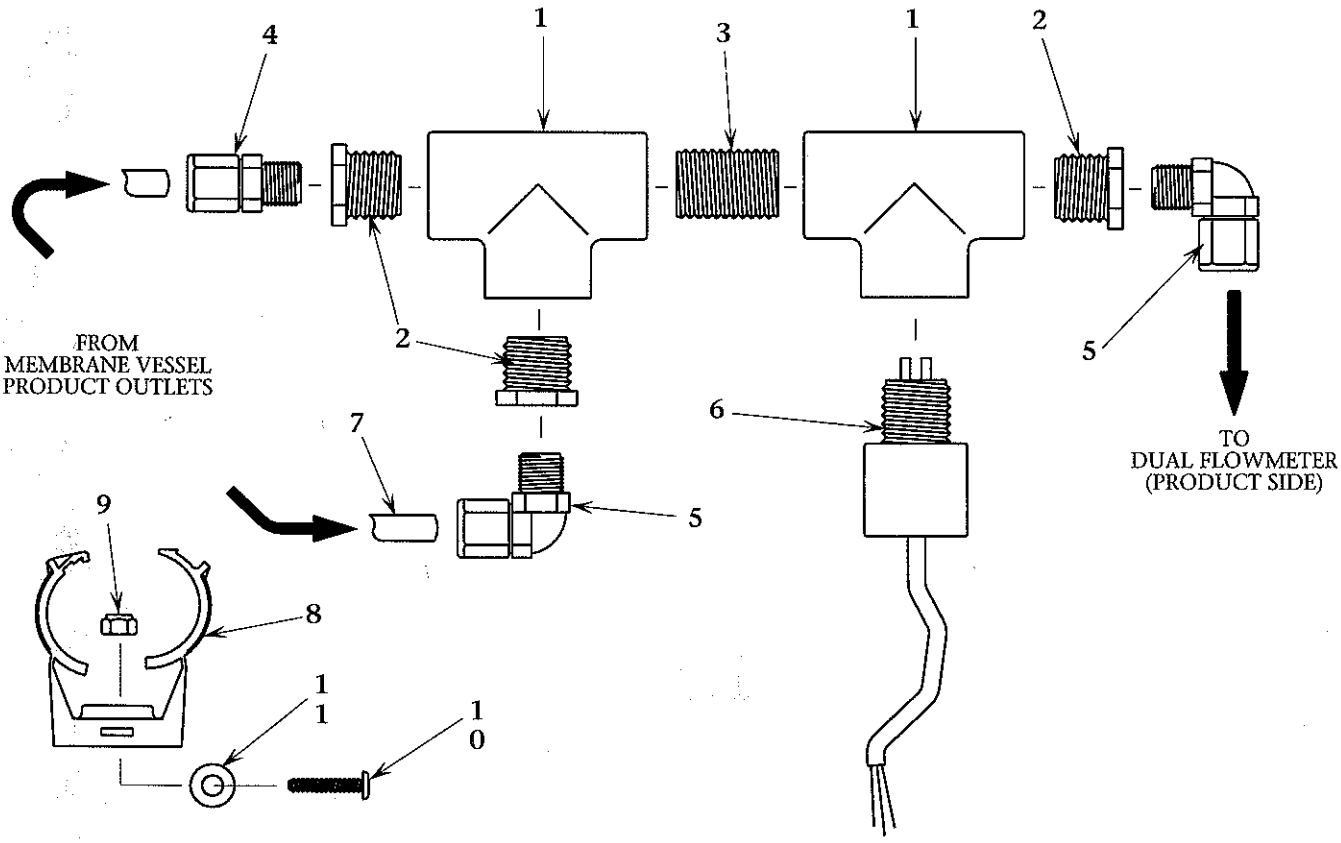
B510900006 DUAL FLOW METER ASSY AquaWhisper MODULAR

ITEM	PART NUMBER	DESCRIPTION	QTY
1-10	B510900006	DUAL FLOW METER ASSY AW MODULAR	1
1	1109111200	FLOWMETER AW	1
2	0101292383	RED BUSH 1/2" MT x 1/4" FT PVC	1
3	0101422583	TEE 1/2" FT x 1/2" FT x 1/2" FT PVC	1
4	0204021769	ELBOW 90° 3/8" TUBE x 1/4" MPT PLASTIC	1
5	B511080001	SALINITY PROBE ASSY -AS	1
6	0204010869	ELBOW 90° 1/4" TUBE 1/4" FPT PLASTIC	1
7	0204021969	ELBOW 90° 3/8" TUBE x 1/2" MPT PLASTIC	1
8	0204012569	ELBOW 90° 1/2" TUBE x 1/2" FPT PLASTIC	1
9	061161131006	SCREW PHIL OVAL 10-32 x 3/8" SS	2
10	0204240869	TEE UNION 1/4" TU x 1/4" TU x 1/4" TU PLASTIC	1



Z511870001 PRODUCT WATER MANIFOLD ASSY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-11	Z511870001	PRODUCT WATER MANIFOLD ASSY	1
1	0101422583	TEE 1/2" FT x 1/2" FT x 1/2" FT PVC	1
2	0101292383	RED BUSH 1/2" MT x 1/4" FT PVC	3
3	01013744CL	NIPPLE 1/2" NPT x CLOSE PVC	1
4	0204090869	CONNECTOR 1/4" MT x 1/4" TUBE PLASTIC	1
5	0204020869	ELBOW 90° 1/4" MT x 1/4" TUBE PLASTIC	2
6	B511080001	SALINITY PROBE ASSY -AS	1
7	0312121969	TUBE BLACK 1/4" PER FOOT	4
8	0501164400	PIPE SUPPORT 1"	2
9	065070031000	NUT LOCKING 10-32 NYLON	2
10	061160631012	SCREW PHIL PAN 10-32 x 3/4" SS	2
11	065080028000	WASHER #10 NYLON	2

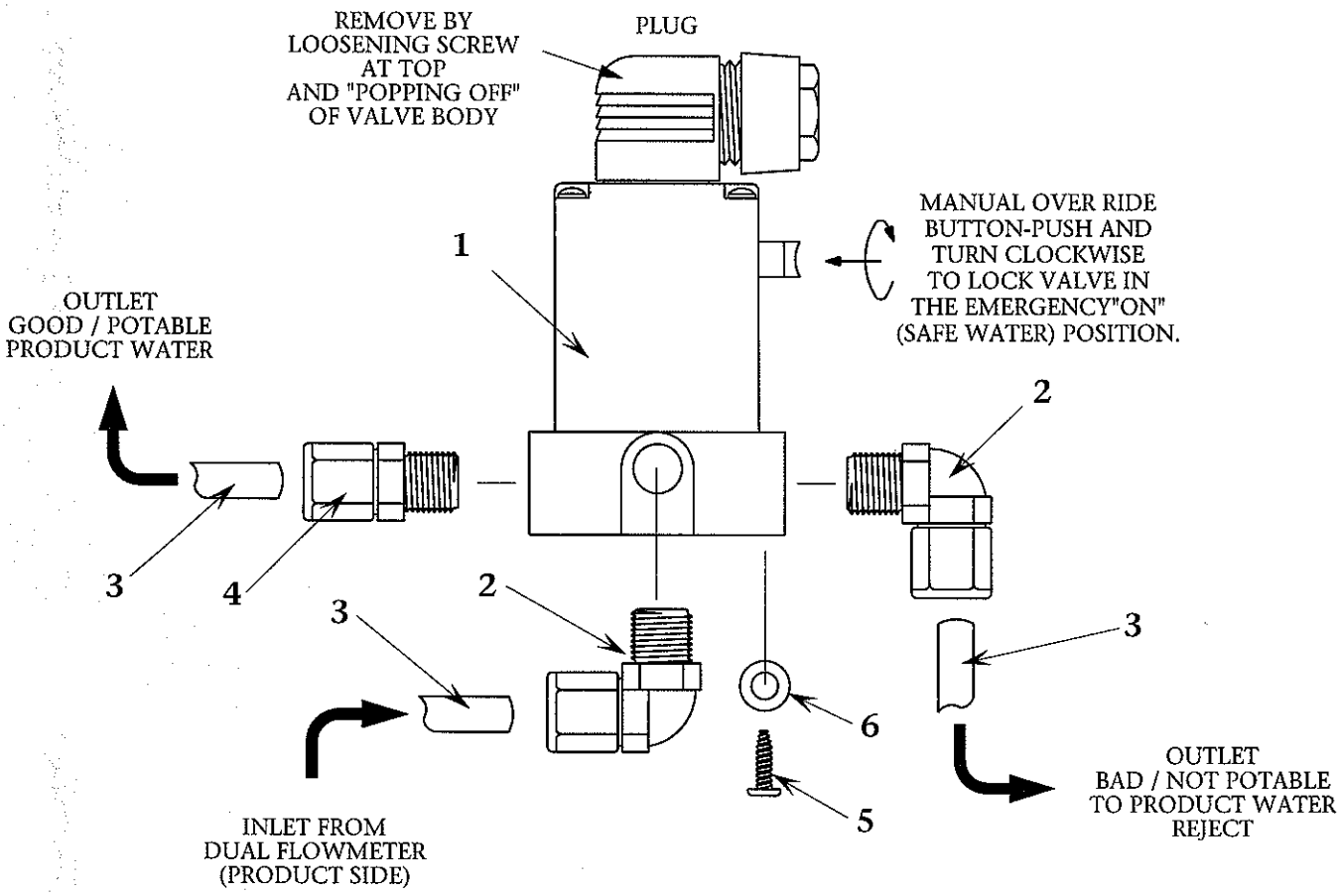


B59580000X ELECTRONIC CONTROLLER ASSY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-9	B595800007	ELEC CONT ASSY TO 240V AW	1
1-10	B595800006	ELEC CONT ASSY 380V & UP	1
1	3131221200	ENCLOSURE AquaWhisper	1
2	31311805CG	HOUR METER 9-60VDC/20-75VAC	1
	061160620012	SCREW PHIL PAN 6-32 x 3/4" SS	2
	065070020000	NUT LOCKING 6-32 NYLON	2
3	31315601CJ	TOUCH PAD MAIN	1
4	3131231700	CHASSIS PLATE CONTROLLER	1
	061160631005	SCREW 10-32 x 5/16" PHIL PAN C/S	7
	3131170147	CHANNEL DIN 35mm RAIL	1
5	31310603BF	CONTACTOR 30 AMPS AquaWhisper >12/99 12VDC	1
	061160631006	SCREW 10-32 x 3/8" PHIL PAN C/S	4
	061120028000	WASHER SPLIT LOCK #10 SS	4
6	31314301CW	POWER SUPPLY 110/208/220/240	1
	3131301500	FUSE 2A - AW POWER SUPPLY ONLY	1
	061160620005	SCREW 6-32 x 1/4" w/WASHERS C/S	4
	067272720004	STANDOFF 6-32 x 1/4" M x F HEX	4
7	31310110BF	CONTACTOR AUX 9 AMP AUX AW>12/99 12VDC	1
8	31311501BY	DIN TERMINAL (BLACK)	2
	31311502BY	DIN TERMINAL (RED)	6
	31311503BY	DIN TERMINAL (BLUE)	4
	31311504BY	DIN TERMINAL (GREEN)	3
	31311602BY	SEPARATOR DIN	3
	3131190347	END ANCHOR	2
9	B596800005	PCB MAIN AW>12/99	1
	061161620004	SCREW PHIL FLAT 6-32 x 1/4" SS	4
	067262820008	STANDOFF 6-32 x 1/2" F x F HEX	5
	061120018000	WASHER SPLIT LOCK #6	4
	061160620005	SCREW 6-32 x 1/4" w/WASHERS C/S	5
10	3131131100	TRANSFORMER 3 PHASE > 240 VAC, AW>2000	1
	3131301600	FUSE 1A - AW TRANSFORMER ONLY	1
	061160631005	SCREW 10-32 x 5/16" PHIL PAN C/S	4
	061120028000	WASHER SPLIT LOCK #10 SS	4
11	1920020732	STRAIN RELIEF CG-6250	2
12	1920026532	STRAIN RELIEF CG-3138	2
13	1920016590	STRAIN RELIEF LIQ-TITE 90° BLK	2
	4928402608	ANACONDA 3/4" BLK PER FOOT	4
	1920023632	STRAIN RELIEF CG90-6250	2
OPTIONAL EQUIPMENT (NOT SHOWN):			
14	B596800006	SOFT START AQUA WHISPER >2000	1

B516800003 DIVERSION VALVE ASSY
AquaWhisper FRAME & COMPACT SERIES

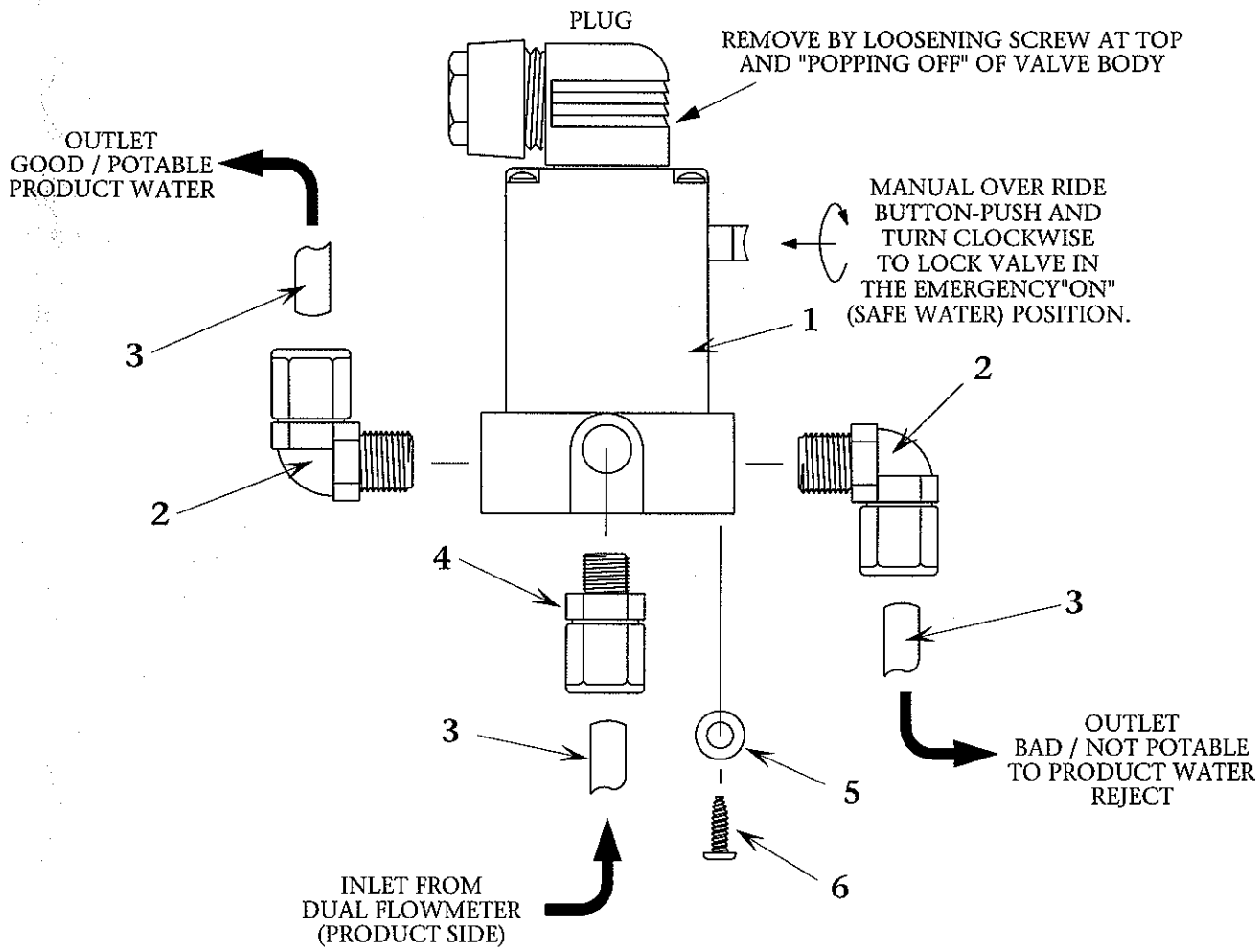
ITEM	PART NUMBER	DESCRIPTION	QTY
1-6	B516800003	DIVERSION VALVE ASSY AW FRAME & COMPACT SERIES	1
1	1401095998	VALVE SOLENOID 12VDC 8W	1
2	0204020869	ELBOW 90° 1/4" MT x 1/4" TUBE PLASTIC	2
3	0312121969	TUBE BLACK 1/4" PER FOOT	2
4	0204090869	CONNECTOR 1/4" MT x 1/4" TUBE PLASTIC	1
5	061170623010	SCREW PHIL PAN TYPE "B" #8 x 5/8" SS	4
6	061080023000	WASHER FLAT OS #8	4



PLUMBING CONNECTIONS
"P" = INLET (COMMON)
"B" = NORMALLY OPEN -TO DISCHARGE (BAD WATER)
"A" = NORMALLY CLOSED -TO CHARCOAL FILTER INLET (GOOD WATER)

B516800005 DIVERSION VALVE ASSY AquaWhisper MODULAR

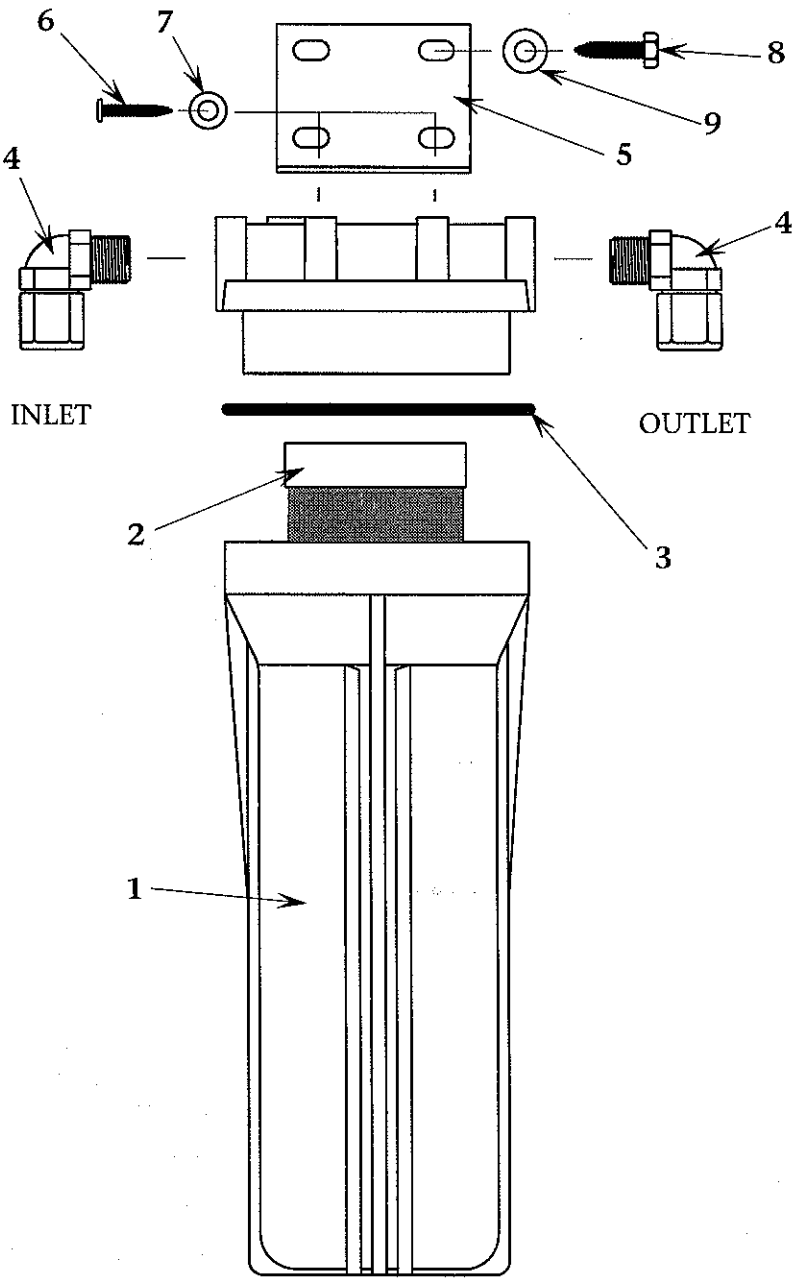
ITEM	PART NUMBER	DESCRIPTION	QTY
1-8	B516800005	DIVERSION VALVE ASSY AW MODULAR	1
1	1401095998	VALVE SOLENOID 12VDC 8W	1
2	0204010869	ELBOW 90° 1/4" MT x 1/4" TUBE PLASTIC	2
3	0312121969	TUBE BLACK 1/4" PER FOOT	2
4	0204091769	CONN 3/8" TUBE x 1/4" MPT PLASTIC	1
5	061170623010	SCREW PHIL PAN TYPE "B" #8 x 5/8" SS	4
6	061080023000	WASHER FLAT OS #8	4



PLUMBING CONNECTIONS
"P" = INLET (COMMON)
"B" = NORMALLY OPEN -TO DISCHARGE (BAD WATER)
"A" = NORMALLY CLOSED -TO CHARCOAL FILTER INLET (GOOD WATER)

B521080001 CHARCOAL FILTER ASSY AquaWhisper SERIES

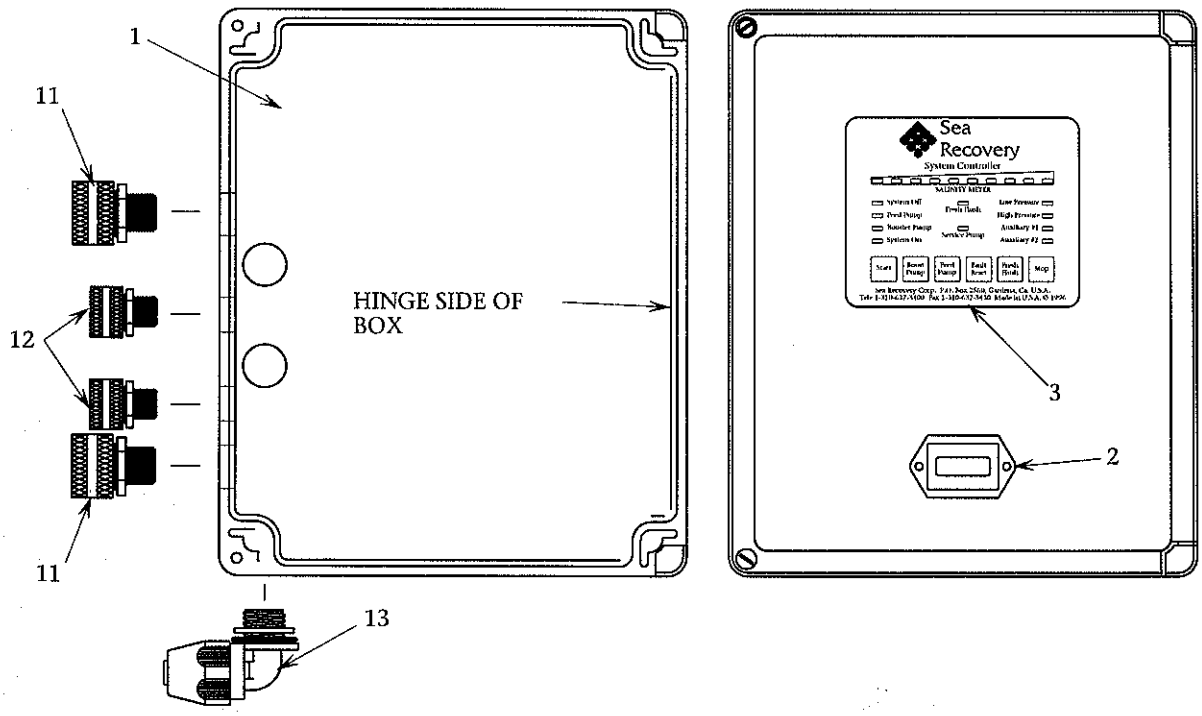
ITEM	PART NUMBER	DESCRIPTION	QTY
1-9	B521080001	CHARCOAL FILTER ASSY AW	1
1	0713020573	FILTER HOUSING / LID 3/8" x 10"	1
2	0803004773	ELEMENT CHARCOAL 10"	1
3	2614010473	O-RING BLUE HOUSING	1
4	0204021869	ELBOW 90° 3/8" MT x 3/8" TUBE PLASTIC	1
5	20200402100	BRACKET PREFILTER	1
6	061170628016	SCREW PHIL PAN TYPE "A" #10 x 1" SS	4
7	065080028000	WASHER FLAT #10 NYLON	4
8	061172143016	SCREW TYPE "A" 1/4" x 1" SS	4
9	061100043000	WASHER FLAT OS 1/4" SS	4



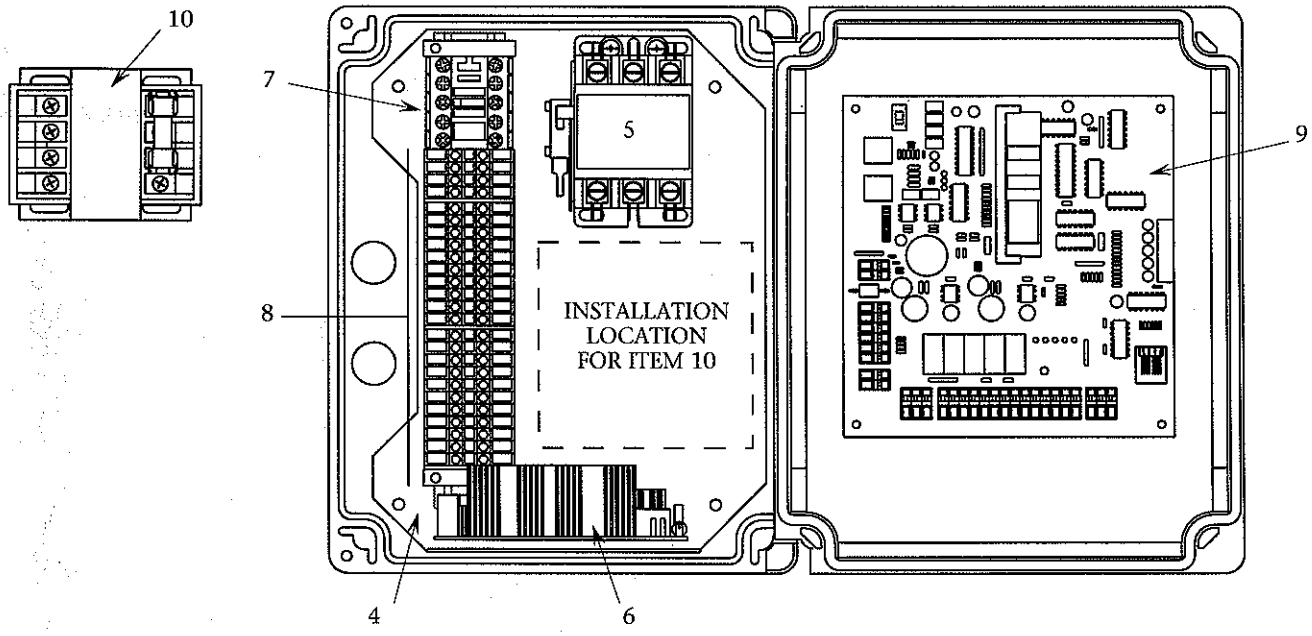
B59580000X ELECTRONIC CONTROLLER ASSY AquaWhisper SERIES

CONTROLLER BOX

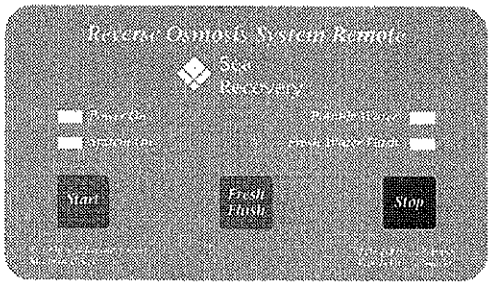
CONTROLLER LID



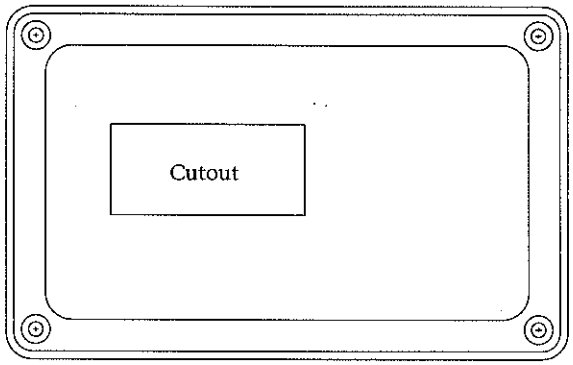
CONTROLLER WITH LID OPEN



Touch Pad Remote

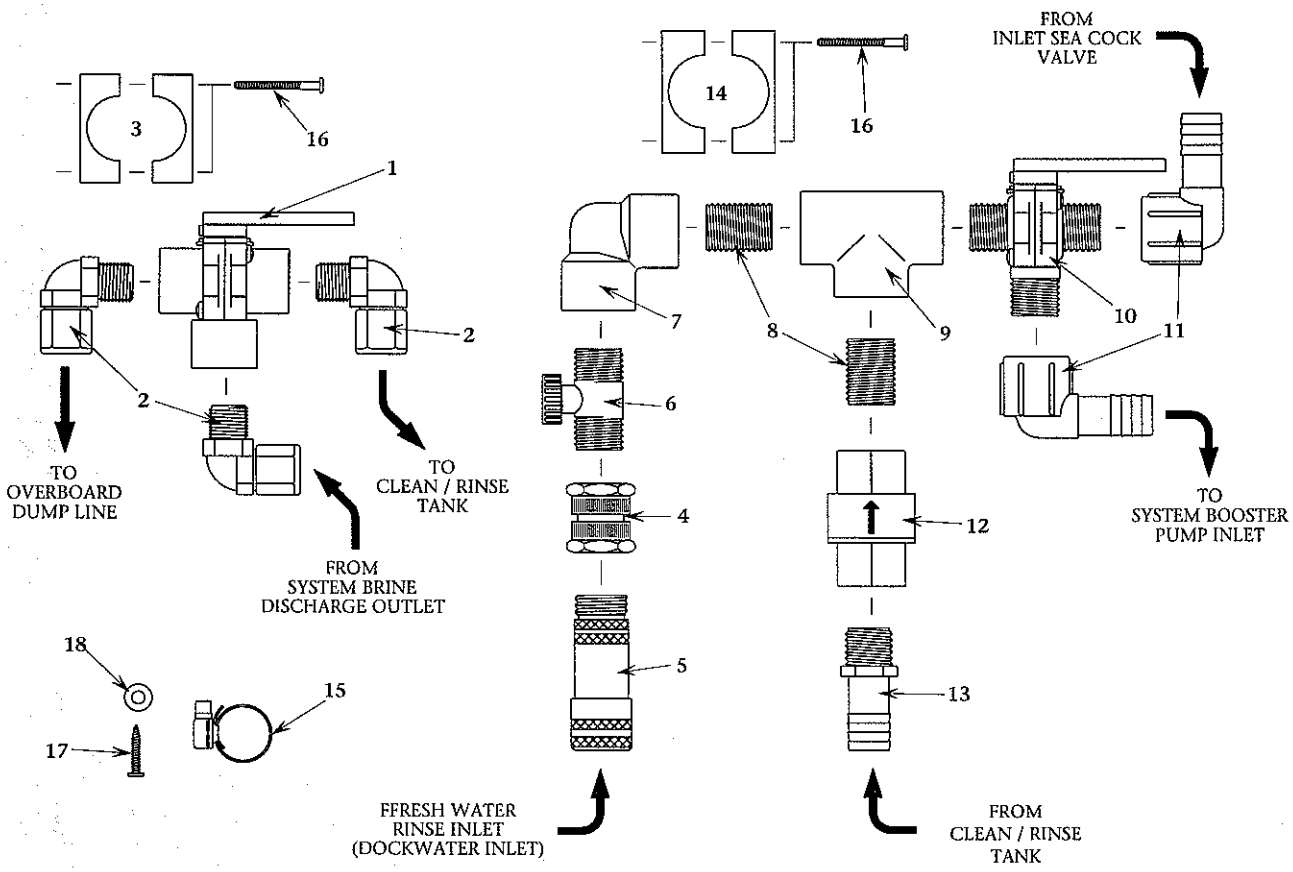


Bezel Remote



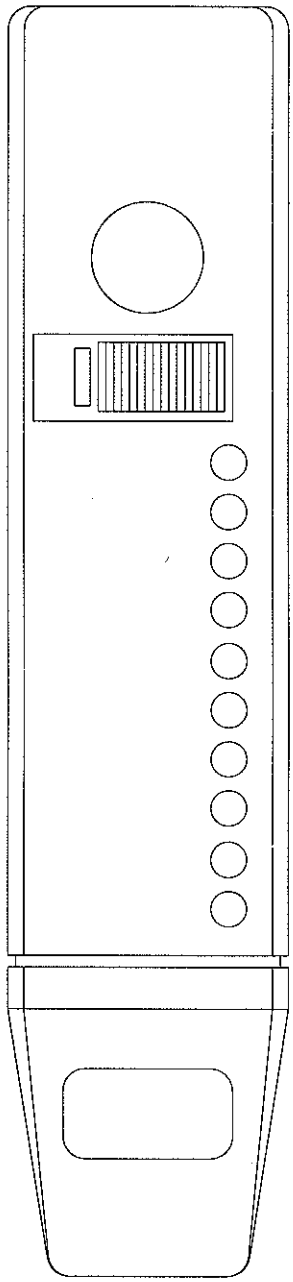
B591080002 CLEAN AND RINSE VALVE ASSY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-18	B591080002	CLEAN AND RINSE VALVE ASSEMBLY	1
1	4011336AR	VALVE THREE W/BALL 1/2" FT	1
2	0204022569	ELBOW 90° 1/2" TUBE x 1/2" MT PLASTIC	3
3	1453131700-02	VALVE BRACKET	1
4	0121093700	COUPLER 3/4" FGHT x 3/4" FGHT BRASS	1
5	14045101AR	VALVE INLINE PRESSURE REGULATOR 20 PSI	1
6	14011136AR	VALVE TWO WAY 3/4" MT x 3/4" GHT	1
7	0101013783	ELBOW 90° 3/4" FT x 3/4" FT PVC	1
8	01013737CL	NIPPLE 3/4" NPT x CLOSE PVC	2
9	0101423783	TEE 3/4" FT x 3/4" FT x 3/4" FT PVC	1
10	14011334AR	VALVE THREE WAY BALL 3/4" MT	1
11	0101063783	ELBOW 90° 3/4" FT x 3/4" BARB PVC	2
12	14012118AR	VALVE CHECK 3/4" FT	1
13	0101653783	ADAPTER 3/4" MT x 3/4" BARB	1
14	1453131700-03	VALVE BRACKET CLEAN RINSE KIT	2
15	05181434AA	HOSE CLAMP 3/4" SS	6
16	061161130028	SCREW PHIL OVAL 10-24 x 1 3/4"	8
17	061172143016	SCREW HEX "A" 1/4" x 1" SS	4
18	061100043000	WASHER FLAT OS 1/4" SS	4



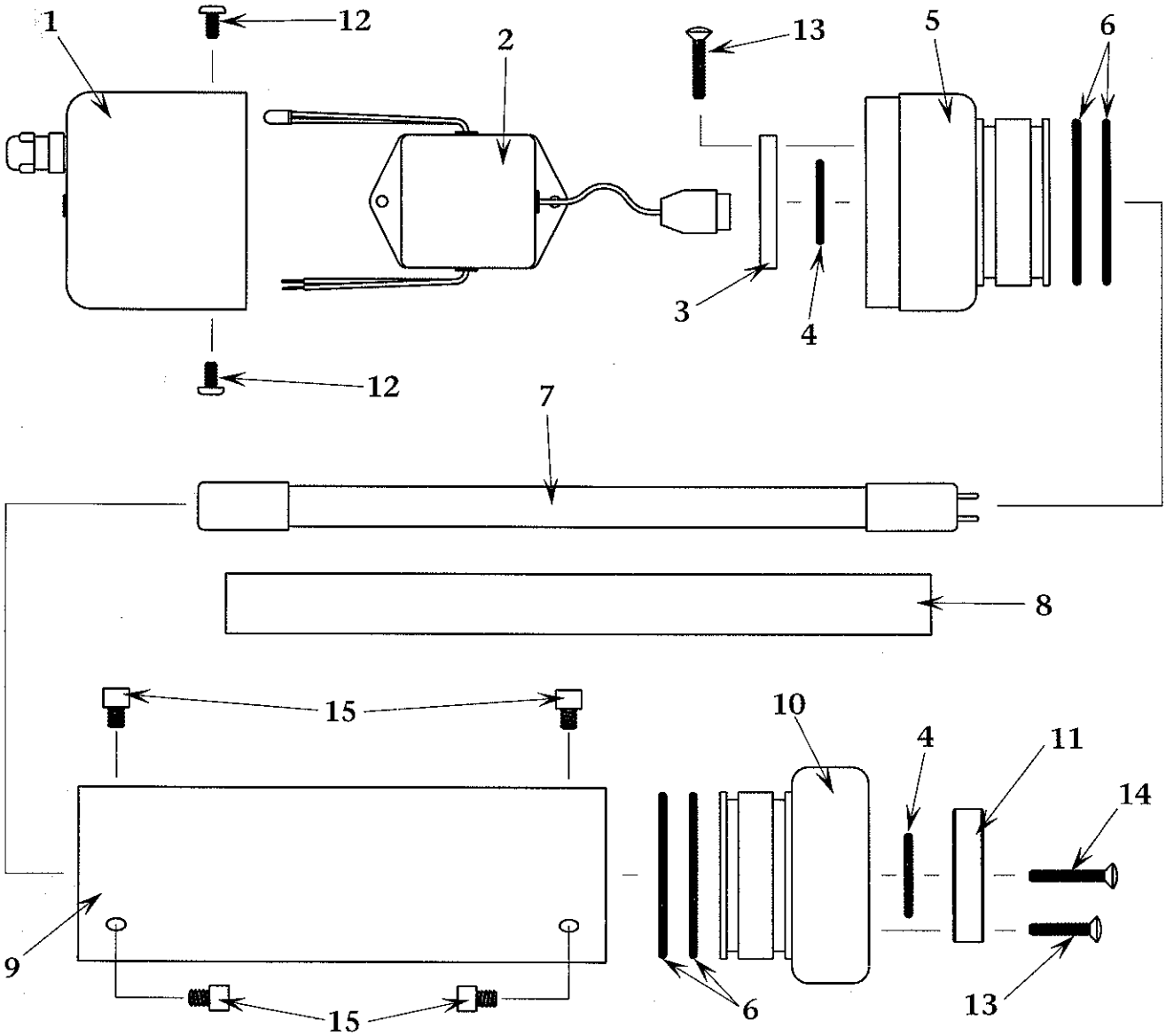
POCKET DS METER

PART NUMBER SRC PDSM



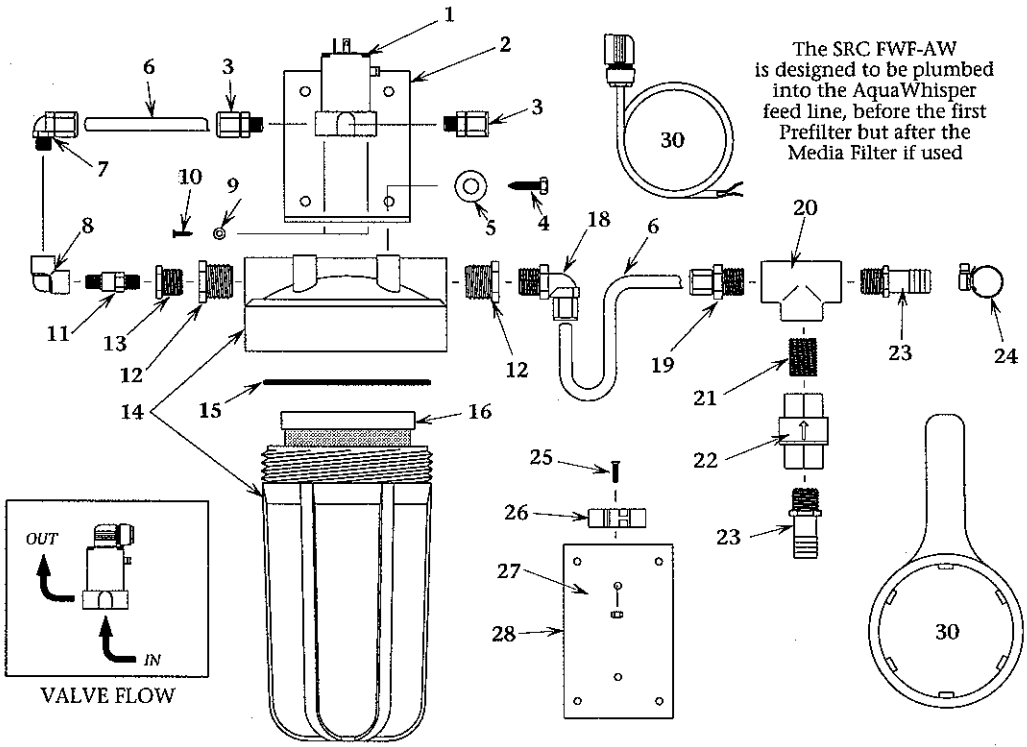
B52680000B ULTRA VIOLET STERILIZER AquaWhisper

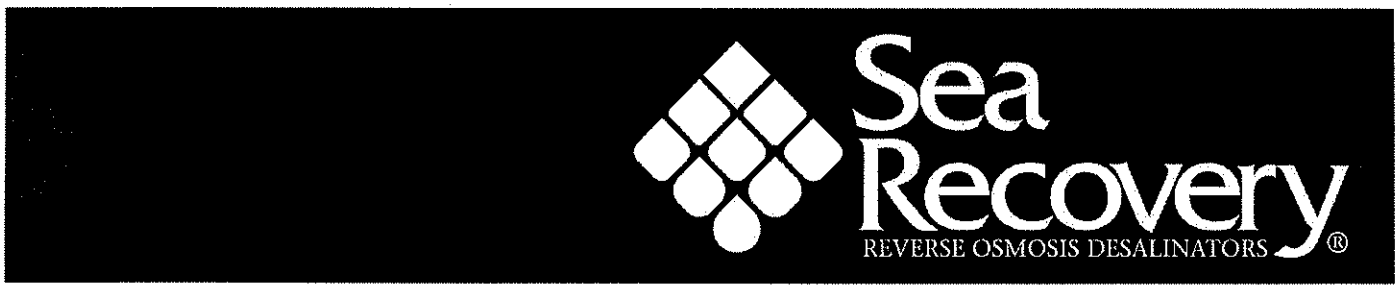
ITEM	PART NUMBER	DESCRIPTION	QTY
1-14	B52680000B	UV STERILIZER AQUA WHISPER	1
1	4000160100	CAP ELECTRICAL UV STERILIZER	1
	1904010643	STRAIN RELIEF 3444	1
2	4000021400	BALLAST 12VDC-4C UV STERILIZER	1
3	4000100200	BUSHING TOP END UV STERILIZER	1
4	2614011800	O-RING AIR BLEED VALVE	2
5	2401532200	END PLUG TOP UV STERILIZER	1
6	2614010200	O-RING END PLUG 2 1/2"	4
7	4000010400	LAMP UV AquaWhisper SERIES	1
8	4000040400	QUARTZ SLEEVE UV STERILIZER	1
9	2417202200	VESSEL UV STERILIZER	1
10	2401522200	END PLUG BOTTOM UV STERILIZER	1
11	4000100300	BUSHING BOTTOM END UV STERILIZER	1
12	061160630008	SCREW PHIL PAN 10-24 x 1/2" SS	2
13	061161130016	SCREW PHIL OVAL 10-24 x 1" SS	6
14	061161130020	SCREW PHIL OVAL 10-24 x 1 1/4" SS	1



B598000002 FRESH WATER FLUSH ASSY AquaWhisper SERIES

ITEM	PART NUMBER	DESCRIPTION	QTY
1-30	B598000002	FRESH WATER FLUSH - AQUA WHISPER SERIES	1
1	1401095998	VALVE SOLENOID 12 VDC 8W	1
2	2020040001	BRACKET CARBON FILTER HOUSING FWF	1
3	0204021769	CONNECTOR 3/8" TUBE x 1/4" MT PLASTIC	2
4	061172149020	SCREW HEX "A" 5/16" x 1 1/4" LAG	4
5	061100049000	WASHER FLAT OS 5/16" SS	4
6	0312123569	TUBE 3/8" BLACK PER FOOT	1
7	0204021769	ELBOW 90° 3/8" TUBE x 1/4" MPT PLASTIC	1
8	0101010883	ELBOW 90° 1/4" FT x 1/4" FT PVC	1
9	065080028000	WASHER FLAT #10 NYLON	4
10	061170623010	SCREW PHILLIPS PAN "B" #8 x 5/8" SS	4
11	14172105AT	VALVE CHECK 1/4"MPT SS	1
12	0101294383	REDUCER BUSHING 1" MT x 3/4" FT PVC	1
13	0101293483	REDUCER BUSHING 3/4" MT x 1/4" FT PVC	1
14	0713020606	FILTER HOUSING BIG BLUE	1
15	2614010500	O-RING BIG BLUE HOUSING	1
16	0803004906	ELEMENT CARBON BRIQUETTE	1
17	0101294283	REDUCER BUSHING 1" MT x 1/2" FT PVC	1
18	0204022069	ELBOW 90° 3/8" TUBE x 3/4" MPT PLASTIC	1
19	0204092069	CONNECTOR 3/8" TUBE x 3/4" MPT PLASTIC	1
20	0101423783	TEE 3/4" FT x 3/4" FT x 3/4" FT PVC	1
21	01013737CL	NIPPLE 3/4" NPT x CLOSE PVC	1
22	14012118AR	VALVE CHECK 3/4" FT	1
23	0101653783	ADAPTER 3/4" MT x 3/4" BARB PVC	2
24	05181434AA	HOSE CLAMP 3/4" SS	4
25	061161626012	SCREW PHILLIPS FLAT 8-32 x 3/4" SS	2
26	0501164400	PIPE SUPPORT 1"	2
27	061060026000	NUT HEX 8-32 w/INSERT SS	2
28	20200400029	BRACKET CHECK VALVE FWF	1
29		CABLE ASSEMBLY FWF-AW	1
30	0713020606-3	FILTER LID WRENCH BIG BLUE	1





SECTION M

Conversion Charts

NOTES:

MICRON / INCH / MESH

COMPARISON MEASUREMENTS

MICRON	INCH	INCH (opening)	MESH
1	.00003937	.0070	100
5	.00019685	.0075	90
10	.00039370	.0075	80
15	.00059055	.0078	70
20	.00078740	.011	60
25	.00098425	.013	50
30	.00118110	.018	40
40	.00157480	.026	30
50	.00196850	.041	20
75	.00295275	.085	10
100	.0039370	.177	5
200	.0078740	.937	1

TEMPERATURES CELSIUS vs FAHRENHEIT

CONVERSION CHART

°F	°C	°F	°C
0	-32	122	50
32	0	131	55
41	5	140	60
50	10	149	65
59	15	158	70
68	20	167	75
78	25	176	80
86	30	185	85
95	35	194	90
104	40	203	95
113	45	212	100

°CELSIUS = 0.556 (°F -32)

°FAHRENHEIT = (1.8°C) +32

Sea Recovery® TEMPERATURE EFFECT COMPARISON CHART

(At 820 psi & 35,000 ppm TDS NaCl feed water conditions)

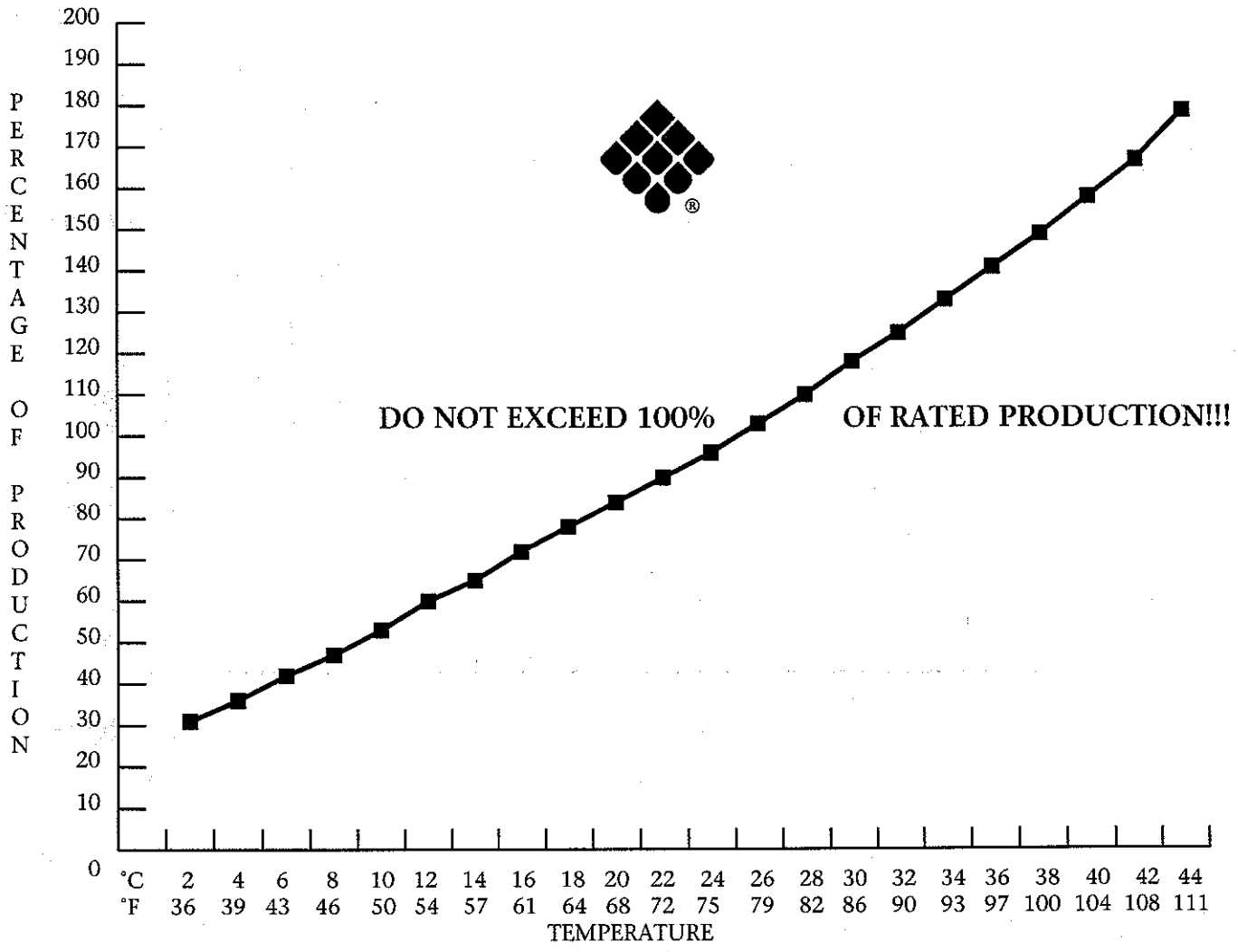
The Temperature Effect Chart on this page illustrates the loss or gain of productivity across the RO membrane.

To determine what normal (in spec.) flow of the RO membrane would be at 77° F / 25° C follow these directions:

1) Determine feed source temperature.
2) Locate the corresponding temperature on the chart
3) Follow the corresponding temperature in a vertical line up to the plotted production line.
4) From this temperature point at the production line, move left horizontally to the plotted productivity percent.
5) Calculate the system's present productivity in U.S. gallons per day by multiplying the gallon per hour product water flow meter reading by 24.
6) Divide the figure reached in step 5 above, present gallon per day productivity, by the plotted productivity percentage from step 4 above. The answer will be equivalent to the membranes present productivity at specification test parameters, 820 psi & 77° F / 25° C.

Example:

1) With the system operating at 820 psi.
2) Present feed temperature is 61°F or 16° C.
3) Plotted productivity is therefore 72% of normal.
4) The system is a 400 gallon per day model and it is presently producing 280 gallons per day.
5) 280 gallons per day divided by .72 equals 388 gallons per day calculated productivity. The system is rated at 400 gallons per day ±15% (340 to 460 gallons per day). Therefore, the system is within specifications at 280 gallons per day actual productivity at 61° F/16° C, 820 psi and 35,000 ppm feed.



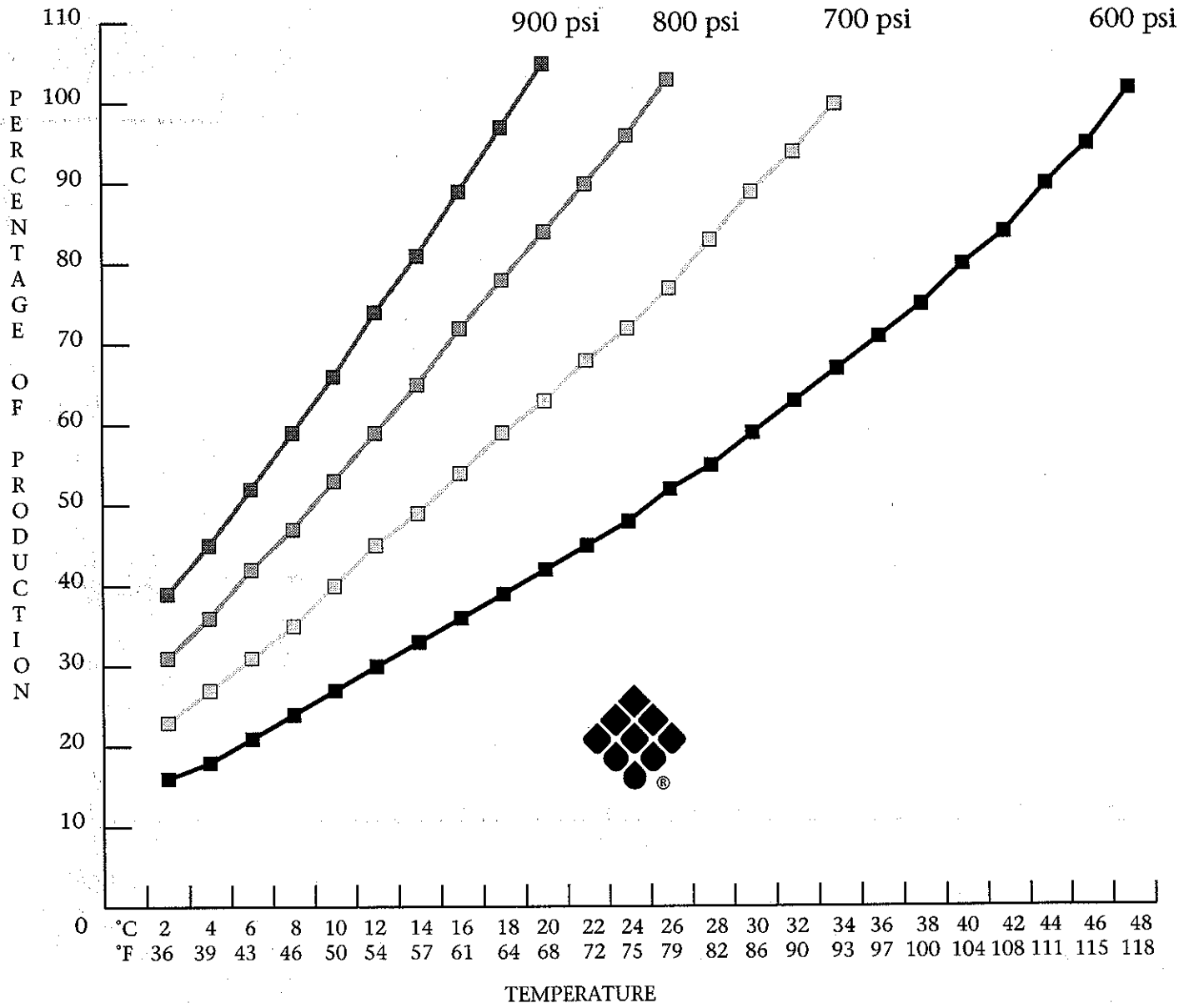
Sea Recovery®

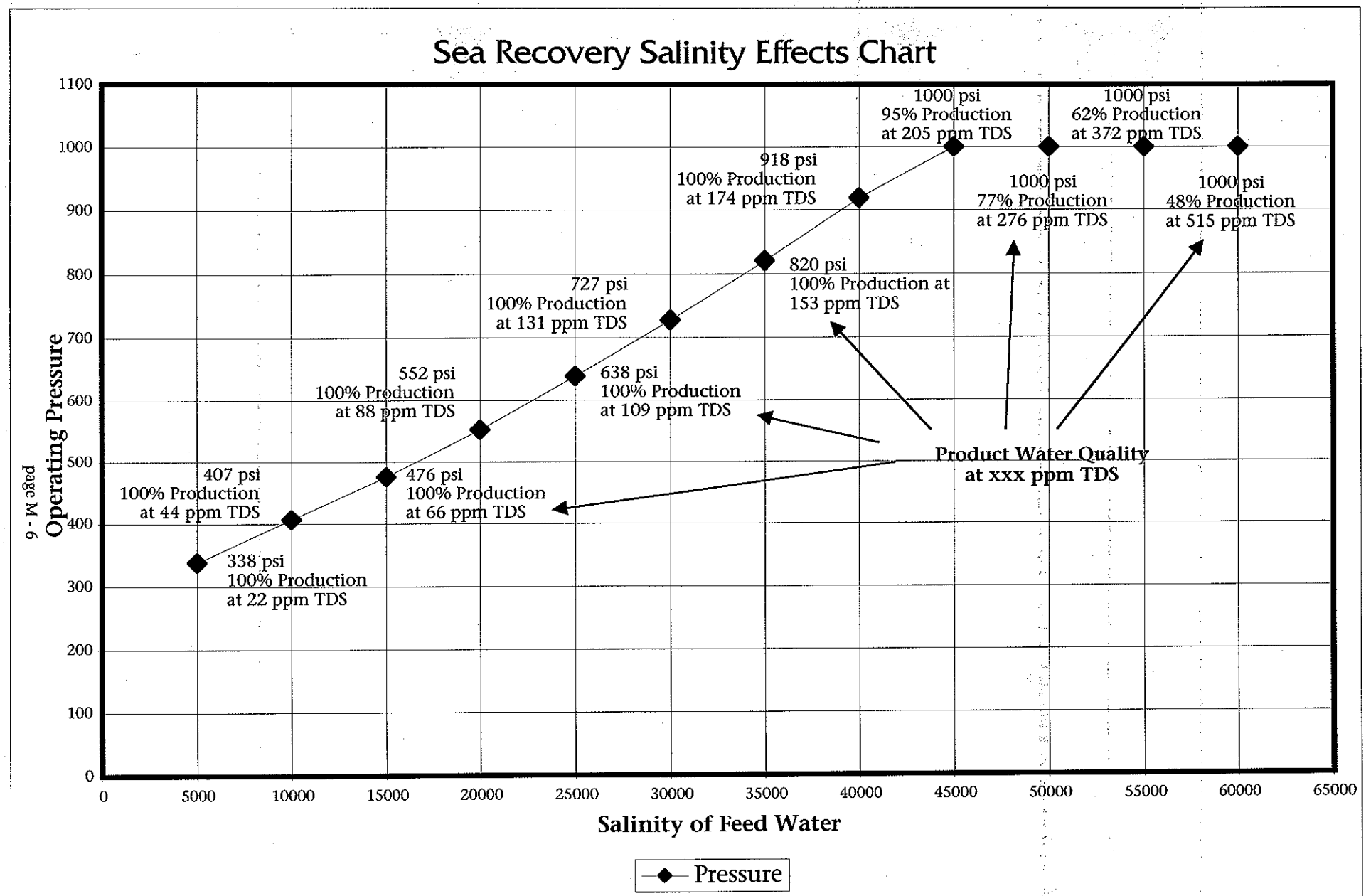
SEAWATER TEMPERATURE & PRESSURE EFFECTS CHART

(Do not use this chart for brackish water systems & applications)

As the seawater temperature increases, the Sea Recovery system pressure must be adjusted so that the system achieves no greater than 100% of rated product water flow. Product water flow greater than 100% of rated product water flow will cause premature fouling of the SRC RO membrane element. This will lead to more frequently required cleaning and void all warranties of the SRC RO membrane element.

DO NOT EXCEED 100% OF RATED PRODUCTION!!!




Sea Recovery Salinity Effects Chart
Operating Pressure
Salinity of Feed Water
Pressure
1100
1000
900
800
700
600
500
400
300
200
100
0
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
60000
65000
1000 psi
95% Production
at 205 ppm TDS
1000 psi
62% Production
at 372 ppm TDS
1000 psi
77% Production
at 276 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
Product Water Quality
at xxx ppm TDS

WATER COMPARISON CHART

GALLONS / VOLUME / WEIGHT

U.S. GALLON	CUBIC FEET	CUBIC YARD	CUBIC METER	TON SHORT	TON METRIC
1	.13	.005	.004	.004	.004
5	.67	.025	.019	.021	.019
10	1.34	.050	.038	.041	.038
25	3.34	.129	.10	.104	.094
50	6.68	.248	.19	.208	.189
100	13.37	.50	.38	.42	.38
200	26.74	.99	.76	.83	.76
300	40.10	1.49	1.14	1.25	1.13
400	53.47	1.98	1.51	1.67	1.51
500	66.84	2.48	1.89	2.08	1.89
600	80.21	2.97	2.27	2.50	2.27
700	93.58	3.47	2.65	2.92	2.65
800	106.94	3.96	3.03	3.33	3.02
900	120.31	4.46	3.41	3.75	3.40
1,000	133.68	4.95	3.79	4.17	3.78
2,500	334.20	12.38	9.46	10.41	9.45
5,000	668.40	24.76	18.93	20.83	18.89
7,500	1002.60	37.13	28.39	31.24	28.34
10,000	1336.81	49.51	37.85	41.65	37.79
25,000	3342.00	123.80	94.60	104.10	94.50
50,000	6684.00	247.60	189.30	208.30	188.90
75,000	100.6.00	371.30	283.90	312.40	283.40
100,000	13368.06	495.11	378.54	416.50	377.85

1 U.S. GALLON	=	**231. CU. INCH**
1 U.S. GALLON OF WATER	=	**8.33 LBS.**
1 SHORT TON	=	**2000 LBS.**
1 METRIC TON	=	**2204.6 LBS.**
1 CU. INCH OF WATER	=	**0.0360 LBS.**
1 CU. FOOT OF WATER	=	**62.4 LBS.**
1 IMPERIAL GALLON OF WATER	=	**10.0 LBS.**
1 GALLON	=	**3.7854 LITERS**
1 CUBIC METER	=	**1000 LITERS**
1 CUBIC METER	=	**264 GALLONS**

PPM CONVERSION CHART

SPECIFIC CONDUCTANCE IN MICROMHOS	SPECIFIC RESISTANCE IN OHMS	DISSOLVED SOLIDS P.P.M.	DISSOLVED SOLIDS MHOS	RESISTANCE* OHMS	RESISTANCE* P.P.M.
.0385	26,000,000	NONE	250.0	4,000	125
.0556	18,000,000	.02777	256.4	3,900	128
.0625	16,000,000	.03125	263.2	3,800	132
.0714	14,000,000	.03571	270.3	3,700	135
.0833	12,000,000	.04166	277.8	3,600	139
.1	10,000,000	.05	285.7	3,500	143
.125	8,000,000	.0625	294.1	3,400	147
.167	6,000,000	.08333	303.0	3,300	152
.2	5,000,000	.1	312.0	3,200	156
.25	4,000,000	.125	322.5	3,100	161
.5	2,000,000	.25	333.3	3,000	166
1	1,000,000	.5	344.8	2,900	172
2	500,000	1	357.0	2,800	179
4	250,000	2	370.4	2,700	185
6	166,666	3	384.6	2,600	192
8	125,000	4	400.0	2,500	200
10	100,000	5	416.6	2,400	208
12	83,333	6	434.8	2,300	217
14	71,428	7	454.5	2,200	227
16	62,500	8	476.2	2,100	238
18	55,555	9	500.0	2,000	250
20	50,000	10	526.3	1,900	263
22	45,454	11	555.5	1,800	278
24	41,666	12	588.2	1,700	294
26	38,461	13	625.0	1,600	312
28	35,714	14	666.6	1,500	333
30	33,333	15	714.2	1,400	357
40	25,000	20	769.2	1,300	384
50	20,000	25	833.3	1,200	416
60	16,666	30	909.0	1,000	500
70	14,286	35	1,000	1,000	500
80	12,500	40	1,111	900	555
100	10,000	50	1,250	800	625
120	8,333	60	1,428	700	714
140	7,142	70	1,666	600	833
160	6,250	80	2,000	500	1,000
180	5,555	90	2,500	400	1,250
200	5,000	100	3,333	300	1,667
			5,000	200	2,500
			10,000	100	5,000

*Approximate dissolved solids expressed as Calcium Carbonate (CaC03)

PRESSURE

psi	Kg/cm²	"Hg	bar	kPa	atmosphere
1	0.0704	2.036	0.0689	6.895	0.0681
14.22	**1**	28.96	0.981	98.07	0.968
0.4912	0.0345	**1**	0.0339	3.386	0.03342
14.504	1.02	29.53	**1**	100	0.987
0.14504	0.0102	0.295	0.01	**1**	0.00987
14.7	1.033	29.92	1.013	101.3	**1**

PRESSURE

psi		Kg/cm²		"Hg		bar		kPa		atmosphere
1 psi	=	0.0704 Kg/cm²	=	2.036 Hg	=	0.0689 bar	=	6.895 kPa	=	0.0681 atm
14.22	=	1	=	28.96	=	0.981		98.07	=	0.968
0.4912	=	0.0345	=	1	=	0.0339	=	3.386	=	0.03342
14.504	=	1.02	=	29.53	=	1	=	100	=	0.987
0.14504	=	0.0102	=	0.295	=	0.01	=	1	=	0.00987
14.7	=	1.033	=	29.92	=	1.013	=	101.3	=	1

METRIC / U.S. CUSTOMARY UNIT EQUIVALENTS

multiply:		by:		to get or multiply:		by:		to get:
LINEAR								
inch	x	25.4	=	millimeters (mm)	x	0.03937	=	inch
feet	x	0.3048	=	meters (m)	x	3.281	=	feet
yard	x	0.9144	=	meters (m)	x	1.0936	=	yard
mile	x	1.6093	=	kilometers (km)	x	0.6214	=	mile
inch	x	2.54	=	centimeters (cm)	x	0.3937	=	inch
VOLUME								
fluid oz	x	29.57	=	milliliters (ml)	x	0.03381	=	fluid oz
U.S. quart	x	0.94635	=	liters(l)	x	1.0567	=	quarts
U.S. gallon	x	3.7854	=	liters(l)	x	0.2642	=	gallons
feet³	x	28.317	=	liters	x	0.03531	=	feet³
feet³	x	0.02832	=	meters³	x	35.315	=	feet³
yard³	x	0.7646	=	meters³	x	1.3080	=	yard³
MASS								
ounces	x	28.35	=	grams(g)	x	0.03527	=	ounces
pounds	x	0.4536	=	kilograms (kg)	x	2.2046	=	pounds
tons (2000lb)	x	907.18	=	kilograms (kg)	x	0.001102	=	tons
tons (2000lb)	x	0.90718	=	metric tons(t)	x	1.1023	=	tons

NOTES: