Sea Recovery®

REVERSE OSMOSIS DESALINATION SYSTEM MANUAL

Crystal Sea™ Series

FIBERGLASS ENCLOSURE STYLE

SRC 170 CS-FE / 12 VDC - SRC 170 CS-FE / 24 VDC

Sea Recovery Corp.
P.O. BOX 2560, GARDENA, CALIFORNIA 90247-0560
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

REVISIONS: November 1, 1997

Congratulations!

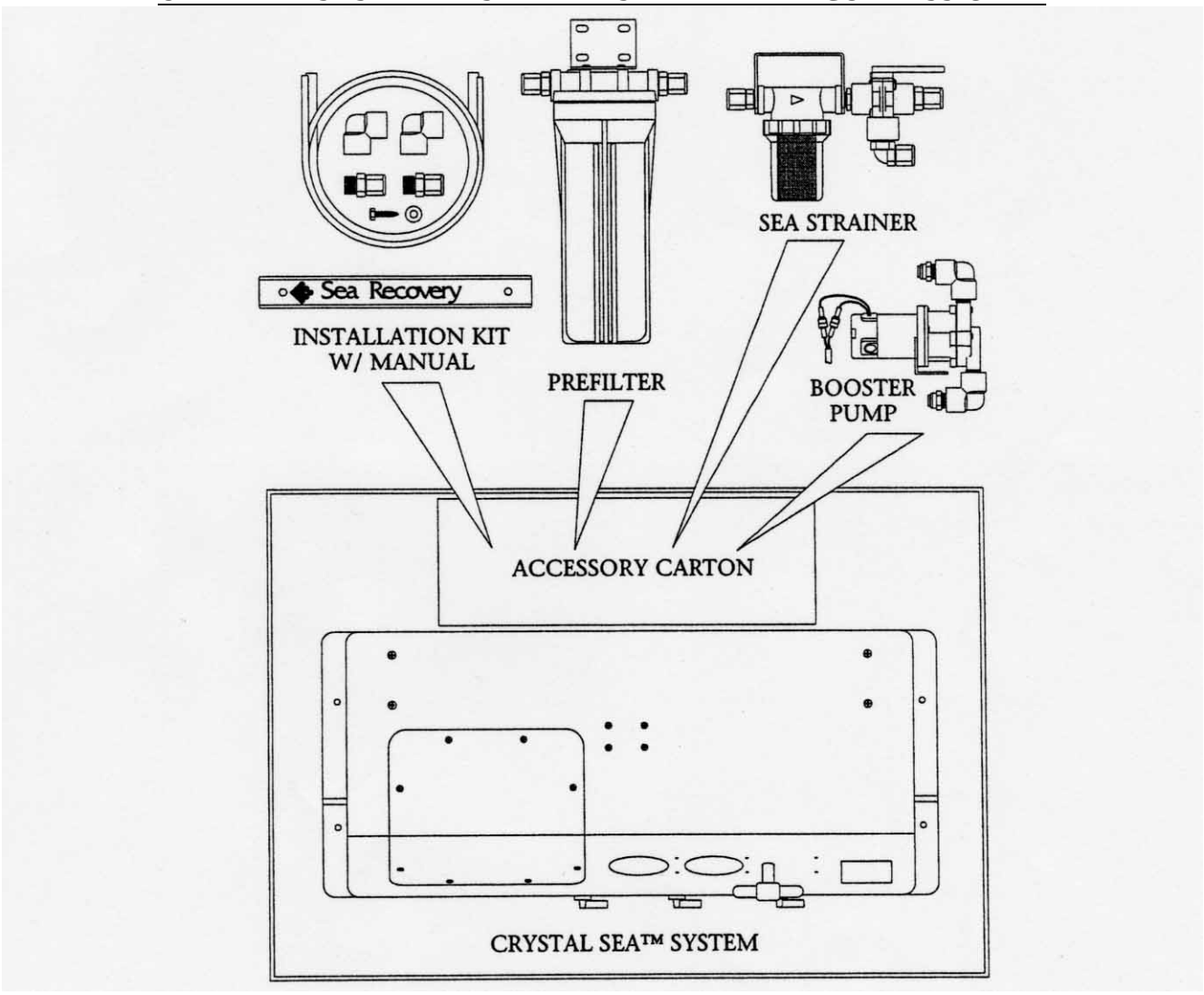
YOU HAVE PURCHASED THE FINEST AND MOST ADVANCED
12 OR 24 VOLT WATER MAKER IN THE WORLD!

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

1. YOUR "Crystal Sea"™ REVERSE OSMOSIS DESALINATOR SYSTEM
2. A PREFILTER HOUSING WITH PREFILTER ELEMENT AND INSTALLATION HARDWARE
3. A BOOSTER PUMP WITH INSTALLATION HARDWARE
4. A RAW WATER SEA STRAINER WITH INSTALLATION HARDWARE
5. THE INSTALLATION KIT
6. OPERATION / MAINTENANCE MANUAL

ONCE EVERYTHING HAS BEEN LOCATED,
STUDY SECTIONS "A" THROUGH AND INCLUDING "E"
OF THIS OPERATION / MAINTENANCE MANUAL

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

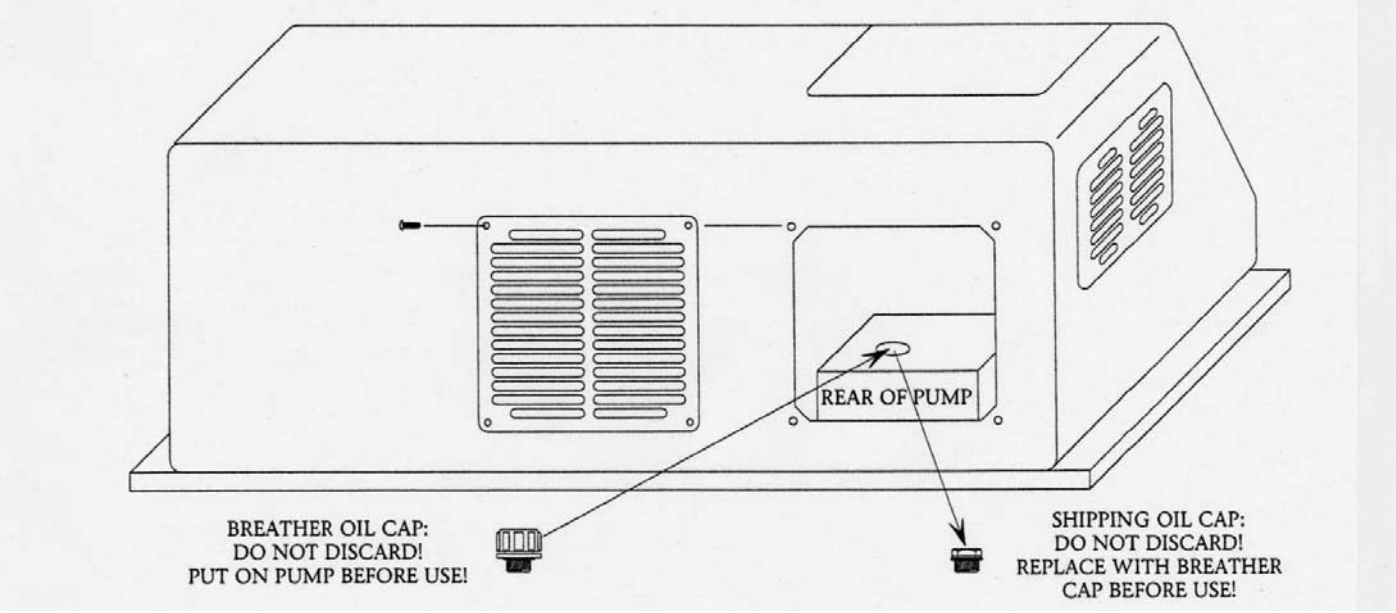


NEW SYSTEM STORAGE CAUTION. The Crystal Sea System has been tested at the factory and rinsed with a mild mixture of storage chemical. This will allow the system to be stored for up to 3 months if kept in a cool place, Do not store the system for longer than 3 months prior to actual use. If storage of 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.

WARNING!!! **BEFORE OPERATING SYSTEM!**

REMOVE SHIPPING PLUG FROM HIGH PRESSURE PUMP AND REPLACE WITH THE ENCLOSED BREATHER OIL CAP. FAILURE TO DO SO CAN CAUSE HIGH PRESSURE PUMP FAILURE! KEEP SHIPPING PLUG IN CASE SERVICE TO PUMP IS REQUIRED. MOUNT VENT PANEL WITH THE 4 ENCLOSED SCREWS TO PREVENT EXPOSURE OF SYSTEM TO CONTAMINATION.



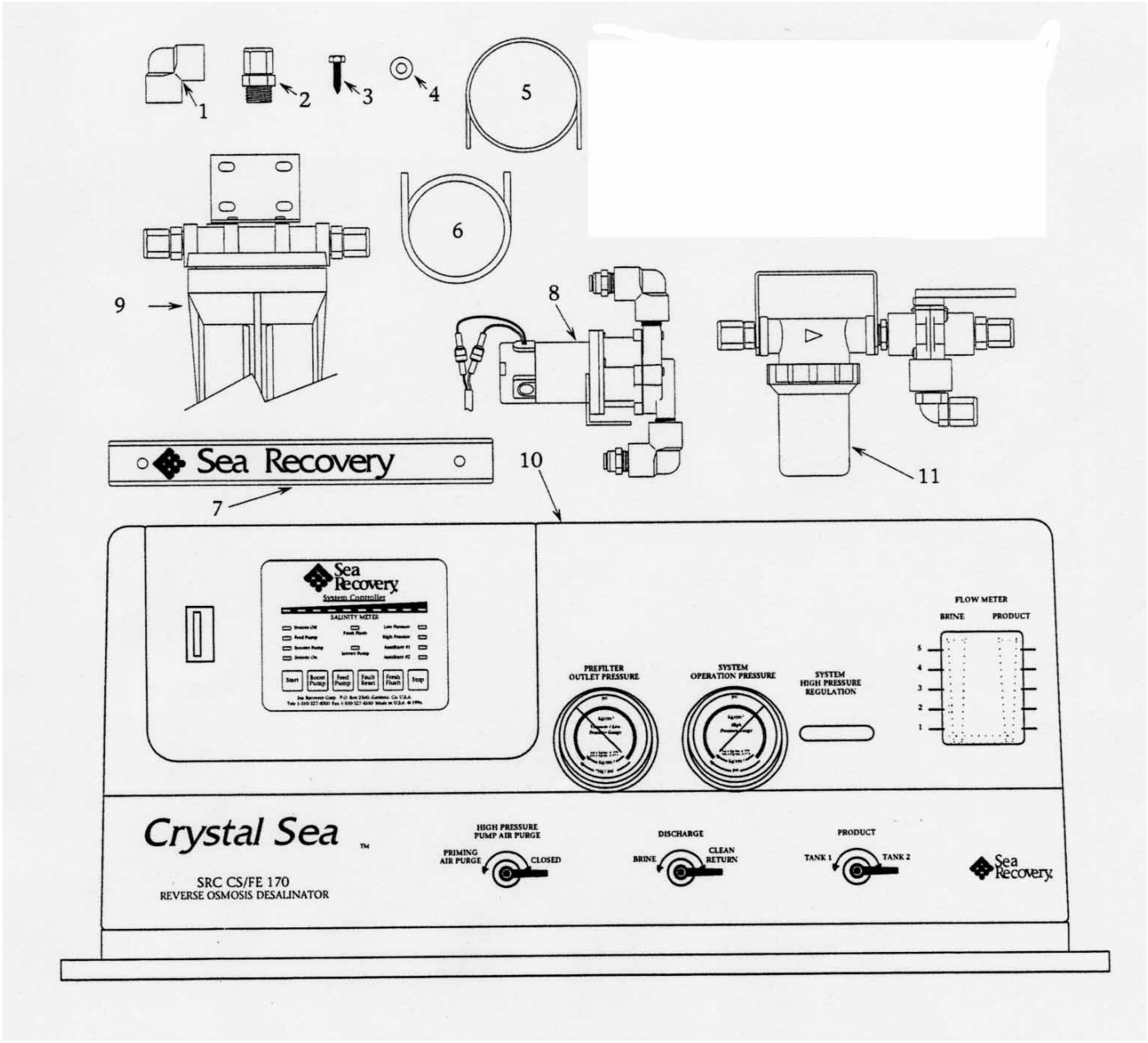
Crystal Sea SRC CS/FE 170

INCLUDED WITH YOUR:

Sea Recovery "Crystal Sea"

Fiberglass Enclosed 170 GPD Reverse Osmosis Desalinator"

1-11	SEA RECOVERY CRYSTAL SEA 170		
1	0101012583	ELB90 1/2" FPT x 1/2" FPT PVC	2 EA
2	0204591969	CONN 3/8" TUBE x 1/2" MPT -MG	2 EA
3	061172143016	SC HEX "A" ¼" x l" S/S	4 EA
4	061100043000	WASHER FLAT OS 1/4" S/S	4 EA
5	0312121969	TUBE 1/4": BLACK NYLON	30 FEET
6	0312123569	TUBE 3/8" BLACK NYLON	50 FEET
7	B651090001	OWNERS MANUAL CRYSTAL SEA	1 EA
8	B016090001	BOOSTER PUMP.5 GPM 15 FT HEAD	1 EA
9	B107090001	PREFILTER ASSEMBLY	1 EA
10	SRC C/S 170	SEA RECOVERY CRYSTAL SEA SYSTEM	1 EA
11	B006090001	SEA STRAINER ASSEMBLY	1 EA



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 (circle one) 12 VDC or 24 VDC

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 2560, GARDENA, CALIFORNIA 90247-0560
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

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 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 2560
GARDENA, CALIFORNIA 90247 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

SRC 170 CS-FE

TABLE OF CONTENTS

SECTION	DESCRIPTION
A	**WARRANTY**
B	**SPECIFICATIONS**
C	**INTRODUCTION**
D	**SYSTEM SCHEMATIC & COMPONENT DESCRIPTIONS**
	INCLUDING ILLUSTRATED P&IDs DURING MOST OPERATIONS
E	**SYSTEM INSTALLATION**
	ON SITE STORAGE & PREPARATION
	SYSTEM DIMENSIONS
	INSTALLATION PROCEDURES
	WIRING DIAGRAMS
F	**COMMISSIONING / INITIAL START UP**
	INITIAL START UP
	INITIAL NEW SYSTEM READINGS
G	**START-UP PROCEDURE**
H	**SHUTDOWN PROCEDURE**
1	**SYSTEM TROUBLESHOOTING GUIDE**
J	**STORAGE & CLEANING PROCEDURE**
	OF THE SYSTEM & R.O. MEMBRANE ELEMENT
	R.O. MEMBRANE ELEMENT PROTECTION
	SHORT TERM SHUTDOWN STORAGE PROCEDURE
	LONG TERM SHUTDOWN STORAGE PROCEDURE
	WINTERIZING AND FREEZING TEMPERATURE STORAGE
	CLEANING **PROCEDURE**
K	**MAINTENANCE & REPAIR**
	OPERATOR'S PREVENTIVE MAINTENANCE
	MAINTENANCE TIME CHART
	OPERATOR MAINTENANCE & CLEANING
	COMPONENT MAINTENANCE & REPAIR
L	**EXPLODED PARTS VIEWS**
M	**CONVERSION CHARTS**

SRC 170 CS-FE

NOTES:

VIII

SECTION "A"

WARRANTY

Sea Recovery ***"Crystal Sea"*** LIMITED WARRANTY

Sea Recovery Corp, warrants that the Sea Recovery Desalination System will perform according to specifications for a period of twelve (12) months from the date of shipment. Sea Recovery's liability under this warranty shall be limited to repair or replacement of the Sea Recovery Desalination System at Sea Recovery's option, and under no circumstances shall Sea Recovery be liable for consequential damages arising out of or in any way connected with the failure of the system to perform as set forth herein. This limited warranty is in lieu of all other expressed or implied warranties, including those of merchantability and fitness for a particular purpose.

In the event of a defect, a malfunction, or failure during the warranty period, Sea Recovery will repair or replace, at its option, the product or component therein which upon examination by Sea Recovery shall appear to be defective, or not up to factory specifications.

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

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

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

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

Some states do not allow exclusions or limitations on the duration of the warranty or exclusions or limitations of incidental or consequential damages, so these limitations or exclusions may not apply to you. This warranty gives you specified legal rights, and you may also have other rights which vary from state to state.

This limited warranty service does not apply to normal reoccurring user maintenance as described below.

Normal reoccurring user maintenance which is not covered by this LIMITED WARRANTY:

1. Sea Strainer Element
2. Cartridge Filter Elements
3. Pump Seals
4. Pump Packings
5. Pump Valve Assemblies
6. Gauge Instrument Calibration
7. Pump Crankcase Oil
8. Auxiliary Tubing
9. Fuses
10. Indication Lamps

The Sea Recovery Reverse Osmosis Membrane Element is guaranteed to be cleanable for a minimum of one year from date of shipment providing cleaning periods are adhered to and foulant is acid soluble metal hydroxides and calcium carbonates or alkaline soluble organic, inorganic substances and microbiological slimes. The Sea Recovery Membrane Element is not guaranteed against iron fouling (rust), chemical attack, extreme temperatures (over 120°F/under 32°F), drying out, or extreme pressures (over 1000 psig).

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

Sea Recovery Corp.
P.O. BOX 2560
GARDENA, CALIFORNIA 90247-0560
U.S.A.

TELEPHONE 1-310-637-3400
FACSIMILE 1-310-637-3430

SECTION "B"

SPECIFICATIONS

SPECIFICATIONS
Crystal Sea™ Series

FIBERGLASS ENCLOSURE STYLE:
SRC 170 CS-FE / 12 VDC - SRC 170 CS-FE / 24 VDC

PERFORMANCE:

RATED PERFORMANCE:

170 U.S. Gallons per 24 hours / 644 Liters per 24 hours

PRODUCT WATER PRODUCED:

(+-15% at 820 psig / 56 BAR, 77°F / 25°C & 35,000 ppm TDS Feed Water Salinity)
SRC 170 CS: 7 U.S. Gallons per hour / 27 Liters per hour

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.

SYSTEM FEED WATER:

FLOW: 12 & 24 VDC Systems Nominal .5 GPM / 1.9 LPM
SALINITY RANGE: Seawater up to 50,000 ppm TDS (NaCI) (typical seawater salinity is 35,000 ppm)
TEMPERATURE RANGE: Max. 122°F / 50°C, Min. 33°F /.5°C,

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 Vacuum 5" Hg / Max. 60 psi
SYSTEM OPERATION: Seawater nominal 820 psi
Brackish Varies w/ppm

DIMENSIONS & WEIGHT:

DIMENSIONS:	Refer to Installation Section "E"	
WEIGHT:	SRC 170 CS-FE / 12 or 24 VDC	75 Lbs / 34 Kg

EXTERNAL INSTALLATION WATER CONNECTIONS:

Inlet	1/2 FNPT	(Female National Pipe Thread, American Standard)
Brine	1/2 FNPT	(Female National Pipe Thread, American Standard)
Product	1/4 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. The Direct Current (12 VDC and 24 VDC) Systems utilize a positive displacement pump with a .5 gpm displacement. Operation of the Crystal Sea System on power sources that create voltage lower or higher than listed below will result in damage to the electric motor and such damage will be considered as non warranty abuse due to operation outside allowable limits.

System Voltage	**Hz (AC)**	**Min. Voltage**	**Max. Voltage**	**Min. Hz**	**Max. Hz**
12 VDC	**n/a**	**11 VDC**	13.5 VDC	**n/a**	**n/a**
24 VDC	**n/a**	**22 VDC**	**27 VDC**	**n/a**	n/a

ELECTRICAL POWER REQUIREMENTS:

(H.P. = Horse Power; FLA = Full Load Amperes)

HIGH PRESSURE PUMP MOTOR:

Crystal Sea Direct Current (DC) SYSTEMS

High Pressure Pump Motor			**Booster Pump Motor**		
VDC	**H.P.**	**FLA**	**VDC**	**H.P.**	**FLA**
12	.33	29	12	.125	3.6
24	.33	14	24	.125	1.8

RECOMMENDED CIRCUIT BREAKER:

Operating Voltage	**Recommended Circuit Breaker Size**
12 VDC	**40 Amperes**
24 VDC	**20 Amperes**

POWER SOURCE: PER ORDER

Additional specific 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.

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 will ensure 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 will affect the rest of the system and lead to further required repairs.

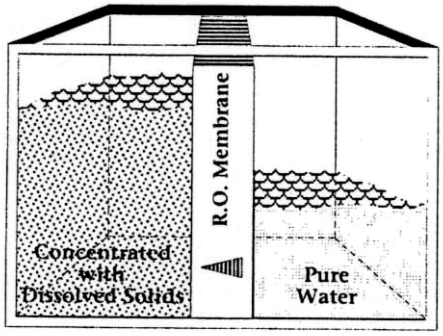
Please take time to read this entire manual several times.

Sea Recovery's Approach to Water Desalination.

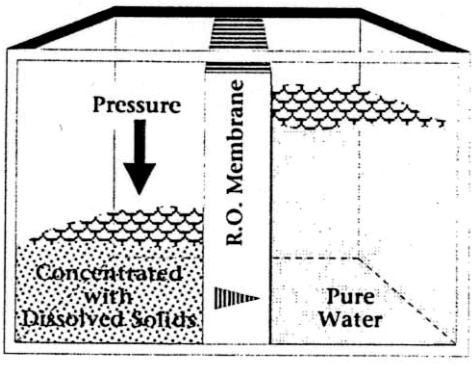
The Problem: Osmosis is the diffusion of two miscible (mixable) solutions through a semipermeable membrane in such a manner as to equalize their concentration.* (By allowing a lesser concentration, potable water, to naturally diffuse through a semipermeable membrane into a higher concentration, sea or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

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

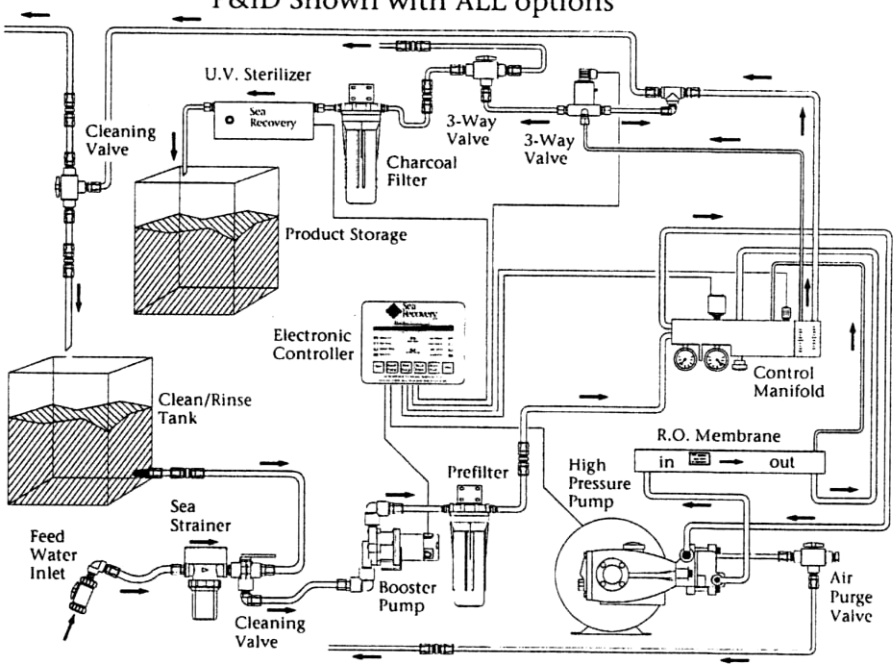
Therefore, sea water or brackish water cannot naturally diffuse through a semipermeable membrane to provide potable, or drinking water.



The 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 "Cyrstal Sea" Series 170 GPD System
P&ID Shown with ALL options



A. Feed Water (Salt Water or Brackish Water) is pumped into the system via a Inlet Valve, then filtered through a raw water Sea Strainer. The pressure level of the Feed water is then increased by the Booster Pump and filtered once more through a tight micron Prefilter. The feed water flow is measured by the Feed Water Flow Meter to ensure proper operation of the High Pressure Pump.

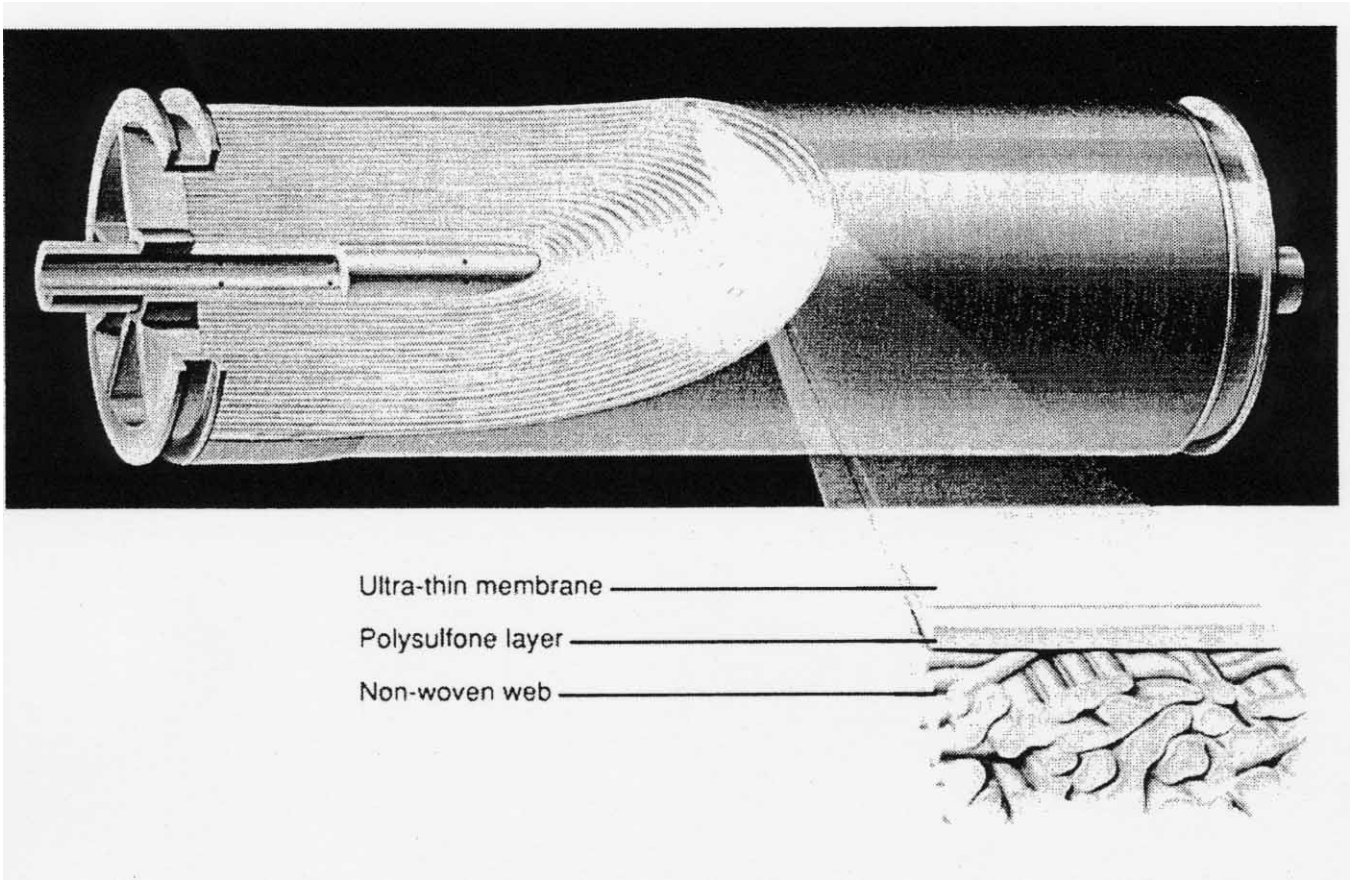
B. The Stainless Steel High Pressure Pump, which features an automatic over pressure safety shut down switch, then increases the filtered feed water to a high pressure level and forces it into the Reinforced Fiberglass Membrane Vessel Assembly. The Back Pressure Regulator controls and automatically maintains the necessary high pressure level in the membrane. Concentrated brie is discharged through the Brine Discharge connector and diverted back to the feed source.

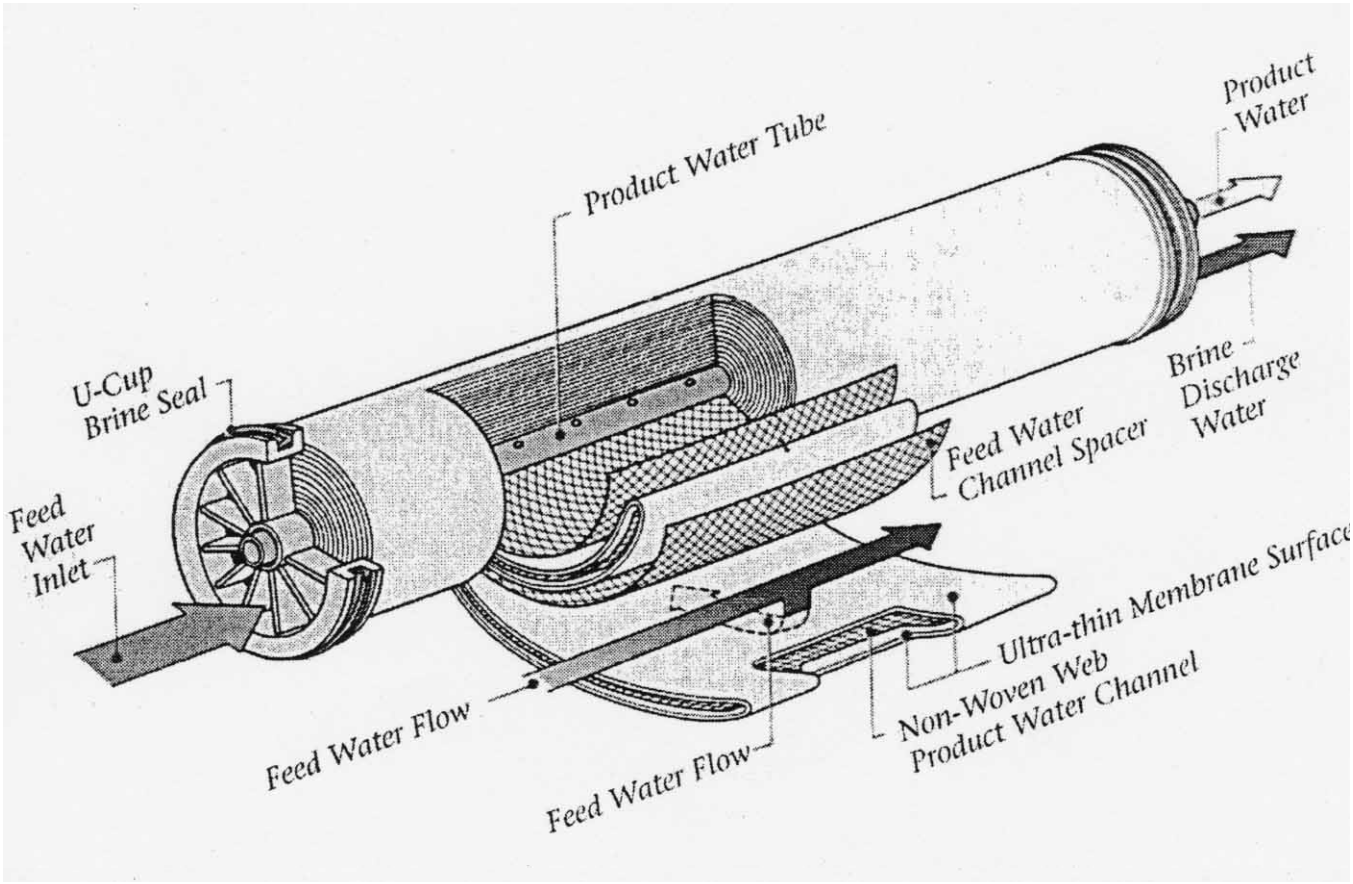
C. The product water flows out of the R.O. Membrane and passes into a Salinity Probe which adjusts automatically for temperature changes and registers, electronically, the salt content of the product water. Next, the Product Flow Meter registers the amount of potable water produced. The product water then proceeds into the 3Way 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.

D. All electrical connections terminate at the Salinity Controller. Highly advanced, the Salinity Controller features computer controlled reliable solid state electronics with advanced proprietarv logic features found in no other desalination system.

* "Tunk & Wagnal's New Cornprehensive International Dictionarry"

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 will continue 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 will continue 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.

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 will 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 will foul the membrane surface. If this occurs, the product water flux (production) will decline.

NOTES :

SECTION "D"

SYSTEM SCHEMATIC

with

COMPONENT IDENTIFICATION

&

COMPONENT DESCRIPTIONS

NOTES:

IDENTIFICATION OF SYSTEM COMPONENTS: Identification numbers correspond to the System Schematic numbers shown on pages D - 4 and D - 5.

NOTE: ** Denotes items supplied by installer; *** denotes optional.

A. PREFILTRATION SUBSYSTEM:

1. Inlet Thru-Hull **
2. Sea Cock Valve **
3. Inlet Connection
4. Sea Strainer
5. Rinse/Clean Inlet Valve
6. Booster Pump
7. Prefilter 5 Mμ
8. Low Pressure Gauge Prefilter Outlet
9. future reference
10. future reference
11. future reference
12. future reference
13. High Pressure Pump Air Purge Valve

B. PRESSURIZATION SUBSYSTEM:

14. High Pressure Pump
15. Electric Motor
16. High Pressure Hose MVA Inlet
17. R.O. Membrane & Vessel Assembly
18. High Pressure Hose MVA Outlet
19. High Pressure Switch
20. High Pressure Gauge
21. Back Pressure Regulator

C. PRODUCT WATER MONITORING SUBSYSTEM:

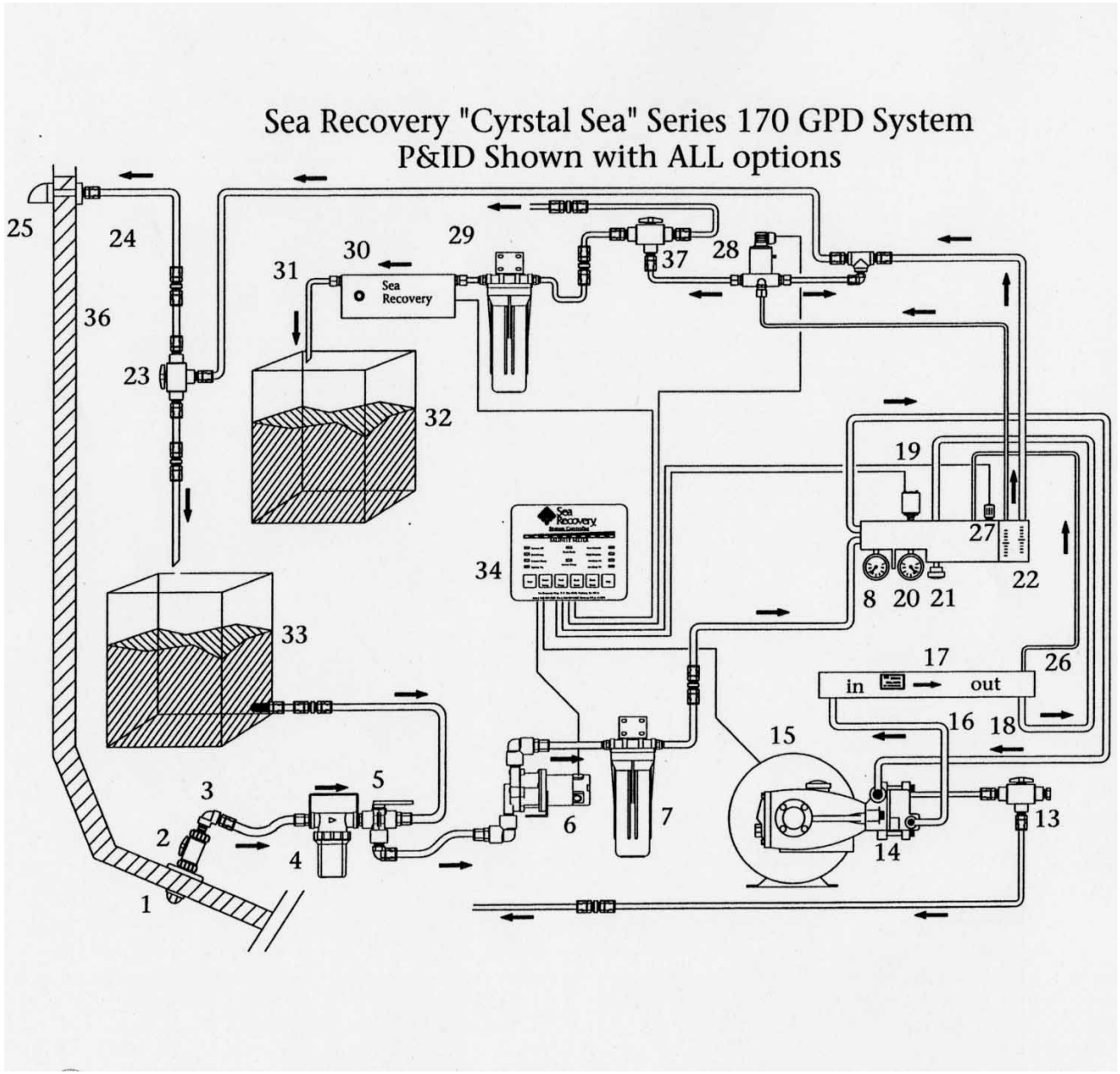
26. Product Water Tube
27. Salinity Probe
28. 3-Way Electric Product Diversion Valve
29. Charcoal Filter ***
30. U.V. Sterilizer ***
31. Product Water Routing Line
32. Potable Water Storage Tank **
37. Test Tap / 2nd Tank Valve

D. ELECTRONIC SUBSYSTEM:

34. Salinity Controller
35. future reference

E. MISCELLANEOUS ITEMS:

22. Brine & Product Water Flow Meter
23. Rinse/Clean Outlet Valve
24. Brine Dump Fitting
25. Discharge Thru-Hull **
33. Cleaning/Rinse Tank **
36. Ship's Hull **



1. Inlet Thru-Hull
2. Sea Cock Valve **
3. Inlet Connection
4. Sea Strainer
5. Clean/Rinse Inlet Valve
6. Booster Pump
7. Prefilter 5 Mμ
8. Low Pressure Gauge Prefilter Outlet
9. future reference
10. future reference
11. future reference
12. future reference
13. High Pressure Pump Air Purge Valve
14. High Pressure Pump
15. Electric Motor
16. High Pressure Hose MVA Inlet
17. R.O. Membrane & Vessel Assembly
18. High Pressure Hose MVA Outlet
19. High Pressure Switch
20. High Pressure Gauge
21. Back Pressure Regulator
22. Brine & Product Water Flow Meter
23. Clean / Rinse Outlet valve
24. Brine dump fitting
25. Discharge Thru-Hull **
26. Product Water Tube
27. Salinity Probe
28. 3-Way Product Diversion Valve
29. Charcoal Filter ***
30. U.V. Sterilizer ***
31. Product Water Routing Line
32. Potable Water Storage Tank **
33. Cleaning/Rinse Tank **
34. Salinity Controller
35. future reference
36. Ship's Hull **
37. Test Tap / 2nd Tank Valve

NOTES: ** : Items supplied by installer
*** : Options

COMPONENT DESCRIPTIONS

The following is a full description of each subsystem and subassembly within the Sea Recovery Crystal Sea 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 by the installer. The identification numbers used correspond to the System Schematic numbers from page D - 4.

A. LOW PRESSURE 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 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 Subsystern will cause 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-HuIl 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 will damage the Sea Recovery Reverse Osmosis Membrane Element.

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 will damage the Sea Recovery Reverse Osmosis Membrane Element.

3. Inlet Connection is supplied with the installation kit from Sea Recovery. This fitting connects the feed water line to the Sea Cock Valve. 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 will damage the Sea Recovery Reverse Osmosis Membrane Element.

4. Sea Strainer (Coarse Strainer) is 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. Attached, from the factory, to the outlet port of the Sea Strainer is Valve #5 described below.

5. 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 pre-assembled onto the outlet of the Sea Strainer.

6. 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 15 Ft Head at 1/2 GPM. Actual resulting pressure into the High Pressure Pump will depend on the final installation.

7. Prefilter contains a special pleated element which filters the feed water to 5 micron. This specialized cartridge element has been developed specifically for R.O. feed water filtration and should never be substituted with industrial or home type elements as damage to the R.O. Membrane Element will result.

8. Low Pressure Gauge displays the Inlet Pressure to the High Pressure Pump after passing through all Prefiltration Sections of the System from the Booster Pump. The gauge assists the operator in diagnosing the Sea Strainer, Booster Pump, Prefilter Element and High Pressure Pump Inlet Valve condition. The gauge is made of high quality stainless steel and is glycerin oil filled for smooth and accurate operation.

9. future Reference

10. future Reference

11. future Reference

12. future Reference

13. High Pressure Pump Air Purge Valve is used to purge the High Pressure Pump of air prior to pressurizing the system, at the time of commissioning and after cleaning the prefiltration section.

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 will not function correctly. This is why it is important that the Prefiltration Subsystem be maintained, so that the Pressurization Subsystem receives a proper flow of Feed Water. The normal operating pressure of the SRC system is 750-820 psi for Sea Water use or 200 to 400 psi for Brackish Water use. The maximum pressure the Sea Water system will develop is 900 psi, because the supplied high pressure switch automatically shuts the system off at 900 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. Under flow will cause an increase in the salt content of the Product Water. Under flow will also cause 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 will affect System productivity. Refer to the Temperature Effect Chart in Section "M" of this Manual.

14. 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 pump has undergone years of research & development, is proven in thousands of installations world wide and it is manufactured to specific Sea Recovery demanding specifications. The High Pressure Pump will last for years with proper installation, use and maintenance.

15. 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.

16 & 18. High Pressure Hose transfers pressurized Sea Water from the High Pressure Pump to the inlet of the SRC R.O. Membrane Element and from the R.O. Membrane Element to the control manifold.

17. 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 H_2O Molecules to pass through the thin membrane surface. A sufficient flow of water across the membrane surface must be continually in progress in order for the correct percentage of salt rejection to occur. Only about 20% of the System Feed Water becomes fresh Product Water. The remainder becomes a concentrated brine solution which carries the rejected salt ions out of the R.O. Membrane Element.

The proper flow of water is also essential to minimize fouling of the R.O. Membrane Element. Reducing the flow of Feed Water would cause the R.O. Membrane Element to recover a higher percentage of the Feed Water. Excessive recovery will rapidly foul the R.O. Membrane Element.

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

20. 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 and High Pressure Pump condition.

21. Back Pressure Regulator is of 316 Stainless Steel construction. 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 productivity of the R.O. Membrane Element.

22. Brine and Product Water Flow Meter is a dual port flow meter which measures the rate of Feed Water into the System (when no operating pressure is applied) or the Brine Discharge water exiting from the System (when operating pressure is applied) in addition to the amount of Product Water being produced.

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 will allow 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.

C. PRODUCT WATER SUBSYSTEM: This section of the System gives a visual indication of the clarity, quantity and quality of product water being produced. By corresponding the quantity 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.

26 & 31. Product Water Line routes the produced product water from the R.O. Membrane Element into the control manifold where the Salinity Probe and Product Water Flow Meter are located. This line continues routing of the Product Water through the Post Filtration and on to the Product Water Storage Tank.

27. 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. A Salinity Meter must be temperature compensated in order to provide accurate readings and protect the health of the individuals consuming the Product Water.

28. 3-Way Automatic 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 will not receive a signal and thus remain in the normally open position which diverts the unpotable Product Water to discharge out the Brine Discharge Line.

29. Product Water 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 would be 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.

30. Product Water Ultra Violet Sterilizer 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 should always be avoided.

27. Product Water Tubing & Storage Tank Connection is provided with the Sea Recovery R.O. System for connection to the Product Water Storage Tank from the R.O. System Product Water outlet connection.

37. 3-Way Manual Product Diversion Valve may be used to route the produced potable water to two separate storage tanks individually or simultaneously or to one tank and also a Test Tap position.

D. 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 serves as the safeguard to ensure that only potable Product Water is allowed to pass into the Product Water Storage Tank.

34. System Salinity Controller is the central connection point for all electrical lines in the system. The controller monitors the salt content of the product water (by means of the Salinity Probe), and signals the 3-Way Product Diversion Valve when Potable Water is being produced. The 3-Way Product Diversion Valve, Motors and U.V. Sterilizer are all directly connected to and governed by the Salinity Controller.

35. future Reference

E. MISCELLANEOUS VALVING, CONNECTIONS AND COMPONENTS:

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

24. Brine Dump Line with Thru-Hull Connection consists of tubing, which is to be used for connection of the Brine Discharge water and a connector to tie into the Thru-Hull Fitting.

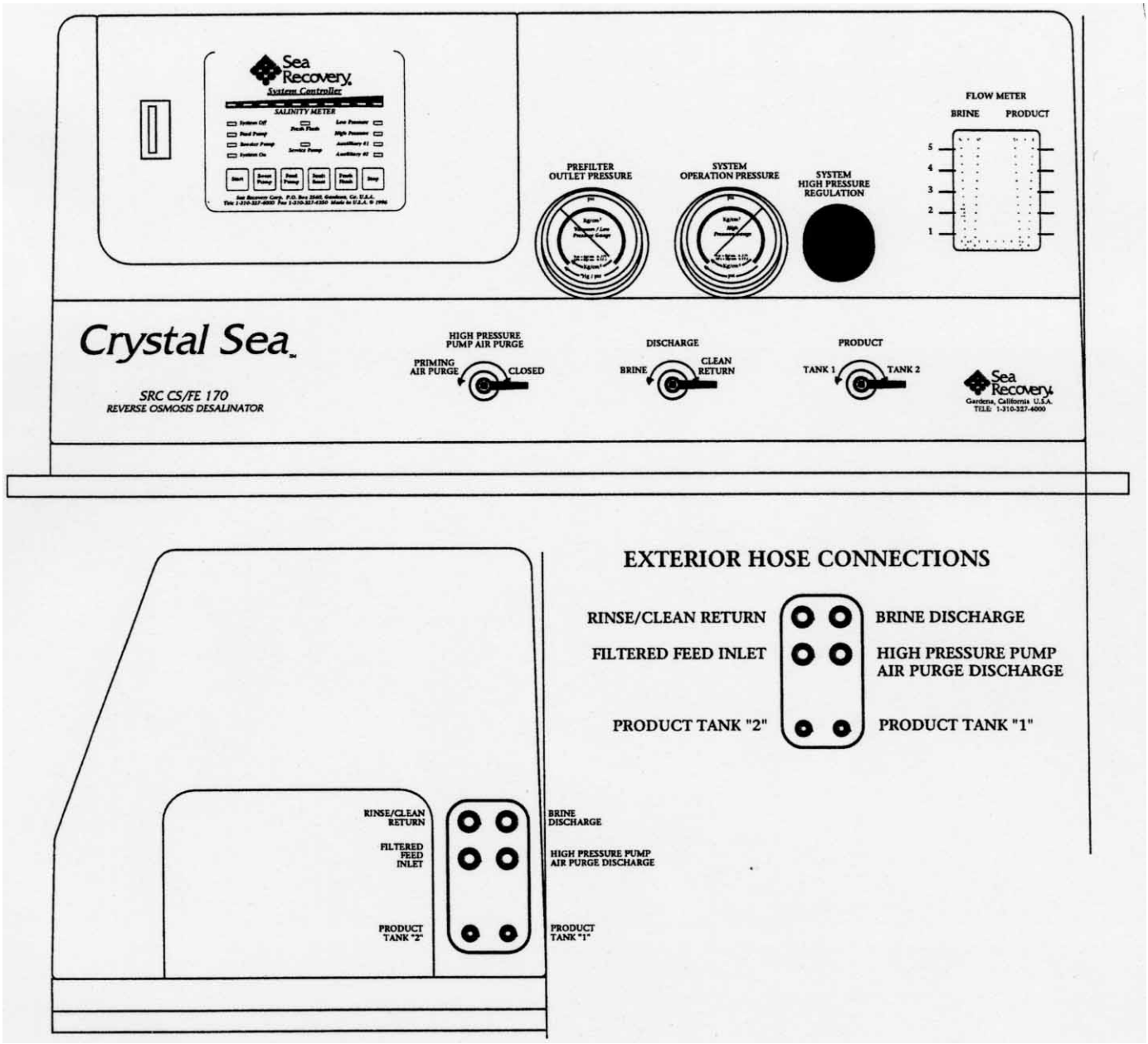
25. Thru-Hull Fitting (Brine Discharge Over Board) must be provided for discharge of the Systems Brine Discharge Water.

32. Potable Water Storage Tank may be any container suitable for storing Potable Water. Usually the existing potable water tank.

33. System Rinse/Clean Tank is used to hold rinse water, storage water or cleaning water with associated chemicals. This tank should be 10 gallons in size (38 liters).

36. Ship's Hull is desired to keep the boat floating and water out of the boat! We just wanted to see if you were awake and really reading this manual.

F. SYSTEM CONTROL PANEL FRONT VIEW & EXTERIOR CONNECTIONS RIGHT END VIEW:



CONTROL PANEL I.D. #s:

8. Low Pressure Gauge
13. High Pressure Pump Air Purge Valve
20. High Pressure Gauge
21. Back Pressure Regulator
22. Brine & Product Water Flow Meter
23. Rinse/Clean Outlet Valve
34. System Salinity Controller
37. 3-Way Manual Product Diversion Valve

EXTERIOR HOSE CONNECTIONS:

Rinse/Clean Return

Brine Discharge

Filtered Feed Inlet High Pressure Pump Air Purge Discharge

Product Water Tank "2"

Product Water Tank " 1 "

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 mos 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 will void 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 will destroy 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 will destroy the R.O. Membrane Element.

C. NECESSARY COMPONENTS SUPPLIED BY OWNER:

1. Inlet Thru-Hull Fitting [11 with Inlet Sea Cock Valve [2]: The Thru-Hull Fitting must include a 1/4 turn Sea Cock Valve with a minimum 1/2" orifice, and a 1/2" 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 will cause 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 will 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 of the forward facing scoop type which will assist in delivering a constant supply of feed water to the Sea Recovery R.O. System. Flush mount type Thru-Hull fittings should be avoided as they can cause a reverse suction effect and cause the Sea Recovery R.O. System to lose prime.
2. Brine Thru Hull Fitting [25] for overboard dump (above water level) for the Brine Discharge Line 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 [181. The Brine Thru-Hull Fitting must not be installed higher than 3 Ft. above the System. It is preferred to install the Brine Thru-Hull Fitting at the same height as the Sea Recovery System but always above water level. ***There should be no valving in the Brine Discharge Line as damage to the system will occur if the Brine Discharge Line is blocked by a closed valve during system operation.***

3. Ships Potable Water Storage Tank [32] with Product Water Storage Tank Connection: This fitting must be minimum 1/4" 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 should be no valving in the Product Water Line as damage to the system will occur if the Product Water Line is blocked by a closed valve or kink during system operation.***

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

Operating Voltage	Recommended Size Power Cable
12 VDC	8 AWG
24 VDC	10 AWG

Increase Power Cable accordingly if voltage drop from supply to system is greater than 1/2 volt.

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

System

Voltage	**Hz (AC)**	**Min. Voltage**	**Max. Voltage**	**Min. Hz**	**Max. Hz**
12 VDC	**n/a**	**11 VDC**	**13.5 VDC**	**n/a**	**n/a**
24 VDC	**n/a**	**22 VDC**	**27 VDC**	**n/a**	**n/a**

ELECTRICAL POWER REQUIREMENTS:

(H.P. = Horse Power; FLA = Full Load Amperes)

HIGH PRESSURE PUMP MOTOR:

Sea Recovery Crystal Sea Direct Current (DC) SYSTEMS

High Pressure Pump Motor			**Booster Pump Motor**		
VDC	**H.P.**	**FLA**	**VDC**	**H.P.**	**FLA**
12	**.33**	**29**	**12**	**.125**	**3.6**
24	**.33**	**14**	**24**	**.125**	**1.8**

RECOMMENDED CIRCUIT BREAKER:

Operating Voltage	**Recommended Circuit Breaker Size**
12 VDC	40 Amperes
24 VDC	20 Amperes

D. TOOLS REQUIRED FOR INSTALLATION:

1. Of course, not all installations are typical. For this reason, it would be wise to have a full set of mechanic's and electricians 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 will operate most efficiently with interconnect lines as short and straight as possible. As the distance of suction lines increase, the feed pressure decreases. As the distance of discharge lines increase, the greater the back pressure on those lines. Any back pressure on the Brine Discharge Line will cause an extended amount of time for the High Pressure Pump to prime. There should be no back pressure on the brine discharge line or product water line.

2. **PLACEMENT AND ROUTING OF THE FEED WATER LINE:** The Crystal Sea System draws only 1/2 U.S. GPM of feed water. Any high loops in the feed water line will trap air which may not be displaced by the feed water due to such low flow requirements of the System. Always plumb the line so that all air may naturally bleed from the feed water line. Priming of the Crystal Sea System may be impossible if the feed water line has been routed with high loops.

   Such a condition will require plumbing correction. This would be considered an installation obstacle and any plumbing or installation correction is the responsibility of the owner. This would not be considered a warranty condition as Sea Recovery has no control over the System feed line installation.

3. **SYSTEM FEED INLET (INLET THRU-HULL FIITING [1])** must be in constant contact with the feed water. Any air suction leaks coming into the system feed line will cause the system to shut down due to low feed pressure condition and require the system to be primed of all air. 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.

   Avoid using 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 can experience irreversible flux loss (loss in production).

5. **GIVE SPECIAL CONSIDERATION TO ACCESS FOR MAINTENANCE** of all components. Such access would include, but not 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 will not be maintained. If it is not maintained it will break. When it breaks the user will call you. You will call us and 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 [1] through inlet of the Crystal Sea System:** 30 feet of 3/8" ID (9.1 meters of 9.5 mm ID) flexible rigid wall tubing is supplied with the system for plumbing of the feed water line including the following components:

From	To
Sea Cock	Sea Strainer Inlet
Sea Strainer Outlet	Booster Pump Inlet
Booster Pump Outlet	Prefilter Inlet
Prefilter Inlet	System Inlet
Inlet Clean/Rinse/Feed Valve	Outlet of the Clean/Rinse Tank

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 will be less pressure at the inlet of the System. Feed pressure loss from the Booster Pump will yield shorter Prefilter Element life, will cause more frequent Prefilter Element changing and will make it difficult to prime the High Pressure Pump. Therefore, keep the distance from the Sea Cock to the System as short and straight as possible. If the distance between the Sea Cock and the System is greater than 30 feet it would then be best to up-size the feed line to 1/2 inch or 5/8 inch rigid wall tubing accordingly. Either may be separately ordered from Sea Recovery.

If the feed water lines are to be extremely long or if there are many fittings and elbows planned which will cause excessive line loss then it will be 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 will only be 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 shipmentt then no credit will be 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.**

2. **Brine Dump Tubing from the System Brine Discharge Outlet Fitting:** 20 feet of 3/8" OD (15 meters of 9.5 mm OD) tubing is supplied with the system to connect the following components:

From	To
System Brine Discharge	Thru-Hull Overboard Dump Fitting
High Pressure Pump Air Purge	Bilge or Tee into Brine Discharge Line
Clean/Rinse Return Fitting	Clean/Rinse Tank

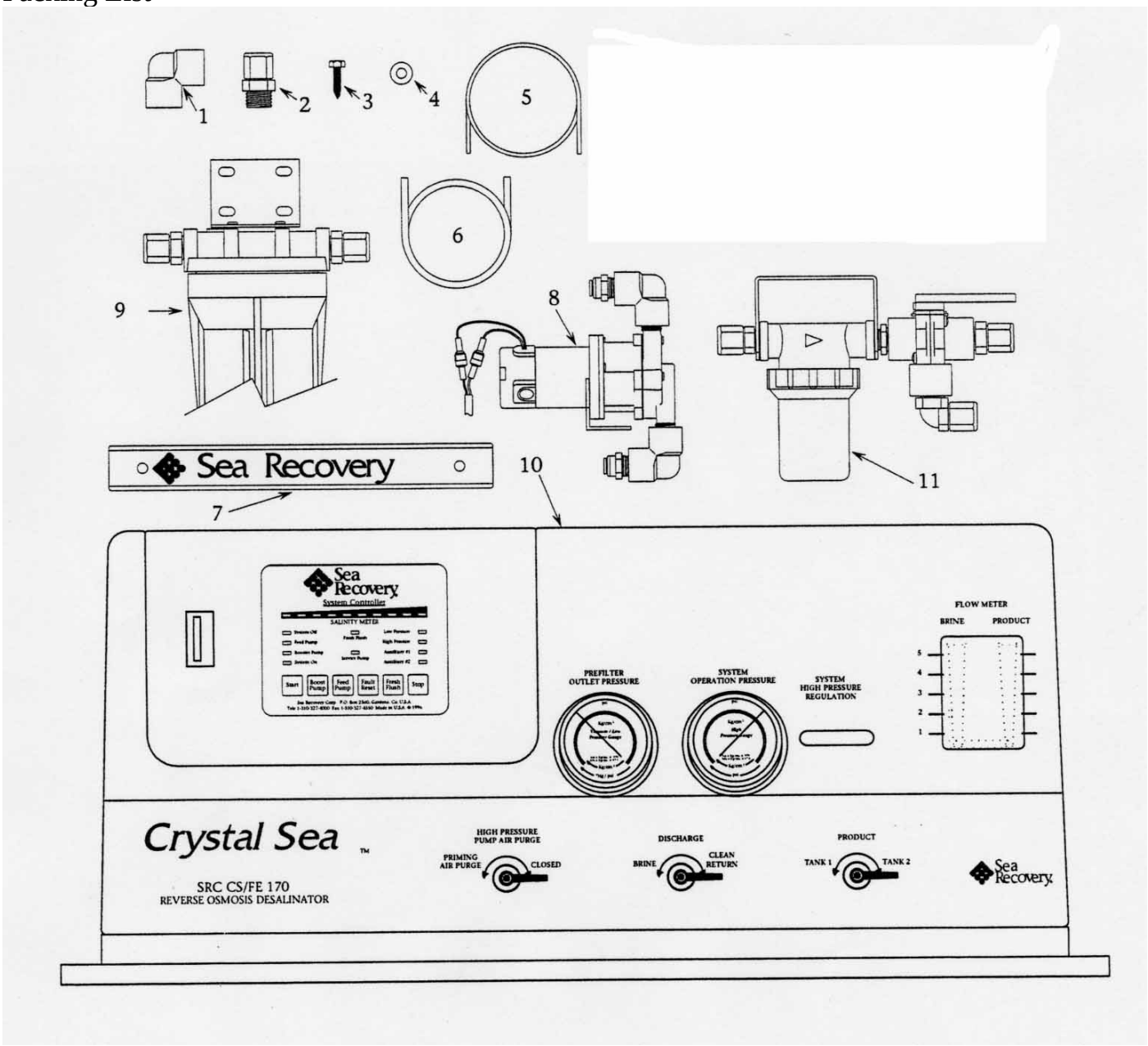
Additional tubing may be ordered from Sea Recovery if required. Caution must be taken in plumbing the Brine Discharge line and Clean/Rinse line to ensure that no back pressure is present on this line as any back pressure will cause extended time in priming of the High Pressure Pump.

3. **Product water tubing from the Product Water outlet connection to the Product Water Storage Tank Inlet [32]:** 50 feet of 1/4" OD (15 meters of 6 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 Une ftom the system to the storage tank and ensure that there are no kinks in this line. Blockage of the Product Water Line will cause extensive damage to the System and the R.O. Membrane Element. Damage caused by a blocked Product Water Une will not be 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.

Packing List

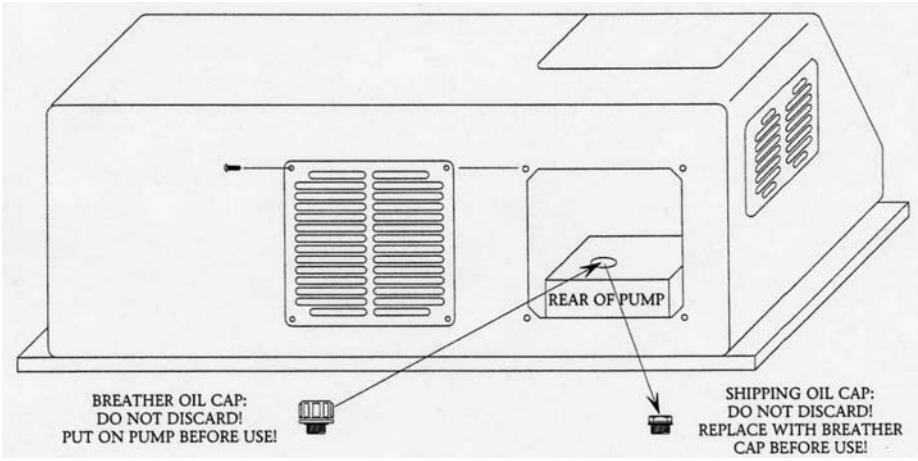


1-11	SEA RECOVERY CRYSTAL SEA 170		
1	0101012583	ELB90 ½” FPT x ½” FPT PVC	2 EA
2	0204591969	CONN 3/8” TUBE x ½” MPT – MG	2 EA
3	061172143016	SC HEX “A” ¼ “ x 1” S/S	4 EA
4	061100043000	WASHER FLAT OS ¼” S/S	4 EA
5	0312121969	TUBE ¼” BLACK NYLON	30 FEET
6	0312123569	TUBE 3/8” BLACK NYLON	50 FEET
7	B651090001	OWNERS MANUAL CRYSTAL SEA	1 EA
8	B016090001	BOOSTER PUMP .5 GPM 15 FT HEAD	1 EA
9	B107090001	PREFILTER ASSEMBLY	1 EA
10	SRC C/S 170	SEA RECOVERY CRYSTAL SEA SYSTEM	1 EA
11	B006090001	SEA STRAINER ASSEMBLY	1 EA

H. HIGH PRESSURE PUMP PREPARATION:

1. ***The High pressure Pump, within the System enclosure, is shipped with a Non <u>Vented PIM</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 will build within the crankcase and cause 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 will void all warranly of the High Pressure Pump_.</u> Sea Recovery Corp. will not accept liability due to the installers neglect. The Installer will be held totally responsible for any damages due to neglect and failure to install the supplied <u>High Pressure Pump Oil Fill Vented Cap</u>***

WARNING!!! BEFORE OPERATING SYSTEM!
CHECK TO ENSURE THAT THE INSTALLER HAS
REMOVED THE SHIPPING PLUG FROM HIGH PRESSURE PUMP
AND HAS REPLACED IT WITH THE ENCLOSED BRE.ATHER OIL CAP.
FAILURE TO DO SO CAN CAUSE HIGH PRESSURE PUMP FAILURE!
KEEP THE SHIPPING PLUG IN CASE SERVICE TO PUMP IS REQUIRED.
ALSO ENSURE <u>THAT THE VENT PANEL</u> IS MOUNTED.



The rear pump crankcase section can be viewed through the rear vent cover. By access through the rear vent hole, Remove the High Pressure Pump orange color Oil Fill ***Plug*** from the top of the High Pressure Pump and replace it with the supplied orange and black color Oil Fill Vent ***Cap*** which has been supplied in a clear plastic bag along with the rear vent cover and vent cover screws. This bag was attached to the Back Pressure Regulator Valve handle prior to packaging at the factory.

2. Check the level of the oil in the High Pressure Pump crankcase. Oil level can be viewed through the rear Air Vent Cover located at the back of the enclosure. Ensure that the oil level is higher than the center of the sight glass. Under filling of oil will cause overheating and damage to the rear crankcase section. Over filling will not cause damage. Over filling will keep the crankcase section cooler and properly lubricated. However, if too much oil is placed into the crankcase the excess oil will percolate 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.

3. Install the supplied rear vent using the included 4 each phillips pan head screws.

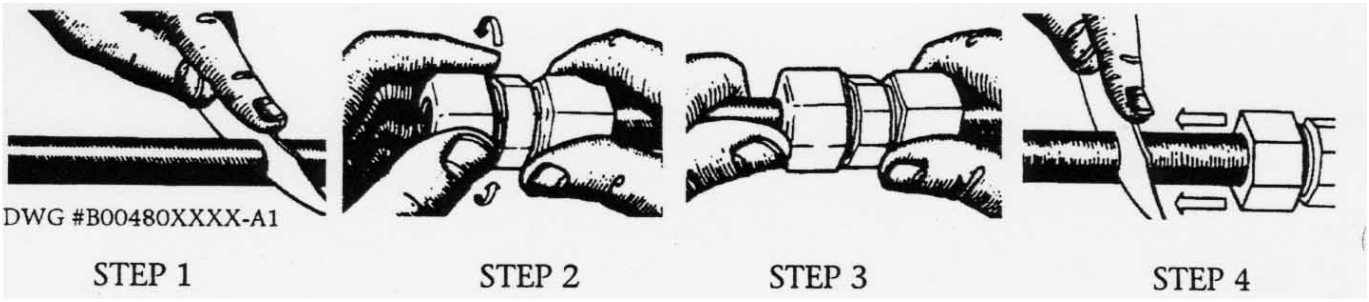
I. COMPONENT INSTALLATION: The unique installation requirements of each component are described in this section. It is important that the stated conditions be adhered to for proper operation and ease of component maintenance. All components prior to and including the Booster Pump [6] MUST be mounted BELOW water level in order to provide positive pressure into the inlet of the Booster Pump.

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 thermal plastic fittings. If pipe threaded fittings leak after installation then remove the fitting, clean the male mating threads, applv 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.

1. FAST-N-TITE TUBING CONNECTIONS:

CROSS SECTION OF FAST-N-TIGHT TUBE FITTING

TUBE FITTING ASSEMBLY AND DISASSEMBLY INSTRUCTIONS



ASSEMBLY:

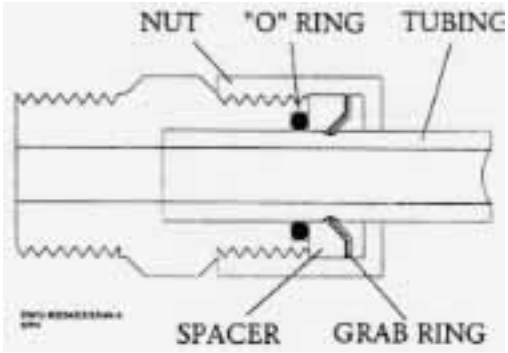
Step 1 Cut tube end square and clean.

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 "0" 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.

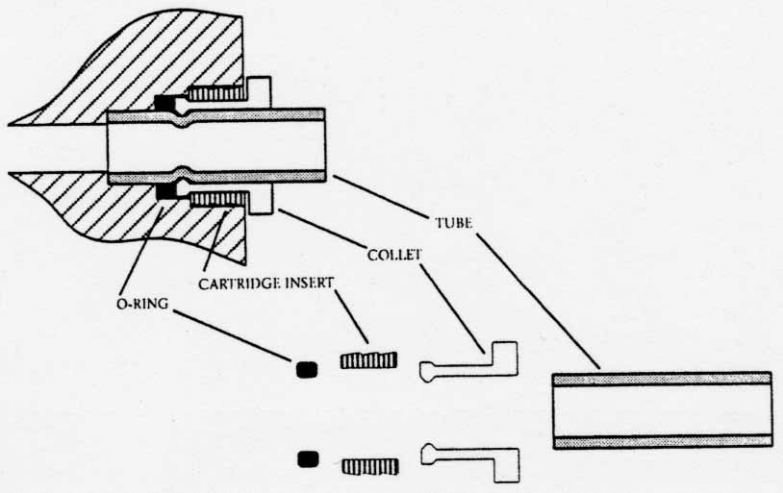
DISASSEMBLY:

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.

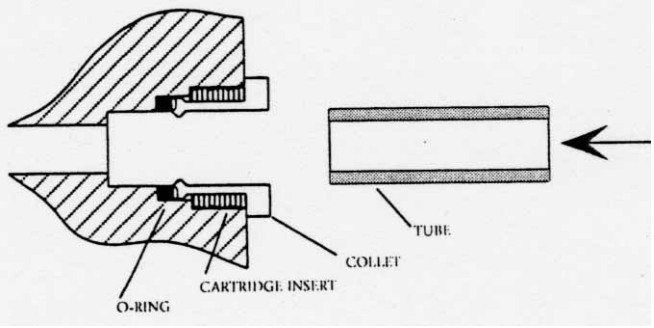


2. TRU-SEAL TUBING CONNECTIONS:

CROSS SECTION OF TRU-SEAL TUBE FITTING



TRU-SEAL TUBE FITTING ASSEMBLY



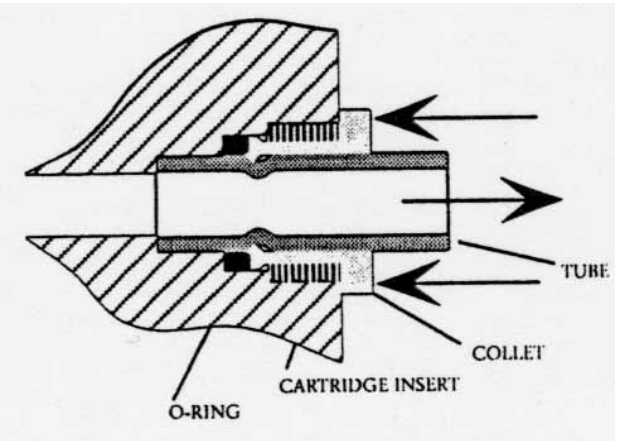
TRU-SEAL TUBE FITTING ASSEMBLY:

Step 1 Cut tube end square and clean

Step 2 Moisten end of tube

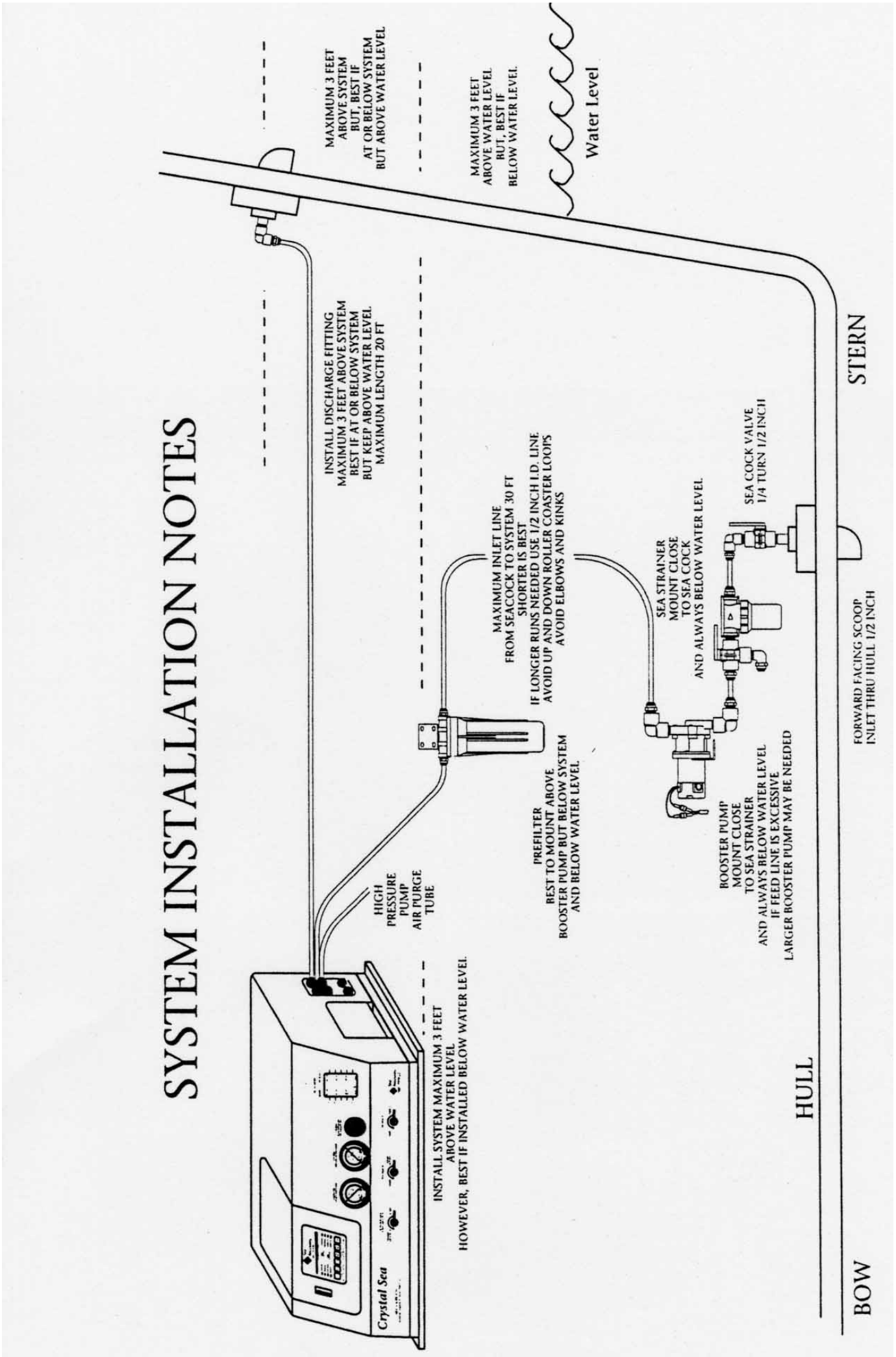
Step 3 Insert tube into fitting until it bottoms

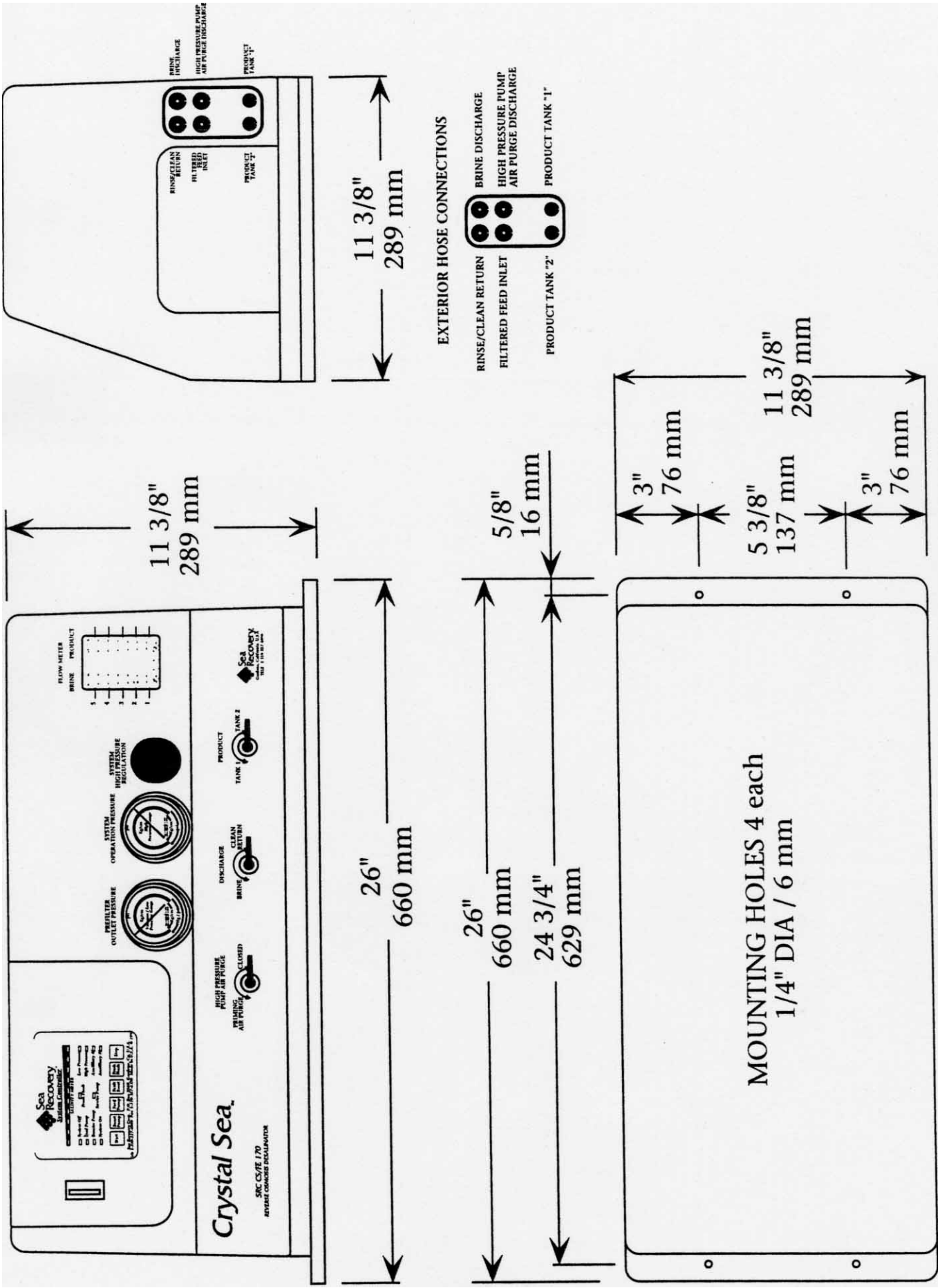
TRU-SEAL TUBE FITTING DISASSEMBLY



Step 1 To remove tubing in order to resue the fitting assembly, push collet into cartridge insert firmly. While pushing collet firmly into cartridge insert pull outward on tubeing. Some force will be required. Collet must be pressed into cartridge insert while pulling outward on tube.

Step 2 If tube is to be used again cut tube end square behind previous collet indentation, Moisten end of tube and insert tube into fitting until it bottoms.

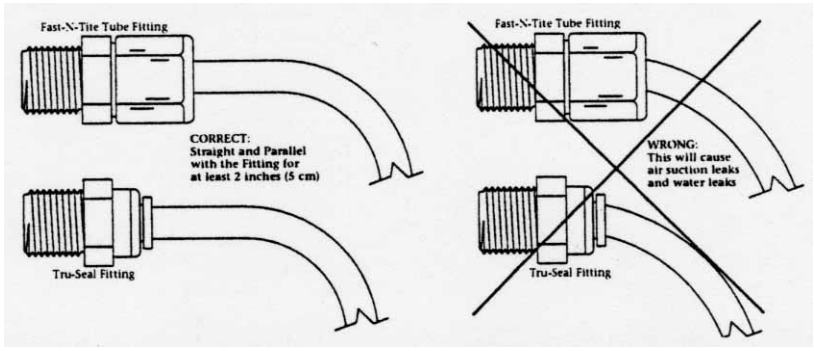

SYSTEM INSTALLATION NOTES
Water Level
MAXIMUM 3 FEET
ABOVE SYSTEM
BUT, BEST IF
AT OR BELOW SYSTEM
BUT ABOVE WATER LEVEL
MAXIMUM 3 FEET
ABOVE WATER LEVEL
BUT, BEST IF
BELOW WATER LEVEL
INSTALL DISCHARGE FITTING
MAXIMUM 3 FEET ABOVE SYSTEM
BEST IF AT OR BELOW SYSTEM
BUT KEEP ABOVE WATER LEVEL
MAXIMUM LENGTH 20 FT
MAXIMUM INLET LINE
FROM SEACOCK TO SYSTEM 30 FT
SHORTER IS BEST
IF LONGER RUNS NEEDED USE 1/2 INCH I.D. LINE
AVOID UP AND DOWN ROLLER COASTER LOOPS
AVOID ELBOWS AND KINKS
SEA STRAINER
MOUNT CLOSE
TO SEA COCK
AND ALWAYS BELOW WATER LEVEL
SEA COCK VALVE
1/4 TURN 1/2 INCH
HIGH
PRESSURE
PUMP
AIR PURGE
TUBE
PREFILTER
BEST TO MOUNT ABOVE
BOOSTER PUMP BUT BELOW SYSTEM
AND BELOW WATER LEVEL
BOOSTER PUMP
MOUNT CLOSE
TO SEA STRAINER
AND ALWAYS BELOW WATER LEVEL
IF FEED LINE IS EXCESSIVE
LARGER BOOSTER PUMP MAY BE NEEDED
FORWARD FACING SCOOP
INLET THRU HULL 1/2 INCH
INSTALL SYSTEM MAXIMUM 3 FEET
ABOVE WATER LEVEL
HOWEVER, BEST IF INSTALLED BELOW WATER LEVEL
Crystal Sea
HULL
BOW
STERN


EXTERIOR HOSE CONNECTIONS
RINSE/CLEAN RETURN
FILTERED FEED INLET
PRODUCT TANK "2"
BRINE DISCHARGE
HIGH PRESSURE PUMP AIR PURGE DISCHARGE
PRODUCT TANK "1"
11 3/8" 289 mm
11 3/8" 289 mm
26" 660 mm
26" 660 mm
24 3/4" 629 mm
5/8" 16 mm
3" 76 mm
5 3/8" 137 mm
11 3/8" 289 mm
3" 76 mm
MOUNTING HOLES 4 each
1/4" DIA / 6 mm
Crystal Sea
SRC CS/FE 170
REVERSE OSMOSIS DESALINATOR

3. **Thru Hull Fitting [40] with Inlet Sea Cock Valve [1 & 2]** should be installed by a competent boat yard. The pipe size of the inlet must be 1/2" NPT, minimum. The Sea Cock must be fitted with 1/2" MNPT at its 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 will cause a reverse suction on the Systern Feed Line and for this reason a flush style Inlet Thru Hull Fitting is not recommended. The systern 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.

4. **Inlet Connection** supplied in the installation kit is a 1/2" FNPT PVC 90° elbow with a 3/8" tube fitting. Wrap Teflon tape onto the Sea Cock Valve 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 inlet.

5. **Sea Strainer [4]** with attached Inlet Clean/Rinse/Feed Valve [5] must be mounted for easy access in cleaning. Allow a minimum of 2" clearance below the bottorn of the bowl for screen removal. Connect the Sea Cock- Valve to the Sea Strainer Inlet using the supplied 3/8 inch O.D. rigid wall tubing. Ensure that the tubing exits and enters it's tube fitting in parallel with the fitting. Do Not cut the tubing short which would cause the tube to exit or enter the fitting at an angle. See drawing below and apply this practice to all tube fitting connections required in the installation of the Sea Recovery R.O. System.



6. **Booster Pump [6].** 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 the Booster Pump will not prime the System and the High Pressure Pump will not receive feed water. **<u>Always install the Booster Pump Below Water Level and Close to the Sea Strainer.</u>**

   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).

   Connect the Booster Pump inlet to the Sea Strainer Outlet (one port of the Clean/Rinse/Feed Valve [5]). Keep this line as short and straight as possible. Avoid up and down loops; avoid 90 degree elbows; avoid kinks. The installer must supply the electrical line from the Booster Pump to the System. Use minimum # 16 gauge wire.

7. **Prefilter [7]** equipped with the Sea Recovery System is a 5 micron Prefilter with specially designed cartridge element. The Prefilter must be mounted against a flat vertical surface using the supplied mounting brackets and hardware. It is preferable to mount the assembly in close proximity to the Booster Pump and System with emphasis on accessibility for bowl removal when filter element changing is required. Mount the Prefilter above the Booster Pump and below the System for best results. If necessary the Prefilter may be mounted even with the top of the System but never above the System. If the Prefilter is mounted above the System air will become trapped in the Prefilter and this air will cause difficulty and extended time in priming of the High Pressure Pump.

Connect the Prefilter Inlet to the Booster Pump Outlet keeping this line as straight as possible. Avoid up and down loops; avoid 90 degree elbows; avoid kinks.

8. **System**. When mounting the System, give consideration for proper ventilation as well as access to the front control panel and side tube fittings. For internal High Pressure Pump lubrication purposes, the frame must be mounted horizontally on a flat base (normal boat movement will not adversely effect the pump lubrication). Keep the mounting base as low as possible. Below water level is preferred but never mount the System more than 3 feet above water level. Mount the System as close to the Sea Cock as possible.

   Connect the Prefilter outlet to the System Filtered Feed Port Inlet using the supplied 3/8 inch tubing.

   Feed Water Line Loss CAUTION: If the System is mounted greater than 3 feet above water level and or if the Feed Water Line is excessive and or contains many bends and elbows this will cause line loss pressure from the Booster Pump. This installation obstacle would cause extended time in attempting to prime the High Pressure Pump and will also result in shortened Prefilter Element life. In such a case it will be necessary to up-size the Booster Pump to a higher capacity pump.

   R.O. Membrane/Vessel Assembly [17] CAUTION: The R.O. Membrane Element is located within the System Enclosure. Temperature extremes to the R.O. Membrane Element is an important consideration. Do not mount the System in an area exposed to direct sunlight, temperatures above 120°F (40°C) or freezing temperatures. Typical Boat engine room installations are acceptable, however use judgment when placing the System. Keep it low and away from any extreme heat generating equipment. (NOTE: Any time the assembly is exposed to 140°F (60°C) while not running or running unpressurized, or to feed water greater than 120°F while running and pressurized, the membrane can be damaged). 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 and will cause damage to those components.

   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)

9. **Brine Thru Hull Fitting** [25] must be minimum 1/2" NPT size and installed above the feed water level if possible and not greater than 3 feet above the System. It is best to keep the Brine Thru-Hull Fitting at the same height as the System. **CAUTION**: **Do Not install any shut off valve in this line as any blockage of this line, while the systern is in operation, will cause extensive damage to the system.** 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 Connector [24]. Supplied in the installation kit is 20 feet of 3/8" OD tubing. Wrap Teflon tape around the 1/2" Brine Thru Hull Fitting nipple. Screw the connector onto the Thru Hull nipple, hand tight. No pressure is present at this point when the system is running, so a hand tightened connection should be 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 may cause the connector to crack.

   Connect the System Brine Discharge Outlet to Thru Hull Overboard Dump fitting using 3/8" O.D. tubing.

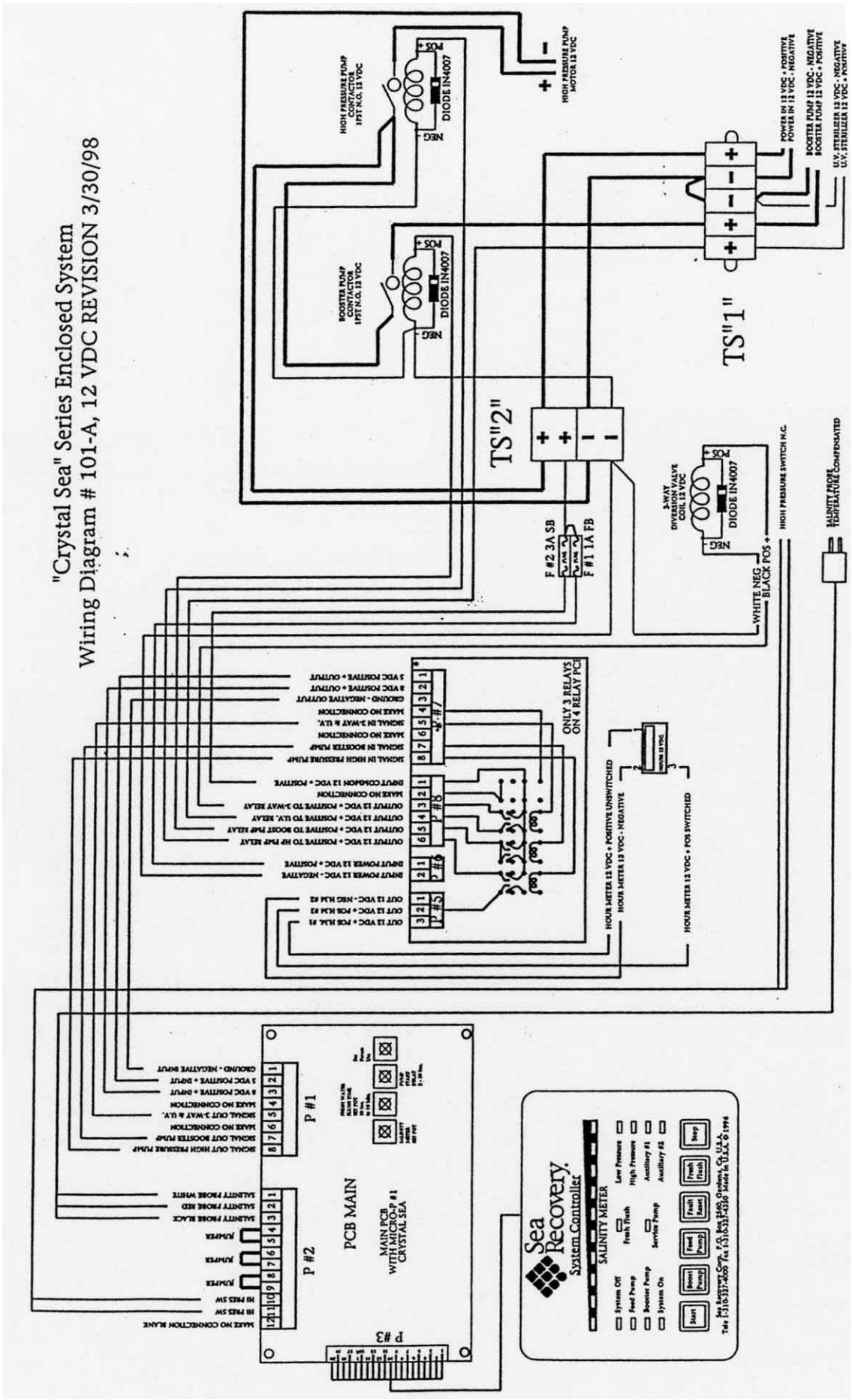
10. **Product Water Tubing.** A 30 foot section of 1/4" OD tubing with a 90° elbow fitting is supplied with the installation kit. The Product Water Tubing is used to interconnect the System Product Water Tank 1 and Tank 2 Outlets to the Charcoal Filter, U.V. Sterilizer and the Product Water Storage Tank.(s). The 90° elbow tube fitting supplied is to be used for the final connection into the ships Product Water Storage Tank. The fitting is a 90° elbow 1/4 inch mnpt x 1/4 inch O.D. tube. The Product Water Storage Tank must have a 1/4 inch fnpt tap to receive the fitting. This connection may also be made in to the tank fill line or suction distribution line.

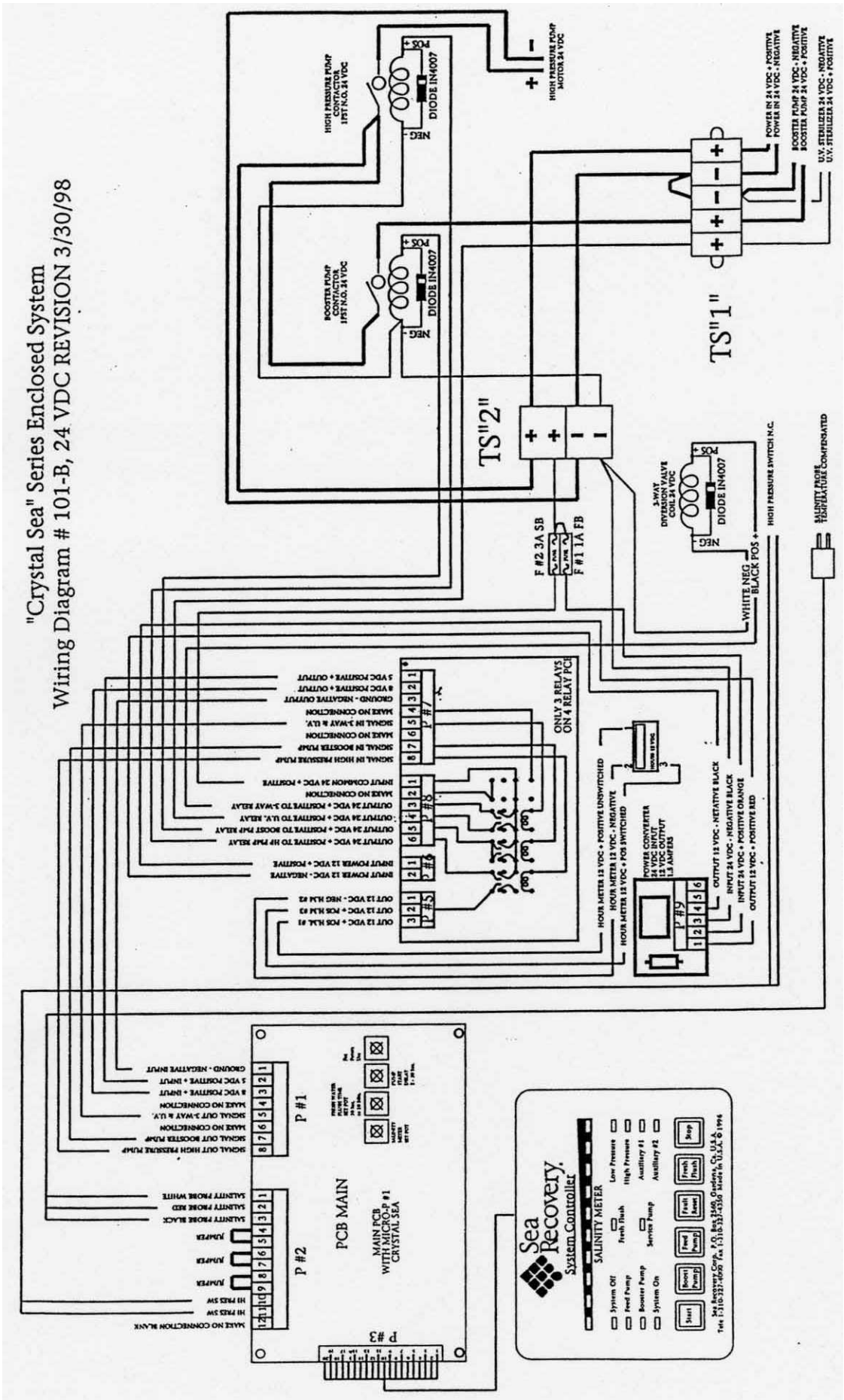
    CAUTION: Do Not connect the Product Water Tubing Connection into the Pressurized Distribution Line.

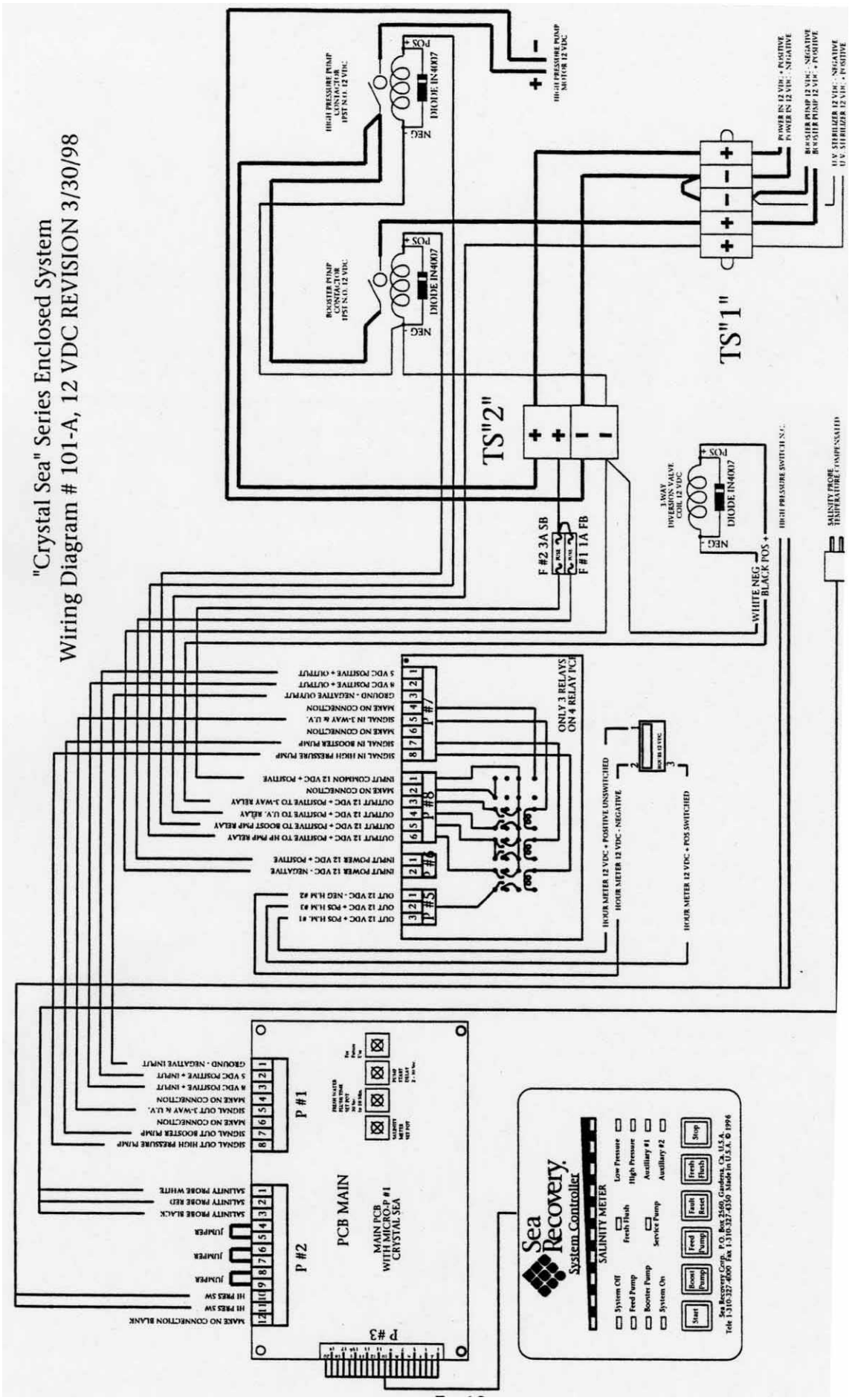
    CAUTION: Do Not install any shut off valve in this line as any blockage of this line, while the system is in operation, will cause extensive damage to the system and the R.O. Membrane Element. Avoid kinks in the Product Water Line.

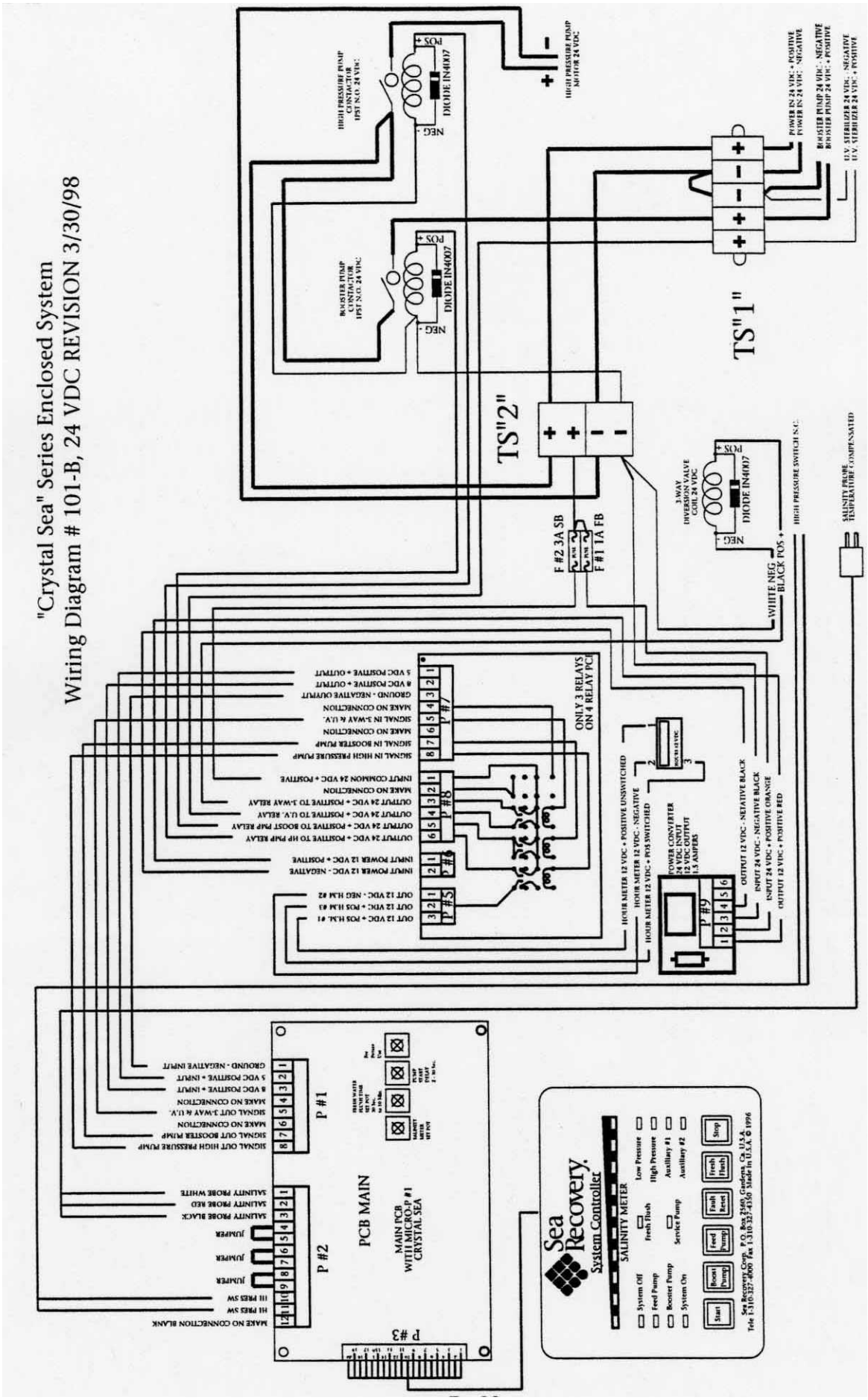
11. **Charcoal Filter [29].** The Charcoal Filter is an option. Use the supplied mounting bracket and appropriate hardware to secure the filter to a flat vertical surface. Leave a minimum 2" space below the bowl for removal of the Charcoal Filter Element. Connect the Charcoal Filter Inlet to the Systern Product Water Tank 1 or 2 fitting. Connect the Charcoal Filter Outlet to the Inlet of the Ships Potable Water Storage Tank or to the Inlet of the optional U.V. Sterilizer if used.

12. **U.V. Sterilizer [30],** if used, is the last 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. Use the incorporated screw holes at both ends of the unit to secure it. Using the supplied 1/4 inch O.D. tubing: Connect the Inlet (bottom) of the U.V. Sterilizer to the Outlet of the Charcoal Filter. Connect the Outlet (top) of the U.V. Sterilizer to the Ships Potable Water Storage Tank [32]. The installer must supply the electrical line from the U.V. Sterilizer to the System. Use minimum #16 gauge wire.


"Crystal Sea" Series Enclosed System
Wiring Diagram # 101-A, 12 VDC REVISION 3/30/98
TS"1"
TS"2"
DIODE IN4007
HIGH PRESSURE PUMP MOTOR 12 VDC
BOOSTER PUMP MOTOR 12 VDC
3-WAY DIVERSION VALVE COIL 12 VDC
F #2 3A SB
F #1 1A FB
WHITE NEG
BLACK POS +
HIGH PRESSURE SWITCH N.C.
SALINITY PROBE TEMPERATURE COMPENSATED
ONLY 3 RELAYS ON 4 RELAY PCB
HOUR METER 12 VDC + POSITIVE UNSWITCHED
HOUR METER 12 VDC - NEGATIVE
HOUR METER 12 VDC + POS SWITCHED
PCB MAIN
MAIN PCB WITH MICROP #1 CRYSTAL SEA
P #1
P #2
P #3
Sea Recovery
System Controller
SALINITY METER


"Crystal Sea" Series Enclosed System
Wiring Diagram # 101-B, 24 VDC REVISION 3/30/98
TS"1"
TS"2"
HIGH PRESSURE PUMP CONTACTOR 1PST N.O. 24 VDC
BOOSTER PUMP CONTACTOR 1PST N.O. 24 VDC
DIODE IN4007
HIGH PRESSURE PUMP MOTOR 24 VDC
POWER IN 24 VDC + POSITIVE
POWER IN 24 VDC - NEGATIVE
BOOSTER PUMP 24 VDC - NEGATIVE
BOOSTER PUMP 24 VDC + POSITIVE
U.V. STERILIZER 24 VDC - NEGATIVE
U.V. STERILIZER 24 VDC + POSITIVE
F #2 3A SB
F #1 1A FB
3-WAY DIVERSION VALVE COIL 24 VDC
HIGH PRESSURE SWITCH N.C.
WHITE NEG
BLACK POS +
SALINITY PROBE TEMPERATURE COMPENSATED
ONLY 3 RELAYS ON 4 RELAY PCB
HOUR METER 12 VDC + POSITIVE UNSWITCHED
HOUR METER 12 VDC - NEGATIVE
HOUR METER 12 VDC + POS SWITCHED
POWER CONVERTER 24 VDC INPUT 13 VDC OUTPUT 1.3 AMPERS
OUTPUT 12 VDC - NETATIVE BLACK
INPUT 24 VDC - NEGATIVE BLACK
INPUT 24 VDC + POSITIVE ORANGE
OUTPUT 12 VDC + POSITIVE RED
PCB MAIN
MAIN PCB WITH MICRO-P #1 CRYSTAL SEA
P #1
P #2
P #3
Sea Recovery
System Controller
SALINITY METER
System Off
Feed Pump
Booster Pump
System On
Low Pressure
Fresh Flush
High Pressure
Service Pump
Auxiliary #1
Auxiliary #2
Start
Boost Pump
Feed Pump
Fresh Alarm
Fresh Flush
Stop


"Crystal Sea" Series Enclosed System
Wiring Diagram # 101-A, 12 VDC REVISION 3/30/98
TS"1"
TS"2"
PCB MAIN
MAIN PCB
WITH MICRO-P #1
CRYSTAL SEA
P #1
P #2
P #3
P #4
P #5
P #6
P #7
P #8
Sea Recovery
System Controller
SALINITY METER
DIODE IN4007
F #2 3A SB
F #1 1A FB
WHITE NEG
BLACK POS +
ONLY 3 RELAYS ON 4 RELAY PCB
HOUR METER 12 VDC + POSITIVE UNSWITCHED
HOUR METER 12 VDC - NEGATIVE
HOUR METER 12 VDC + POS SWITCHED
SALINITY PROBE BLACK
SALINITY PROBE RED
SALINITY PROBE WHITE
JUMPER
JUMPER
JUMPER
HI PRES SW
HI PRES SW
MAKE NO CONNECTION BLANK
GROUND - NEGATIVE INPUT
5 VDC POSITIVE + INPUT
8 VDC POSITIVE + INPUT
SIGNAL OUT 3-WAY & U.V.
MAKE NO CONNECTION
SIGNAL OUT BOOSTER PUMP
SIGNAL OUT HIGH PRESSURE PUMP
INPUT POWER 12 VDC - NEGATIVE
INPUT POWER 12 VDC + POSITIVE
OUT 12 VDC - NEG H.M. #2
OUT 12 VDC + POS H.M. #2
OUT 12 VDC + POS H.M. #1
SIGNAL IN HIGH PRESSURE PUMP
SIGNAL IN BOOSTER PUMP
MAKE NO CONNECTION
SIGNAL IN 3-WAY & U.V.
MAKE NO CONNECTION
GROUND - NEGATIVE OUTPUT
8 VDC POSITIVE + OUTPUT
5 VDC POSITIVE + OUTPUT
Start
Boost Pump
Feed Pump
Flush Reset
Fresh Flush
Stop
System Off
Feed Pump
Booster Pump
System On
Fresh Flush
Service Pump
Low Pressure
High Pressure
Auxiliary #1
Auxiliary #2


"Crystal Sea" Series Enclosed System
Wiring Diagram # 101-B, 24 VDC REVISION 3/30/98
TS"1"
TS"2"
PCB MAIN
MAIN PCB
WITH MICRO-P #1
CRYSTAL SEA
Sea Recovery
System Controller
SALINITY METER
DIODE IN4007
F #2 3A SB
F #1 1A FB
WHITE NEG
BLACK POS +
ONLY 3 RELAYS
ON 4 RELAY PCB

SECTION "F"

SYSTEM COMMISSIONING

&

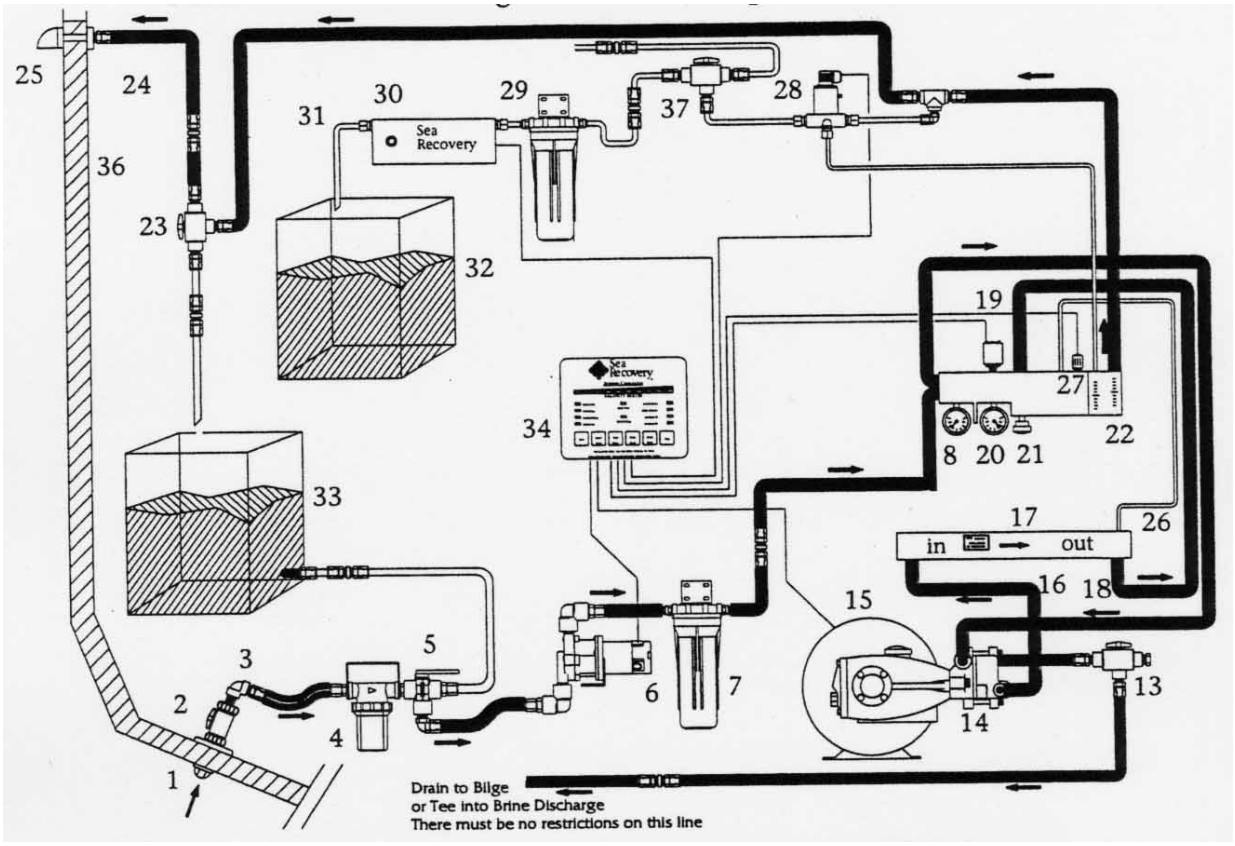
INITIAL START UP OF A NEW SEA RECOVERY Crystal Sea R.O. SYSTEM

WITH

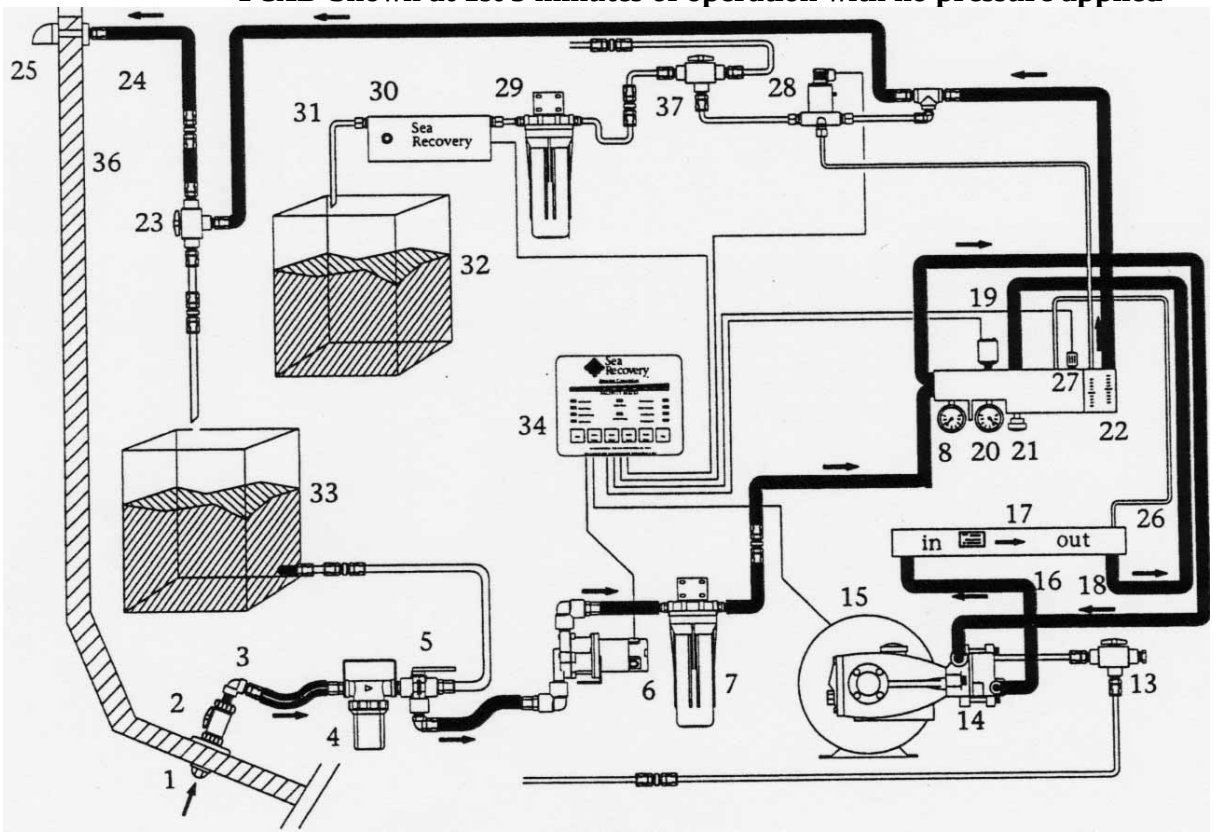
INITIAL NEW SYSTEM READINGS FORM

NOTES

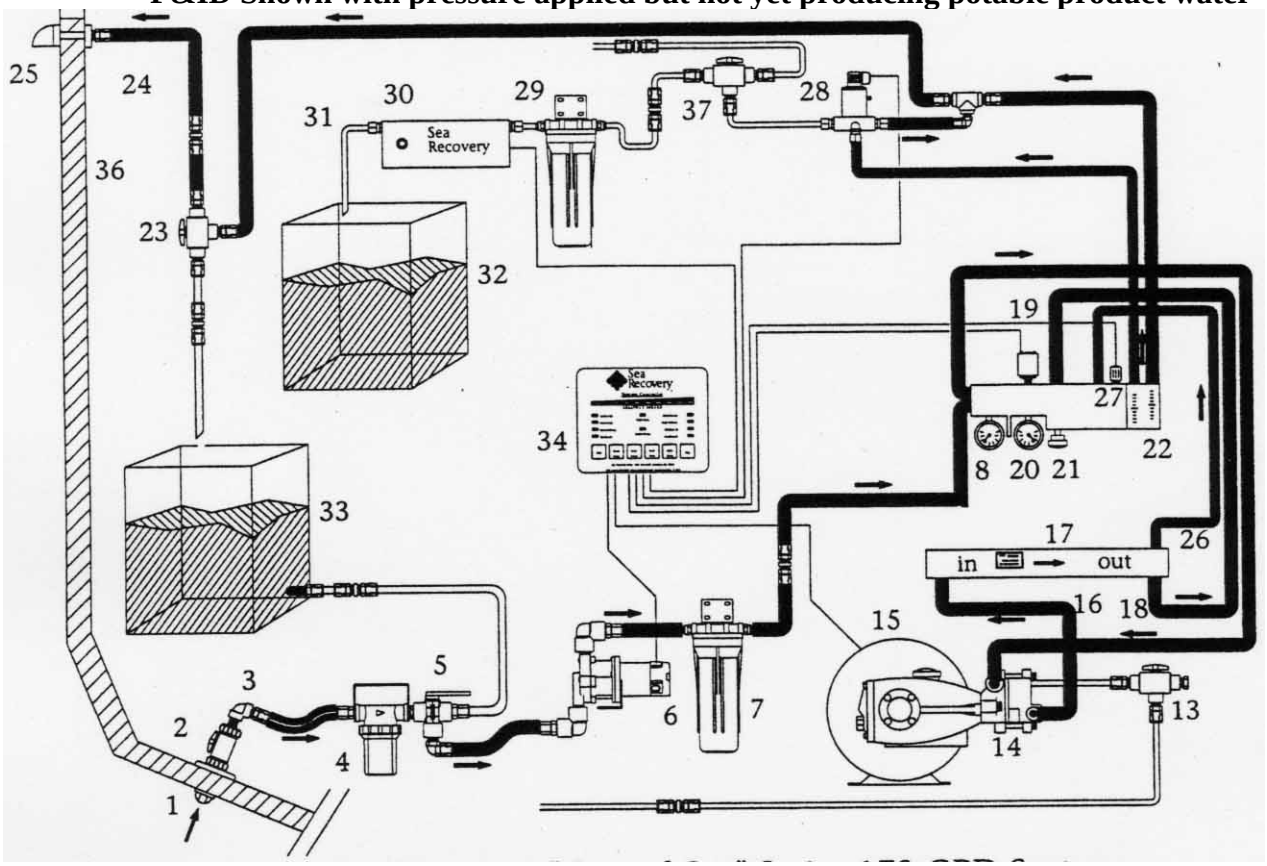
Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with high Pressure Pump Air Purge Valve Open



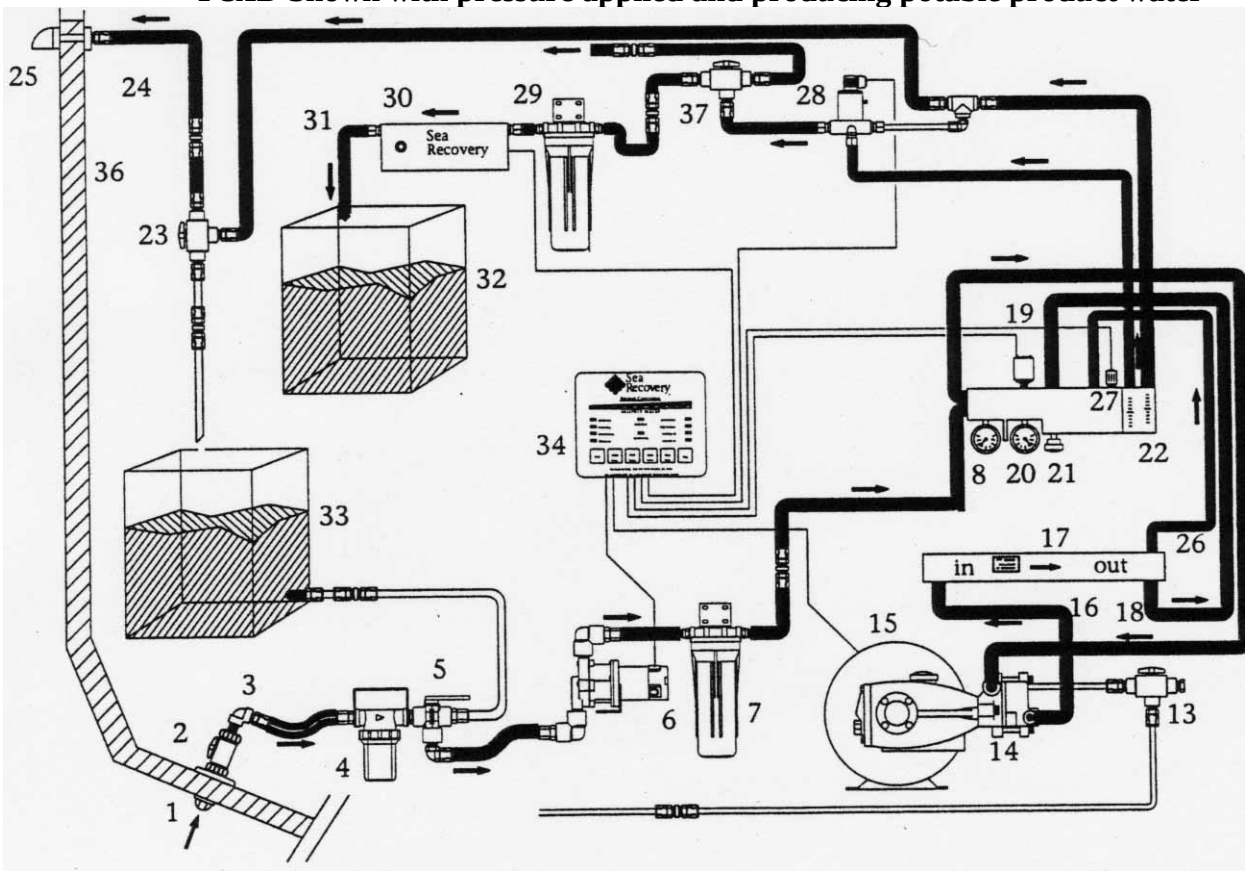
Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown at 1st 5 minutes of operation with no pressure applied



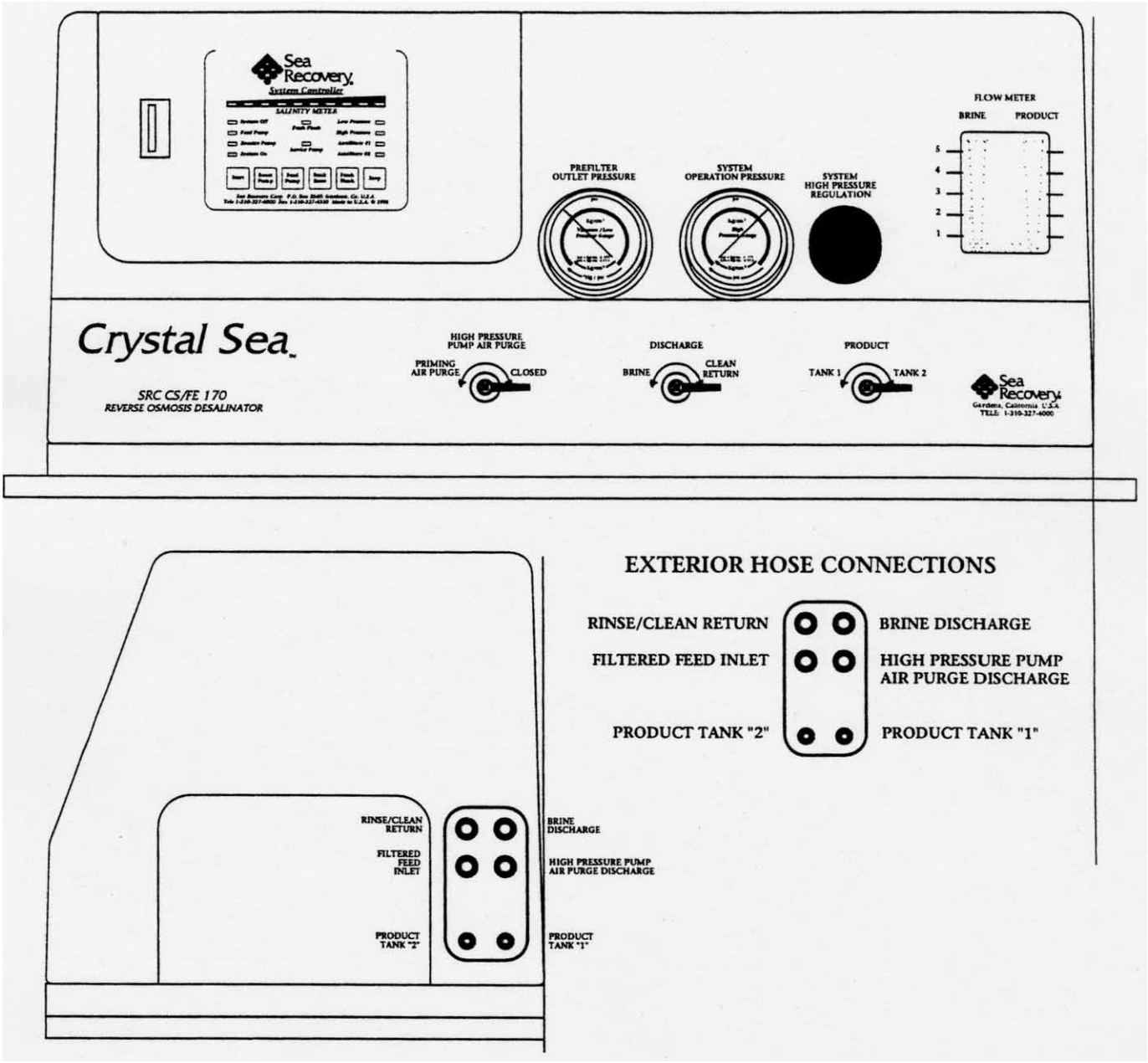
Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with pressure applied but not yet producing potable product water



Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with pressure applied and producing potable product water



FRONT & SIDE PANEL VIEWS



INITIAL START-UP PROCEDURE OF A NEW SEA RECOVERY Crystal Sea SYSTEM:

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 Éther to ensure that all connections are properly made, or because the system is new at the initial start-up and therefore requires special precautions and procedures.

Failure to follow these procedures exactly could lead 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. 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 will cause 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 will not be covered under warranty by Sea Recovery.

2. 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.

3. Remove the side electrical connection cover and check the wiring at the terminal strip to ensure proper (correct polarity) and tight connections of all electrical lines***. Do not rely on the installers word, check it yourself*** If you are the installer, check these electrical lines again. Any damage due to improper installation will not be covered under warranty by Sea Recovery.

   DC power source Caution: If the DC power lines are reversed this will cause the high pressure pump and booster pump motors to run in reverse direction. Reverse direction rotation will cause the booster pump to not properly deliver the required pressure and flow to the system. Further, reverse polarity to High Pressure Pump will lead to lack of proper lubrication to the pump's crankcase section. Damage to the system and a non functional systern due to improper electrical connection will not be covered by Sea Recovery Warranty, this would be an installation problem, not a systern problem.

4. Replace the side electrical connection cover.

5. Ensure that the installer has replaced the ***orange color Non Vented Oil Fill Plug*** with the supplied ***orange and black color Vented Oil Fill Cap*** onto the top rear crankcase section of the High Pressure Pump. Also ensure that the installer has checked, and if necessary has corrected, the oil level in the High Pressure Pump crankcase and has further installed the rear vent cover located at the back of the system. Both the Oil Fill Cap and Rear Vent Cover were shipped with the system but in a separate clear bag and attached to the Back Pressure Regulator Knob. The system is shipped with a non vented plug so that où does not spill from the High Pressure Pump during shipment. This Non Vented Plug must be replaced with the Supplied Vented Oil Fill Cap. If the crankcase is not vented with the proper cap, pressure will build within the crankcase and cause oil seal failure, loss of crankcase oil and, in turn, damage to the High Pressure Pump due to lack of lubricating oil. Such a failure due to neglect will void all warranty of the High Pressure Pump.

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

7. At the Sea Strainer, position the "INLET CLEAN/RINSE/FEED" valve [5] to the "FEED WATER" position, towards the Sea Strainer [4].

8. At the front panel of the System, position the "DISCHARGE" valve [23] to the "BRINE" position, left.

9. At the front panel of the System, position the "HIGH PRESSURE PUMP AIR PURGE" valve [13] to the "PRIMING AIR PURGE" position, left.

10. At the front panel of the System, position the "PRODUCT" valve [37] to the "TANK 1 " position, left OR to the "TANK 2" position, right, as appropriate. This valve will route the produced product water through the appropriate product water line from the system to the final collection point that the installer has chosen.. If this valve is in the center, handle vertical, position then product water will flow to both the "Tank 1" and "Tank 2" positions.

11. Open any auxiliary Valve within the incoming Feed Line from the Inlet Thru-HuIl Fitting [1] to the System; Outgoing Brine Discharge Line from the System to the Brine Thru-HuIl Fitting [251; and Outgoing Product Water Line from the System to the Ships Potable Water Storage Tank [321.

    CAUTION: Any auxiliary Valve, pinch, kink or other blockage in these lines will damage the Sea Recovery System if left closed or blocked during starting and operation of the Sea Recovery System. Damage to the System caused by blocked lines external of the System will not be covered under the Sea Recovery Warranty, this would be an installation error.

12. Open the Back Pressure Regulator Valve [21] FULL OPEN by turning the valve handle counter clockwise until the valve stem is disengaged from its connecting threads.

    The Back Pressure Regulator Valve is designed to disengage from it's connecting threads within the Control Manifold. After all threads are cleared the Back Pressure Regulator stem and handle will move inward and outward freely approximately 1/8 of an inch. This is normal and by design.

    CAUTION: The Back Pressure Regulator Valve must be full open when starting the Sea Recovery R.O. System for the first time. The System will not purge all air and will not prime itself if there is any back pressure on the Brine Discharge during initial commissioning.

13. 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.

    Upon applying power to the System all LED indicator lamps will illuminate for approximately 2 seconds. During this time the micro processor is initializing itself.

14. Start the booster pump only at this time by pressing the "Booster Pump" switch located on the System Front Panel Touch Pad. The "Booster Pump" lamp, located on the Touch Pad, should illuminate and the Booster Pump should now be operating.

    After the Booster Pump has filled water into the Feed Line and Prefilter, Feed Water will discharge from the side of the System through the High Pressure Pump Air Purge Tubing. Ensure that the installer has positioned this line so that it is discharging water in a safe area and not spilling onto other equipment.

15. After the Booster Pump has been operating for a minimum of 5 minutes and with any leaks corrected, Close the High Pressure Pump Air Purge Valve.

16. Start the System by pressing the "Start" switch located on the System Front Panel Touch Pad. The "System On" lamp, located on the Touch Pad, should illuminate and the System's High Pressure Pump and Booster Pump should now both be operating.

FULL AIR PURGING OF THE SYSTEM: The High Pressure Pump is specifically designed to deliver a relatively low volume of flow for the Crystal Sea System. The stroke (length of travel) of the ceramic plungers within the High Pressure Pump is extremely short (about 2 mm). This short stroke requirement, for low volume flow, causes air to remain within the discharge valve chambers of the pump for up to 15 minutes. Any time air kas been introduced into the feed line, as with the case of a new system after installation or after major maintenance, the high pressure pump will then require up to 15 minutes to purge all air.

If air is present within the High Pressure Pump discharge valve chamber the High Pressure Pump will deliver the proper flow of water ONLY IF NO back pressure is applied to the pump. If air is trapped within the High Pressure Pump when the Back Pressure Regulator valve is turned inward this will cause the High Pressure Pump to loose all flow or deliver less than normal flow. For this reason, the System must be operated as the High Pressure Pump Air Purge Valve and Back Pressure Regulator Valve are alternately opened and closed several times. This opening and closing causes turbulence at the High Pressure Pump and assists it in purging all air.

a. Position the High Pressure Pump Air Purge Valve to the Priming Air Purge position for 20 seconds then close it for 20 seconds. Repeat this procedure 3 times then leave the valve in the closed position.

b. By design, the Back Pressure Regulator valve stem [21] will fully disengage from it's threaded chamber when rotated fully counter-clockwise. In order to reengage the valve stem into it's threaded chamber, for pressure adjustment, push inward with gentle force while rotating the handle clockwise. Observe the exposed stem to determine that it has engaged into its threaded chamber while rotating it clockwise. Slowly continue clockwise adjustment of the Back Pressure Regulator valve stem 3 to 4 full turns.

C. Position the High Pressure Pump Air Purge Valve to the Priming Air Purge position for 20 seconds then close it for 20 seconds. Repeat this procedure 2 more times then leave the valve in the closed position

d. Rotate the Back Pressure Regulating Valve Handle counter clockwise fully until the Valve Stem disengages from it's threaded chamber.

e. Position the High Pressure Pump Air Purge Valve to the Priming Air Purge position for 20 seconds then close it for 20 seconds. Repeat this procedure 2 more times then leave the valve in the closed position.

f. **If the feed water source is BRACKISH WATER (not full salinity sea water)** adjust the Back Pressure Regulator Valve from 100 PSI to 800 PSI. Lower or increase pressure so that the product water output, as registered on the Product Water Flow Meter [221, is within system specifications. The product water output flow specification to be maintained and not exceeded is 7 gallons per hour or 170 gallons per day which is approximately mid point on the Product Water Flow Meter.

DO NOT EXCEED PRODUCT WATER FLOW SPECIFICATIONS. PERMANENT DAMAGE TO THE R.O. MEMBRANE ELEMENT WILL RESULT IF PRODUCT WATER FLOW SPECIFICATIONS ARE EXCEEDED.

Press inward on the Back Pressure Regulating Valve Handle and turn the handle clockwise to engage the Valve Stem into it's threaded chamber. Continue to slowly rotate the Back Pressure Regulating Valve Handle clockwise 3 to 4 full turns. You should now see pressure building at the High Pressure Gauge. Continue to slowly rotate the Back Pressure Regulating Valve Handle clockwise until 800 psi is achieved. If the Valve Stem stops prior to reaching 800 psi this would indicate that there is still air in the High Pressure Pump. If this is the case then jog the High Pressure Pump Air Purge Valve open and closed in 10 second intervals several times. Close the High Pressure Pump Air Purge Valve.

g. If the feed water is Sea Water then adjust the Back Pressure Regulating Handle to achieve 800 psi. Pressure may continue to build up slowly. Therefore, watch the pressure gauge and back out the Back Pressure Regulating Valve Handle should pressure climb above 800 psi. Pressure may build from 600 to 800 psi over several minutes if air is still trapped within the High Pressure Pump. If this is the case allow the System to slowly build pressure and adjust the Back Pressure Regulator Valve Handle to ensure that the System does not achieve greater than 800 psi.

h. If pressure builds to 400 to 600 psi very slowly then open the Back Pressure Regulator Valve full open, wait 1 minute, purge the air with the High Pressure Pump Air Purge Valve, then Press inward on the Back Pressure Regulating Valve Handle and turn the handle clockwise to engage the Valve Stem into it's threaded chamber. Continue to slowly rotate the Back Pressure Regulating Valve Handle clockwise 3 to 4 full turns. You should now see a more positive and quicker response to pressure build up.

i. If after several purge attempts, the pressure will not climb up to 800 psi:

Check to ensure that the power supply is at least 12.5 VDC at the System.

Check to ensure that the Low Pressure Gauge is reading positive pressure, above 1 psi.

Check to ensure that the Suction Line (all lines prior to the Booster Pump) are not sucking air.

Check to ensure that the High Pressure Pump Air Purge Valve is in the Closed position.

17. The GPM Feed Water Flow Meter will allow observation of the water passing through it. Any air passing through the meter will cause the flow reading to fluctuate. Once all air is bled and eliminated from the system, the meter may be read reliably. Mid point of the Brine Discharge Flow Meter indicates normal, or about.3 GPM Brine Discharge.

18. If leaks develop, decrease pressure by adjusting the Back Pressure Regulator Valve [21] full open, counter clockwise, then press the system STOP switch and correct any problems.

19. Determine that product water is being produced. This can be assured by a noticeable flow through the Product Water Flow Meter [22]. 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, further most right led in the salinity meter, will turn off and the 3-Way Product Diversion Valve [28] will energize and direct flow to the "potable" (good water) position. This allows product water to pass through the tank selection valve [37] labeled "Product" on the System front panel and in turn flow from the appropriate selected tube fitting at the "Tank 1" or "Tank 2" position from the side of the System and on to the corresponding components in that particular line.

20. 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.

    CAUTION: Do not allow a system which is operating in Sea Water to exceed 800 psi.

    Normal Operation: Under normal conditions, the SRC system will perform as indicated in the Specifications located in Section "B" of this Manual and as correlated to the Temperature Effects Charts in Section "M" of this Manual. Any deviation in performance will indicate that some maintenance or adjustment may be required.

    If the system is allowed to continue running after deviating from normal operation, the original problem component may cause subsequent damage to properly functioning components. The Warranty will be voided on components damaged as a result of operator negligence in allowing a malfunction to go uncorrected.

21. Prior to shut down fill out the two forms on the following pages of this section.

22. Refer to section "H" of this manual for proper shut down procedures.

Sea Recovery Reverse Osmosis Desalination System

"Crystal Sea" 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 a copy of the completed 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: _____ VDC or _____ 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:

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

Product Water Salinity: _____ PPM

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

Unusual occurrences: _____

_____

_____

NOTES:

Sea Recovery Reverse Osmosis Desalination System

"Crystal Sea" 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 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 a copy of the completed 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: _____ VDC or _____ 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:

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

Product Water Salinity: _____ PPM

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

Unusual occurrences: _____

_____

_____

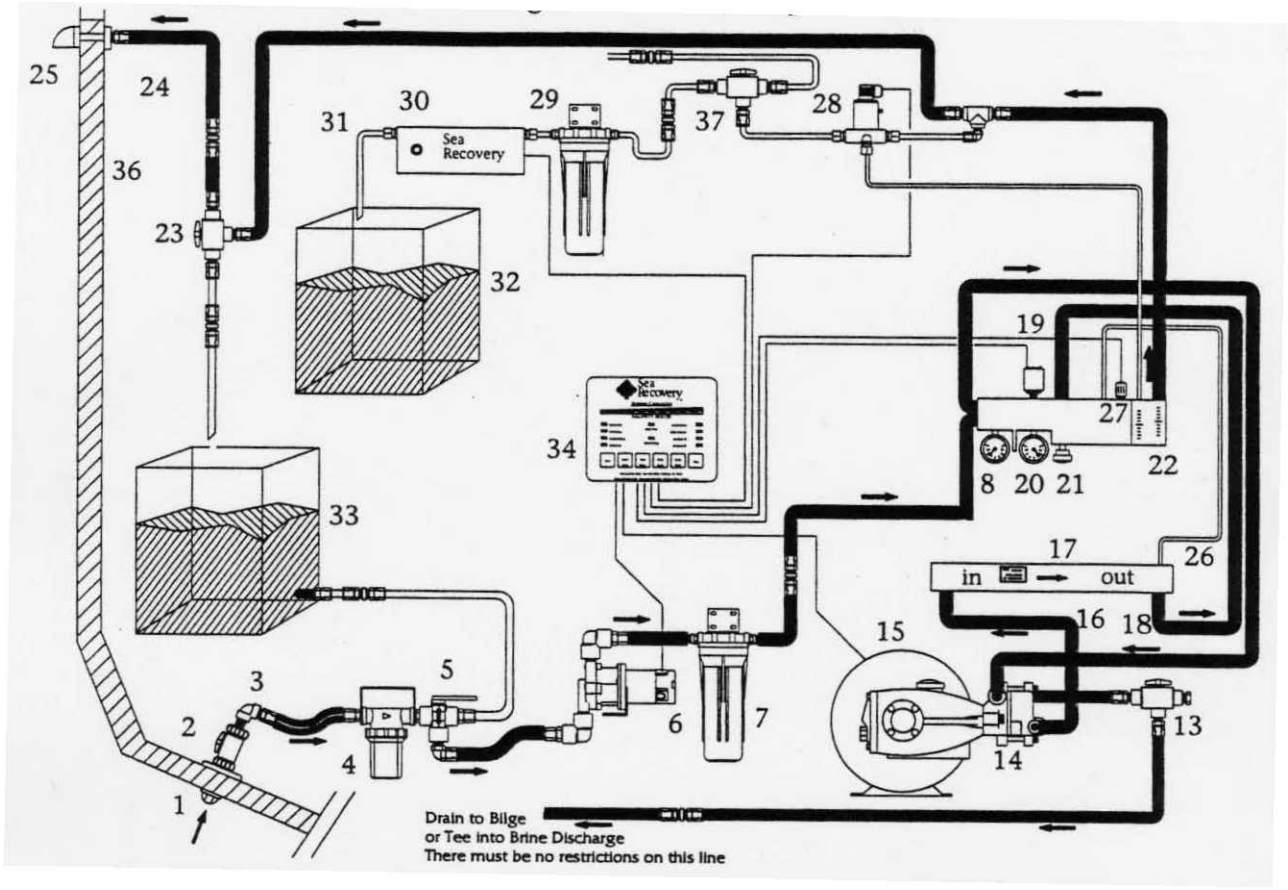
NOTES:

SECTION “G”

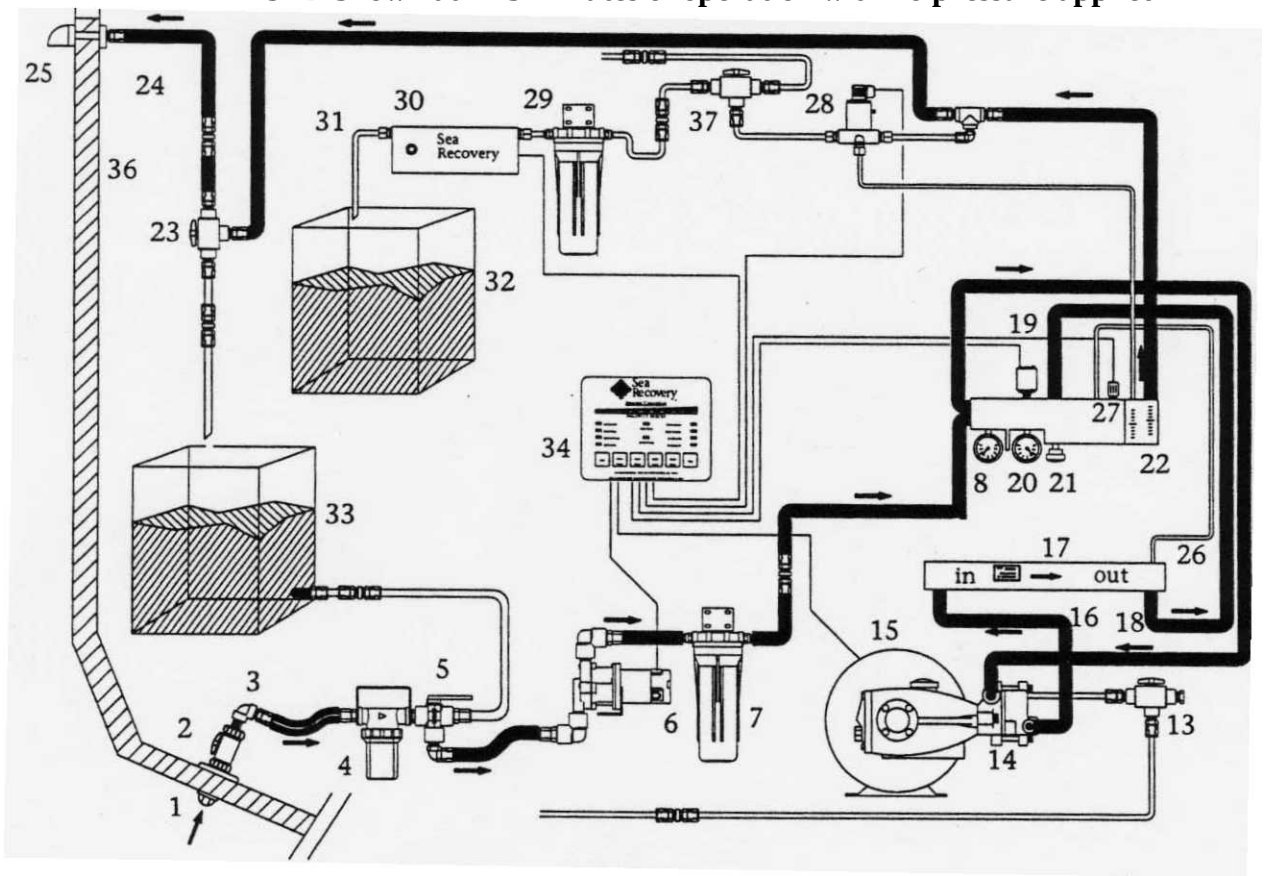
SYSTEM START UP

NOTES:

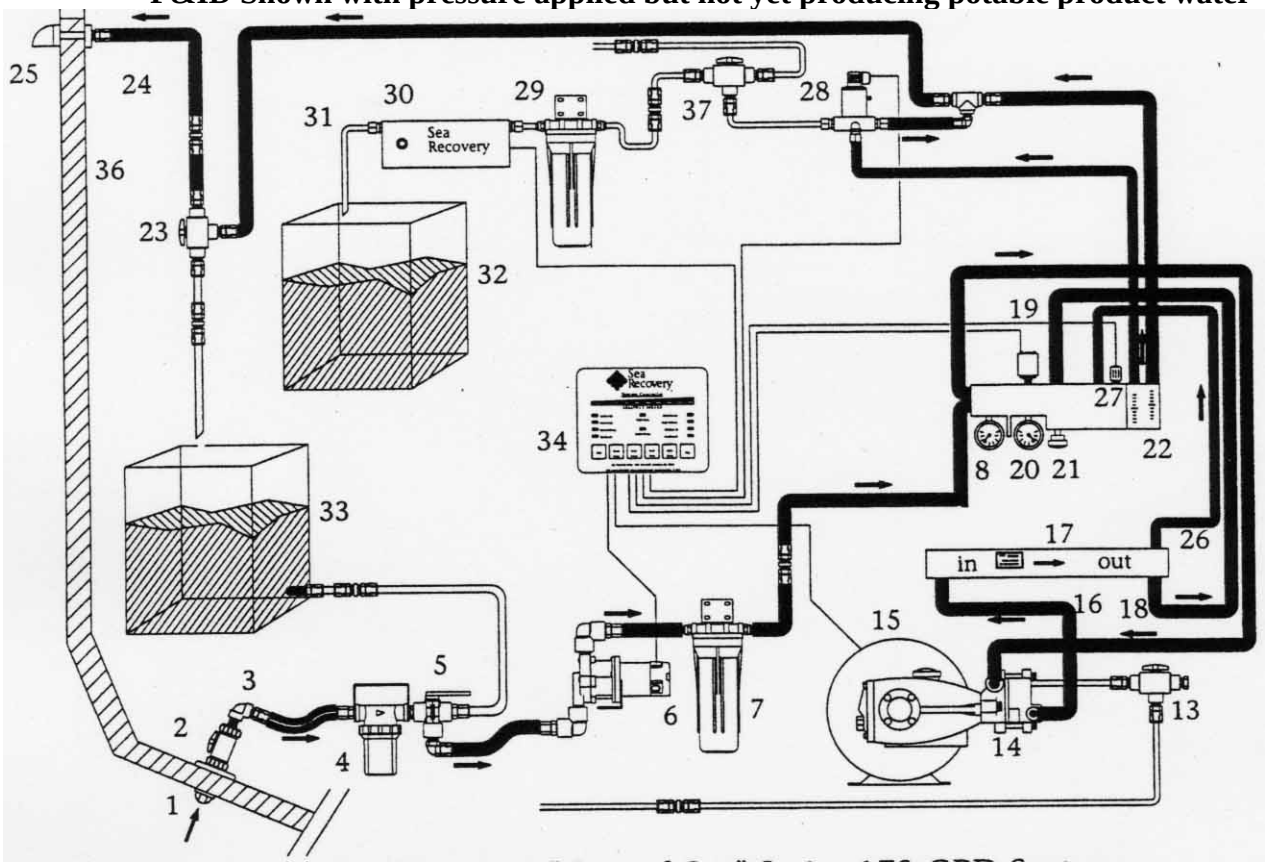
Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with High Pressure Pump Air Purge Valve Open



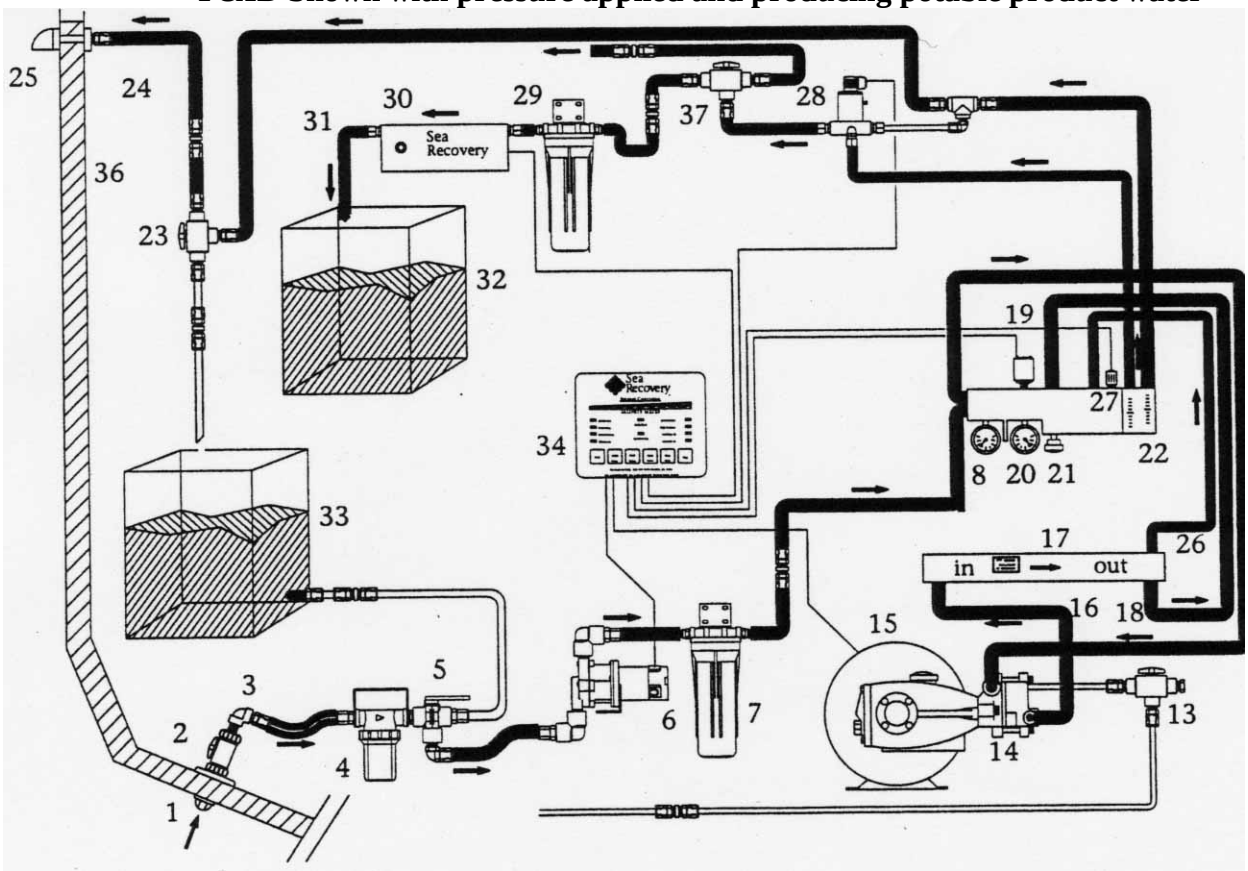
Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown at 1st 5 minutes of operation with no pressure applied



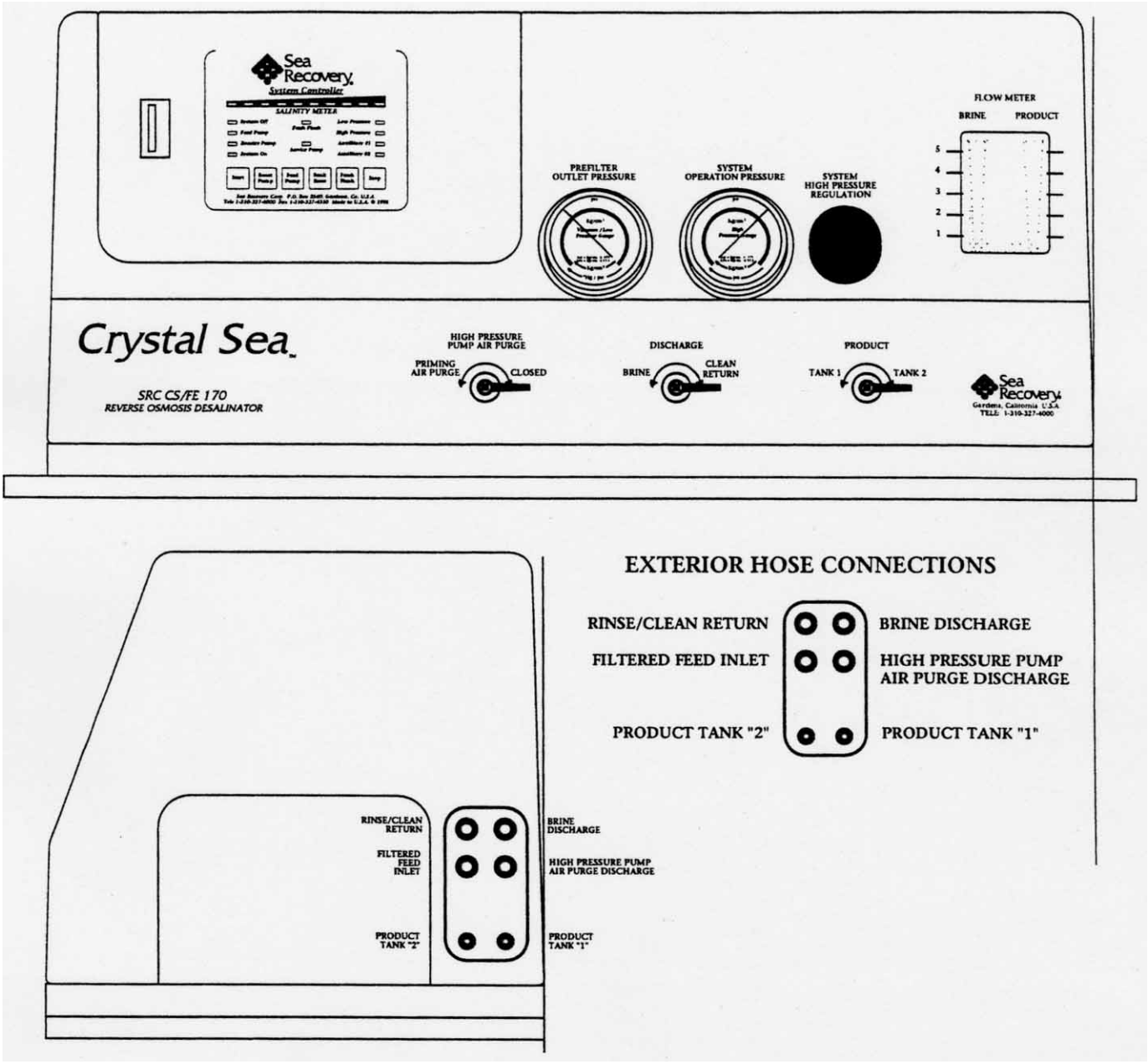
Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with pressure applied but not yet producing potable product water



Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with pressure applied and producing potable product water



FRONT & SIDE PANEL VIEWS



START-UP PROCEDURE OF A SEA RECOVERY "Crystal Sea" SYSTEM:

The following instructions must be carried out for start-up of a system.

Failure to follow these procedures exactly could lead 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. Check each tube connection at the side panel of the System to ensure that there are no loose connections or kinks in the lines.

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

3. At the Sea Strainer, position the "INLET CLEAN/RINSE/FEED" valve [51 to the "FEED WATER" position, towards the Sea Strainer [4].

4. At the front panel of the System, position the "DISCHARGE" valve [23] to the "BRINE" position, left.

5. At the front panel of the System, position the "HIGH PRESSURE PUMP AIR PURGE" valve [13] to the "PRIMING AIR PURGE" position, left.

6. At the front panel of the System, position the "PRODUCT" valve [37] to the "TANK 1 " position, left OR to the "TANK 2" position, right, as appropriate. This valve will route the produced product water through the appropriate product water line from the system to the final collection point that the installer has chosen.. If this valve is in the center, handle vertical, position then product water will flow to both the "Tank 1" and "Tank 2" positions.

7. 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 [25]; and Outgoing Product Water Line from the System to the Ships Potable Water Storage Tank [32].

   CAUTION: Any auxiliary Valve, pinch, kink or other blockage in these lines will damage the Sea Recovery System if left closed or blocked during starting and operation of the Sea Recovery System. Damage to the System caused by blocked lines external of the System will not be covered under the Sea Recovery Warranty, this would be an installation error.

8. Open the Back Pressure Regulator Valve [21] FULL OPEN by turning the valve handle counter clockwise until the valve stem is disengaged from its connecting threads.

   The Back Pressure Regulator Valve is designed to disengage from it's connecting threads within the Control Manifold. After all threads are cleared the Back Pressure Regulator stem and handle will move inward and outward freely approximately 1/8 of an inch. This is normal and by design.

   CAUTION: The Back Pressure Regulator Valve must be full open when starting the Sea Recovery R.O. System. This is to ensure that cool feed water flushes through the System prior to pressurizing it.

9. 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.

   Upon applying power to the System all LED indicator lamps will illuminate for approximately 2 seconds. During this time the micro processor is initializing itself.

10. Start the booster pump only at this time by pressing the "Booster Pump" switch located on the System Front Panel Touch Pad. The "Booster Pump" lamp, located on the Touch Pad, should illuminate and the Booster Pump should now be operating.

11. After the Booster Pump has been operating for a minimum of 20 seconds close the High Pressure Pump Air Purge Valve. If the Prefilter Element has been changed since the last operation then leave the High Pressure Pump Air Purge Valve Open for 60 seconds then close it. This is to ensure that all air is purged from the feed water line.

12. Start the System by pressing the "Start" switch located on the System Front Panel Touch Pad. The "System On" lamp, located on the Touch Pad, should illuminate and the System's High Pressure Pump and Booster Pump should now both be operating.

13. By design, the Back Pressure Regulator valve stem [21] will fully disengage from it's threaded chamber when rotated fully counter-clockwise. In order to reengage the valve stem into it's threaded chamber, for pressure adjustment, push inward with gentle force while rotating the handle clockwise. Observe the exposed stem to determine that it has engaged into its threaded chamber while rotating it clockwise. Slowly continue clockwise adjustment of the Back Pressure Regulator valve stem until 800 psi is achieved at the High Pressure Gauge if operation of the System is in full salinity Sea Water.

    If the feed water source is BRACKISH WATER (not full salinity sea water) adjust the Back Pressure Regulator Valve from 100 PSI to 800 PSI. Lower or increase pressure so that the product water output, as registered on the Product Water Flow Meter [22], is within system specifications. The product water output flow specification to be maintained and not exceeded is 7 gallons per hour or 170 gallons per day which is approximately mid point on the Product Water Flow Meter.

    DO NOT EXCEED PRODUCT WATER FLOW SPECIFICATIONS. PERMANENT DAMAGE TO THE R.O. MEMBRANE ELEMENT WILL RESULT IF PRODUCT WATER FLOW SPECIFICATIONS ARE EXCEEDED.

    IF THE SYSTEM WILL NOT DEVELOP PRESSURE AND THE BRINE DISCHARGE FLOW METER DROPS TO NO READING WHEN ATTEMPTING TO BUILD PRESSURE IT IS LIKELY THAT THE HIGH PRESSURE PUMP HAS BEEN EXPOSED TO AIR IN THE FEED LINE. IF SO THEN REFER TO SECTION F OF THIS MANUAL AND FOLLOW THE PRIMING PROCEDURES LISTED.

14. The GPM Feed Water Flow Meter will allow observation of the water passing through it. Any air passing through the meter will cause the flow reading to fluctuate. Once all air is bled and eliminated from the system, the meter may be read reliably. Mid point of the Brine Discharge Flow Meter indicates normal, or about .3 GPM Brine Discharge.

15. Determine that product water is being produced. This can be assured by a noticeable flow through the Product Water Flow Meter [22]. 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, further most right led in the salinity meter, will turn off and the 3-Way Product Diversion Valve [28] will energize and direct flow to the "potable" (good water) position.

    This allows product water to pass through the tank selection valve [371 labeled "Product" on the System front panel and in turn flow from the appropriate selected tube fitting at the "Tank 1" or "Tank 2" position from the side of the System and on to the corresponding components in that particular line.

16. Check 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.

    CAUTION: Do not allow a system which is operating in Sea Water to exceed 800 psi.

    Normal Operation: Under normal conditions, the SRC system will perform as indicated in the Specifications located in Section "B" of this Manual and as correlated to the Temperature Effects Charts in Section 'M' of this Manual. Any deviation in performance will indicate that some maintenance or adjustment may be required.

    If the system is allowed to continue running after deviating from normal operation, the original problem component may cause subsequent damage to properly functioning components. The Warranty will be voided on components damaged as a result of operator negligence in allowing a malfunction to go uncorrected.

17. Refer to section "H" of this manual for proper shut down procedures.

SECTION "H"

SHUTDOWN PROCEDURE

NOTES:

Sea Recovery Reverse Osmosis Desalination System

"Crystal Sea" 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.

Serial Number: _____ Model Number: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VDC or _____ 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:

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

Product Water Salinity: _____ PPM

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

Unusual occurrences: _____

_____

_____

_____

Sea Recovery Reverse Osmosis Desalination System

"Crystal Sea" 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.

Serial Number: _____ Model Number: _____

Name of Operator: _____ Date: _____

Name & Company of Installer: _____

Name of Owner: _____

System Power: _____ VDC or _____ 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:

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

Product Water Salinity: _____ PPM

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

Unusual occurrences: _____

_____

_____

_____

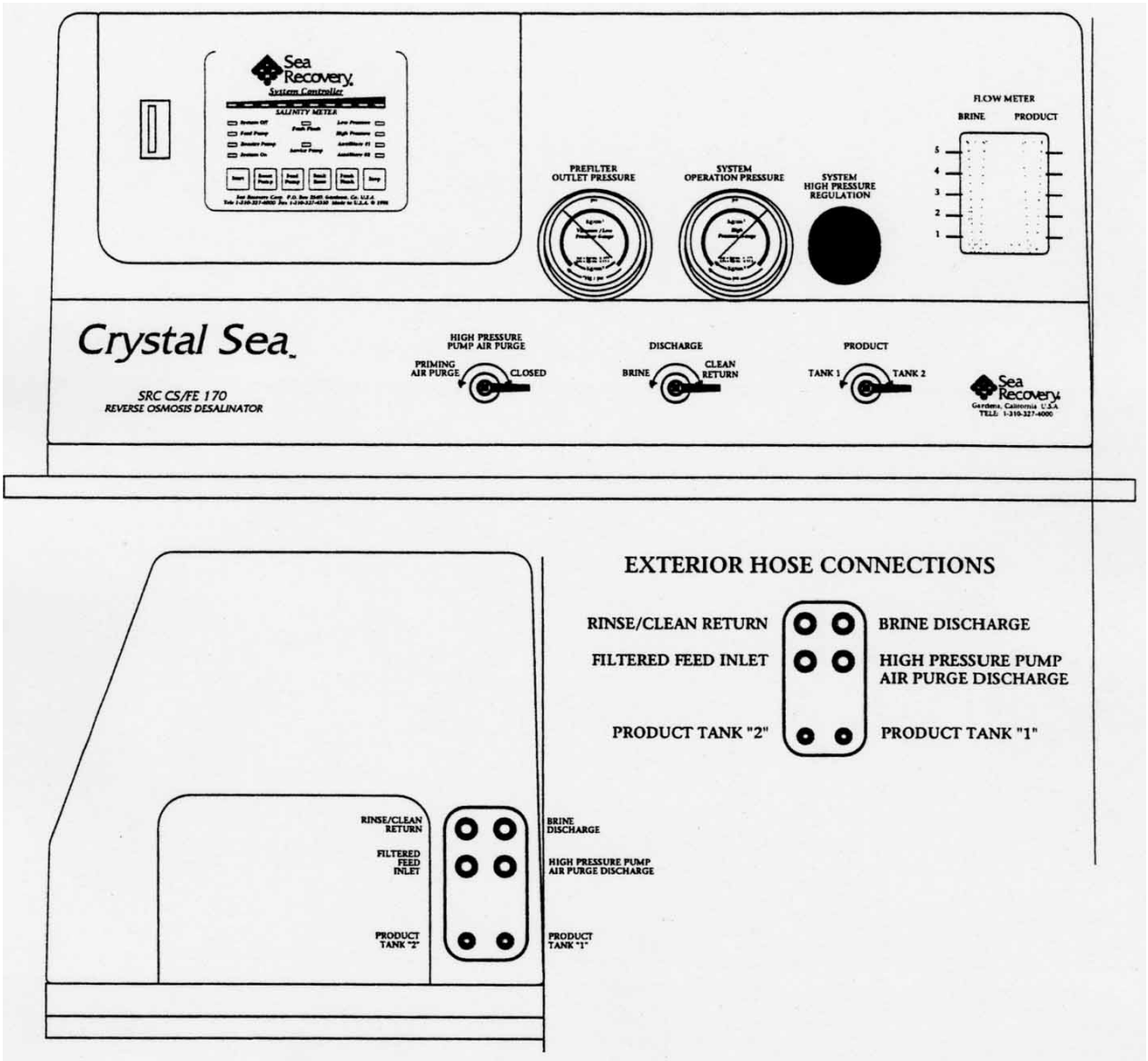
SHUTDOWN PROCEDURE

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 can be identified and corrected prior to, the next use of the system. This will ensure a properly functioning system when it's needed. If an observed problem is easily defined as a minor one, which will not affect other system components, wait until the product water storage tank(s) is (are) full before shutdown.

High Temperature Condition: The Prefiltration Subsystem, High Pressure Pump and/or R.O. Membrane Elements may have been mounted in a location that is subject to excessive heat. As an example, overheating may occur when the components are mounted in a vessel's engine compartment, or in an unventilated building. The transfer of atmospheric heat could raise the standing water temperature in the components above 122°F/50°C. At or above this high temperature, pressurized hot water could cause irreversible damage to the SRC R.O. Membrane Elements. Therefore, the Back Pressure Regulator Valve [21] must be opened at the time of shutdown. This will ensure that, at the next start-up, new water may enter and cool the system while it is unpressurized.

"Crystal Sea" CONTROL PANEL



SHUTDOWN PROCEDURES:

1. Record the Sea Recovery System readings onto a blank copy of the "DAILY LOG OF SYSTEM READINGS" form (page H-3 & H-4 of this manual).
2. Release the pressure on the System by adjusting the Back Pressure Regulator Valve [21] open full counter clockwise. This is important for the following reason:
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:

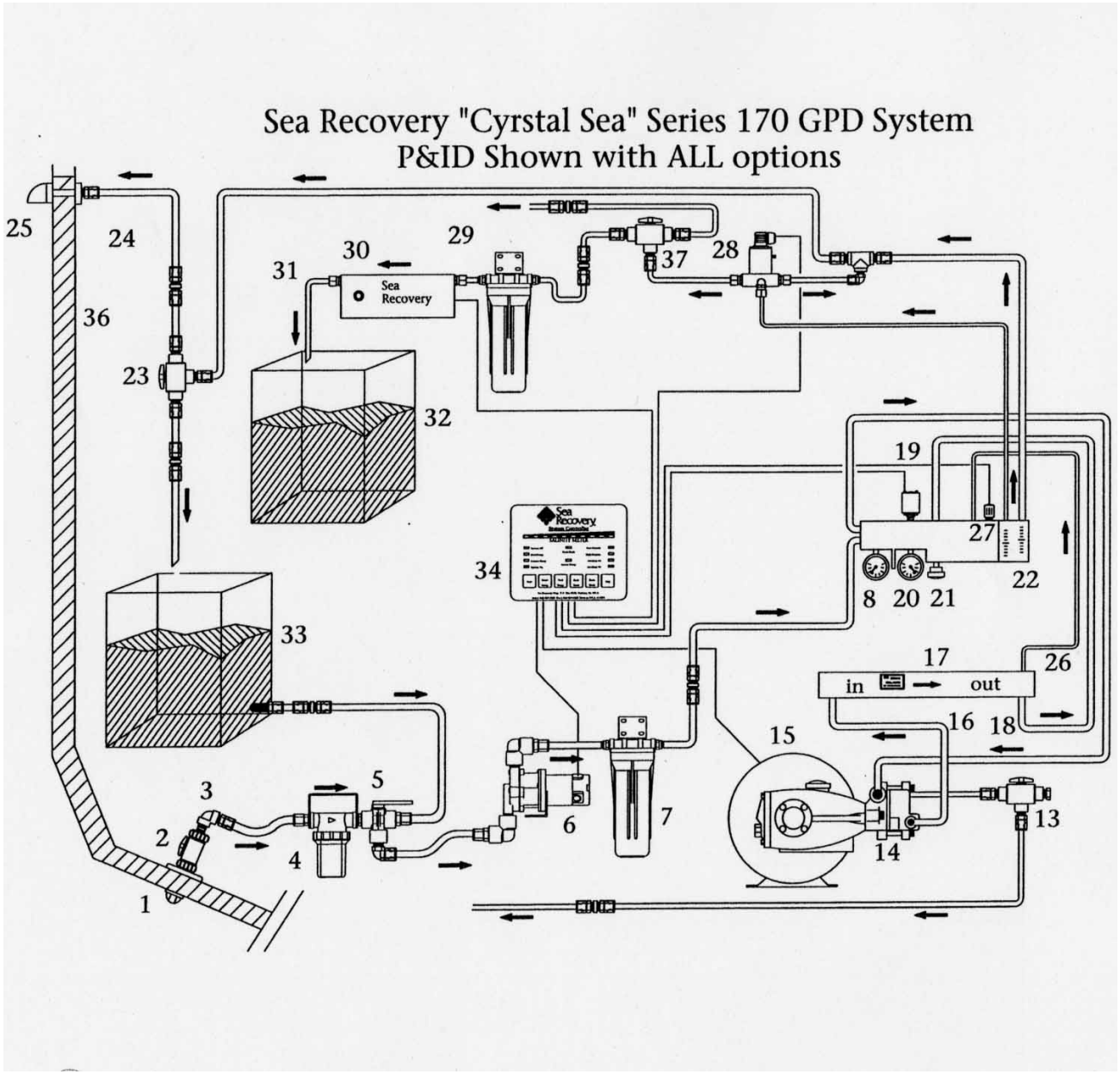
   a. If a water line should develop a leak while the system is shut down, and the Inlet Sea Cock Valve is open, the incoming feed water will fill the bilge.

   b. By closing the Inlet Sea Cock Valve immediately after system shutdown, siphoning will not occur prior to the next start-up. Holding water in the system ensures immediate water to the High Pressure Pump at the next startup. If water drains from the High Pressure Pump and air enters the High Pressure Pump Discharge Valve Chamber a prolonged period of priming for up to 15 minutes will be required at the next start up.

5. Turn off the electrical power source (circuit breaker) to the system. This will eliminate the chance of accidentally starting the system should an electrical short develop, or should someone unintentionally depress the START switch.
6. Refer to Section 'J", "Storage & Cleaning Procedure" of this manual.

SECTION "I"

SYSTEM TROUBLESHOOTING GUIDE



1. Inlet Thru-Hull
2. Sea Cock Valve **
3. Inlet Connection
4. Sea Strainer
5. Clean/Rinse Inlet Valve
6. Booster Pump
7. Prefilter 5 Mμ
8. Low Pressure Gauge Prefilter Outlet
9. future reference
10. future reference
11. future reference
12. future reference
13. High Pressure Pump Air Purge Valve
14. High Pressure Pump
15. Electric Motor
16. High Pressure Hose MVA Inlet
17. R.O. Membrane & Vessel Assembly
18. High Pressure Hose MVA Outlet
19. High Pressure Switch
20. High Pressure Gauge
21. Back Pressure Regulator
22. Brine & Product Water Flow Meter
23. Clean / Rinse Outlet valve
24. Brine dump fitting
25. Discharge Thru-Hull **
26. Product Water Tube
27. Salinity Probe
28. 3-Way Product Diversion Valve
29. Charcoal Filter ***
30. U.V. Sterilizer ***
31. Product Water Routing Line
32. Potable Water Storage Tank **
33. Cleaning/Rinse Tank **
34. Salinity Controller
35. future reference
36. Ship's Hull **
37. Test Tap / 2nd Tank Valve

NOTES: ** : Items supplied by installer
*** : Options

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 its possible cause. In order to correct the problem or repair the part, refer to the Maintenance and Repair Section "K" of this manual.

A. PRESSURE GAUGE READINGS: For "normal" readings refer to the "Initial New System Readings" form in section "F" of this manual. The numbers in brackets indicate the identification number shown on pages 1-3 & 1-4.

1. VACUUM / LOW PRESSURE GAUGE [81 reading is at or below -5" (negative 5 inches):

a. Prefilter elernent [7] is fouled
Replace the fouled Prefilter Element with a new Sea Recovery element. Use ONLY Sea Recovery prefilter elements to avoid damage to the R.O. Membrane Element.

b. Sea Strainer Mesh Screen [4] is obstructed with debris.
Clean the debris from the Sea Strainer Mesh Screen or replace it.

c. Inlet Sea Cock Valve [2] partially closed.
Fully Open the Inlet Sea Cock Valve.

d. Debris has plugged up the inlet thru-hull fitting [1].
Check the inlet thru-hull fitting for blockage (plastic bag, seaweed, jelly fish, etc) and correct.

e. Suction Line is obstructed with debris or collapsed.
Clean the marine growth or obstruction from the Suction Line or straighten any kinks or line collapse.

2. VACUUM / LOW PRESSURE GAUGE [8] reading is at 0 psi (zero) and air is passing through the brine discharge flow meter [221. Or the pressure gauge pulsates violently up and down from -10" to 0 psi (negative 10" to 0 psi) and air is intermittently present in the brine discharge flow meter [22].

a. Prefilter element [7] is fouled
Replace the fouled Prefilter Element with a new Sea Recovery element. Use ONLY Sea Recovery prefilter elements to avoid damage to the R.O. Membrane Element.

b. Sea Strainer Mesh Screen [4] is obstructed with debris.
Clean the debris from the Sea Strainer Mesh Screen.

c. Booster Pump [6] is sucking air from the feed line between the Inlet Thru Hull Fitting [1] and the inlet of the Booster Pump.
Tighten or change the Inlet Sea Cock Valve packings.

Tighten all pipe threads and tube fittings in the Suction Line.
Tighten the Sea Strainer bowl or change the "0" ring between the Sea Strainer housing and bowl.
Check for broken or missing o-rings at the Sea Strainer and all tube fittings.
Check the booster pump for a broken gasket or loose front housing.

3. HIGH PRESSURE GAUGE [16] - High Pressure Pump Outlet - Across R.O. Membrane Elements - Back Pressure Regulator Inlet [20] reading lower than normal:

Use caution in diagnosing the reading of the High Pressure Gauge [20]. 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 [141 or the High Pressure Pump Electric Motor [15], Back Pressure Regulator Valve [21], the co-polymer control manifold and or the High Pressure Gauge [20].

A low High Pressure Gauge reading ***along with*** a low Brine Flow Meter reading would indicate that possibly the High Pressure Pump has lost it's prime. Refer to Section G of this manual for priming procedures.

A low High Pressure Gauge reading ***along with*** a low Brine Flow Meter reading may indicate that possibly the High Pressure Pump has one or more worn or broken seals, 0-rings or valves or that the High Pressure Pump Electric Motor is rotating too slow under load.

A low High Pressure Gauge reading ***but a normal*** Brine Flow Meter reading would indicate that possibly the Back Pressure Regulator Valve [21] has a worn Valve Stem or worn Control Manifold Valve Body Seat.

A normal High Pressure Gauge reading ***but a low*** Brine Flow Meter reading would indicate that the High Pressure Pump Electric Motor is rotating too slow, likely due to low incoming power from the ships power source.

a. If the Brine Discharge Water Flow Meter [22] reading is normal and the Product Water Flow Meter [221 reading is also normal (for the given pressure reading) then the Back Pressure Regulator [21] may simply require adjustment.
While the system is in operation adjust the Back Pressure Regulator Valve clock wise until the High Pressure Gauge [20] reads 800 psi (sea water feed source).

b. If the Brine Discharge Water Flow Meter [221 reading drops below normal and the High Pressure Gauge does not develop normal pressure as the Back Pressure Regulator Valve is adjusted clock wise and if the Product Water Flow Meter [22] reading is low or does not show a reading at all, then it is likely that the High Pressure Pump [14] is experiencing a problem.
The High Pressure Pump may have lost it's prime.
The High Pressure Pump internal parts may be worn or broken.
The High Pressure Pump Electric Motor is bogging down under load likely due to low voltage from the ships power source.

c. If the Brine Discharge Water Flow Meter [221 reading remains normal as the Back Pressure Regulator Valve is adjusted clock wise and the Product Water Flow Meter [22] reading is low or does not show a reading at all, then it is likely that the Back Pressure Regulator Valve Stem or Control Manifold Body Seat is worn and requires replacement.
Dissemble and inspect the Back Pressure Regulator Valve Stem and Body cavity Seat.

d. If the Brine Discharge Water Flow Meter [221 reading remains normal as the Back Pressure Regulator Valve is adjusted clock wise and the Product Water Flow Meter [22] reading is also normal, then it is likely that the High Pressure Gauge is defective and reading lower than the actual pressure present.
Replace the High Pressure Gauge [201.

B. 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, High Pressure Pump, High Pressure Pump Electric Motor and the electrical power source. 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.

1. **The 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 produce water]).

   The High Pressure Pump is a positive displacement pump. This means that it will always draw a pre-defined amount of water unless there is a problem at the High Pressure Pump. Therefore, a drop frorn normal reading on the Brine Discharge Water Flow Meter indicate that either the High Pressure Pump is not functioning properly, the High Pressure Pump is being starved by the prefiltration section or the High Pressure Pump is being driven at a lower than normal RPM from it's electric motor.

   An increase from normal reading on the Brine Discharge Water Flow Meter indicates that the High Pressure Pump is being driven at greater than normal RPM by the Electric Motor. This would be due to higher than normal voltage from the ships power supply.

   Therefore, proper diagnosis of the Brine Discharge Water Flow Meter reading can assist in locating a problem at the High Pressure Pump.

a. Brine Discharge Water Flow Meter reading is less than normal with no operating pressure applied to the system:

If the low pressure gauge, at the system control panel, is reading a vacuum, below -5" (negative 5 inches), the High Pressure Pump is being starved by lack of feed water. Refer to pressure gauge readings above and check all prefiltration components.

If the low pressure gauge, at the system control panel, is reading above -5" (above negative 5 inches) then the High Pressure Pump may have lost it's prime due to air entering the feed line.

If the low pressure gauge, at the system control panel, is reading above -5" (above negative 5 inches) then the High Pressure Pump is being driven too slowly by the Electric Motor due to low voltage to the motor if the system is a Direct Current (DC) powered system.

b. 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:

Air has been introduced into the High Pressure Pump and the pump has lost it's prime.

The power source to the system is insufficient and is dropping in voltage, if DC system, or cycles, if AC system, causing the electric motor to slow down under load.

High Pressure Pump has worn or broken valves.

High Pressure Pump has a worn or corroded manifold.

c. Brine Discharge Water Flow Meter reading is normal with no pressure applied to the system and the Product Water Flow Meter shows high Product Water Flow:

R.O. Membrane Element has a broken product water tube. This would be caused by a blockage in the product water line from the System. to the boats Product Water Storage Tank. A blockage, kink or valve, in the Product Water Delivery line will cause back pressure to the R.O. Membrane Element product water tube and will lead to breakage of the R.O. Membrane Element product water tube if the system. is shut down when pressure is present in the product water delivery line. This is an installation problem and would not be covered by warranty.

Worn or broken product water o-ring within the Membrane Vessel Assembly.

d. 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 Feed Water Flow Meter bobbin pulsates more radically:

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

2. **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 will not register until the System Pressure exceeds 420 PSI. For each 100 PSI applied over 420 PSI the Product Water Flow Meter will register 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 when the system is at or below 420 PSI operating pressure this would indicate that the R.O. Membrane Vessel Assembly has a problem, such as a defective "0" ring, defective Membrane Element, broken product water tube or damaged High Pressure Vessel. If full operating pressure of 820 PSI produces a Product Water Flow Meter reading below normal this would indicate that the system Feed Water is at a low temperature, 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 chernical 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.

   a. Product Water Flow Meter registers substantial flow when the system operating pressure is below 420 PSI and the system is operating in Sea Water.
   The R.O. Membrane Element is broken.
   The Product Water "0" Rings within the High Pressure Vessel are defective.

   b. 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 and requires cleaning.
   High Pressure Gauge is defective and registering higher than the actual applied pressure.
   Temperature and Pressure correction has not been properly calculated, refer to Section "M" of this manual.
   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.

C. PRODUCT WATER QUALITY:

1. **Quantity of feed water delivered to the R.O. Membrane Element by the High Pressure Pump:** The R.O. Membrane Element requires a specified amount of Feed Water flow in order to reject impurities. Less than required Feed Water flow will cause the R.O. Membrane Element to recover a high percentage of Product Water (ratio of Feed Water to Product Water) and will also cause the R.O. Membrane Element to foul quickly. 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 correct the problem and do not operate the system until the Feed Flow problem is corrected.

2. **Condition and clarity (quality) of the Feed Water, as filtered by the Prefiltration Section of the System:** 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 will quickly become fouled and lose its ability to reject the dissolved solids or impurities in the Feed Water. Always ensure that there are Prefilter Elements within the Prefilter Housings. Never use Prefilter Elements that are not Sea Recovery supplied. Non Sea Recovery supplied Prefilter Elements may be of the wrong micron rating, wrong material, wrong size or wrong type. Use of non Sea Recovery Prefilter Elements will lead to rapid fouling of the R.O. Membrane Element and render them unusable in a short period of time.

3. **Operating Pressure of the System and the Temperature of the Feed Water:** 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 will cause low Product Water Production as well as poor Product Water Quality (increase of impurities in the Product Water). The Operating Pressure must, however, be correlated to the Feed Water Temperature.

   With a Feed Water Temperature below 77°F / 25°C the system may be operated at higher pressures 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, with Feed Water Temperature above 77°F / 25°C there will be a decline in Product Water Quality (increase in impurities in the Product Water). This is a natural and predicted occurrence with Reverse Osmosis applications. Therefore, when operating the System with Feed Water Temperature above 77°F / 25°C a decline in Product Water Quality should not be of concern. As this would not indicate a problem. This condition will correct itself as Feed Water Temperature lowers.

a. Salinity Meter [30] reads higher than normal or the red light will not go out:

The system operating pressure is below normal, adjust it accordingly.
The R.O. Membrane Elements are fouled and require cleaning.
The Brine Discharge Water Flow Meter reading is lower, refer to the Brine Discharge Water Flow Meter troubleshooting.
A product water "0" ring within the R.O. Membrane Element Vessel is defective and requires replacement.
The R.O. Membrane Element has developed a hole.
The Temperature of the Feed Water is higher than normal.
The Salinity Meter set point has drifted and requires calibration.

D. HIGH PRESSURE PUMP:

The high pressure pump [11] is a positive displacement pump. The pump will always deliver the normal amount of water flow unless a problem has developed within the pump or the RPM frorn the Electric Motor has changed due to low or high Cycles (AC systems) or low or high Voltage (DC systems) from the Power Source.

1. **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 will drop 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 will drop in predictable flow registration by design. That would not indicate a problem.

   However, if flow drops beyond the normal decrease then:
   The High Pressure Pump has lost it's prime due to air in the feed line.
   Worn High Pressure Pump seals are allowing internal by-passing and require replacement.
   Worn High Pressure Pump valves, valve seats and or valve seat "0" rings are allowing internal by-passing and require replacement.
   Worn, corroded or eroded discharge manifold is allowing internal by-passing and requires replacement.
   The Electric Motor RPM has lowered due to improper Cycles and or Voltage to the Motor from the Power Source to the System.

2. **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 valves, valve seats, valve springs and or debris is trapped within a High Pressure Pump valve chamber.

3. **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 orifice or replace the gauge.

4. **High Pressure Pump leaks oil:**
   Locate the leak source and repair as required.

5. **High pressure pump leaks water from its bottom, between the manifold and the crankcase housing:**
   Worn low pressure inlet packings, replace the packings. Look for signs of erosion or corrosion on the manifold under the packings during replacement. If signs of erosion or corrosion is present replace the manifold.

E. PRESSURE SWITCH:

The High Pressure Switch [19] 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 exceeds 900 psi.

1. HIGH PRESSURE SWITCH:

a. **The System shuts down when applying pressure to the system but operating pressure does not exceed 850 psi:**
The High Pressure Switch [19] is opening prematurely and requires adjustment upward to maximum 900 psi, minimum 850 psi.
The High Pressure Gauge [201 is defective and reading low.

b. The System does not shut down when the operating pressure applied exceeds 900 psi:
The high pressure switch [19] is adjusted too high and not opening. It requires adjustment downward to maximum 900 psi, minimum 850 psi.
The High Pressure Gauge [201 is defective and reading high.

F. POST FILTRATION SUBSYSTEM:

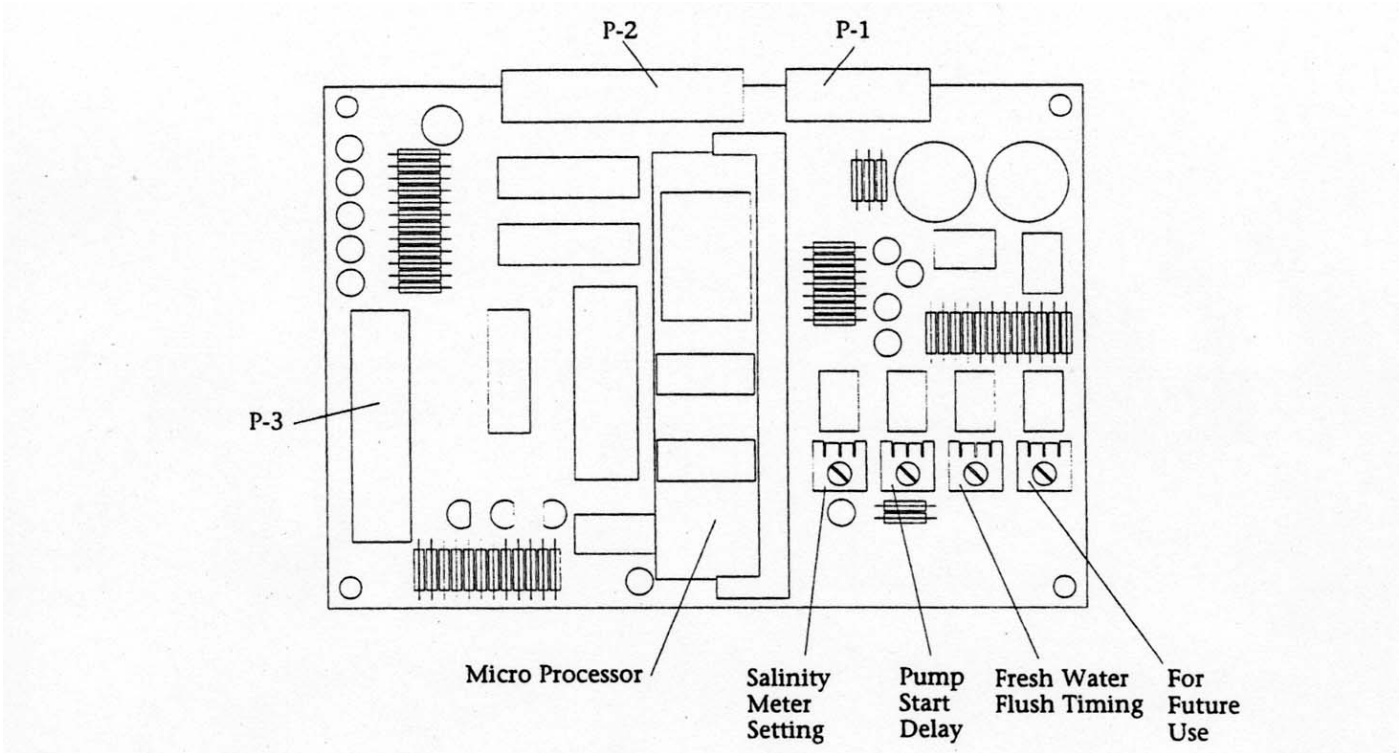
1. **Product water leaks from Product Water Tubing when 3 Way Product Diversion Valve [23] energizes to direct water to Post Filtration:**
There is a blockage in the product water line from the system. Locate the blockage and correct it so that the Product Water Line is free and clear from the system to the product water storage tank.
One or more of the post filters are plugged, change the plugged filter element(s).

2. **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 [29], 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 and correct.

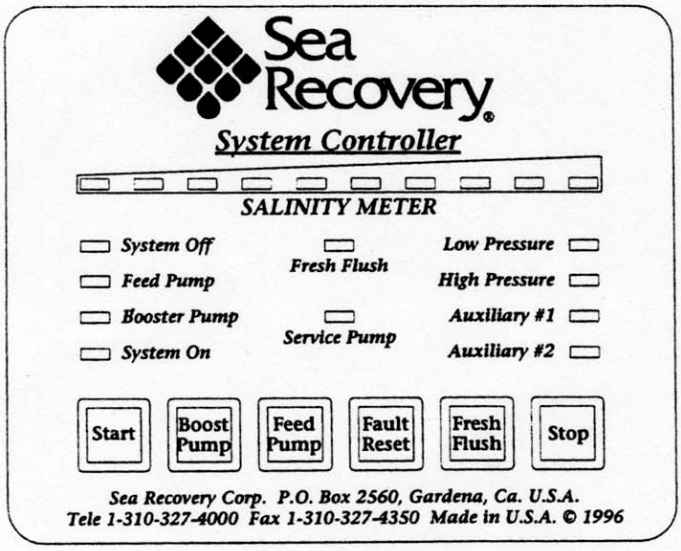
3. **The Ultra Violet Sterilizer [301 lamp continuously flickers or does not illuminate.**
The U.V. Lamp has lost it's power. Change the U.V. Lamp.
The Starter within the U.V. Sterilizer housing has become weak. Replace the Starter.
The Voltage to the U.V. Sterilizer is too low. The U.V. Sterilizer ballast is very voltage sensitive. Over voltage will destroy the ballast, under voltage will cause 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:

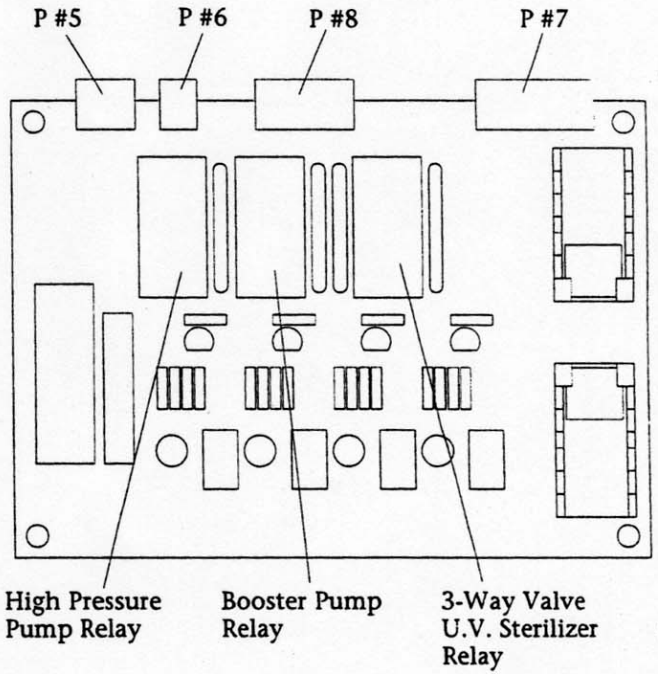
Sea Recovery Main Printed Circuit Board
Micro Processor Controlled



Sea Recovery Touch Pad with 21 LED Indications and 5 Function Switches



Sea Recovery 3 Relay Control Board with Power Supply



1. **Features Not Used with the Crystal Sea System:** The following features of the Electronic Circuit, although functioning, are not utilized within the Sea Recovery Crystal Sea System and should therefore be ignored:

    a. Feed Water Pump Switch at the touch pad
    b. Feed Water Pump LED Indicator Lamp at the touch pad
    c. Fresh Water Flush Switch at the touch pad
    d. Fresh Water Flush LED Indicator Lamp at the touch pad
    e. Fresh Water Flush Timing POT at the Main Printed Circuit Board
    f. Low Pressure LED Indication Lamp at the touch pad
    g. Low Pressure Switch Connection at the Main Printed Circuit Board
    h. Auxiliary #1 LED Indication Lamp at the touch pad
    i Auxiliary #1 Switch Connection at the Main Printed Circuit Board
    j. Auxiliary #2 LED Indication Lamp at the touch pad
    k. Auxiliary #2 Switch Connection at the Main Printed Circuit Board

1. **Salinity Meter registers full scale, red light on, continuously.**
   The R.O. Membrane Element may be fouled.
   The Salinity Probe may have debris on it.
   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.

2. **Salinity Meter registers low scale, green or yellow light on, but the product water has a definite salt taste.**
   The Salinity Probe may be dirty and require cleaning
   The Salinity Meter may require calibration.

3. **Start switch is depressed but the system does not attempt to start:**
   Fault LED lamp is illuminated and requires resetting by pressing the Fault Reset Switch at the touch pad.
   Power source is switched off, reset the power source (breaker or disconnect)
   Blown fuse in the controller, check fuse condition.
   Micro Processor has locked up. Turn power off for 10 seconds to reset the Micro Processor.
   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.

4. **Stop switch is depressed but the system does not attempt to stop:**
   Micro Processor has locked up. Turn power off for 10 seconds to reset the Micro Processor.
   Stop switch at the touch pad is defective and not closing to make the circuit.

5. **Fuse in controller blows at start up:**
   Shorted wire, locate shorted wire and repair it.
   Low or high voltage into the system, correct at the source into the system.

6. **3 Way Product Diversion Valve [23] will 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.
   Defective valve coil.
   Defective PCB Relay.
   Defective PCB Main.

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 will void 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 will destroy 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 will destroy the R.O. Membrane Element.

R.0. 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 / O°C. Never store the R.O. membrane assembly in direct sunlight. High temperature will cause 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 will 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) will occur. This damage is 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) will occur if the element is allowed to become extensively fouled by biological slimes. Some, but not all, flux may be regained after thorough cleaning.

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 will be exposed to micro-organisms. Simply operating the system will not protect the R.O. Membrane Element(s) from biological fouling. Up to 40 percent flux loss (loss of productivity) due to biological fouling can occur 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 Crystal Sea 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 will damage the R.O. Membrane Element.

Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with System in the Rinse Once Through Mode

Sea Recovery "Crystal Sea" Series 170 GPD System
P&ID Shown with System in the Cleaning Closed Loop Mode

A. SHORT TERM SHUTDOWN:

A short term shutdown may be defined as a period of time in which the SRC system will not be utilized for a period of two days to two weeks. An excellent, yet 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 will prolong 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", should be preformed as follows:

ONE TIME THROUGH FRESH WATER RINSE PROCEDURE: Follow the directions below. This procedure will displace the system feed water with fresh water and thus render the system suitable for a short term shutdown for up to two weeks. A minimum of 10 gallons / 38 liters of fresh product or potable water will be required for this process. Refer to the Once Through Rinse diagram on page j -4 above. Numbers in brackets correspond to the identification numbers within the diagram.

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

2. If not already connected, from the side of the Crystal Sea System, connect the "RINSE/CLEAN INLET" line from the System to the pick up point of the Rinse/Clean Tank [33].

3. Fill the Rinse/Clean Tank [33] 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 will require approximately 10 gallons / 38 liters. If the system will be exposed to freezing temperatures add twenty percent (2 gallons / 7.5 liters) food grade glycerin (propylene glycol) to the rinse water. This will protect the water in the system from freezing.

4. Bleed the line from the Rinse/Clean Tank to the Rinse/Clean Inlet Valve, at the Sea Strainer, to ensure that this line is full with rinse water from the Rinse/Clean Tank to the Rinse/Clean Inlet Valve [5] with no air in the line. If air is in this line then priming and purging of the High Pressure Pump will be necessary.

5. At the Sea Strainer, position the Rinse/Clean Inlet Valve [5] to the Rinse/Clean Tank position [33].

6. At the System Front Panel, position the Rinse/Clean Outlet Valve [23] to the Brine Discharge position [25] normal operation position.

7. Open the Back Pressure Regulating Valve [21] 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. This will allow the system to produce a minimal amount of product water which will ensure that the product water line remains wet. NOTE: If any air has entered the High Pressure Pump, from the rinse line, then the High Pressure Pump may not be able to develop pressure for up to 5 minutes of operating until the high pressure valve chamber is cleared of air. It will take approximately 20 minutes to deplete the 10 gallons of rinse water.

10. Prior to depleting the rinse water from the tank stop the system.

11. Position the Rinse/Clean Inlet Valve [51 to the Normal Operating Position towards the Sea Strainer [4]. 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.

B. LONG TERM SHUTDOWN.

A Long Term or Prolonged Shutdown may be defined as a period of time in which the SRC system will not be utilized for longer than one month. For a prolonged shutdown, longer than one month, 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 Crystal Sea Long Term Shutdown procedure will require a total of 20 gallons / 75 liters of potable water.

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)

WINTERIZING AND FREEZING TEMPERATURE STORAGE NOTE: If the system will be exposed to freezing temperatures 2 gallons / 7.5 liters of food grade glycerin (propylene glycol) will also be required for addition to the final storage chemical mixture. This will protect the water in the system from freezing.

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

2. If not already connected, from the side of the Crystal Sea System, connect the "RINSE/CLEAN INLET" line from the System to the pick up point of the Rinse/Clean Tank [331.

3. Fill the Rinse/Clean Tank [33] 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 will require approximately 10 gallons / 38 liters. If the system will be exposed to freezing temperatures add twenty percent (2 gallons / 7.5 liters) food grade glycerin (propylene glycol) to the rinse water. This will protect the water in the system from freezing.

4. Bleed the line from the Rinse/Clean Tank to the Rinse/Clean Inlet Valve, at the Sea Strainer, to ensure that this line is full with rinse water from the Rinse/Clean Tank to the Rinse/Clean Inlet Valve [5] with no air in the line. If air is in this line then priming and purging of the High Pressure Pump will be necessary.

5. At the Sea Strainer, position the Rinse/Clean Inlet Valve [5] to the Rinse/Clean Tank position [33].

6. At the System Front Panel, position the Rinse/Clean Outlet Valve [23] to the Brine Discharge position [25] normal operation position.

7. Open the Back Pressure Regulating Valve [21] 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. This will allow the system to produce a minimal amount of product water which will ensure that the product water line remains wet. NOTE: If any air has entered the High Pressure Pump, from the rinse line, then the High Pressure Pump may not be able to develop pressure for up to 5 minutes of operating until the high pressure valve chamber is cleared of air. It will take approximately 20 minutes to deplete the 10 gallons of rinse water.

10. Prior to depleting the rinse water from the tank stop the system. If the tank is depleted and air is allowed to enter the Rinse/Clean Line then priming of the High Pressure Pump will be required for the next steps. So stop the System prior to depleting all of the rinse water.

11. Open the Back Pressure Regulating Valve [21] full open counter clockwise.

12. Add 10 gallons / 75 liters of product water to the Rinse/Clean Tank [33].

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 1/4 (one fourth [one quarter]) bottle of Sea Recovery **SRC SC Storage Chemical.** Use only 1/4 (one f**ourth) of the 1.5 lb. bottle or 6 dry weight ounces.** Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution contents of the bucket or container into the Rinse/Clean Tank [33].

    WINTERIZING AND FREEZING TEMPERATURE STORAGE NOTE: If the system will be exposed to freezing temperatures add twenty percent (2 gallons / 7.5 liters) food grade glycerin (propylene glycol) to the Storage Chemical Solution at this time. This will protect the water in the system from freezing.

14. Operate the system by pressing the System Start Switch. The Storage Chemical Solution is now displacing the original rinse water in the entire Sea Recovery R.O. System and discharging to waste out the Brine Discharge Line.

    After approximately 20 minutes of running stop the System by pressing the Stop Switch.

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 greatly and is dependent upon many conditions such as the age of the R.O. Membrane Element, the amount of fouling prior to the storage, temperatures the System is exposed to during storage and other 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 may provide 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 may provide only a month or less of safe storage. Evaluate these factors prior to determining the length of time safely allowable 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 will*** likely be 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 will require cleaning from time to time. Biological growth and salt accumulation will 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 and system pressure must be taken into consideration (Refer to the Temperature and Pressure Effects Chart 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) can indicate that the R.O. Membrane Element may require cleaning.

A. **R.O. MEMBRANE ELEMENT CLEANING INSTRUCTIONS:** 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 will take from 40 to 100 gallons / 151 to 379 liters of combined fresh non chlorinated product water depending if you clean the R.O. Membrane Element with MCC1, MCC2 and or MCC3 chemical cleaners.

Product Water Required for Cleaning of R.O. Membrane Element:

Chemical	Rinse	Clean	Recirc Rinse	Final Rinse	Total Water Use
SRC MCC 1	10	10	10	10	40
SRC MCC2	--	10	10	10	70
SRC MCC3	--	10	10	10	100

SIMPLIFIED VERSION OF SRC Crystal Sea System
MEMBRANE RECIRCULATING CLEANING LOOP

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. Should the R.O. Membrane Elements be 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.

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.

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 will usually be the first cause of the R.O. Membrane Element to show signs of fouling. The System, including the R.O. Membrane Element is constantly exposed to Sea Water and therefore fouling by biological growth will occur 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 Element can become unusable and uncleanable even with no actual System use. This fouling can never be stopped, it can however be 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 will usually be a very slow process 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 will likely be biological fouling. If the System has in excess of 1000 hours of use then there may be some mineral fouling combined likely 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.

Sea Recovery SRC MCC1Membrane 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)

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.

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

2. Replace the prefilter Element with a new Sea Recovery 5 mg Prefilter Element and clean the prefilter housing bowl.

3. If not already connected, from the side of the Crystal Sea System, connect the "RINSE/CLEAN INLET" line from the System to the pick up point of the Rinse/Clean Tank [33].

4. Fill the Rinse/Clean Tank [33] 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 will require approximately 10 gallons / 38 liters.

5. Bleed the line from the Rinse/Clean Tank to the Rinse/Clean Inlet Valve, at the Sea Strainer, to ensure that this line is full with rinse water from the Rinse/Clean Tank to the Rinse/Clean Inlet Valve [5] with no air in the line. If air is in this line then priming and purging of the High Pressure Pump will be necessary.

6. At the Sea Strainer, position the Rinse/Clean Inlet Valve [51 to the Rinse/Clean Tank position [33].

7. At the System Front Panel, position the Rinse/Clean Outlet Valve [23] to the Brine Discharge position [25] normal operation position.

8. Open the Back Pressure Regulating Valve [21] full open counter clockwise.

9. 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.

10. Apply 200 PSI of pressure to the System by turning the Back Pressure Regulator Clockwise. This will allow the system to produce a minimal amount of product water which will ensure that the product water line remains wet. NOTE: If any air has entered the High Pressure Pump, from the rinse line, then the High Pressure Pump may not be able to develop pressure for up to 5 minutes of operating until the high pressure valve chamber is cleared of air. It will take approximately 20 minutes to deplete the 10 gallons of rinse water.

11. Prior to depleting the rinse water from the tank stop the system. If the tank is depleted and air is allowed to enter the Rinse/Clean Line then priming of the High Pressure Pump will be required for the next steps. So stop the System prior to depleting all of the rinse water.

12. Open the Back Pressure Regulating Valve [21] full open counter clockwise.

13. Add 10 gallons / 75 liters of product water to the Rinse/Clean Tank [33].

14. 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 1/2 (one half) bottle of Sea Recovery **SRC MCC1, SRC MCC2 or SRC MCC3 as appropriate for the particular fouling. Use only 1/2 (one half) of the 1.5 lb. bottle or 12 dry weight ounces.** Mix and thoroughly dissolve the solution in the container. Pour the dissolved solution contents of the bucket or container into the Rinse/Clean Tank [33].

15. At the front of the System, position the Rinse/Clean Outlet Valve [23] to the Rinse/Clean Tank return [33] for recirculation.

16. Operate the system by pressing the System Start Switch. The Cleaning Chemical mixture is now flowing from the Rinse/Clean tank through the System and back into the Rinse/Clean tank in a closed loop recirculating configuration. Allow the Cleaning Chemical to circulate in this closed loop configuration for up to one hour (60 minutes).

17. After 60 minutes of circulation and while the System is still in operation position the Rinse/Clean Outlet Valve [23] to the Normal Operating Position towards the Brine Discharge [25]. This allows the cleaning chemical mixture to discharge through the brine discharge fitting. It will take approximately 20 minutes for the mixture to be depleted.

18. Just prior to depletion of the chemical mixture stop the system. Do not allow the System to suck air from the Rinse/Clean Tank.

19. Fill the Rinse/Clean Tank [33] with 10 gallons (38 liters) of non-chlorinated (chlorine free) product water.

20. Position the Rinse/Clean Outlet Valve [23] back into the Rinse/Clean Tank, position for recirculation.

21. Operate the system by pressing the System Start Switch. The rinse water is now flowing from the Rinse/Clean tank through the System and back into the Rinse/Clean tank in a closed loop recirculating configuration. Allow the Rinse Water to recirculate for up to 20 minutes.

22. After 20 minutes of recirculation, and while the system is still in operation, position the Rinse/Clean Outlet Valve [23] to, the Brine Discharge position [25]. This allows the Rinse Water to empty from the Rinse/Clean Tank and discharge through the Brine Discharge fitting.

23. Prior to depleting the rinse water from the tank stop the system. If the tank is depleted and air is allowed to enter the Rinse/Clean Line then priming of the High Pressure Pump will be required for the next steps. So stop the System prior to depleting all of the rinse water.

    At this time to ensure that all of the cleaning chemicals are removed from the System a final once through rinse is necessary.

24. Fill the Rinse/Clean Tank [33] 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 will require approximately 10 gallons / 38 liters.

    The System must now receive a final rinse. To the rinse water you may or may not wish to add either Storage Chemical and or Food Grade Glycerin depending on the intended use or non use of the System.

    If there will be further cleaning then go on to step 25 below.

    If there will be ***no*** further cleaning ***and if*** the System ***will*** *be* used within the next month ***and if*** the temperatures ***will not*** be below freezing then go on to step 25 below.

    If there will be ***no*** further cleaning ***and if*** the System ***will*** *be* used within the next month but prior to, use ***if*** the temperatures ***will be*** below freezing then first add 2 gallons of food grade glycerin (propylene glycol) to the final rinse water then go on to step 25 below.

    If there will be ***no*** further cleaning ***and if*** the System ***will not*** be used within the next month or longer ***and if*** the temperatures will ***not be*** below freezing then add and thoroughly mix (dissolve) to the final rinse water 1/4 bottle (6 dry weight ounces) of Sea Recovery Storage Chemical SRC SC and then go on to step 25 below.

    If there will be ***no*** further cleaning ***and if*** the System ***will not*** be used within the next month or longer ***and if*** the temperatures ***will be*** below freezing then add and thoroughly mix (dissolve) to the final rinse water 1/4 bottle (6 dry weight ounces) of Sea Recovery Storage Chemical SRC SC ***and*** 2 gallons food grade glycerin (propylene glycol) and then go on to step 25 below.

25. Operate the system by pressing the System Start Switch. The final rinse water is now rinsing the entire Sea Recovery R.O. system and discharging out to waste.

26. Prior to depleting the rinse water from the tank stop the system. If the tank is depleted and air is allowed to enter the Rinse/Clean Line then priming of the High Pressure Pump will be required for the next steps. So stop the System prior to depleting all of the rinse water.

If there will be further cleaning then go back to step 13 above.

If there will be **no** further cleaning then go to step 27 below.

27. Position the Rinse/Clean Inlet Valve [5] located at the Sea Strainer to the normal operating position towards the Sea Strainer. DO NOT OPEN THE INLET SEA COCK VALVE UNTIL THE NEXT USE.

If the System will now be operated then go to Section G Start Up Procedure.

SECTION "K"

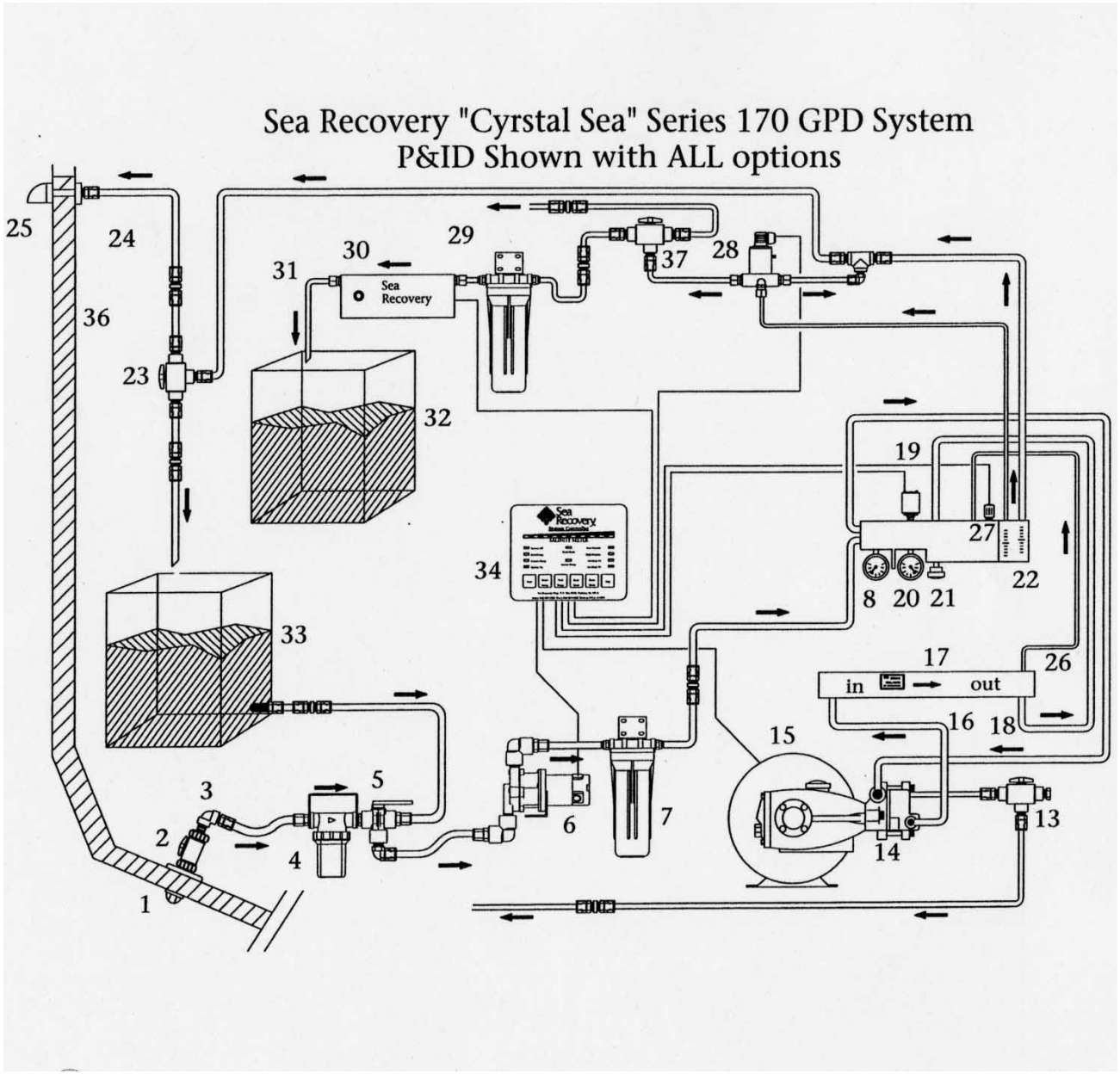
MAINTENANCE & REPAIR

OPERATOR'S PREVENTIVE MAINTENANCE

MAINTENANCE TIME CHART

COMPONENT MAINTENANCE & REPAIR

NOTES:



1. Inlet Thru-Hull
2. Sea Cock Valve **
3. Inlet Connection
4. Sea Strainer
5. Clean/Rinse Inlet Valve
6. Booster Pump
7. Prefilter 5 Mμ
8. Low Pressure Gauge Prefilter Outlet
9. future reference
10. future reference
11. future reference
12. future reference
13. High Pressure Pump Air Purge Valve
14. High Pressure Pump
15. Electric Motor
16. High Pressure Hose MVA Inlet
17. R.O. Membrane & Vessel Assembly
18. High Pressure Hose MVA Outlet
19. High Pressure Switch
20. High Pressure Gauge
21. Back Pressure Regulator
22. Brine & Product Water Flow Meter
23. Clean / Rinse Outlet valve
24. Brine dump fitting
25. Discharge Thru-Hull **
26. Product Water Tube
27. Salinity Probe
28. 3-Way Product Diversion Valve
29. Charcoal Filter ***
30. U.V. Sterilizer ***
31. Product Water Routing Line
32. Potable Water Storage Tank **
33. Cleaning/Rinse Tank **
34. Salinity Controller
35. future reference
36. Ship's Hull **
37. Test Tap / 2nd Tank Valve

NOTES:

** : Items supplied by installer

*** : Options

OPERATORS PREVENTIVE MAINTENANCE

Approximately every 50 hours of use, the SRC system should be inspected as part of a preventive maintenance program. The following steps should be taken to ensure that potential problems are resolved prior to leading into major repairs. Any electromechanical pumping system requires similar preventive maintenance. Numbers in brackets [ ] correspond to the identification numbers on the Sea Recovery R.O. System Schematic illustrated throughout this manual.

1. Mounting Hardware: Because the system may be subject to vibrations transferred from the ship, all mounting hardware should be inspected for tightness. Inspect all screws, brackets, nuts and bolts. Pay special attention to the mounting of the High Pressure Pump [11] to the Electric Motor 12] since this will be subject to more vibration than the rest of the system.

2. High Pressure Pump [11]: Regularly check the level of the crankcase oil. When the pump is horizontal, the minimum oil level should be at the center of the sight glass, located at the rear crankcase cover of the High Pressure Pump. The maximum oil level should be at the top of the sight glass. Over filling of the High Pressure Pump oil will not harm the pump. Use only Sea Recovery SRC PO High Pressure Pump crankcase oil. The Sea Recovery SRC PO High Pressure Pump crankcase oil is a hydraulic oil which 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 off any part of the system by rinsing with a rag wetted with fresh water. Dry all parts, and as protection 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, without tools. Use caution in tightening the gray PVC fittings.

5. Regularly check all tubing and high pressure hoses for wear and friction against abrasive surfaces. Hoses should not be in contact with heated or abrasive surfaces.

OPERATOR MAINTENANCE TIMETABLE

The frequency of required maintenance is dependent on the regularity of usage, the condition of the intake water, the length of time the system is exposed to water, and the total running time following each system cleaning. Because of this, 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 actual system depending upon it's use and condition.

COMPONENT	MAINTENANCE REQUIRED	TIME INTERVAL INTERMITTENT DUTY
Coarse Strainer	Inspect & clean screen & housing	100 hrs
Prefilter(s)	Replace elements & clean housing	200 hrs
Booster Pump	Replace Motor Brushes	When Brushes are worn out approx. 500 hrs.
Flow Meters	Clean inside the clear tube	As Required When Dirty
High Pressure Pump	Change Crankcase Oil	500 hrs
High Pressure Pump	Change Packings, seals and “O” rings	2000 hrs
High Pressure Pump Motor 12 VDC	Change Brushes	1000 hrs
SRC R.O. Membrane	Clean w/SRC Cleaning Compound	When production or salt rejection decreases by 10%
Salinity Probe	Clean Probes	Annually
Three-Way Actuator Valve	NO MAINTENANCE REQUIRED - Solid PVC	
Charcoal Filter	Replace Element	Monthly
U.V. Sterilizer	Replace lamp & clean quartz sleeve	4000 Hours

Other _____

Other _____

COMPONENT MAINTENANCE & REPAIR

CAUTION AVOID CHEMICAL AITACK 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 or any other specific chemical not approved in writing by Sea Recovery Corp. Use of non authorized or misuse of authorized chemicals will void 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 will destroy 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 will destroy 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 will cause 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.

A. SUCTION LINE & PRETREATMENT

1. **Inlet Thru-HuIl 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 will restrict the feed water and result in a low feed pressure condition which will cause cavitation and loss of prime to the High Pressure Pump.

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 will cause the System to loose prime at the High Pressure Pump. Clean the valve cavity of debris or replace the seal and seat as required.

3. **Sea Strainer or Coarse Strainer [4]:** 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 this will result in a low feed pressure condition which will cause the High Pressure Pump to cavitate. 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 welded 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 “O” ring 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 “O” ring is missing, not properly seated or if the bowl is over tightened air will enter the feed line and cause the system to shut off due to low feed pressure. Excess tightening can cause the o-ring to pinch and cause an air suction leak.

4. **Booster Pump [6]: Booster Pump SRC BP-CS/12VDC and SRC BP-CS/24VDC:** The 12 VDC Crystal Sea System utilizes a magnetic drive centrifugal booster pump. Debris trapped within the impeller chamber or a broken o-ring seal would be the only cause for maintenance. The motor brushes may be replaced when worn at approximately 500 to 1000 hours. The brush life will vary depending on the condition of use and voltage applied.

   DISASSEMBLY: Remove the 4 each volute screws. From front to rear in the following order remove: Suction manifold with attached o-ring; Discharge manifold with attached o-ring; Rear motor adaptor with attached impeller, impeller shaft retaining washer, magnet driven unit.

   Remove any debris or growth on or within the above mentioned parts. Replace the o-rings and reassemble the pump onto the motor.

5. **Prefilter [7] Element Replacement:** The prefilter element must be replaced when plugged to the extent that the Compound Vacuum/Low Pressure Gauge at the control panel reads below -5" (negative 5 inches) of mercury. At or slightly below -5" (negative 5 inches) of mercury the High Pressure Pump will loose efficiency and cavitate. This loss of normal flow at the High Pressure Pump will damage the High Pressure Pump by cavitation and the resulting lower than normal flow into the R.O. Membrane Element will prematurely foul the R.O. Membrane Element with mineral fouling. Therefore, regular and timely maintenance of the Prefilter Element will eliminate premature costly High Pressure Pump repairs and R.O. Membrane Element cleaning and replacement.

   CAUTION: Use of non Sea Recovery filter elements can allow suspended solids to enter the R.O. Membrane Element and damage or foul it. Further, certain types of prefilter elements will have dramatically reduced life causing frequent replacement and greater cost. <u>USE ONLY SEA RECOVERY PREFILTER ELEMENTS!</u>

The standard prefilter consists of one filter housing which contains a pleated and specially treated 5 micron Prefilter Element (SRC PFE 10/05). To replace the Prefilter 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 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. Lubricate the “O” ring sparingly with silicon base “O” ring lubricant. Place the “O” ring back onto the bowl. Place a new Sea Recovery supplied Prefilter Element SRC PFE 10/05 into the bowl. Fill the bowl full with water, product or feed. It is important that the prefilter bowl be filled with water as this will reduce the time necessary to prime the system and purge the High Pressure Pump Discharge Valve chamber. 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 will enter the feed line or water will leak from the bowl.

6. **Compound Vacuum/Low Pressure Gauge [8]:** The pressure gauges used in the Sea Recovery R.O. system are repairable if foreign debris has entered and plugged the orifice. If the gauge does not revert to 0 (zero) when the system is not in operation or if the gauge does not register with pressure or vacuum applied then the orifice may be plugged with foreign debris. The orifice may be cleaned with a needle, pin, gas orifice cleaning wire or small diameter drill bit 1/64" / 2 mm diameter. No other symptom or failure is repairable. After removing and prior to reinstalling the pressure gauges check the two o-ring seals to ensure that they are intact and have no nicks or imperfections. Replace the o-rings if damage has occurred to them.

7. **Combination Feed Water / Brine Discharge and Product Water Flow Meter [22]:** Since the flow meter body is clear acrylic, light can penetrate it and support biological growth within. Removal of the flow meter from the control manifold is necessary in order to clean both the inlet and discharge section of the meter as these ports are at right angles of each other.

   a) Remove the flow meter from the control manifold by loosening and removing 4 each flow meter attachment nuts.

   b) Two O-rings seal the flow meter to the control manifold. Take caution to not lose or damage these two O-Rings. Inspect these O-rings and replace them if they are nicked or damaged.

   c) After removing the Flow Meter from the control manifold then remove the product water tube and brine discharge tube by pushing the Tube Collet into the Cartridge Insert firmly. While pushing the Collet firmly into the Cartridge Insert pull outward on the tubing. Some force will be required. The collet must be pressed into cartridge insert while pulling outward on the tube.

   d) To avoid further disassembly you should attempt to clean the flow meter ports by soaking the flow meter in a soapy alkaline solution. If this does not clear the flow meter of biological growth then disassembly will be necessary.

NOTE: If total disassembly is necessary, in order to clean the flow meter, you must have on hand new tube assemblies and new wire mesh as destruction of these items during disassembly is likely. A wire mesh is fitted between the cartridge insert and the flow meter body. This wire mesh keeps the flow meter bobbin (ball) from ejecting out of the flow meter.

e) Proceed only if a new Tube Fitting Assembly (Collet, Insert and O-Ring) and new wire mesh are on hand. Remove the Tube Fitting Collet by grasping the Collet edge and pulling outward. Discard the old Collet.

f) The Cartridge Insert is pressed into the flow meter port and can only be removed with a stiff hook wire. Hook the bottom edge of the Insert with a hook wire and pull outward. As much as 30 pounds of force will be required to remove the insert. Discard the old Insert.

g) Remove the Tube Fitting O-Ring and discard it.

h) Remove the wire mesh and discard it. CAUTION: Once the wire mesh is removed the bobbin (stainless steel ball) will fall from the flow meter outlet port. Take care to not lose the bobbin.

i) Clean the flow meter ports with a soft rag. Do not insert metal parts into the flow meter as metal will scratch the acrylic flow meter.

j) After cleaning insert the bobbin into the port.

k) Press a new mesh screen into its retaining groove.

l) Place a new Tube Fitting O-Ring into the port.

m) Press a new Tube Cartridge Insert into the port.

n) Press a new Tube Collet into the Cartridge Insert.

o) Insert the Brine Discharge Tube into the Flow Meters Brine Discharge Port.

p) Insert the Product Water Tube into the Flow Meter's Product Water Port.

q) Place new O-Rings in the Flow Meter's side Product Water Port O-Ring groove and Brine Discharge Port O-Ring groove for mating to the Control Manifold.

r) Reattach the Flow Meter to the Control Manifold

B. PRESSURIZATION SUBSYSTEM MAINTENANCE

1. High Pressure Pump [11]:

Problem or Failure Signs and possible causes (troubleshooting):

Problem:	Pulsations at the combination vacuum/low pressure gauge, at the High Pressure Gauge and or at the Brine Discharge Flow Meter:
Possible Cause:	Worn or broken Valve. Debris in Valve Chamber. Check Valve Chambers for debris and inspect Valves. Replace Valve assemblies if 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:	Loss of flow when not pressurized.
Possible Cause:	Discharge Valve Chamber has air trapped within it. Allow more time to prime and ensure that there are no air suction leaks.
Problem:	Inability to build up pressure
Possible Cause:	Discharge Valve Chamber has air trapped within it. Allow more time to prime and ensure that there are no air suction leaks.

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 0.50/SS) includes new valve o-rings, valve seat, valve, spring and cage, 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.) Inspect the manifold for wear or damage.

7.) Insert a new valve assembly and squarely push it into place in the valve cavity.

8.) Replace the valve cap 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 Collet

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 will damage the plungers.

3.) Normally the seal assemblies will 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.) Inspect the seal cavity for any signs of damage, cavitation, erosion or etching.

c. Packing Installation:

Tools Required:
Seal Insertion Tool

1.) Make sure the seal cavities are clean and dry. (Note: Do Not use assembly lubricant)

2.) Place the 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.

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

4.) 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 going in first.

5.) The last piece is the seal retainer. 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 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 similar tools on the plunger they are ceramic and can be damaged easily. Inspect the plunger again for any sign of damage, also look in the bore of the plunger for any sign of rust. Rust here would indicate that the plunger retainer o-rings have failed, allowing water to leak between the manifold and crankcase and for water to enter the crankcase section.

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: Once the slingers have been used DO NOT reuse them. They lose their original dimensions).

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

f. 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 wet end 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 will also be 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 going to change 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 will pop out.

g. 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 be resting on the bottom shoulder of the crankcase).

3.) Install the crankshaft bushing into the non-drive side bearing (be careful not to 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).

5.) When installing the rod you will meet some resistance at the oil seals, slightly twist the rod from side to side and push gently (This way you will not dislodge the garder spring in the seal).

6.) 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: you will have to work the rods back and forth while turning the crankshaft to achieve proper alignment). The crankshaft will stop 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.

7.) 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.

8.) Install the crankshaft bearing bushing bolt and washer. Apply a medium strength thread locker and torque to specifications.

9.) The oil seal must now be installed. Seat it squarely in position on the shaft and seat it flush with the crankcase.

10.) Next 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

11.) Replace the rear cover. Make sure the o-ring gasket is in good condition and properly seated on the cover. Torque to specification.

12.) The motor adapter flange is the last piece to be installed and torqued to specification.

13.) Turn the pump over by hand, making sure it turns free and smooth

14.) Fill the crankcase with Sea Recovery Pump Oil

15.) Finish assembling the wet end of the pump according to the previous instructions.

h. TORQUE SPECIFICATIONS:

Item	Description	Quantity	Ft. Lbs of Torque
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

2. Electric Motor [12]: The 12 or 24 VDC Electric Motor requires armature Brush replacement every 1000 hours or at failure whichever occurs first. To expose the brushes for replacement remove the motor rear cover.

3. High Pressure Hose [10]: The High Pressure Hose compression fitting collet must be pressed inward in order to release the High Pressure Hose for removal.

4. R.O. Membrane Element and High Pressure Vessel Assembly [14]:

For cleaning of the Reverse Osmosis Membrane Element refer to Section "J" of this Manual. For removal and 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 4 “O”rings (2 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.

1.) Disconnect the Product Water Tube and the two High Pressure Hoses from both the leading (inlet) end and discharge end of the High Pressure Vessel. To remove the high pressure hose and product water tubing from the vessel assembly, push the tube fitting collet into its cartridge insert firmly. While pushing the collet firmly into the cartridge insert pull outward on the tubing. Some force will be required. The Collet must be pressed into the cartridge insert while pulling outward on the tube. Remove the two high pressure hoses and the product water tube in this manner.

2.) Remove the High Pressure Vessel from the System Enclosure by removing the High Pressure Vessel Mounting Bracket screws located on the top rear of the system enclosure.

3.) The End Plug assemblies are held in place by the 3 piece Segment Rings and the 3 piece Segment Rings are held in place by 3 each Socket Head Cap Screws. Remove the 3 each Socket Head Cap Screws from one end of the High Pressure Vessel. Push inward lightly on the end plug in order to relieve the 3 piece Segment Ring from its mating groove in the High Pressure Vessel. Remove the 3 piece Segment Ring. Repeat for the other end of the Vessel.

4.) With the Retaining Ring Screws removed, the End Plugs are now being supported in place with only the assistance of 1 (one) Brine “O”ring. An end plug removal tool is available from Sea Recovery. Place the 3 each Socket Head Cap Screws into the End Plug Removal Tool and screw each screw into the End Plug. Pull outward on the End Plug Removal Tool handle.

CAUTION: Between each End Plug and the inside wall of the High Pressure Vessel is a Port Retainer (round stainless steel washer). This Port Retainer will fall out and away from the end plug as the end plug is removed from the Vessel. This Port Retainer washer holds the High Pressure Tube Fitting in place. Do Not lose these Port Retainers.

CAUTION: If the End Plug assembly is removed rapidly from the High Pressure Vessel damage may occur to the Brine “O”ring as it passes over the segment ring groove.

CAUTION: At each end of the Reverse Osmosis Membrane Element is a product water tube approximately 5/8 inch diameter by 3/4 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 kept fret of scratches. Never use pliers or other grabbing tools on or near the Reverse Osmosis Membrane Element Product Water Tube.

5.) With the End Plugs removed from the High Pressure Vessel the Reverse Osmosis Membrane Element can now be seen in the exposed end of the High Pressure Vessel. With your hand in the discharge (down stream) end push the Reverse Osmosis Membrane Element out of the inlet (feed) end.

6.) Run a rag through the High Pressure Vessel several times to remove any biological or oil build up.

b. Inspection and "O" ring replacement: Inspect the inside of the High Pressure Vessel. Ensure that the inside of the Vessel is clean, smooth and free of scratches.

1.) Remove the brine "O" ring and product water "O" rings from the two end plugs. Clean the end plugs with a cloth. Sparingly lubricate 2 new brine "O" rings and 2 new product water "O" rings with Parker "O" ring lubricant and place them onto the end plugs.

c. Replacement of the Reverse Osmosis Membrane Element. A new Sea Recovery Reverse Osmosis Membrane Element will come from Sea Recovery complete with a "U" cup Brine Seal at one end of the Element. This Brine Seal must be at the leading (inlet) end of the High Pressure Vessel. Refer to the Cross Sectional View in Section K of this Manual.

1.) Insert the down stream end (end without a brine seal) of the Reverse Osmosis Membrane Element into the upstream inlet end of the High Pressure Vessel. 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 3 inches past the end lip of the High Pressure Vessel.

2.) Reassemble the End Plugs, with Port Retainer washers, into the High Pressure Vessel. Be sure to place the Port Retainer washer onto the High Pressure Feed and Brine Ports of the End Plug when inserting them into the High Pressure Vessel.

3.) Reassemble the 3 piece Segment Rings and Socket Head Cap Screws onto each end of the High Pressure Vessel.

4.) Reassemble the High Pressure Vessel back into the System. Be sure to orient the Inlet and Outlet ends properly.

5.) 4. Attach the Feed High Pressure Hose, Brine High Pressure Hose and Product Water Hose properly into the respective port.

6.) Place the Port Retainer washer onto the High Pressure Feed and Brine Ports of the End Plug when inserting them into the High Pressure Vessel.

5. High Pressure Switch [19]: The High Pressure Switch contains one S.P.ST. (Single Pole Single Throw) N.C. (Normally Closed) contact. As the Brine Discharge Water travels from the R.O. Membrane Vessel Outlet and into the Control Manifold the System Operating High Pressure is built up at the Back Pressure Regulator. Just prior to the Back Pressure Regulator, within the Control Manifold, the High Pressure Gauge and High Pressure Switch are ported to measure the System Operating High Pressure.

If this pressure remains below 850 PSI the High Pressure Switch will remain closed and keep the System in operation. Should the System Operating Pressure increase above 850 to 950 PSI the High Pressure Switch will Open and immediately shut the System off. Should the operating pressure open the High Pressure Switch the LED fault lamp at the Touch Pad will illuminate and remain lit until the fault reset switch is pressed.

The internal switching mechanism of the High Pressure Switch is very sensitive and improper adjustment may damage the switch and render it inoperable. In field, on site, adjustment of the High Pressure Switch is, therefore, not recommended. Improper interpretation of the High Pressure Switch actions and subsequent improper adjustment of the High Pressure Switch will lead to damage of **the High Pressure Pump and R.O. Membrane** Element if adjusted too High or cause continual premature shutdown if adjusted too Low.

However, if in field adjustment is necessary: Start the Sea Recovery system, Fully open the Back Pressure Regulator Valve so that the system is in operation with no pressure reading at the High Pressure Gauge. Remove the calibration sealing cap 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 1/8th 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. Slowly increase operating pressure and check the high pressure switch opening set point. Do not exceed 950 PSI.

Once the High Pressure Switch is properly set replace the calibration hole sealing cap and adjust the Back Pressure Regulator Valve full open for the next system operation.

6. **High Pressure Gauge [20]:** The pressure gauges used in the Sea Recovery R.O. system are repairable if foreign debris has entered and plugged the orifice. If the gauge does not revert to 0 (zero) when the system is not in operation or if the gauge does not register with pressure or vacuum applied then the orifice may be plugged with foreign debris. The orifice may be cleaned with a needle, pin, gas orifice cleaning wire or small diameter drill bit 1/64" / 2 mm diameter. No other symptom or failure is repairable. After removing and prior to reinstalling the pressure gauges check the two o-ring seals to ensure that they are intact and have no nicks or imperfections. Replace the o-rings if damage has occurred to them.

7. **Back Pressure Regulator [17]** : Due to the high velocity of brine water at the valve threads, continual wear over time will make the valve inoperable. The Back Pressure Regulator should be checked for erosion if leaks occur or if it fails to maintain desired pressure. However, do not confuse the failure to maintain pressure symptom with problems elsewhere such as air in the High Pressure Pump Discharge Valve chamber or worn or broken High Pressure Pump Seals and Valves. When diagnosing these type of problems the pressure gauges and flow meter readings must be observed and considered into the equation and problem present in order to determine the exact location and cause of the problem.

C. Post-Filtration Subsystem Maintenance

1. **GPH Product Water Flow Meter [211:** Refer to item A.10 of this chapter, Combination Feed Water / Brine Discharge and Product Water Flow Meter

9	Screw SHCS 18mm Long	4	7.3

2. **Salinity probe [22]:** The salinity probe will require cleaning approximately once a year. To clean the probe, disconnect the three electrical salinity probe leads from the electrical controller. Remove the retaining pin screw which holds the salinity probe into the control manifold then pull outward on the probe. Do Not pull the probe by it's wires. Hold the PVC body of the probe while pulling it away from the control manifold. The Salinity Probe is sealed with an o-ring which will cause friction and require some pulling force to remove the probe from the control manifold.

Using a soft bristle, stainless steel bristle or brass bristle brush scrub the monel probes to remove any built up debris. Examine the o-ring to ensure its integrity and replace the o-ring if necessary

.

Push the Salinity Probe back into the control manifold while maintaining alignment with the locking pin screw groove and the screw hole. Replace the locking pin screw. Replace the wires back onto the main printed circuit board. Refer to the wiring diagram to ensure proper placement of the three wires.

3. **Charcoal Filter [24]:** A sulfurous smell (like rotten eggs) from the product water indicates that replacement of the Charcoal Filter Element is necessary. If no such smell develops beforehand, the Charcoal Filter Element should be replaced monthly. The Charcoal Filter Element is not cleanable.

To replace the element, unscrew the blue bowl counter clockwise by hand. Take care not to spill the feed 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. Lubricate it sparingly with silicon base "O" ring lubricant and place the "O" ring back onto the bowl.

Insert a new SRC CFE Charcoal 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 will leak from the bowl.

4. Ultraviolet Sterilizer [25]: Maintenance of the U.V. Sterilizer will consist of lamp replacement and quartz sleeve cleaning. Replace the lamp at the intervals suggested in the Maintenance Timetable, or if the lamp fails to start, whichever comes first. The lamp becomes progressively weaker over time, so after six months of use, it may be ineffective though it still is emitting light.

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

CAUTION. The quartz tube is fragile, handle it carefully with gloves or a cloth. Be as careful with the aluminum reflectors, as they are very easily scratched.

@CAUTION. The quartz tube will crack or shatter if the compression nuts are over tightened.

SECTION L

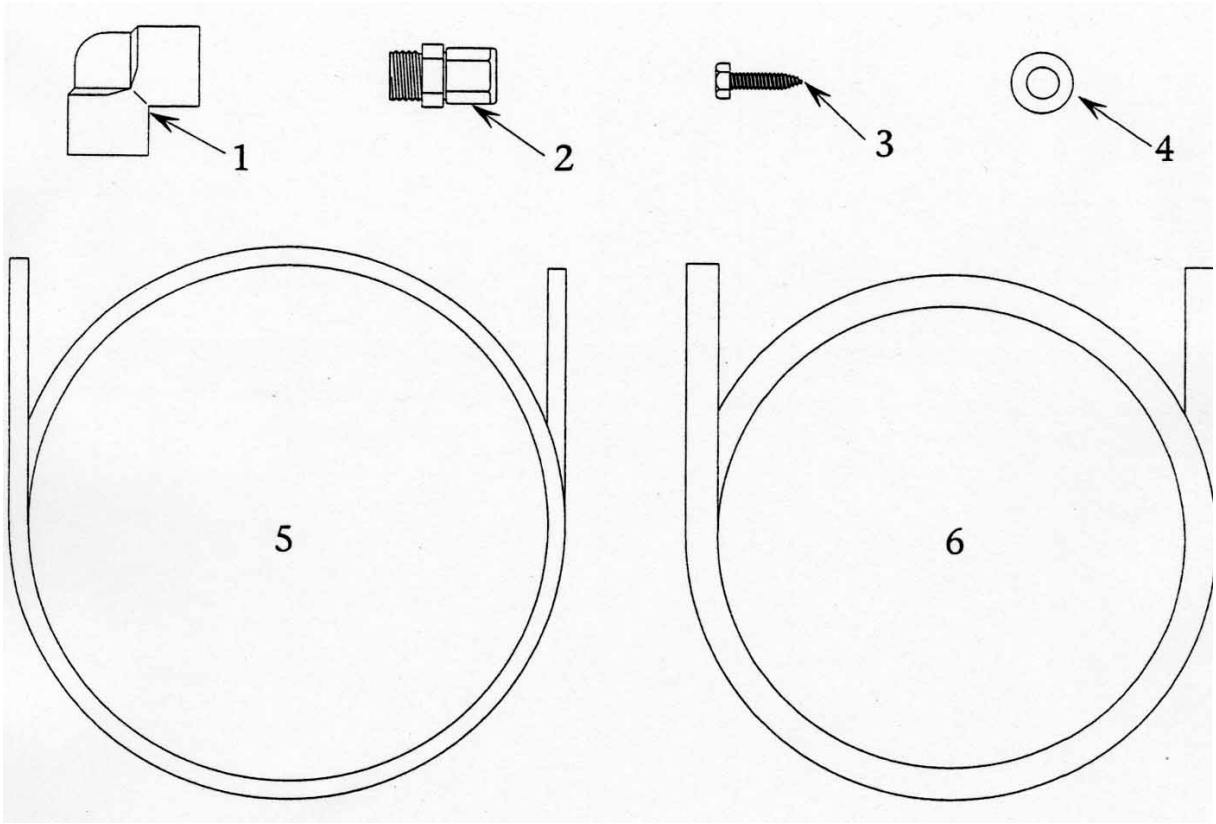
EXPLODED PARTS VIEWS

WITH

DESCRIPTION & PART NUMBERS

NOTES:

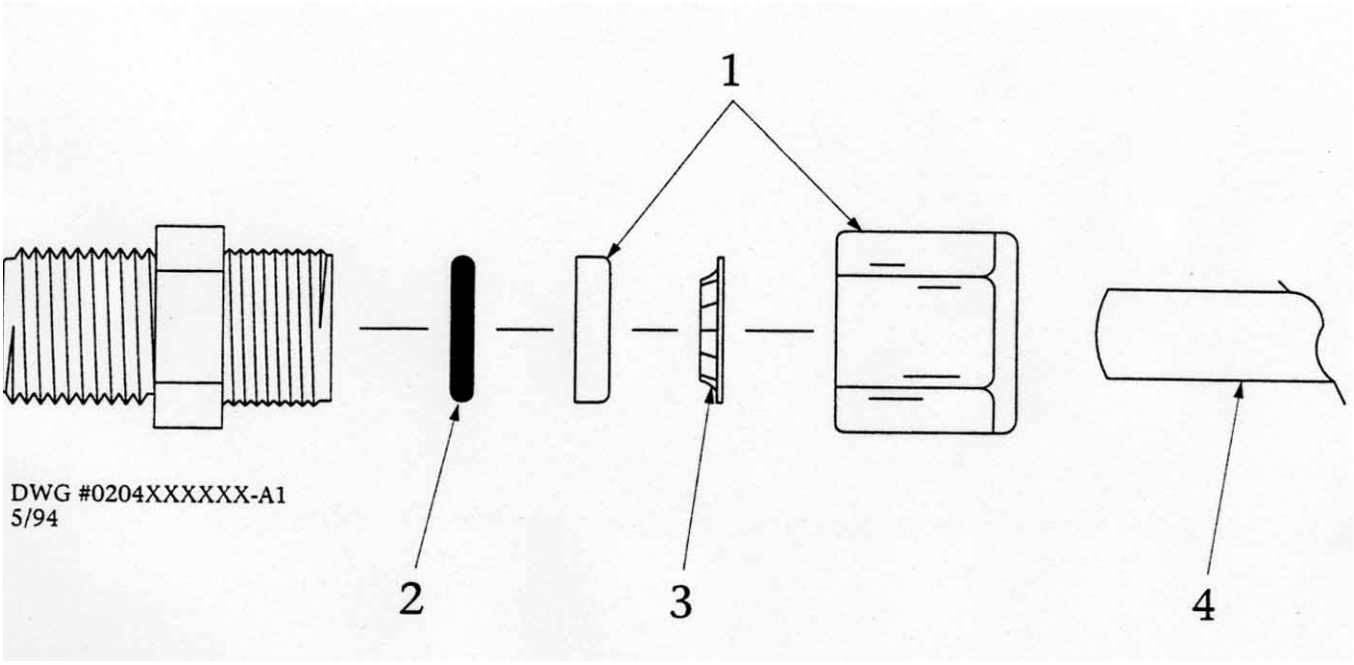
INSTALLATION KIT
ASSEMBLY NO. Z001090001



Z001090001 INSTALLATION KIT ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-7	Z001090001	INSTALLATION KIT CRYSTAL SEA FE	1 EA
1	0101012583	ELB90 1/2" FPT x 1/2" FPT PVC	2 EA
2	0204091969	CONN 3/8" TUBE x 1/2" MPT PLASTIC	2 EA
3	061172143016	SC HEX "A" 1/4" x 1" S/S	4 EA
4	061100043000	WASHER FLAT OS 1/4" S/S	4 EA
5	0358121369	TUBE 1/4" BLACK POLYURETHANE	30 FEET
6	0358123169	TUBE 3/8" BLACK POLYURETHANE	50 FEET
7	B651090001	OWNERS MANUAL CRYSTAL SEA FE	1 EA

THERMAL PLASTIC FAST-N-TITE TUBE COMPRESSION FITTINGS
REPLACEMENT PARTS



ITEM .....DESCRIPTION .....PART NUMBER

FOR 1/4" O.D. TUBE

1 ..... NUT &- SPACER, 1/4" TU13E 0204380869
2 ..... 0-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

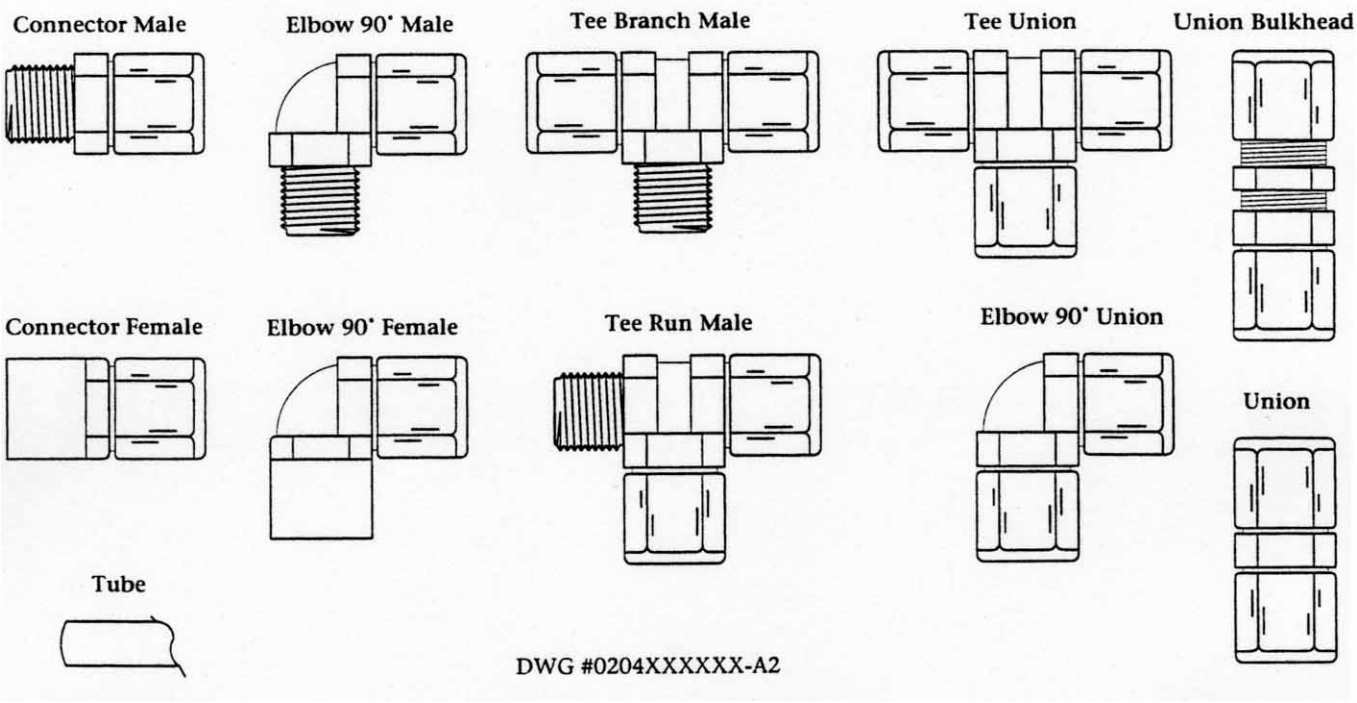
FOR 1/2" O.D. TUBE

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 .....0-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



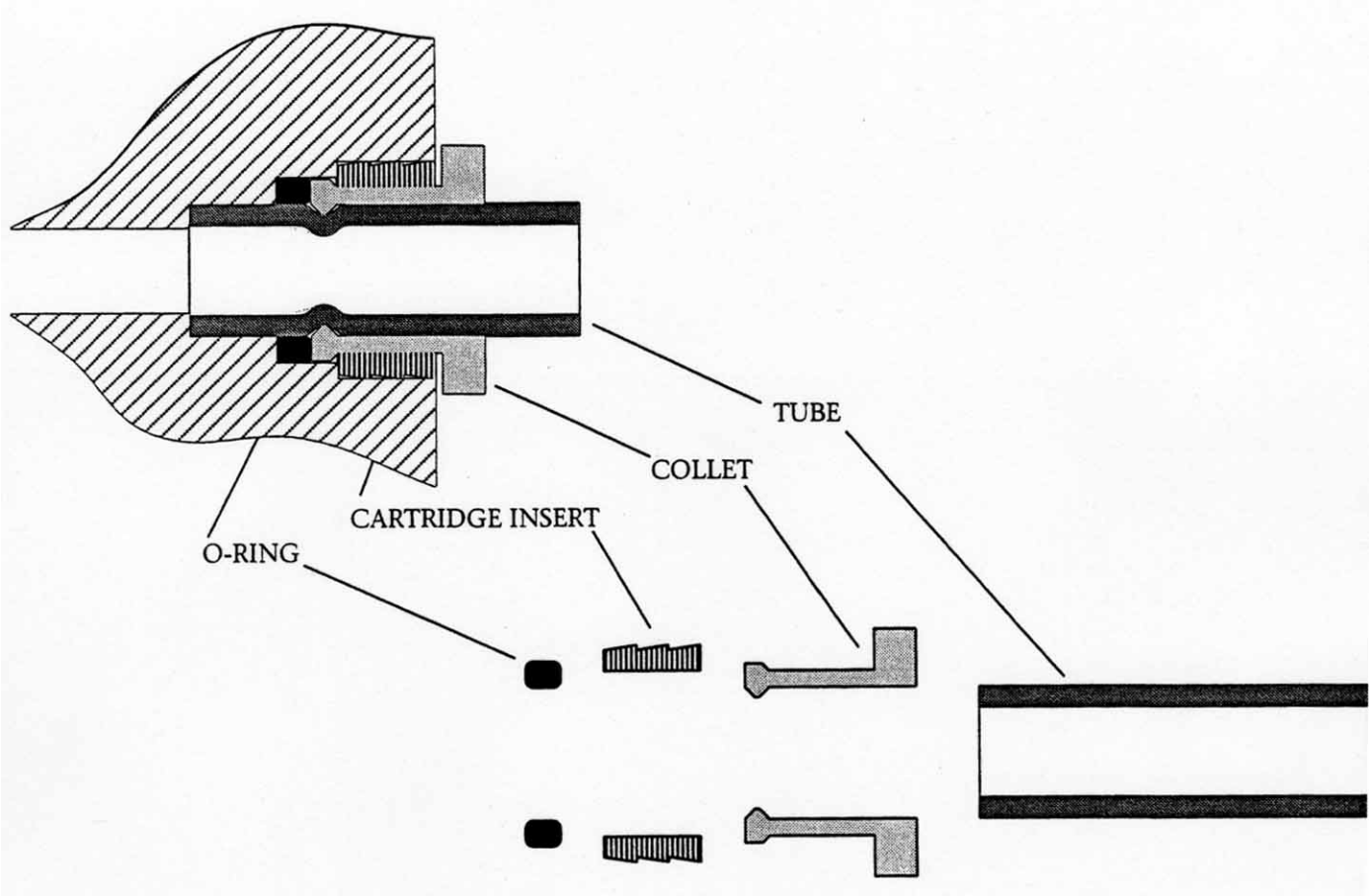
DESCRIPTION	P/N
Connector Male	
1/4 inch tube x 1/8 inch mnpt	0204090669
1/4 inch tube x 1/4 inch mnpt	0204090869
3/8 inch tube x 1/8 inch mnpt	0204091669
3/8 inch tube x 1/4 inch mnpt	0204091769
3/8 inch tube x 3/8 inch rrmpt	0204091869
3/8 inch tube x 1/2 inch mnpt	0204091969
3/8 inch tube x 3/4 inch 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 nmpt	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

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

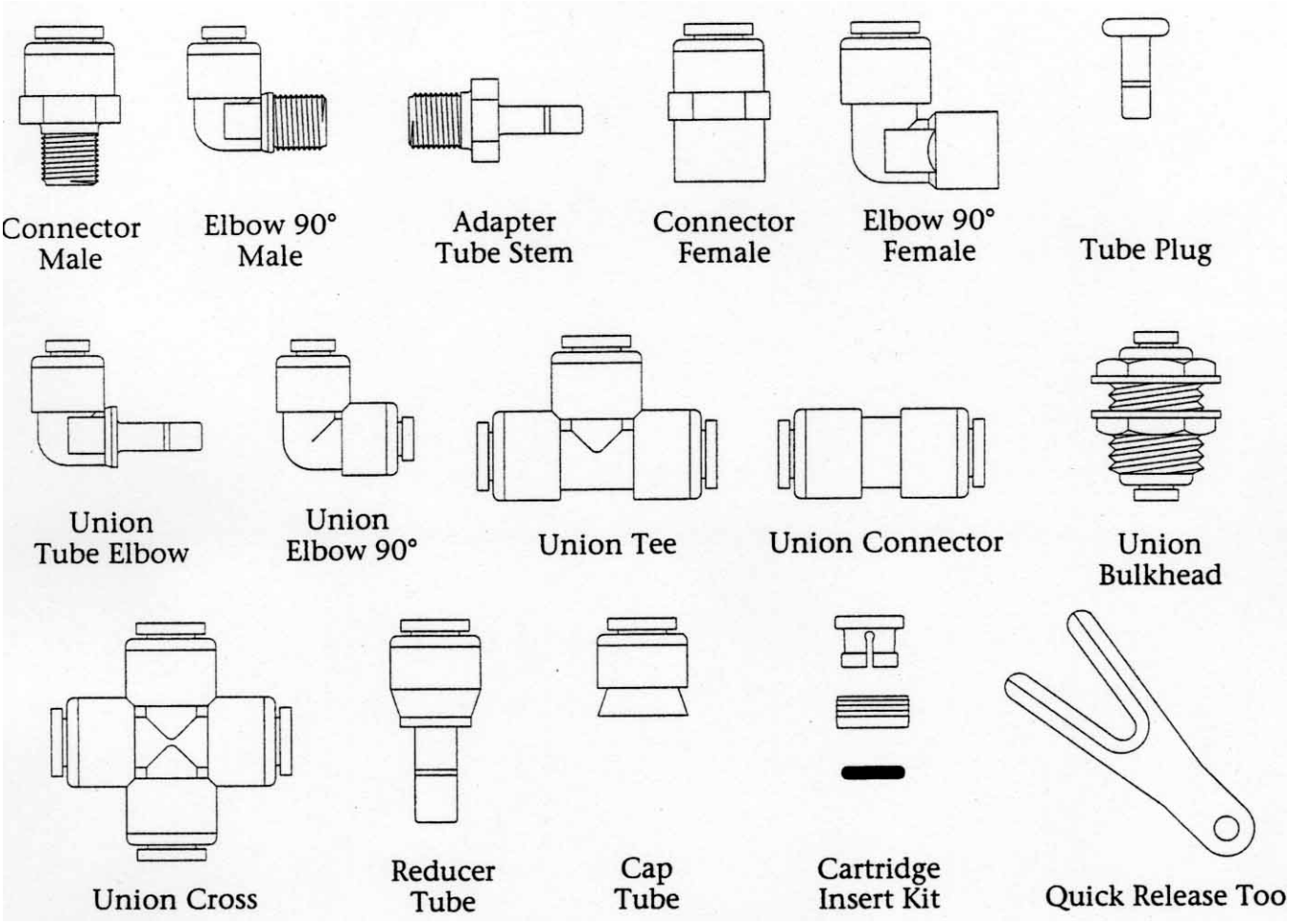
THERMAL PLASTIC TRUESEAL TUBE COMPRESSION FITTINGS
REPLACEMENT PARTS



REPLACEMENT PARTS KIT

Description
0-Ring, Cartridge Insert & Collet Set for 1/4" Tube
0-Ring, Cartridge Insert & Collet Set for 3/8" Tube

AVAILABLE THERMAL PLASTIC TRUESEAL TUBE COMPRESSION FITTINGS



DESCRIPTION **P/N**

Connector Male
1/4 inch tube x 1/8 inch mnpt
1/4 inch tube x 1/4 inch mnpt
1/4 inch tube x 3/8 inch mnpt
3/8 inch tube x 1/8 inch mnpt
3/8 inch tube x 1/4 inch mnpt
3/8 inch tube x 3/8 inch mnpt
3/8 inch tube x 1/2 inch mnpt
1/2 inch tube x 3/8 inch mnnpt
1/2 inch tube x 1/2 inch mnpt

Elbow 90° Male
1/4 inch tube x 1/8 inch mnpt
1/4 inch tube x 1/4 inch mnpt
1/4 inch tube x 3/8 inch mnpt
3/8 inch tube x 1/4 inch mnpt
3/8 inch tube x 3/8 inch mnpt

DESCRIPTION **P/N**

Adapter Tube Stem
1/4 inch tube x 1/8 inch mnpt
1/4 inch tube x 1/4 inch mnpt
3/8 inch tube x 1/4 inch mnpt
3/8 inch tube x 3/8 inch mnpt
1/2 inch tube x 1/4 inch mnpt
1/2 inch tube x 3/8 inch mnpt
1/2 inch tube x 1/2 inch mnpt

Connector Female
1/4 inch tube x 1/8 inch fnpt
1/4 inch tube x 1/4 inch fnpt
3/8 inch tube x 1/4 inch fnpt
3/8 inch tube x 3/8 inch fnpt
1/2 inch tube x 3/8 inch fnpt
1/2 inch tube x 1/2 inch fnpt

Continued on page L-6

AVAILABLE THERMAL PLASTIC TRUESEAL TUBE COMPRESSION FITTINGS CONTINUED

DESCRIPTION

Elbow 90° Female
3/8 inch tube x 1/4 inch fnpt

Tube Plug
1/4 inch tube
3/8 inch tube
1.2 inch tube

Union Tube Elbow 90°
1/4 inch tube x 1/4 inch stem
1/4 inch tube x 3/8 inch stem
3/8 inch tube x 1/4. inch stem
3/8 inch tube x 3/8 inch stem

Union Elbow 90°
1/4 inch tube x 1/4 inch tube
3/8 inch tube x 1/4 inch tube
3/8 inch tube x 3/8 inch tube
1/2 inch tube x 3/8 inch tube
1/2 inch tube x 1/2 inch tube

Union Tee
Run x stem
1/4 inch tube x 1/4 inch tube
3/8 inch tube x 1/4 inch tube
3/8 inch tube x 3/8 inch tube
1/2 inch tube x 1/2 inch tube

Union Connector
1/4 inch tube x 1/4 inch tube
3/8 inch tube x 1/4 inch tube
3/8 inch tube x 3/8 inch tube
1/2 inch tube x 3/8 inch tube
1/2 inch tube x 1/2 inch tube

Union Bulkhead
1/4 inch tube
3/8 inch tube
1/2 inch tube

DESCRIPTION

ReducerTube
1/4 inch tube x 3/8 inch stem
3/8 inch tube x 1/2 inch stem

Tube Cap
1/4 inch tube

Cartridge Insert Kit
1/4 inch tube
3/8 inch tube

Locking Clip
1/4 inch tube
3/8 inch tube
1/2 inch tube

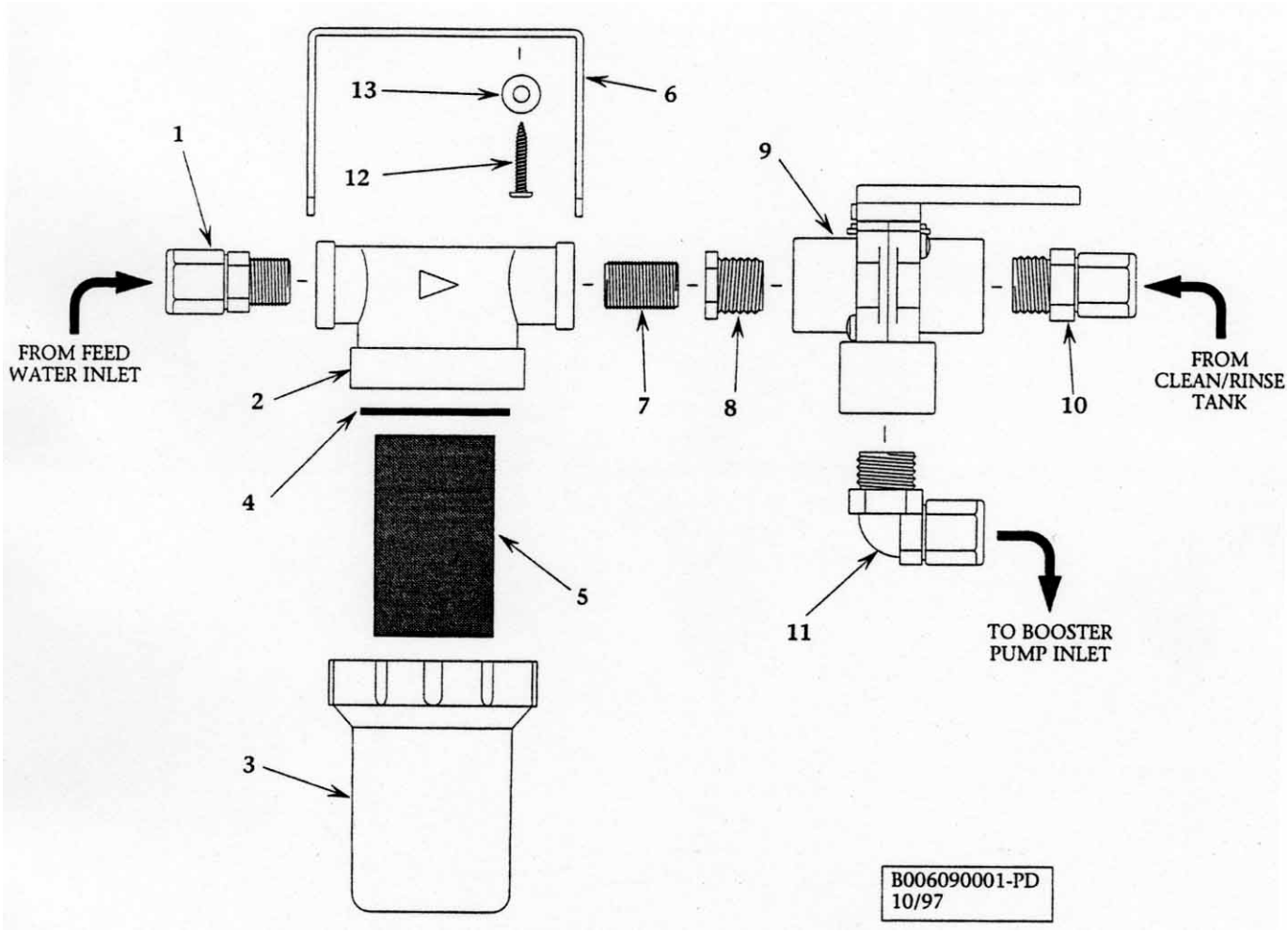
Tube Support
1/4 inch tube
3/8 inch tube
1/2 inch tube

Quick Release Tool
One Size Fits All

Tube Cutter
One Size Fits All

SEA STRAINER ASSEMBLY WITH RINSE/CLEAN INLET VALVE #5

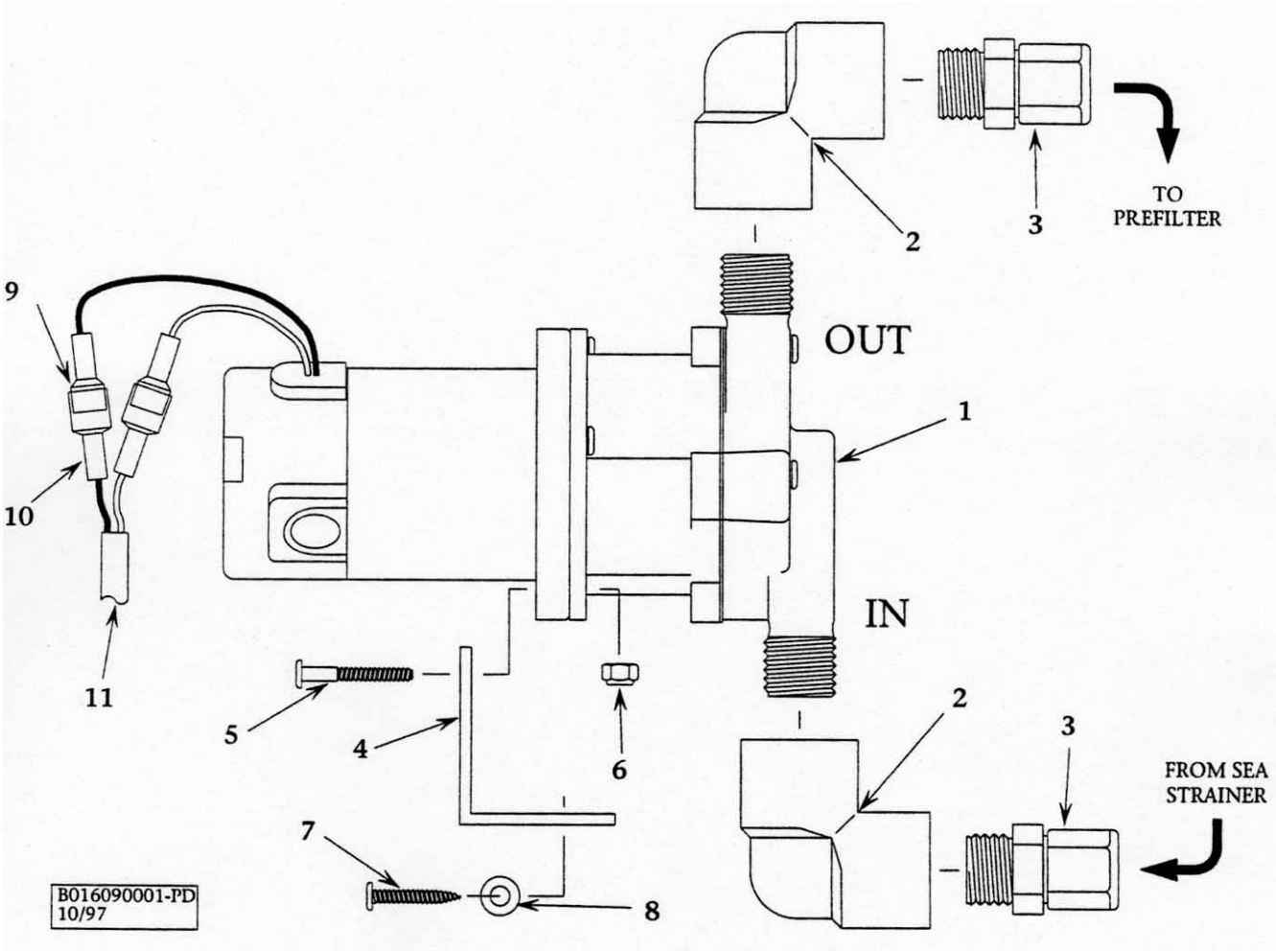
ASSEMBLY NO. B006090001



B006090001 SEA STRAINER ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-13	B006090001	SEA STRAINER CRYSTAL SEA	1 EA
1	0204091869	CONN 3/8" TUBE x 3/8" MPT PLASTIC	1 EA
2	0412034678-1	SEA STRAINER LID, 3/8"	1 EA
3	0412034678-2	SEA STRAINER BOWL, 3/K	1 EA
4	2614100278	O-RING SEA STRAINER	1 EA
5	0804743278	MESH SCREEN	1 EA
6	20200403010	BRACKET STRAINER 3/8"	1 EA
7	01013718CL	NIPPLE 3/8" NPT x CLOSE PVC	1 EA
8	0101292483	RED BUSH 1/2" MPT x 3/8" FPT PVC	1 EA
9	14011334AR	VALVE 3-WAY BALL 1/2" FPT	1 EA
10	0204091969	CONN 3/8" TUBE x 1/2" MPT PLASTIC	1 EA
11	0204021969	ELB90 3/8" TUBE x 1/2" MPT PLASTIC	1 EA
12	061170628016	SC PHIL PAN "A" 10 x 1" S/S	2 EA
13	065080028000	WASHER FLAT #10 NYLON	2 EA

BOOSTER PUMP ASSEMBLY 12 VDC
ASSEMBLY NO. B016090001



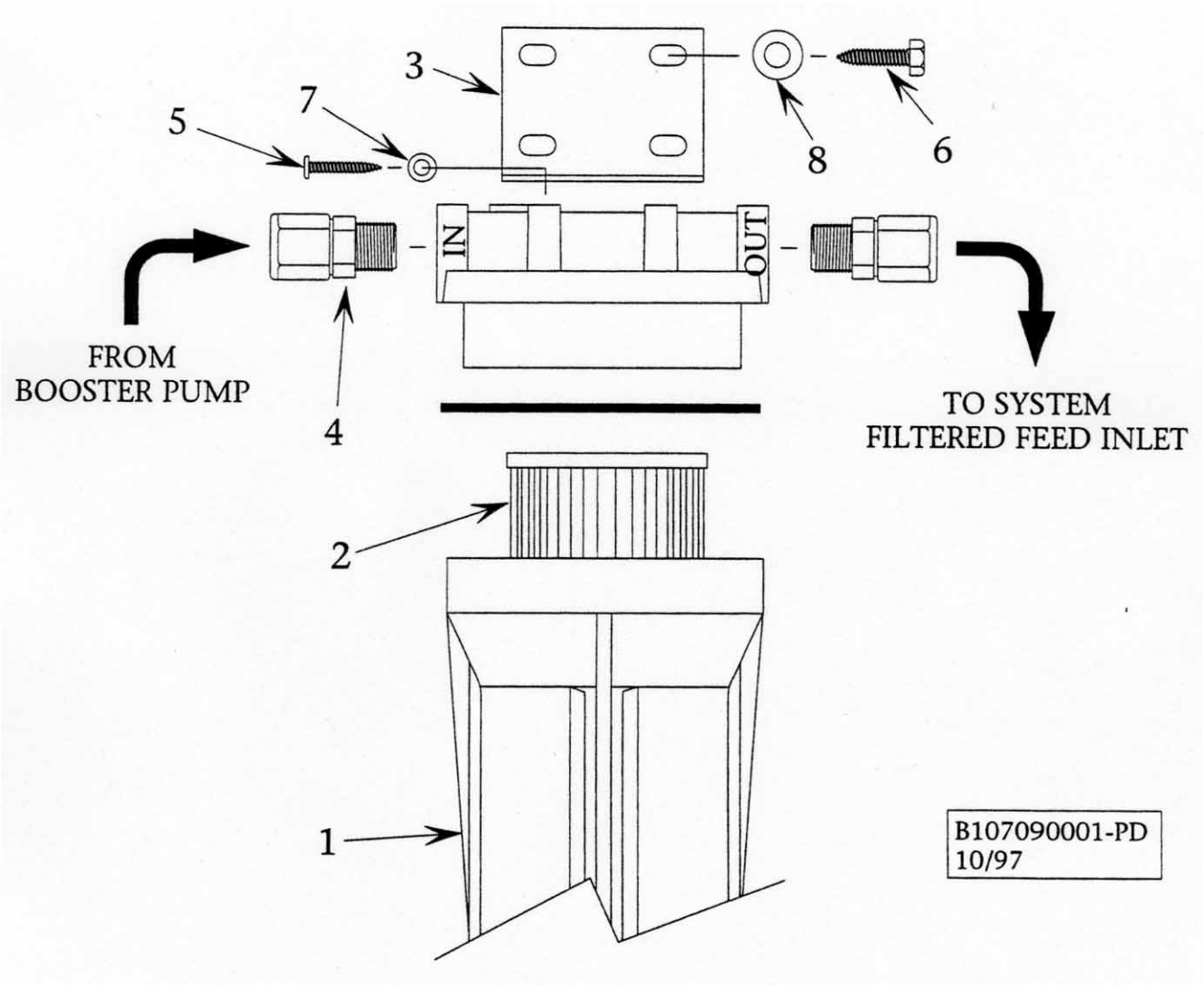
B016090001 BOOSTER PUMP ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1~11	B016090001	BOOSTER PUMP ASSY C/S	1 EA
1	12214901CX	BOOSTER PUMP 12VDC C/S	1 EA
2	0101012583	ELB90 1/2" FPT x 1/2" FPT PVC	2 EA
3	0204091969	CONN 3/8" TUBE x 1/2" MPT PLASTIC	2 EA
4	2020042200-01	BRACKET BOOSTER PUMP 12VDC C/S	1 EA
5	061160626012	SC PHIL PAN 8-32 x 3/4" S/S	2 EA
6	061060026000	NUT HEX 8-32 W/INSERT S/S	2 EA
7	061170628016	SC PHIL PAN "A" 10 x 1" S/S	4 EA
8	061100028000	WASHER FLAT OS #10 S/S	4 EA
9	3131383300	TERMINAL MALE DISC RED ASA50	2 EA
10	3131383200	TERMINAL FEMALE DISC RED A5A51	2 EA
11	4942220808	WIRE 18/2 GREY JACKET SJTO	10 FEET

BOOSTER PUMP ASSEMBLY 24 VDC
ASSEMBLY NO.

FUTURE REFERENCE

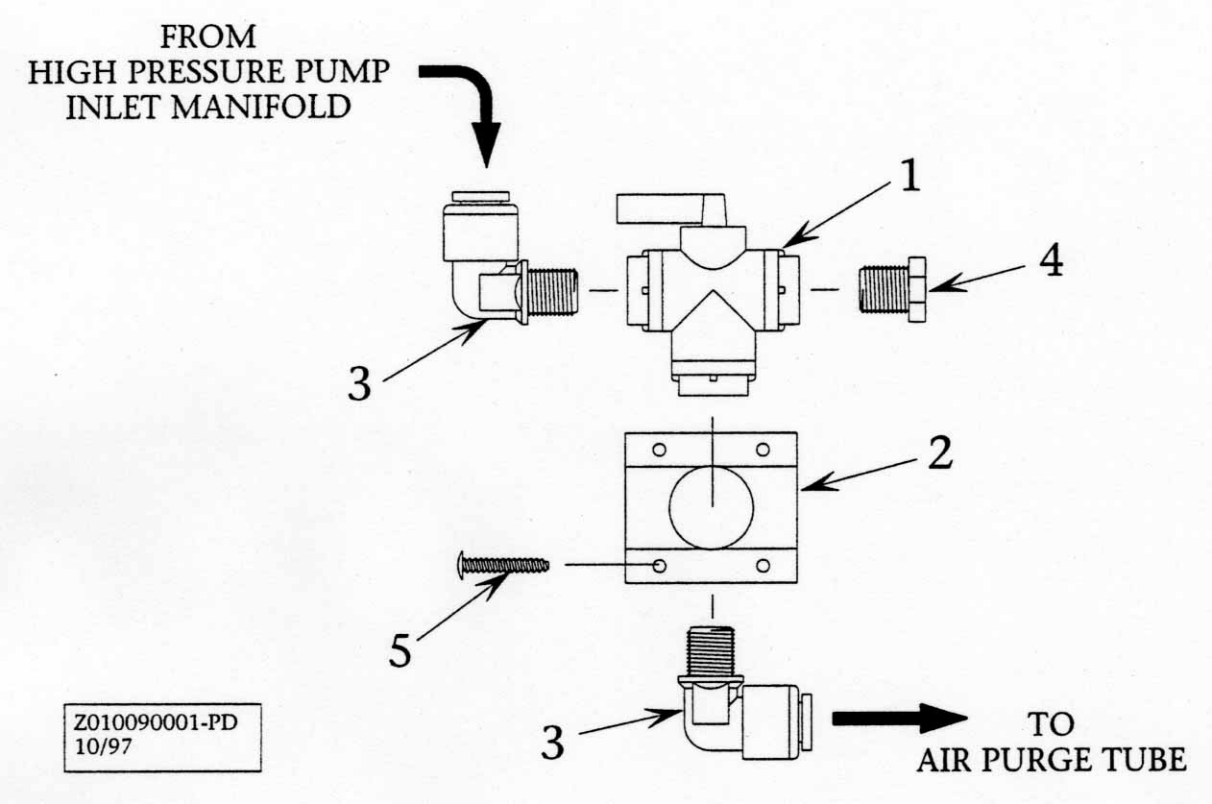
PREFILTER ASSEMBLY
ASSY NO. B107090001



B107090001 PREFILTER ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-8	B107090001	PREFILTER CRYSTAL SEA	1 EA
1	0713020573	FILTER HOUSING w/LID 3/8" x 10"	1 EA
2	0801060157	ELEMENT PREFILTER 10/05	1 EA
3	20200402100	BRACKET PREFILTER/CHRCL/PLNKTN	1 EA
4	0204091869	CONN 3/8" TUBE x 3/8" MPT PLASTIC	2 EA
5	061170628016	SC PHIL PAN "A" 10 x 1" S/S	4 EA
6	061172143016	SC HEX "A" 1/4" x 1" S/S	4 EA
7	065080028000	WASHER FLAT #10 NYLON	4 EA
8	061100043000	WASHER FLAT 1/4" S/S	4 EA

HIGH PRESSURE PUMP AIR PURGE VALVE #13
ASSEMBLY NO. Z010090001

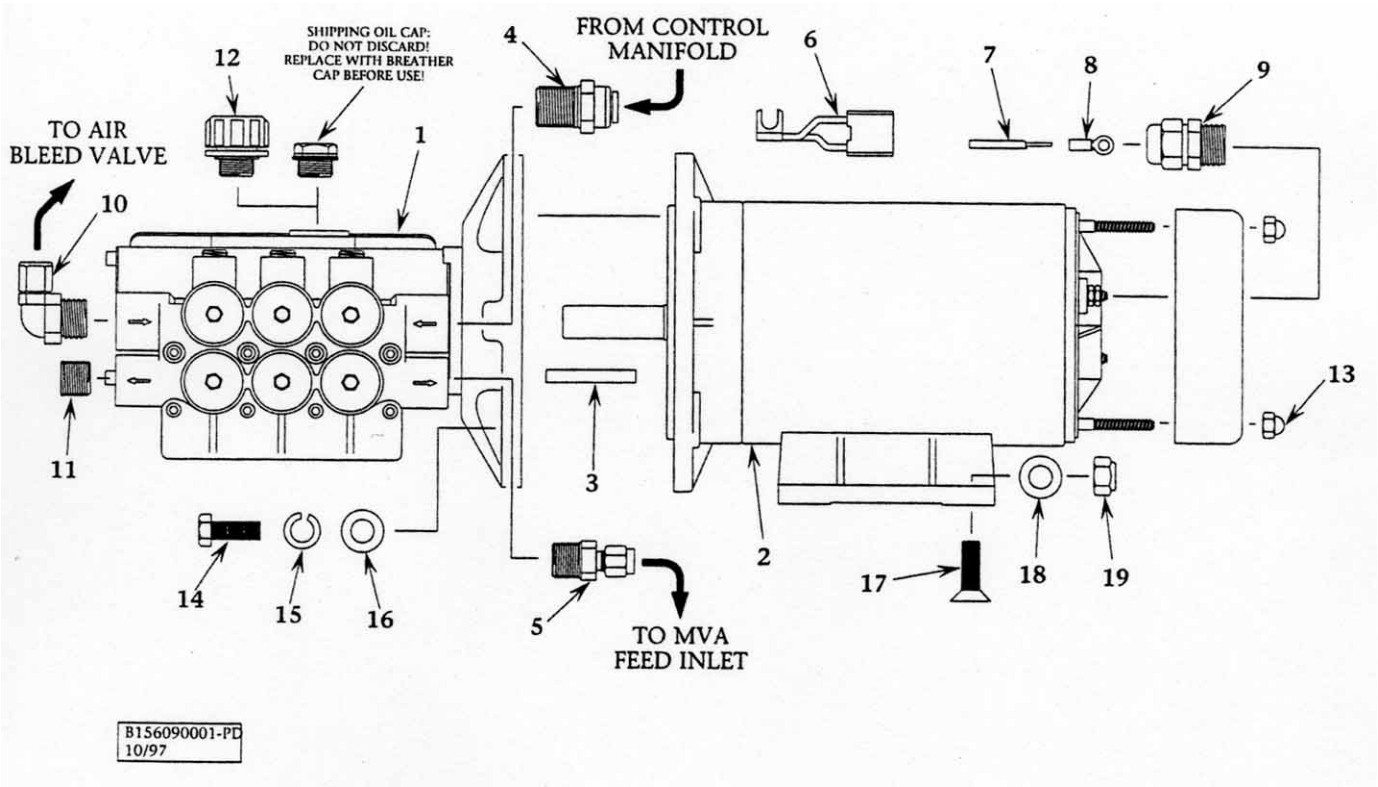


Z010090001 HP PUMP AIR PURGE VALVE ASSEMBLY (Valve #13)

ITEM	PART NUMBER	DESCRIPTION	QTY
1 ~ 5	Z010090001	HP PUMP AIR PURGE VALVE ASSY Valve #13	1 EA
1	14014006AR	VALVE 3 WAY BALL 1/4" FT NEVER CLOSE	1 EA
2	0553200100	BRACKET 3 WAY BALL VALVE C/S	1 EA
3	0204591769	ELB90 3/8" TUBE x 1/4" MPT -MG	2 EA
4	0101340883	PLUG 1/4" MPT PVC	1 EA
5	061162626012	SC PHIL TRUSS 8-32 x 3/4" S/S	2 EA

HIGH PRESSURE PUMP & MOTOR ASSEMBLY ENCLOSED SYSTEM 12 VDC

ASSEMBLY NO. B156090001



B156090001 HP PUMP/MOTOR 12VDC ASSEMBLY

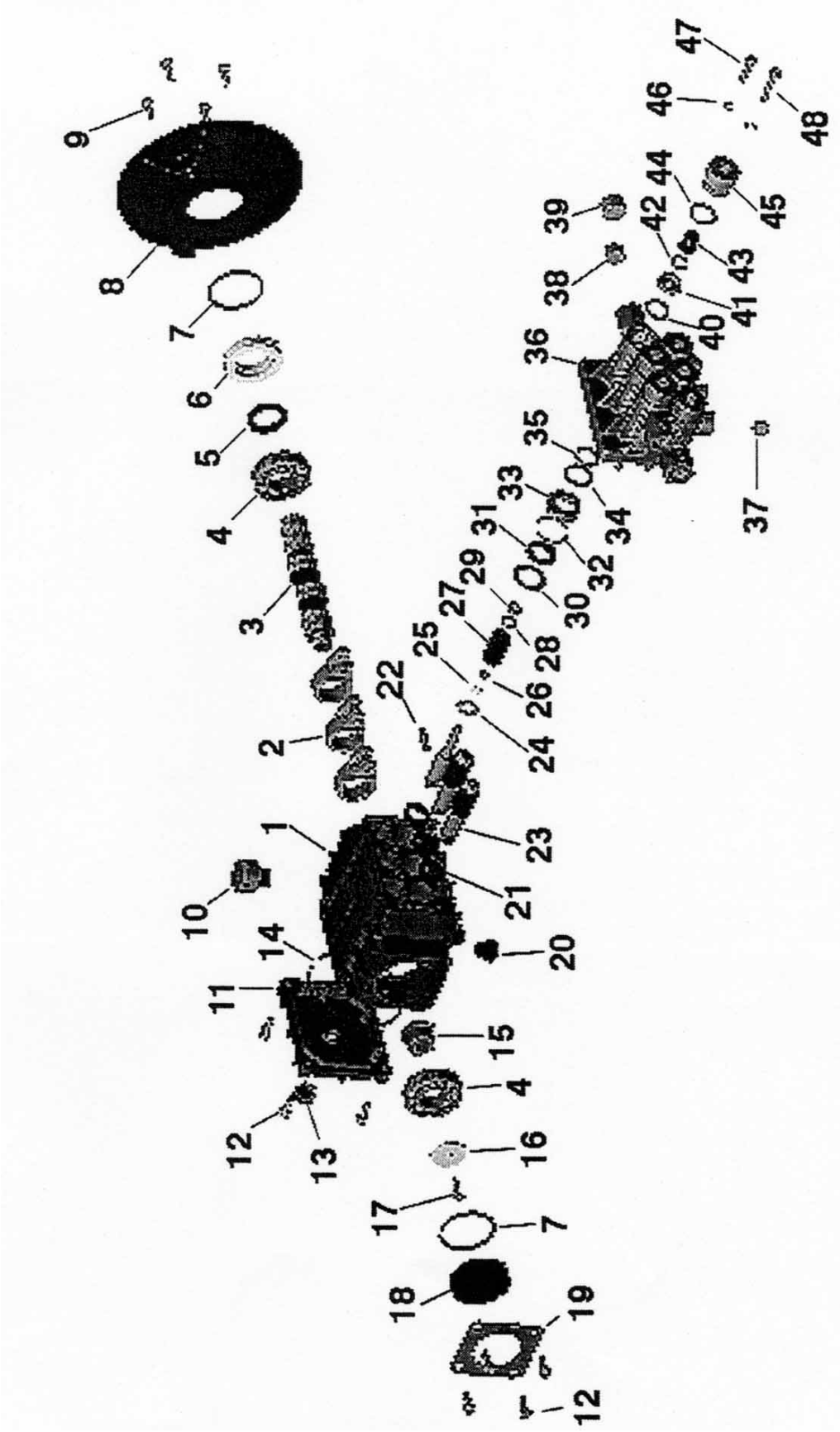
ITEM	PART NUMBER	DESCRIPTION	QTY
1- 19	B156090001	HP PUMP/MOTOR 12VDC C/S	1 EA
1	12180510CO	HP PUMP 1/2gpm S/S (CRYSTAL SEA)	1 EA
2	15093110CF	MOTOR 1/3hp 12VDC C/S	1 EA
3	4416010300	KEY MOTOR 1/3hp 12VDC C/S	1 EA
4	0204591969	CONN 3/8" TUBE x 1/2" MPT -MG	1 EA
5	0217090987	CONN 1/4" TUBE x 3/8" MPT S/S	1 EA
6	15093110CF-01	MOTOR BRUSH 12/24VDC C/S	2 EA
7	4932221115	WIRE 12/2 SO 600 BLACK JACKET	3 FEET
8	3131383190	TERMINAL RING YELLOW RC 10- 14	2 EA
9	904010743	STRAIN RELIEF 3219	IEA
10	0204021969	ELB90 3/8" TUBE x 1/2" MPT PLASTIC	1 EA
11	0117341800	PLUG 3/8" MPT S/S	1 EA
12	12180510C0-10	BREATHER CAP	1 EA
13	061040045000	NUT ACORN 1/4-20 S/S	2 EA
14	061142157016	BOLT HEX 3/8-16 x 1" S/S	4 EA
15	061120056000	WASHER SPLIT LOCK 3/8" S/S	4 EA
16	061100056000	WASHER FLAT OS 3/8" S/S	4 EA
17	061161850020	SC ALLEN FLAT 5/16-18 x 1 1/4" S/S	4 EA
18	061100049000	WASHER FLAT OS 5/16" S/S	4 EA
19	061060050000	NUT HEX 5/16-18 W/INSERT S/S	4 EA

HIGH PRESSURE PUMP & MOTOR ASSEMBLY ENCLOSED SYSTEM 24 VDC

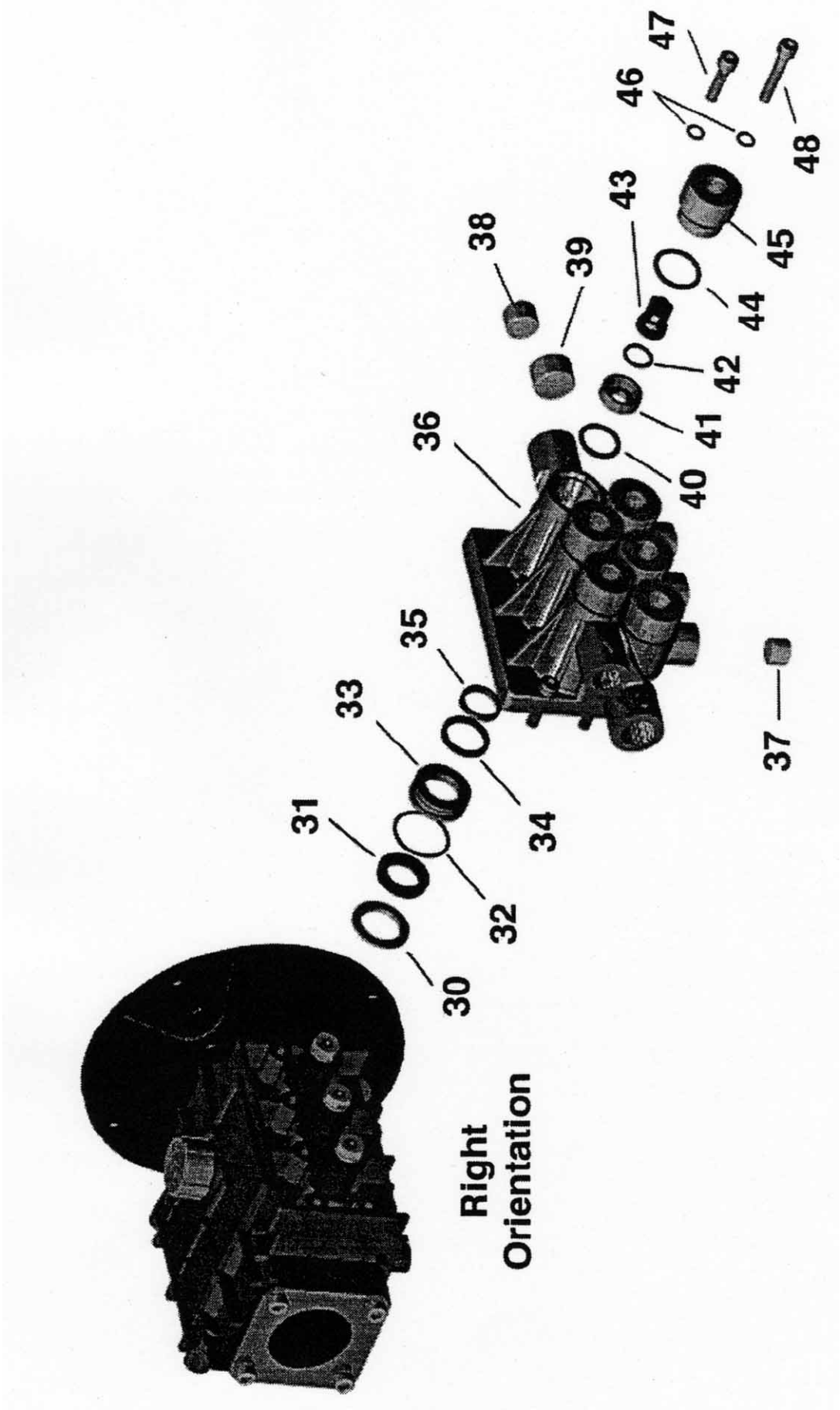
ASSEMBLY NO.

FUTURE REFERENCE

HIGH PRESSURE PUMP 1/2 U.S. GPM S/S PART NUMBER 12180510C0



HIGH PRESSURE PUMP 1/2 U.S. GPM S/S PART NUMBER 12180510C0



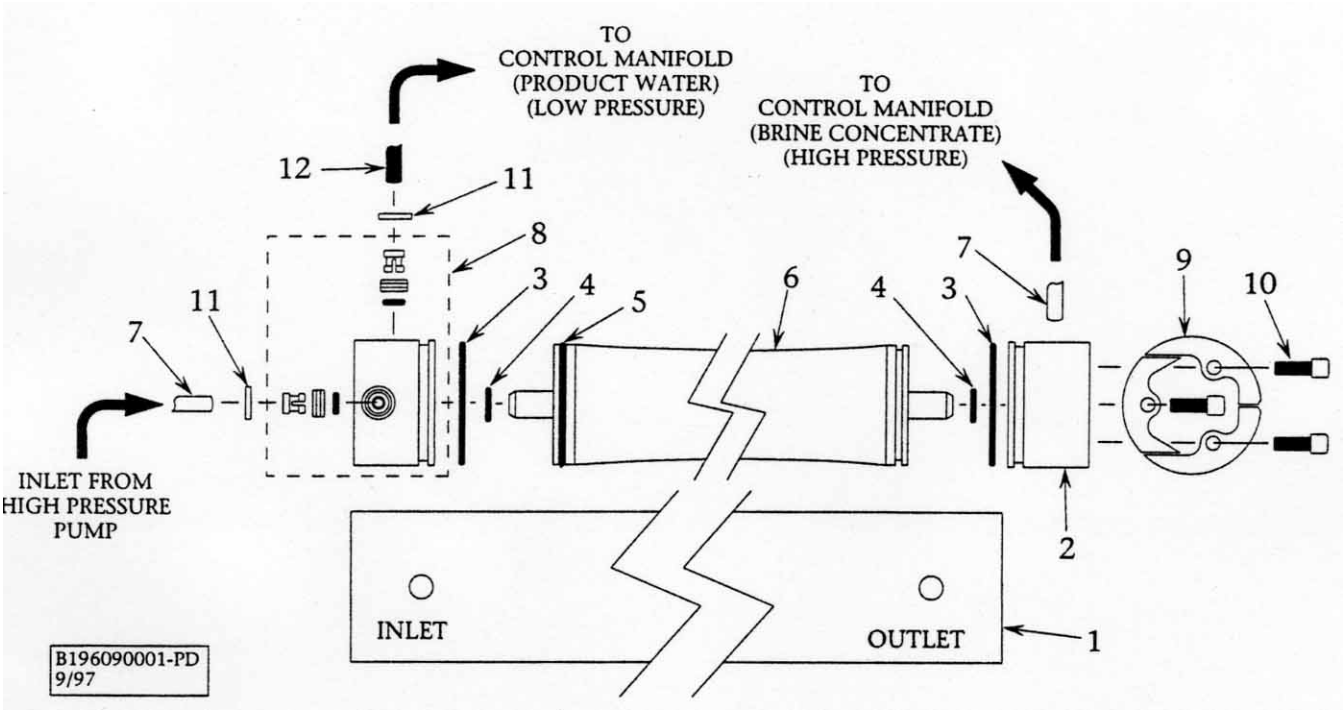
HIGH PRESSURE PUMP 1/2 U.S. GPM S/S PART NUMBER 12180510CO

Item	Part #	Description	Qty
1-50	1218051 C0	Pump HP.5 GPM S/S	1
1-29	1218051C0-DE	Drive End Pump HP .5 GPM S/S	1
30-50	1218051C0-WE	Wet End Pump HP.5 GPM S/S	1
1	12180510C0-01	Crankcase	1
2	12180510C0-02	Connecting Rod	3
3	12180510C0-03	Crankshaft 5/8" Hollow 0.5 GPM	1
4	12180510C0-04	Bearing	2
5	12180510C0-05	Oil Seal, Crankshaft	1
6	12180510C0-06	Retainer, Oil Seal	1
7	12180510C0-07	0-Ring, Oil Seal Retainer/Side Cover	2
8	12180510C0-08	Flange, NEMA 56C Face	1
9	12180510C0-09	Screw SHCS 18mm Long	4
10	12180510C0-10	Oil Cap Vented	1
11	12180510C0-11	Rear Cover	1
12	12180510C0-12	Screw SHCS 16mm Long	8
13	12180510C0-13	Sight Glass	1
14	12180510C0-14	0-Ring, Rear Cover	1
15	12180510C0-15	Bushing	1
16	12180510C0-16	Washer	1
17	12180510C0-17	Screw HHCS 20mm long	1
18	12180510C0-18	Side Cover	1
19	12180510C0-19	Side Plate	1
20	12180510C0-20	Oil Drain Plug	1
21	12180510C0-21	Oil Seal Plunger	3
22	12180510C0-22	Wrist Pin	3
23	12180510C0-23	Plunger Rod	3
24	12180510C0-24	Slinger	3
25	12180510C0-25	Anti-Extrusion Ring	3
26	12180510C0-26	0-Ring Plunger	3
27	12180510C0-27	Plunger 18mm	3
28	12180510C0-28	Washer, Plunger Rod	3
29	12180510C0-29	Nut, Plunger Rod	3
30	12180510C0-30	Seal Retainer	3
31	12180510C0-31	Low Pressure Seal	3
32	12180510C0-32	0-Ring Seal Case	3
33	12180510C0-33	Seal Case	3
34	12180510C0-34	Square Ring, High Pressure Seal	3
35	12180510C0-35	Glyd Ring, High Pressure Seal	3
36	12180510C0-36	Manifold	1
37	12180510C0-37	1/4 NPT Plug	3
38	12180510C0-38	3/8 NPT Plug	1
39	12180510C0-39	1/2 NPT Plug	1
40	12180510C0-40	0-Ring Valve Spacer	6
41	12180510C0-41	Valve Spacer	6
42	12180510C0-42	0-Ring Valve	6
43	12180510C0-43	Valve 6	
44	12180510C0-44	0-Ring Valve Plug	6
45	1218051OC0-4S	Valve Plug	6
46	12180510C0-46	Washer, Ribbed Lock	8
47	12180510C0-47	Screw SHCSMS x 25mm Long	4
48	12180510C0-48	Screw SHCS MS x 35mm. Long	4

B647800003	Pump Oil 16 oz.		
REPAIR KITS P/N:	Model Number	Items in Kit	Assy Per Kit
B653090001	SRC HPP SK 0.50/SS	30, 31, 32, 33, 34 & 35	3
B654090001	SRC HPP VK 0.50/SS	40, 41, 42, 43 & 44	6
B652090001	SRC HPPK 0.50/SS	30, 31, 32, 33, 34, 35, 40, 41, 42, 43 & 44	

R.O. MEMBRANE & VESSEL ASSEMBLY 170 GPD

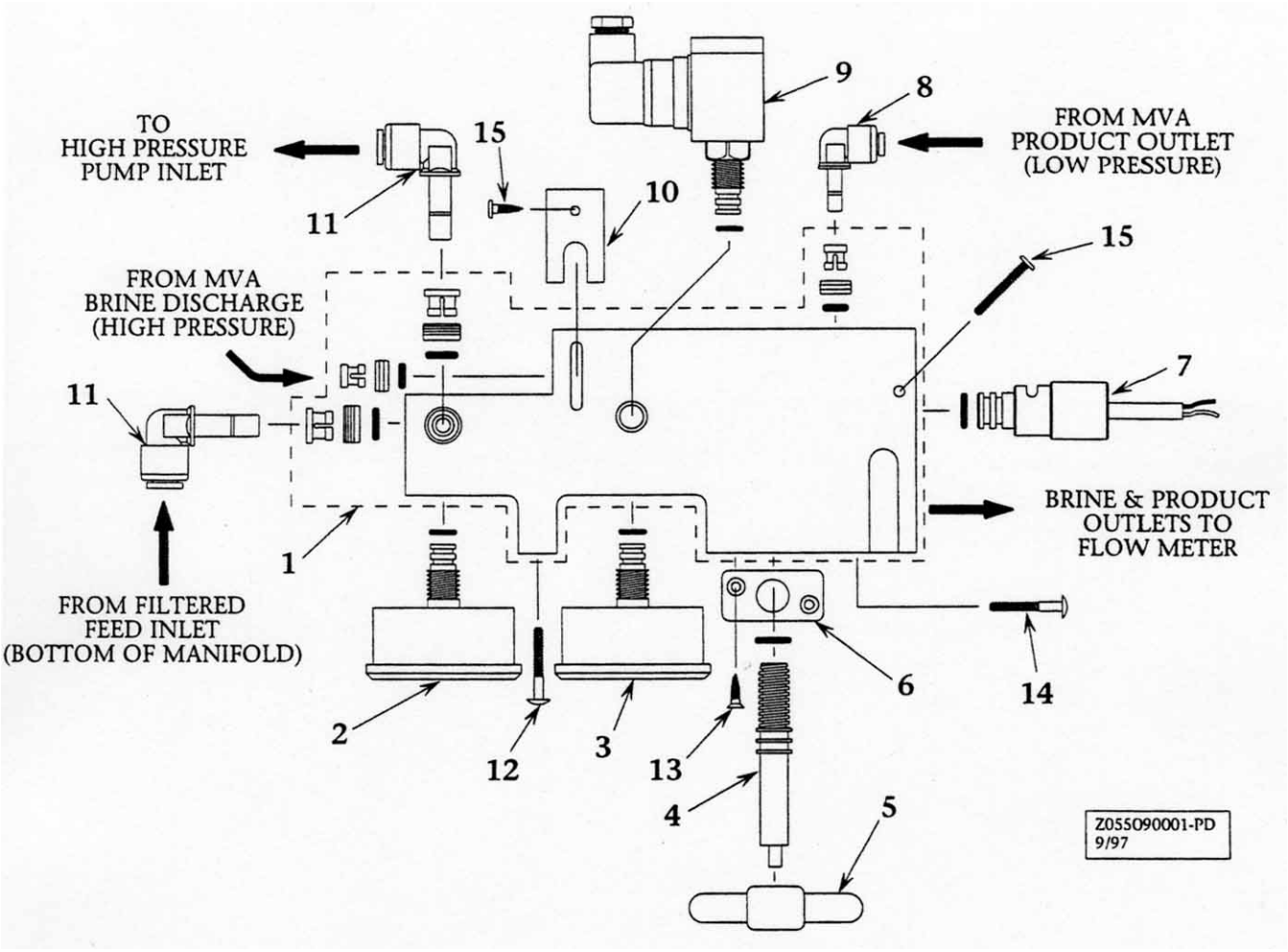
ASSEMBLY NO. B196090001



BI 96090001 MEMBRANE VESSEL ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1 ~ 12	B196090001	MEMBRANE VESSEL ASSY C/S	1 EA
1	2408132100	VESSEL 170 GPD	1 EA
2	2453372200	END PLUG OUTLET SINGLE PORT C/S	1 EA
3	2614010200	O-RING BRINE 2 1/2" END PLUG	2 EA
4	2614017200	O-RING PRODUCT C/S	2 EA
5	2614050133	BRINE SEAL 2 1/2"	1 EA
6	2724020333	MEMBRANE 170 GPD W/BRINE SEAL	1 EA
7	0312201700	TUBE 1/4" NYLON WHITE	8 FEET
8	2453362200	END PLUG INLET DUAL PORT C/S	1 EA
9	20201022000	SEGMENT RING C/S	2 EA
10	061162345012	SC SOC CAP 1/4-20 x 3/4" S/S	6 EA
11	0517210500	RETAINER PORT VESSEL C/S S/S	3 EA
12	0358121369	TUBE 1/4" BLACK POLYURETHANE	1 FOOT

CONTROL MANIFOLD ASSEMBLY
ASSEMBLY NO. Z055090001

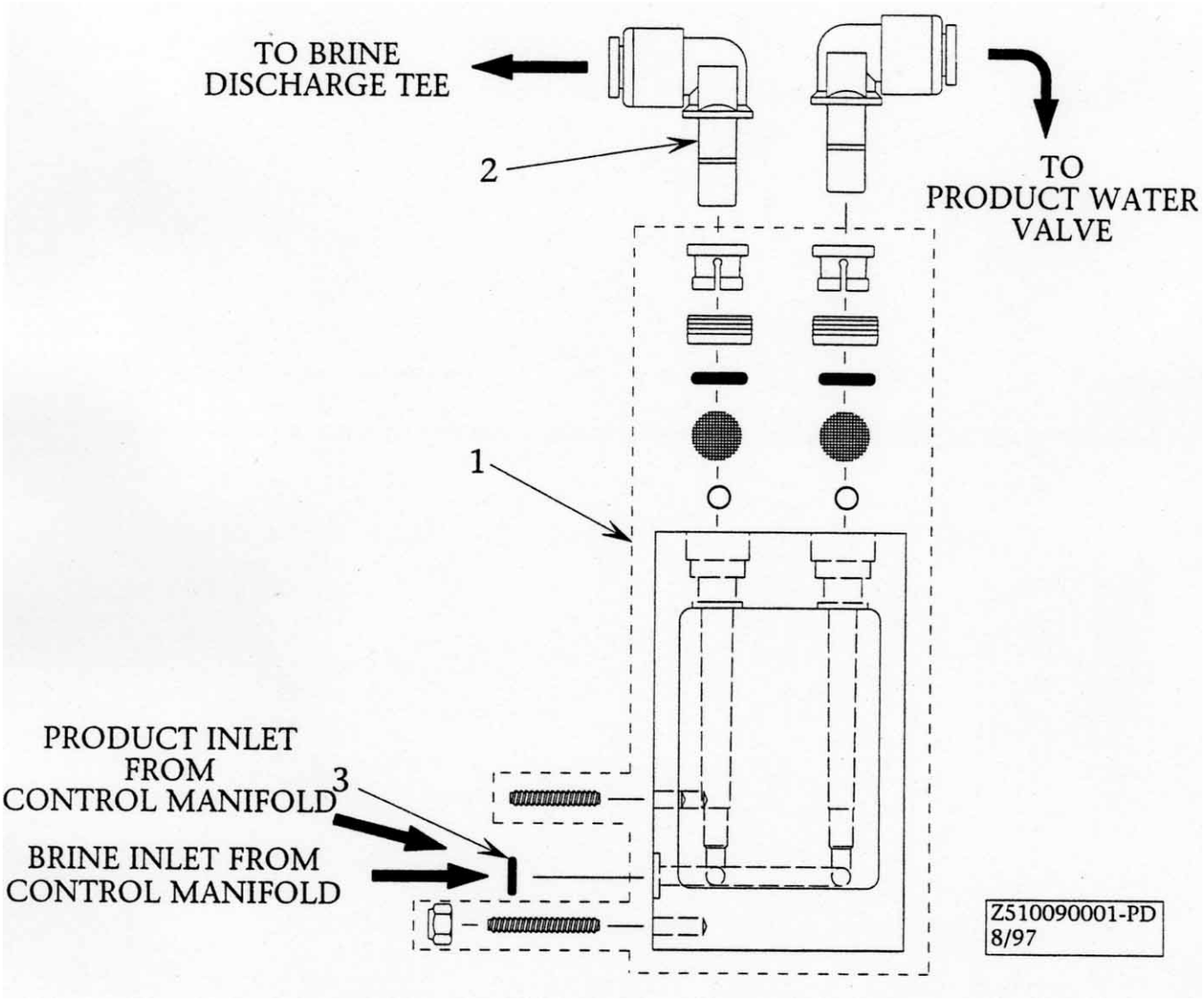


Z055090001 MANIFOLD CONTROL ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-16	Z055090001	MANIFOLD CONTROL ASSEMBLY C/S	1 EA
1	5353300200	MANIFOLD HIGH PRESSURE C/S	1 EA
2	10181320CC	GAUGE -30/0/70 CBM 0-RING SEAL	1 EA
3	10181421CC	GAUGE 0-1400 CBM O-RING SEAL	1 EA
4	1417021400	REGULATOR B.P. C/S	1 EA
5	1413450000	HANDLE B.P.R. C/S	1 EA
6	0520120100	RETAINER BACK PRESSURE REGULATOR	1 EA
7	B511090001	SALINITY PROBE ASSEMBLY C/S	1 EA
8	0204710869	ELB90 1/4" TUBE x 1/4" TEU -MG	1 EA
9	2321020458	SWITCH HIGH PRESSURE 900psi O-RING	1 EA
10	0520211600	RETAINER HIGH PRESSURE TUBE	1 EA
11	0204711869	ELB90 3/8" TUBE x 3/8" TEU -MG	2 EA
12	061162630016	SC PHIL TRUSS 10-24 x 1" S/S	6 EA
13	061171623008	SC PHIL FLAT "A" #8 x 1/2" S/S	2 EA
14	061160630024	SC PHIL PAN 10-24 x 1 1/2" S/S	1 EA
15	061170618109	SC PHIL PAN "A" #6 x 3/4" S/S	1 EA

FLOW METER ASSEMBLY

ASSEMBLY NO. Z510090001

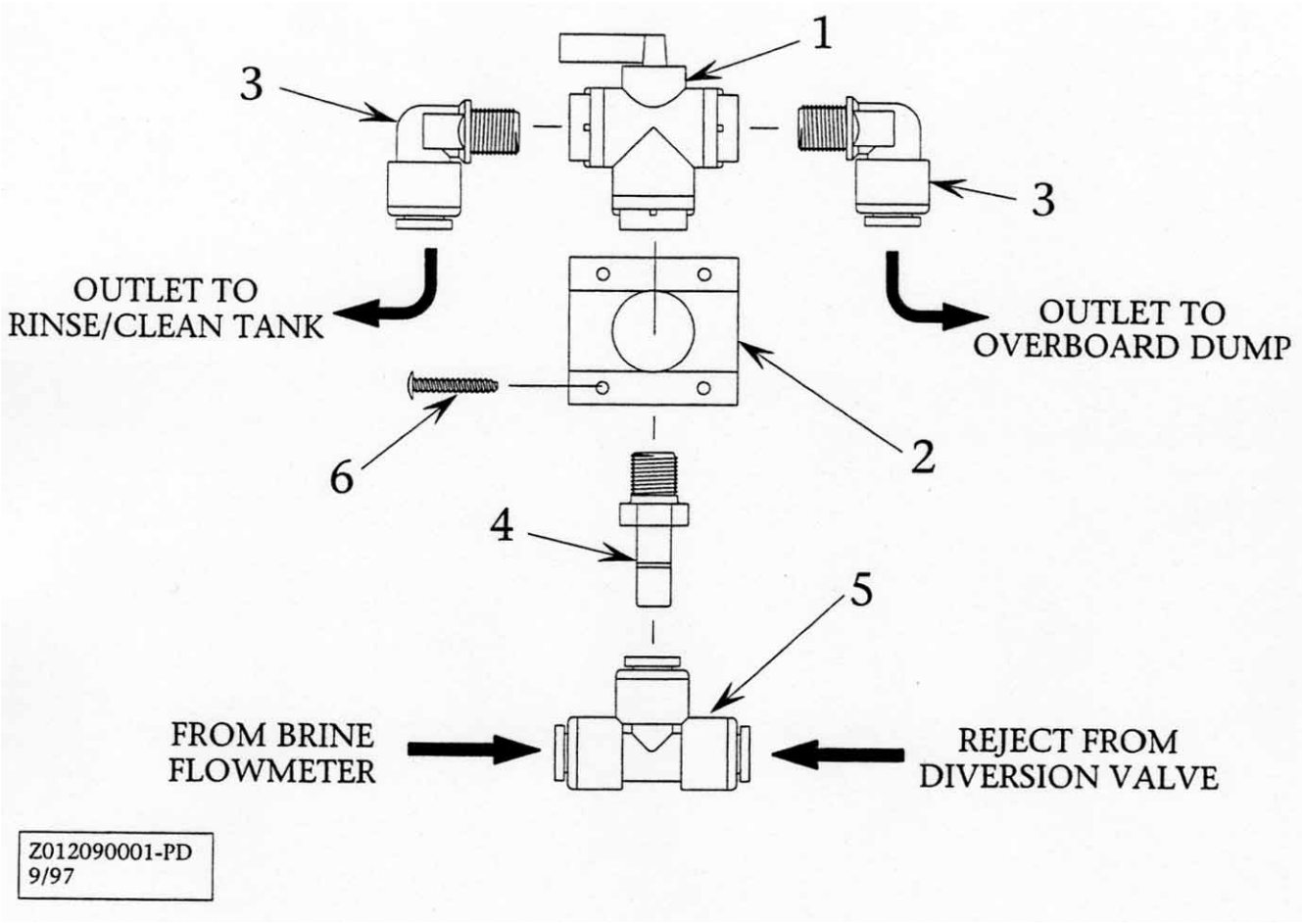


Z510090001 FLOWMETER ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-3	ZSIO090001	FLOWMETER .5gpm CRYSTAL SEA	1 EA
1	1104100100	FLOWMETER .5gpm CRYSTAL SEA	1 EA
2	0204711869	ELB90 3/8" TUB x 3/8" TEU –MG	2 EA
3	2614014300	O-RING INLET.5gpm FLOWMETER	2 EA

CLEAN/RINSE OUTLET VALVE ASSEMBLY #23

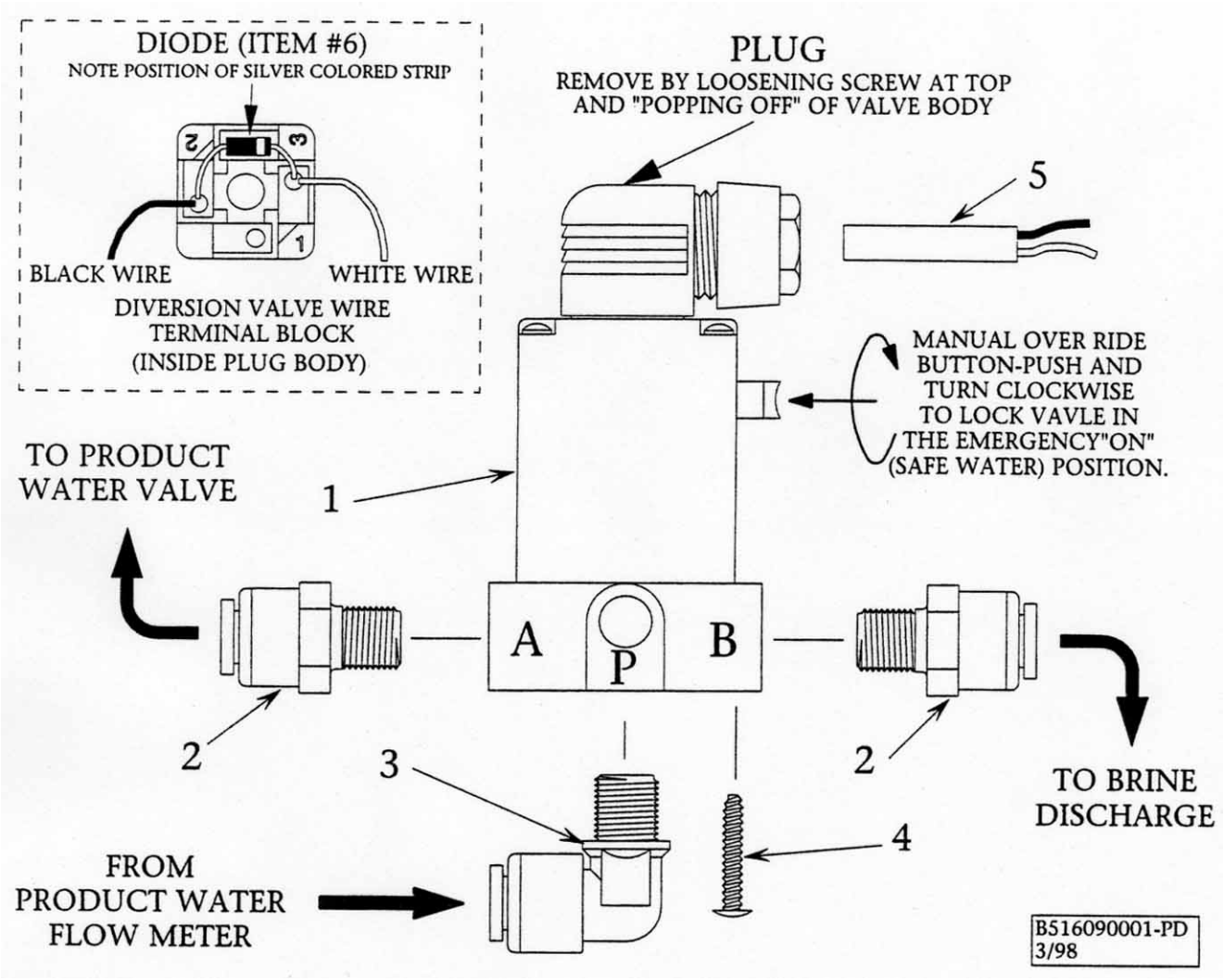
ASSEMBLY NO. Z012090001



Z012090001 CLEAN/RINSE OUTLET VALVE ASSEMBLY (Valve #23)

ITEM	PART NUMBER	DESCRIPTION	QTY
1-6	Z012090001	CLEAN/RINSE OUTLET VALVE ASSY (#23)	1 EA
1	14014006AR	VALVE 3 WAY BALL 1/4" Fr NEVER CLOSE	1 EA
2	0553200100	BRACKET 3 WAY BALL VALVE C/S	1 EA
3	0204591769	ELB90 3/8" TUBE x 1/4" MPT -MG	2 EA
4	0254581769	CONN 3/8" TUBE UNION x 1/4" MPT	1 EA
5	0204741869	TEE 3/8" TU x 3/8" TU x 3/8" TU -MG	1 EA
6	061162626012	SC PHIL TRUSS 8-32 x 3/4" S/S	2 EA

PRODUCT WATER DIVERSION VALVE (3-WAY VALVE) ASSEMBLY
ASSEMBLY NO. B516090001

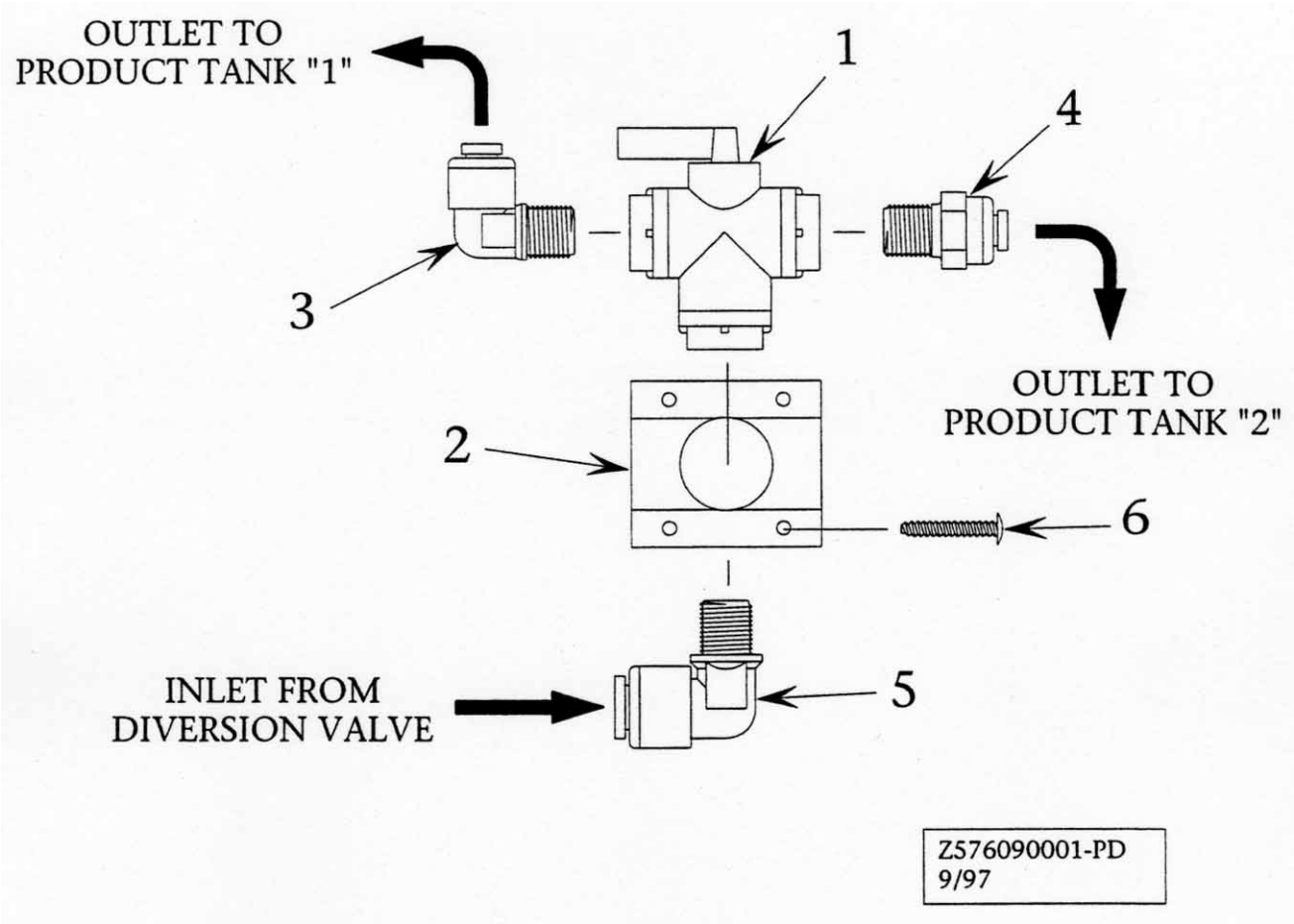


PLUMBING CONNECTIONS
"P" = INLET (COMMON)
"B" = NORMALLY OPEN -TO DISCHARGE (BAD WATER)
"A" = NORMALLY CLOSED -TO CHARCOAL FILTER INLET (GOOD WATER)

B516090001 DIVERSION VALVE ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1~6	B516090001	DIVERSION VALVE ASSEMBLY C/S	1 EA
1	1401095998	VALVE SOLENOID 12VDC –AS	1 EA
2	0204590969	CONN 3/8" TUBE x 1/4" MPT –MG	2 EA
3	0204591769	ELB90 3/8" TUBE x 1/4" MPT –MG	1 EA
4	061172623008	SC PHIL TRUSS #8 x 1/2" TYPE "B"	4 EA
5	4942120720	WIRE 20/2 BRAIDED SHEILDED WHITE	2 FEET
6	3131260500	DIODE 1N4007	1 EA

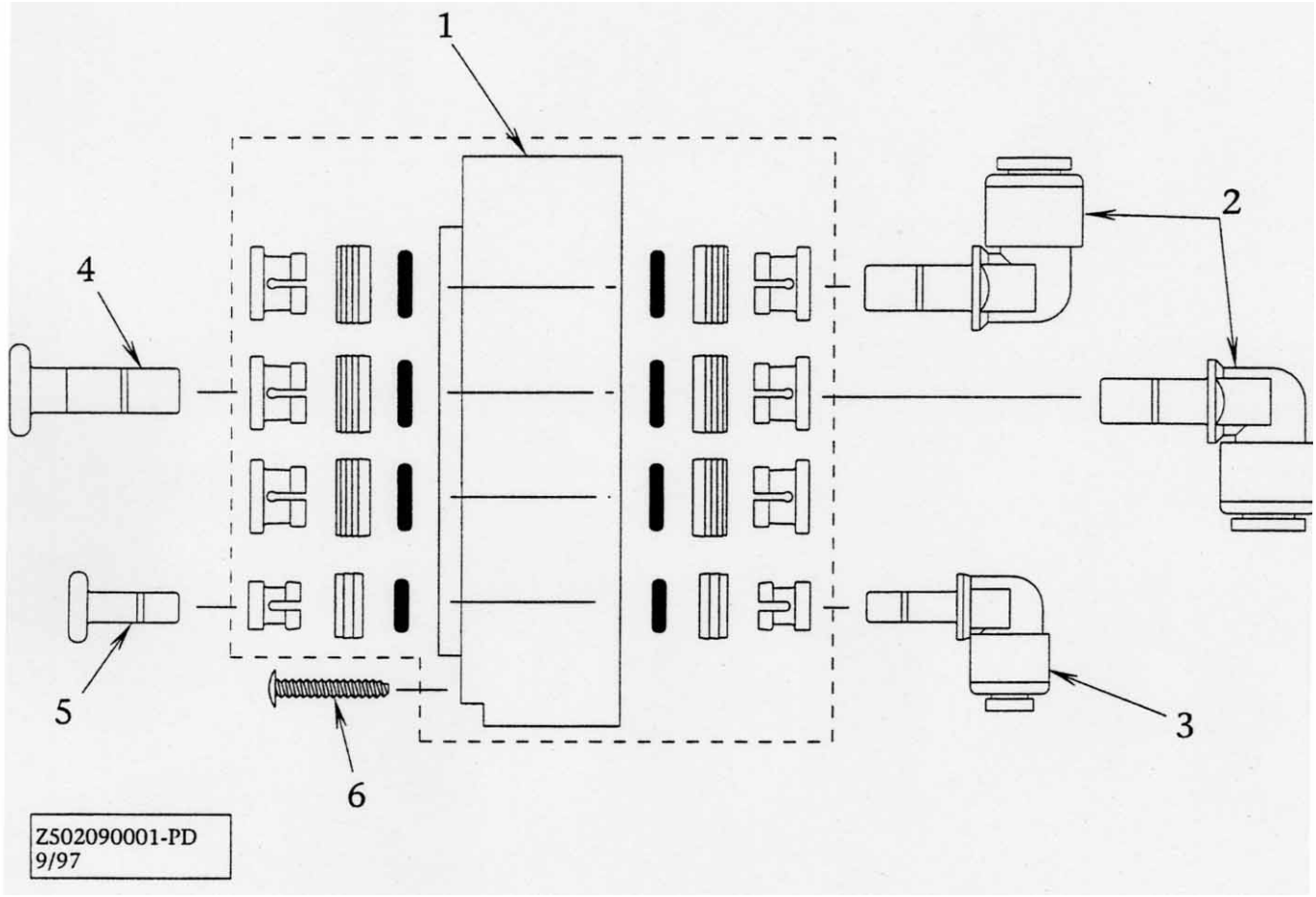
TEST TAP / 2nd TANK VALVE ASSEMBLY #37
ASSEMBLY NO. Z576090001



Z576090001 TEST TAP/2nd TANK VALVE ASSEMBLY (Valve #37)

ITEM	PART NUMBER	DESCRIPTION	QTY
1-6	Z576090001	TEST TAP/2ND TANK VALVE ASSY (#37)	1 EA
1	14014006AR	VALVE 3 WAY BALL 1/4" Fr NEVER CLOSE	1 EA
2	0553200100	BRACKET 3 WAY BALL VALVE C/S	1 EA
3	0204520869	ELB90 1/4" TUBE x 1/4" MPT -MG	1 EA
4	0204590869	CONN 1/4" TUBE x 1/4" MPT -MG	1 EA
5	0204021869	ELB90 3/8" TUBE x 1/4" MPT -MG	1 EA
6	061162626012	SC PHIL TRUSS 8-32 x 3/4" S/S	1 EA

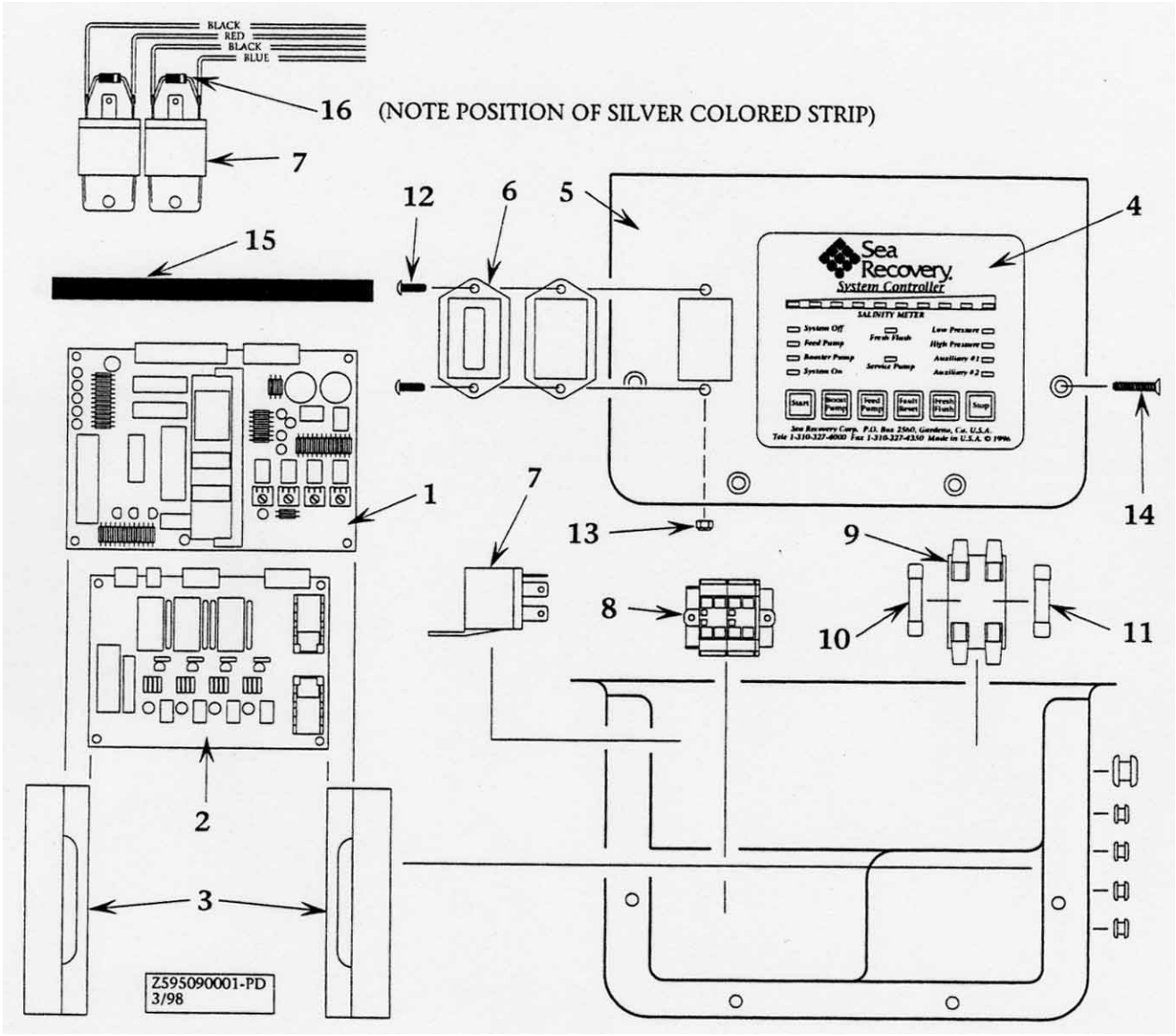
IN & OUT MANIFOLD ASSEMBLY
ASSEMBLY NO. Z502090001



Z502090001 MANIFOLD IN/OUT ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-6	Z502090001	MANIFOLD IN/OUT ASSEMBLY C/S	1 EA
1	5325300200	MANIFOLD IN/OUT TUBE C/S	1 EA
2	0204711869	ELB90 3/8" TUBE x 3/8" TEU -MG	3 EA
3	0204710869	ELB90 1/4" TUBE x 1/4" TEU -MG	2 EA
4	0204991869	PLUG INSERT (A6TPL) 3/8"	4 EA
5	0204990869	PLUG INSERT (A4TPL) 1/4"	2 EA
6	061162626012	SC PHIL TRUSS 8-32 x 3/4" S/S	4 EA

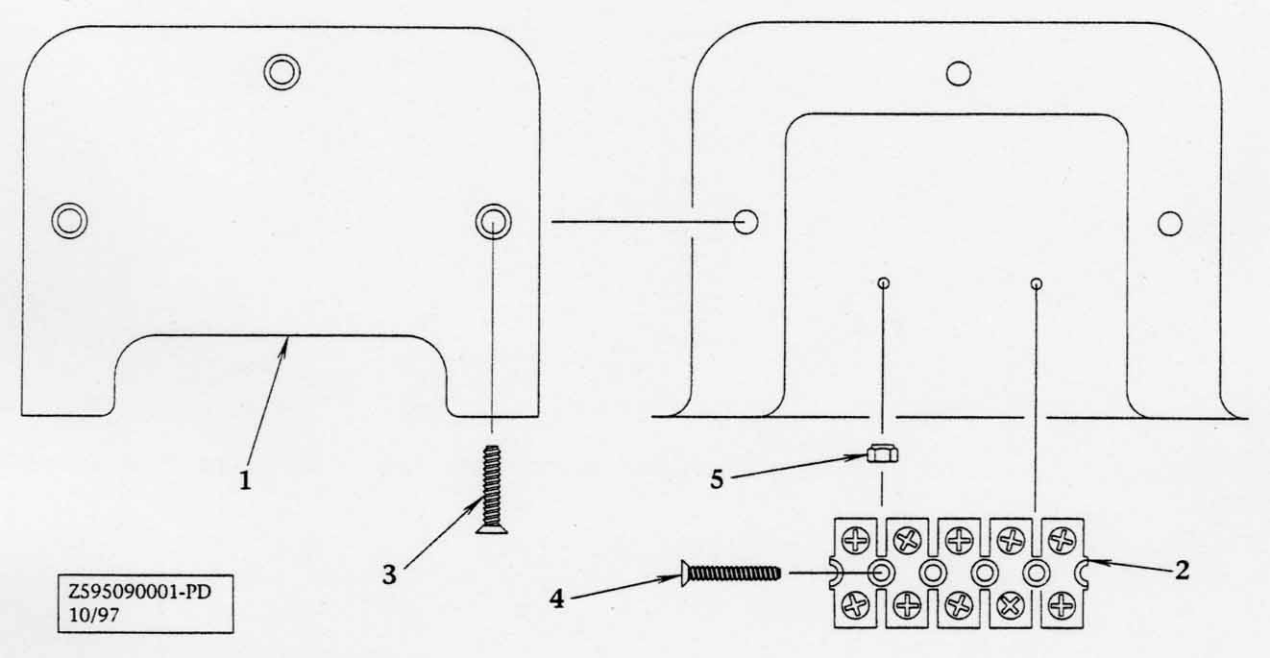
ELECTRONIC CONTROLLER ASSEMBLY
ASSEMBLY NO. Z595090001



Z595090001 ELECTRONIC CONTROLLER ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-16	Z595090001	ELECTRONIC CONTROLLER ASSEMBLY	1 EA
1	B596800003	PCB MAIN C/S COMPUTER CIRCUIT ASSY	1 EA
2	B597800004	PCB LED 4 RELAY ASSEMBLY C/S	1 EA
3	2001042200	BRACKETS PCB/LED MOUNTING	2 EA
4	31315601CJ	TOUCH PAD MAIN	1 EA
5	43070102CP	FACE PLATE C/S (FRONT)	1 EA
6	31311805CG	HOUR METER 9-60VDC/20-75VAC	1 EA
7	3131110600	RELAY 1 FORM A (lPST-N.O.) 12V	2 EA
8	3131155xCW	TERMINAL BLOCK 4 CONDUCTOR	1 EA
9	3131310100	FUSE BLOCK DOUBLE (2 FUSE)	1 EA
10	3131300800	FUSE 3 AMP SLOW BLOW	1 EA
il	3131300900	FUSE 1 AMP FAST BLOW	1 EA
12	061160620012	SC PHIL PAN 6-32 x 3/4" S/S	1 EA
13	065070020000	NUT LOCKING 6-32 NYLON	2 EA
14	061161626012	SC PHIL FLAT 8-32 x 3/4" S/S	8 EA
15	2632180500	GASKET ADHESIVE STRIP	3 FEET
16	3131260500	DIODE 1N4007	2 EA

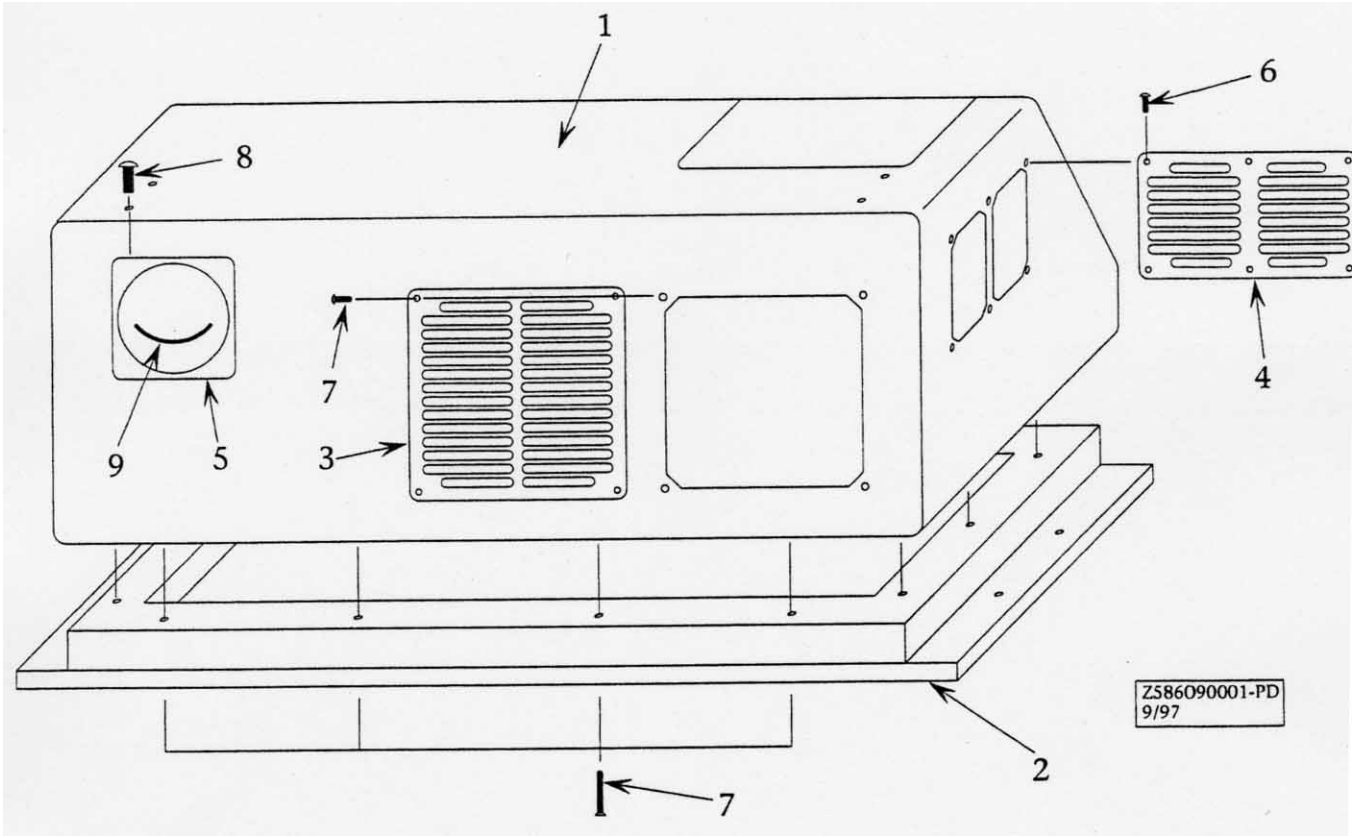
ELECTRICAL TERMINAL ASSEMBLY
ASSEMBLY NO. Z595090001



Z595090001 ELECTRICAL TERMINAL ASSEMBLY (CON'T)

ITEM	PART NUMBER	DESCRIPTION	QTY
1-5	Z595090001-1	POWER TERMINAL ASSY C/S	1 EA
1	43070105CP	FACE PLATE TERMINAL STRIP C/S	1 EA
2	3131155500	TERMINAL BLOCK 5 CONDUCTOR	3 EA
3	061161626012	SC PHIL FLAT 8-32 x 3/4" S/S	3 EA
4	061160620012	SC PHIL PAN 6-32 x 3/4" S/S	4 EA
5	065070020000	NUT LOCKING 6-32 NYLON	4 EA

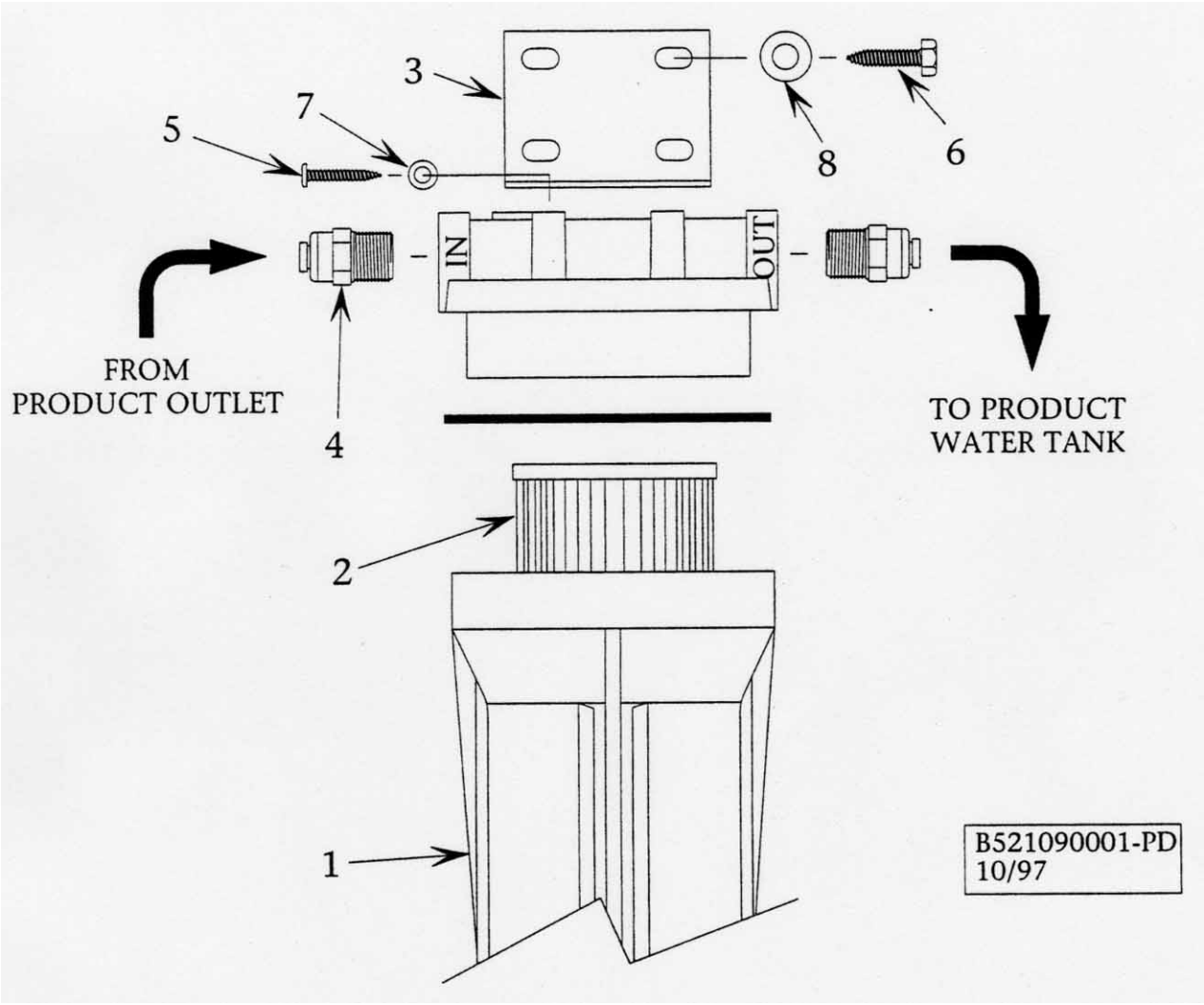
ENCLOSURE ASSEMBLY
ASSEMBLY NO. Z586090001



Z586090001 ENCLOSURE ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-9	Z586090001	ENCLOSURE ASSEMBLY CRYSTAL SEA	1 EA
1	31082210CL	ENCLOSURE 12/24V CRYSTAL SEA	1 EA
2	20600322010	BASE MOUNTING PLATE C/S W/ SPACER	1 EA
3	20200520010	VENT CRYSTAL SEA/AQUA CUBE 6" x 6"	1 EA
4	20200522010	VENT CRYSTAL SEA 3" x 6"	2 EA
5	0520050400	BRACKET MEMBRANE VESSEL C/S	2 EA
6	061162626006	SC PHIL TRUSS 8-32 x 3/8" S/S	14 EA
7	0611616260028	SC PHIL FLAT 8-32 x 1 3/4" S/S	13 EA
8	061142645012	SC PHIL TRUSS 1/4-20 x 3/4" S/S	4 EA
9	2632180526	DECOFELT 1/16" x 1" BLACK ADHESIVE	6 FEET

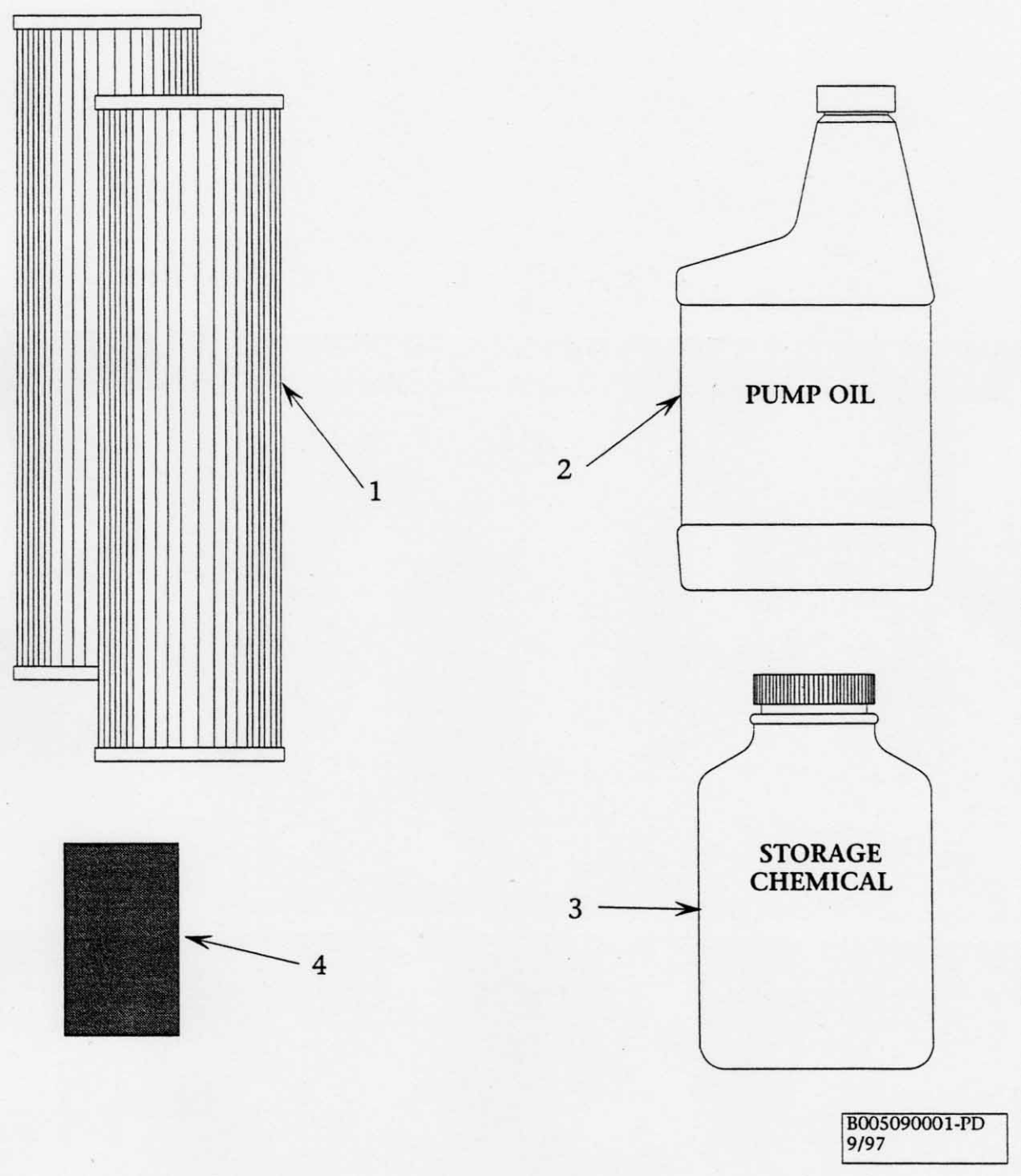
CARBON FILTER ASSEMBLY - CS
ASSEMBLY NO. B521090001



B521090001 CARBON FILTER ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-8	B521090001	CARBON FILTER CRYSTAL SEA	1 EA
1	0713020573	FILTER HOUSING w/LID 3/8" x 10"	1 EA
2	0803004773	ELEMENT CHARCOAL 10"	1 EA
3	20200402100	BRACKET PREFILTER/CHRCL/PLNKTN	1 EA
4	0254590969	CONN 1/4" TUBE x 3/8" MPT -MG	2 EA
5	061170628016	SC PHIL PAN "A" 10 x 1" S/S	2 EA
6	061172143016	SC HEX "A" 1/4" x 1" S/S	2 EA
7	065080028000	WASHER FLAT #10 NYLON	2 EA
8	061100043000	WASHER FLAT 1/4" S/S	2 EA

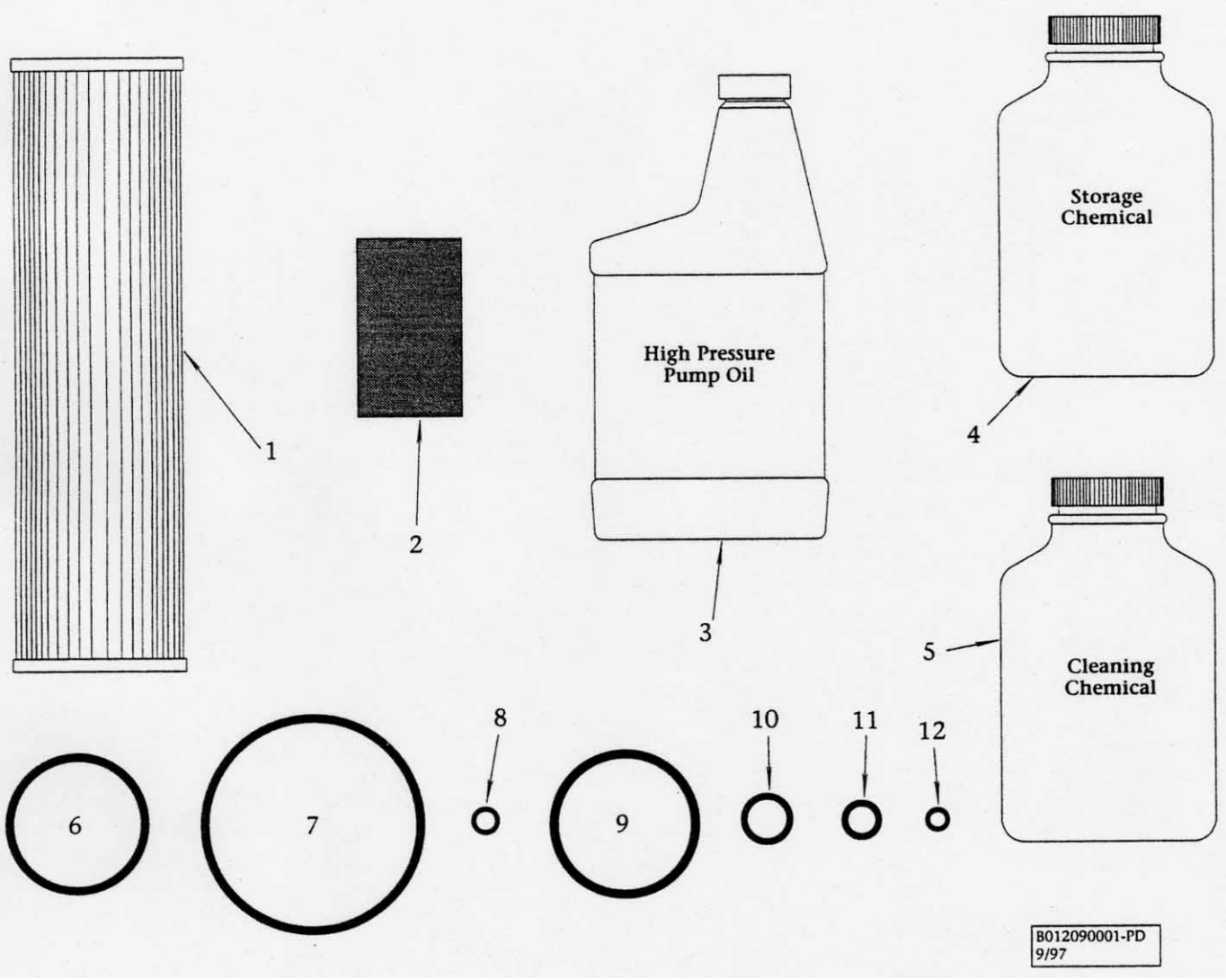
STARTER KIT ASSEMBLY
ASSEMBLY NO. B005090001



B005090001 STARTER KIT ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1~4	B005090001	STARTER KIT C/S	1 EA
1	0801060157	ELEMENT PREFILTER 10/05	2 EA
2	B647800003	PUMP OIL 16oz	1 EA
3	B645800003	STORAGE CHEMICAL	1 EA
4	0804743278	MESH SCREEN STRAINER 3/8"	1 EA

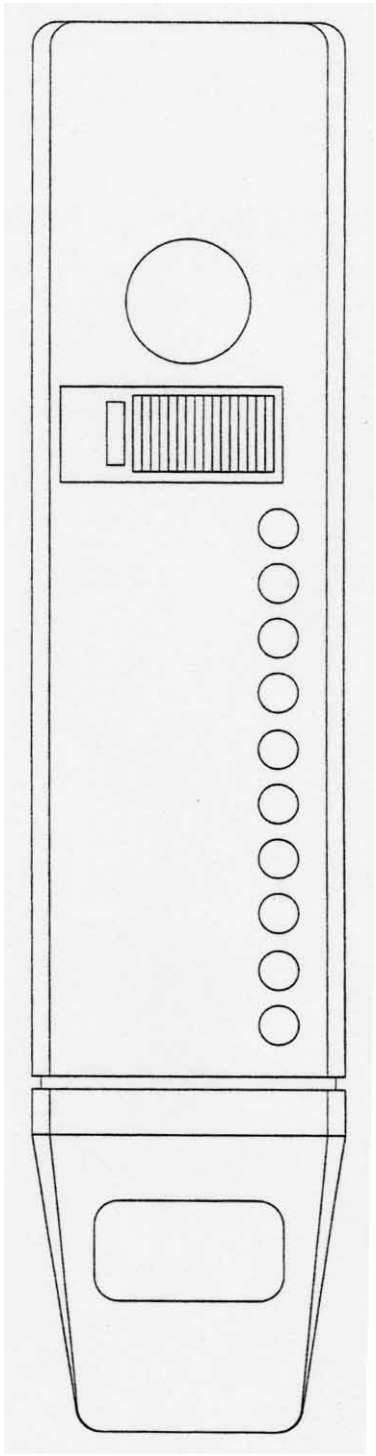
CRUSING KIT ASSEMBLY
ASSEMBLY NO. B012090001



B012090001 CRUISING KIT ASSEMBLY

ITEM	PART NUMBER	DESCRIPTION	QTY
1-12	B012090001	CRUISING KIT CRYSTAL SEA	1 EA
1	0801060157	ELEMENT PREFILTER 10/05	12 EA
2	0804743278	MESH SCREEN STRAINER 3/8"	1 EA
3	B647800003	PUMP OIL 16oz	1 EA
4	B645800003	STORAGE CHEMICAL	1 EA
5	B645800001	MCC-1 ALKALINE CLEANER	1 EA
6	2614100278	O-RING SEA STRAINER 3/8"	2 EA
7	2614010473	O-RING BLUE HOUSING	2 EA
8	2614015800	O-RING GAUGE/PRESSURE SWITCH C/S	4 EA
9	2614010200	O-RING BRINE 2 1/2" END PLUG	2 EA
10	2614017200	O-RING PRODUCT CRYSTAL SEA	2 EA
il	261401XXXX	O-RING B.P.R./SALINITY PROBE C/S	4 EA
12	2614014300	O-RING INLET.5gpm FLOWMETER	2 EA

POCKET DS METER
PART NUMBER SRC PDSM



SECTION "M"

CONVERSION CHARTS

NOTES:

MICRON / INCH / MESH
COMPARISON MEASUREMENTS

MICRON	INCH	INCH	MESH (opening)
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

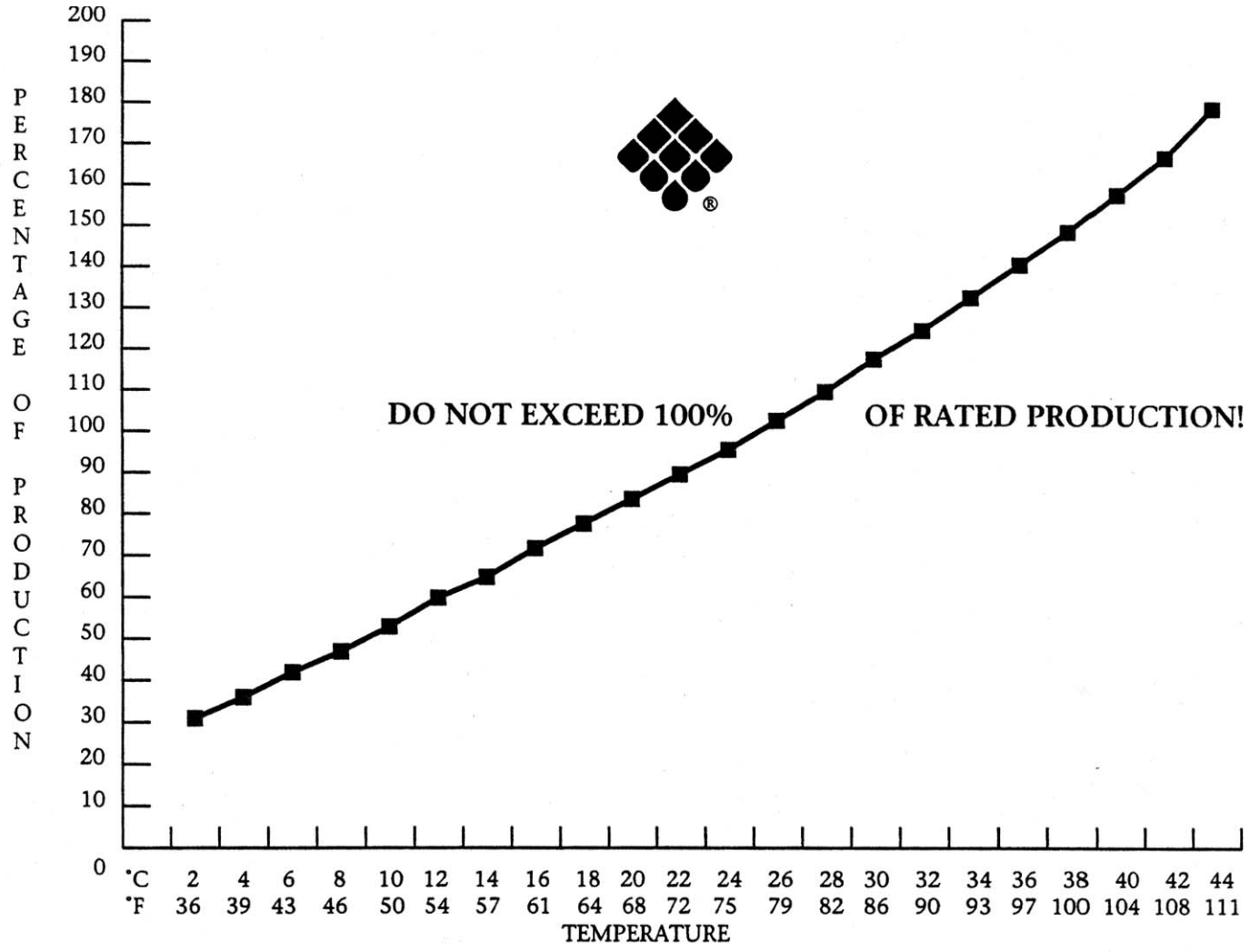
(At 820 psi & 35,000 ppm TDS NaCI feed water conditions)

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 pet day by multiplying the gallon pet hour product water flow meter reading by 24.
6) Divide the figure reached in step 5 above, present gallon pet 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 170 gallon per day model and it is presently producing 110 gallons per day.
5) 110 gallons per day divided by.72 equals 152 gallons pet day calculated productivity. The system is rated at 170 gallons pet day ±15% (144 to 200 gallons pet day). Therefore, the system is within specifications at 110 gallons pet day actual productivity at 61° F/16° C, 820 psi and 35,000 ppm feed.



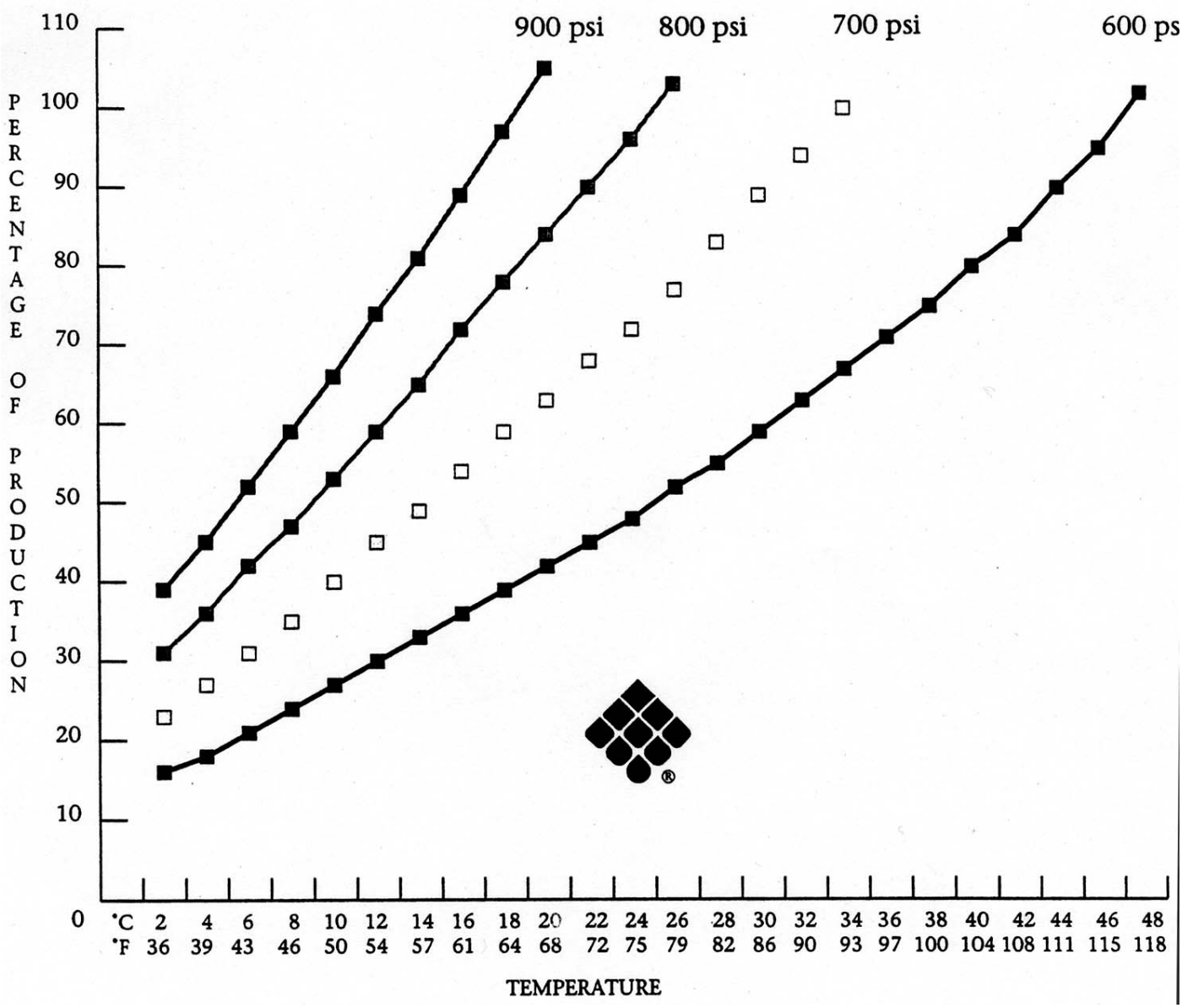
Sea Recovery.

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!



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.	RESISTANCE MHOS	RESISTANCE OHMS	* P.P.M.
.0385	26,000,000	NONE	250.0	4,000	125
0.0556	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**

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 (20001b)	x	907.18	kilograms (kg)	x	0.001102	tons
tons (20001b)	x	0.90718	metric tons(t)	x	1.1023	tons