HC MODELS

USERS MANUAL

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I. SK Watermakers Introduction

CONGRATULATIONS, YOU HAVE JUST PURCHASED THE MOST TROUBLE-FREE, ECONOMICAL MARINE DESALINATOR AVAILABLE!!!

All of our units are manufactured using the highest quality components and utilizing the latest technologies available in the industry today. SK's innovative engineering has changed the conception of marine desalinators from an expensive, maintenance prone product of choice, to an affordable and reliable necessity for all types of watercraft.

We understand the importance of each and every watermaker. We manufacture and design all of our units to be simple, reliable, and easy to maintain. We currently have desalinators operating in extreme conditions form the freezing arctic waters of Antarctica to the warm humid climates of the Amazon.

SK Watermakers line of Marine Desalinators are reliable and easy to install but the greatest advantage of purchasing a unit from us is affordability

II. General Product Specifications

DESCRIPTION

Membrane Housing	Fiberglass/aluminum (Lifetime Warranty)
Membranes	Thin composite R.O. membranes

TEST CONDITIONS

Temperature	78° F (25° C)
Operating Pressure	800 PSI. 900 PSI Max
Feed Water Quality	32,000 PPM Total Dissolved Solids (32.0K mg/L)
Salt Rejection Performance	99.2% Rejection NaC1 (Typical)

AMPERAGE

DB/HC/SC 200-600	1 1/2 HP Motor	115v @ 15 amps	230v @ 8.0 amps
DB/HC/SC 600	2 HP Motor	115v @ 20 amps	230v @ 11.0 amps
DC 150	12V HP Motor	21-24 amps	(24V available)

Note: (Larger units will vary with capacity)

WATER PRODUCTION CAPABILITIES

MODEL	GPD	GPH
DC 150	**150**	**5 - 7**
DB/HC/SC 200	**200**	**7 - 9**
DB/HC/SC 400	**400**	**15 - 18**
DB/HC 500	**500**	**18 - 22**
DB/HC/SC 600	**600**	**24 - 28**
DB/HC/SC 800	**800**	**30- 36**
DB/HC/SC 1000	**1000**	**32 - 42**
DB/HC/SC 1200	**1200**	**39-50**
DB/HC/SC 1500	**1500**	**48-63**
DB/HC/SC 2000	**2000**	**70-85**

III. Installation Instructions of Panel Mount Units

Primary Equipment Positioning

Locate the best position for your primary equipment (prefilter pump, prefilter high pressure pump, membrane, and control housing). The high pressure pump, membrane(s) and control housing should be close to each other, the module with the membrane and housing can be anywhere in between as in a series. Of course, the configuration can be any combination you wish; keeping in mind that the high-pressure hose size is designed for about 15 ft. total and a much longer length would require a larger hose at more expense. Hoses can be built to owner's specifications if desired.

Determine the Saltwater Feed Source

If the saltwater feed source is to be a thru hull, we recommend that it be dedicated to only the desalinator to forego any problems that may be created by 2 devices on the same thru hull, such as a negative pressure or air entering the system, although salt water wash down, toilet pickups are acceptable The thru hull should be as close to the keel as possible, especially with sailboats so air will not be a problem when heeling over. The area immediately forward of the thru hull should be free of any protrudances on the hull (such as pickups or transducers) for a distance of at least 6 ft. (see diagram, page 5) and power should have a scoop.

NOTE: The positioning of the parts is critical; remember to keep the prefilter pump at or below the waterline if you do not have a pressurized water source. Keep loops out of intake to the prefilter pump; they can cause an air lock. The high-pressure pump and all the high pressure hoses should be securely mounted and strapped down to prevent any chaffing of hoses by vibration. Vibration dampeners are included in your installation kit. The membranes may be mounted in any position

Wiring

After all components are mounted, wire the power feed, high pressure pump and the feed water pump to the junction box. (wire the optional auto flush at this time if provided) To do this you have to simply remove 4 screws from the junction box. The terminals will be marked and identified in the electrical schematic. Run stranded wire to junction box from breaker panel. Use #12 for 1-1/2 HP and #10 for 2-3 HP. Use the next size gauge wire over 30 ft. The wire should be fused at 20 amps for #12 and 30 amps for #10 wire, #14 and #12 wire can be used with 220V units. Replace cover and proceed with the next step.

III. Installation Instructions of Panel Mount (cont.)

Run Hoses

We suggest you run 3/4" clear braid beverage hose from the intake to the pumps and filters and secure. The cleaning valve assembly will require some thought for proper placement and neat installation.

NOTE: The RO membrane will fare much better if they are situated in the coolest section of the engine room as you can manage to fend off biological growth.

Check Connections

- Check all hose connections for tightness and seaworthiness
- Make sure all hose clamps are securely tightened. (Failure to do so will allow air into the system. The suction side of prefilter pump is key area of concern.)
- Open the thru hull seacock valve to feed the system with seawater.
- You are now ready to go to the start-up

Initial Start-Up

Fill prefilter with clean saltwater, back off the high pressure all the way counter-clockwise, press start switch and observe the clear braid hose for water flow. The raw water should start flowing within a minute and build up pressure on the prefilter pressure gauge on your control panel, do not run for more than 30 seconds without flow. If no water is moving in the system, check for an air leak in the low pressure hose fittings (with a prefilter pump this is generally not a problem). You may have to keep the start button pressed for a short time as there is a low pressure safety switch in your control; this activates after 2 PSI and deactivates the system below 2 PSI. After a couple of minutes and the water is flowing clear with no bubbles observed, slowly turn the high pressure valve clockwise to 800 PSI. The adjustable automatic regulator has been preset to approximately 850 PSI at the factory. We suggest you do not increase this for long life of your system, but it will operate up to 900 PSI without a problem. **Status Lights**: In normal operation after starting, the yellow led in the center of the logo will come on until the TDS (total dissolved solids) drops below the set point on the TDS controller. This is preset at the factory for approx. 700 PPM (parts per million), (the suggested, max by the World Health Organization is 800 PPM). At this time water will be rejected to the overboard automatically, although the sample valve and flow gauge will be operational at all times if needed for test purposes. The product water can also be manually diverted with the sample valve.

III. Installation Instructions of Panel Mount (cont.)

After the aforementioned delay, water will be diverted to tank and the: **Product water to tank** green led light will come on. Now the RO will be in normal operational mode**.** Be sure to turn the sample valve to sample and let the product water run overboard for 1 hour to rinse out any preservative on start-up or after pickling. This only has to be done when the unit has been pickled, then turn sample valve handle to TANK and enjoy a drink of pure water.

IV. Operating Instructions

Normal Startup

- Turn high-pressure control valve counterclockwise to fully open position
- Turn power switch to **RO ON** position, observing normal operation
- Check for leaks. Make sure water is flowing
- If water is not flowing after 1 minute stop here, shut down the system and **TROUBLE-SHOOT**

Manual Water Quality Check

- Let system run for 30 minutes
- Sample water and use the handheld salinity provided to test water quality.

Operation in Brackish or Fresh Water

Seawater normally has about 32000 – 35000 parts per million of salt in the Atlantic and the normal operating pressure should be at 800 – 850 PSI. However, as the salinity drops in brackish water, less pressure will be required for normal production. Do no exceed your unit's rated capacity of product water output. Use your flow gauge to determine operating pressure. For instance, totally fresh & brackish water will require approximately only 100 to 300 PSI for rated production. Water in higher salinity areas such as the Middle East will have to operate at higher pressure (950 PSI) to achieve drinkable water and high production

The system is filled with preservative solution. Salinity (TDS) will improve after a short period of operation. When in operation it is advisable to start up with no pressure for a few seconds. When stopping the RO unit, the pressure should be turned down first. The above steps are not necessary, but will help increase the life of the unit.

WARNING!!

It is advisable not to use an RO unit in a highly polluted or silted harbor. If it is necessary, carefully monitor the prefilter. The pump should be shut down when low pressure gauge reads 2 PSI minimum

V. Water Quality

The water quality produced by the RO unit upon starting will be low due to the normal osmotic pressure (salt tends to diffuse into fresh sea level). Under normal everyday use drinkable water would become available in a very short time (usually under a minute). If the unit sits without use for an abnormal period, the time required to produce acceptable water will increase. Flushing after use will decrease this time.

Low Water Quality Symptoms Causes

- Time between use (every day use would be best)
- Temperature (hot climates and engine rooms tend to increase bacterial activity)
- Seawater quality
- Salinity

Low Water Quality Symptoms Reduction

- Use every day
- Locate the membrane in a cooler area
- Fresh or permeate water flush
- Preserving (pickling the membrane)

Depending on the model you purchased, your unit will be provided with an electronic tester (handheld or built in). The built in models will read directly in T.D.S. (total dissolved solids) which will be salt content in parts per million. The hand held meter will also read directly in T.D.S.

The world health organization recommends approximately 800 PPM as a limit, but if your unit has increased to 600 or higher, we recommend you clean or replace your membrane. Also for an accurate reading, let the RO unit run for 10-15 minutes before sampling.

VI. Maintenance and Cleaning

Short Duration Shut Down Procedure-(less than 2 weeks)

*If you purchased fresh **water flush** with system see section on fresh water flush operation instead of this section*

- Connect a 3/8" hose to sample port
- Stick the other end of the hose in a 5 gallon bucket
- Turn on RO unit
- Turn sample valve to sample position and fill bucket with RO product water
- Stop RO unit
- Connect 3/4" hose to clean/flush port on pickling valves
- Stick the other end of the 3/4" hose into 5 gallon bucket of water
- Turn high-pressure control valve counter-clockwise to fully open position
- Turn the 3/4" 3-way valve handle toward clean/flush port
- Turn RO on
- Run system until almost all of the water has been sucked out of the 5 gallon bucket
- Shut system off!!

WARNING!!!

DO NOT LET THE PUMP SUCK AIR-LEAVE SOME WATER IN BUCKET

Do not use water from on board tanks. Chlorine may have been used in the tanks. Chlorine will permanently damage the RO membranes.

Long Duration Shut Down Procedure - (more than 2 weeks)

1.) Collect (2) 5 gallon containers of RO water if unit does not have a flush, only (1) is needed if it has a flush. This water can also be pure fresh water with no chlorine or ozone.
2.) Turn high pressure control all the way counterclockwise (lowest pressure) and place sample valve in sample position and flush for 10 minutes if unit has a flush.
3.) If unit does not have a flush system: (a) turn intake valve on left to pickling position. (No. 2) Leave valve on right in normal overboard position. (b) Place short hoses on pickling valves long enough to reach bottom of 5 gallon container. Place 3/4" or left hose in the container, turn RO on until water is almost empty (do not run dry), this will flush most of the seawater from the system.
4.) Now place the right-hand valve in the pickling position, both valves should have the arrow pointing towards the center. (See diagram on P.14) Pour the container of pickling material in the 5 gallon bucket of water previously made in step 1. Make sure high pressure valve is turned all the way down and start RO; the pickling solution will then be drawn into the system and back out the reject valve to the bucket, circulating in a closed loop. Run for approximately for 30 minutes.
5.) Turn valves back to the original position.

VI. Maintenance and Cleaning (cont.)

Long Duration Shut Down Procedure - (more than 2 weeks) - (cont.)

6.) Stop RO unit
7.) When resuming normal operation turn sample valve to sample position.
8.) Start system and let it run for 30 minutes
9.) Check product water with the salinity meter provided. If within operation limits you can now send product water back to tank

Pump Maintenance

Change pump seals on Cat Pumps after 2000 hours of use or if leak noticed. Failure to do so will void warranty.

Profilers

Observe prefilter gauge pressure. This will give you a good indication of your prefilter condition. If pressure falls below 5 PSI it time to change your prefilter and clean intake strainer (plankton filter-if one is in line).

Control Housing

Check fittings for leaks, clean housing with plain soap and water. Check high-pressure pump for leaks at fittings.

Salinity Controller

Check product water from time to time with handheld meter or taste test. If salinity reading is high on monitor, but tests low with a handheld, try cleaning probe located on rear of control panel.

Membrane

If production falls and TDS goes above 700 PPM the membrane may need to be cleaned. If production does not come up after cleaning, repeat procedure. If the cleaning procedure is not successful, the membrane will need to be replaced.

Membrane Cleaning Procedure

Follow the Long Duration Shut Down Procedure detailed previously but instead of using 1/3 lb. preservative, dissolve 1/3 lb. Alkaline Membrane Cleaner into your 5 gallons of water. Cleaner should be at 95 to 100 degrees for proper cleaning.
Discard contents of container and change cleaning valves to normal position and run for 30 minutes at lowest pressure. (High pressure regulator turned all the way counterclockwise). Return to normal operating pressure and discard product water for 30 minutes.

WARNING!!!

Use of any cleaning, pickling cartridges, or chemicals not specifically recommended by SK will void your warranty on ALL SK Watermakers equipment.

VII. Trouble-Shooting Guide

CONDITION	CAUSES	REMEDY
Low pressure reading on prefilter gauge	Clogged water inlet	Check for stoppage
	Stopped up or kinked hose from inlet	Remove debris or replace hose
	Dirty prefilter or strainer	Clean strainer or change filters
High pressure gauge will not come up to 800 PSI	No intake water	Check prefilter and vacuum gauge, check intake, replace filters if necessary
HP pump runs rough	Air in inlet plumbing	Tighten connections Check for proper location of inlet thru hull
	Restrictions in inlet plumbing	Check for kinks or dirty prefilters
	Defective valve or seals in HP pump	Repair or replace pump
Low product water	Fouled or worn RO membrane	Clean or replace RO membrane
Higher product water flow	Failed RO membrane	Replace membrane
	Using RO unit in fresh or brackish water with pressure set too high	Lower pressure

VII. Trouble-Shooting Guide (cont.)

CONDITION	CAUSES	REMEDY
HP pump does not run	Defective electric motor	Repair or replace electric motor
	Defective breaker, switch or fuse	Replace breaker switch or fuse
Product water quality above 800 PPM	Fouled membrane	Clean or replace membrane
Unit will not run when start button is preset		Blown fuse worn Worn out breaker Short in wiring
Unit will run only when start button is pressed		Clogged filters or intake Defective low pressure switch (unlikely)
Unit shuts down after short time in operation		Air in system (can be caused by leak in plumbing or usually by operation in rough weather or high speed

VIII. Installation and Operation of Freshwater Flush *(Manual or Automatic)*

Installation of Manual Freshwater Flush

- Locate convenient location and install flush
- Run 3/8" hose or line to pressurized water from ship's freshwater system supply
- Run 3/8" hose from freshwater flush to 3/8" barb on prefilter (if installed by owner, run hose from flush to tee installed as shown in install diagram (see diagram 5)

Operation of Manual Freshwater Flush

- RO unit should be **OFF** while flushing
- High pressure valve on control should be in the open position (all the way counterclockwise)
- Turn blue handle on the fresh water flush so the handle is inline with the valve and let it flush for 5 to 10 minutes
- Close valve on fresh water flush filter - flushing is complete
- Flushing is very good insurance against membrane failure and will increase the life of your entire system
- Flushing may be done at any time after RO shutdown with a simple turn of the valve on the carbon filter
- A good practice would be to flush your RO after every use, if it is not to be used everyday

Operation of Automatic Freshwater Flush

1. Normal operation is initiated when the RO unit pressure is backed down to zero and red stop button is pressed after RO operation.

2. Fresh water then flows over the carbon block filter into the RO system and membrane. This will flush contaminates and bacteria from the membrane, pumps and controls.

3. The RO unit does not have to be running to operate the flush. For instance, if it is desirable to flush unit once a week while not in service, simply press the green start button then immediately push the red stop button or turn breaker off and flushing will start.

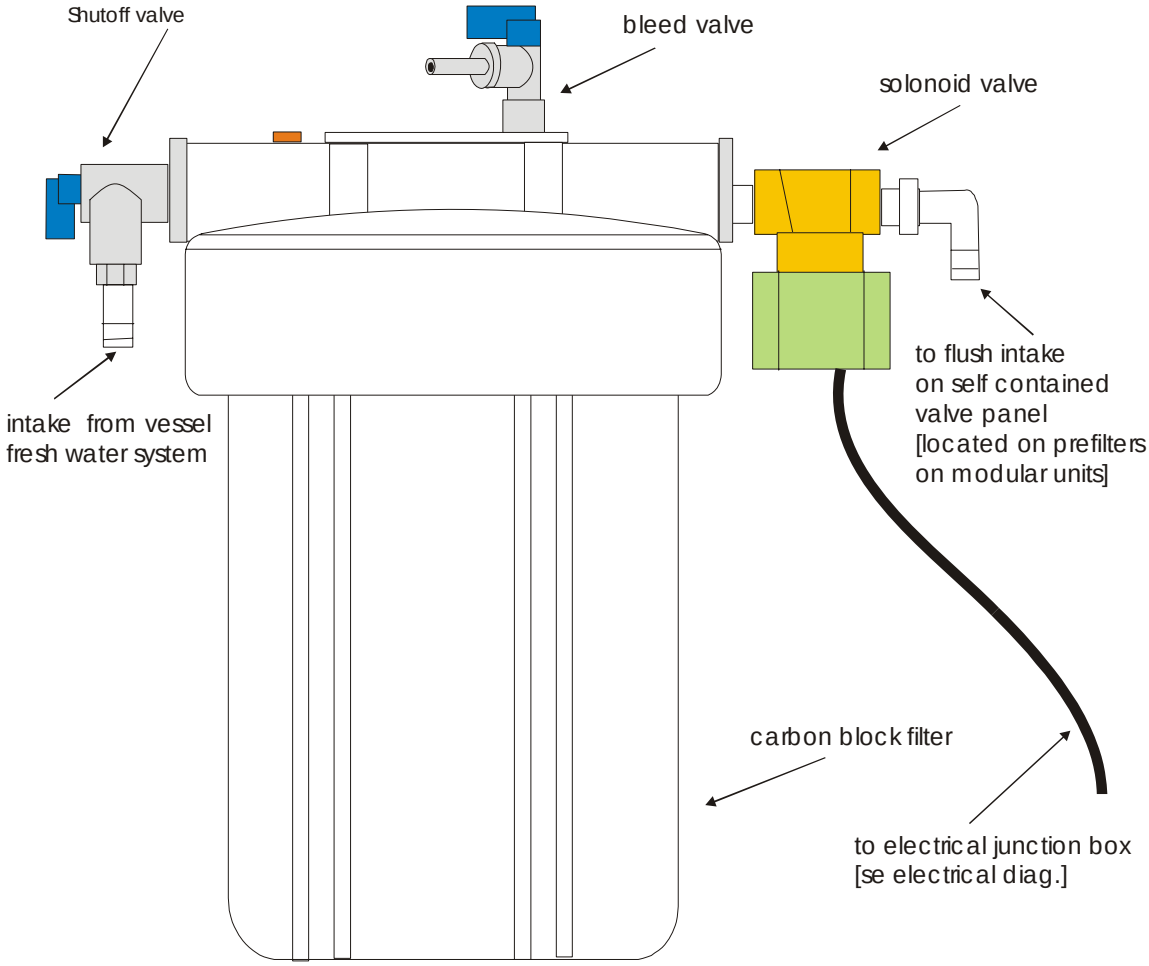
4. Flushing will take between 5 - 10 minutes. The carbon block filter should be changed every 6 months to a year.

5. After new carbon filter is installed, remove hose from output side of filter if a manual flush is used. If an auto flush is used, turn purge valve on top turn on flush to flush carbon fines from new cartridge. This should take only about 1 minute. Unit is now ready for operation. Freshwater flush is energized upon stopping unit. Push stop button firmly. Do not start and stop rapidly (cycle Unit). Do not start unit for 5 minutes after stopping. However, starting unit during the flush cycle will terminate the flush and not damage the unit.

The activated carbon filter must be changed at a maximum of 12 months regardless of use. Use a high quality filter as any chlorine will damage the RO membrane(s)

IX. Diagram of Automatic/Timed Flush

NOTE! When changing filters, turn off water, and open bleed valve to relieve pressure, turn water back on and bleed for 1 minute to clear any foreign material.



FRESH WATER AUTO / TIMED FLUSH

X. Installation of Engine Driven Units

Sizing the pulleys

The RPM of the pump cannot exceed 1700 Max. (1500 RPM is a good average speed) The pump is designed to pump adequate water at 1500 RPM. The pulley on the electric clutch is 7" in diameter, so if the pulley on the engine is 7" in diameter you will have a ratio of 1 to 1, consequently you develop the rated RPM of the pump at the same RPM of the engine (i.e. 1500 eng.=1500 pump RPM). However, some boats will cruise at a higher RPM and the drive will have to be adjusted accordingly.

For instance, a common cruising RPM for diesel motors is 1800 RPM, in this case a 6" pulley on the engine coupled so the 7" pulley on the pump will bring the pump speed at 1540 RPM approximately (6/7ths of engine RPM). If RPM falls, it will not damage the units, but will be reflected in a lower production of water.

SKW supplies oversize pumps for engine driven units for 2 reasons:

1. That the engine may drive the pump at a lower RPM for longer life.
2. If the intended RPM is extended, the pump will not be damaged by excessive crankshaft speed

Remember!!! DO NOT EXCEED 1750 RPM AT THE PUMP

XI. Tips for Operation of Marine Desalinators

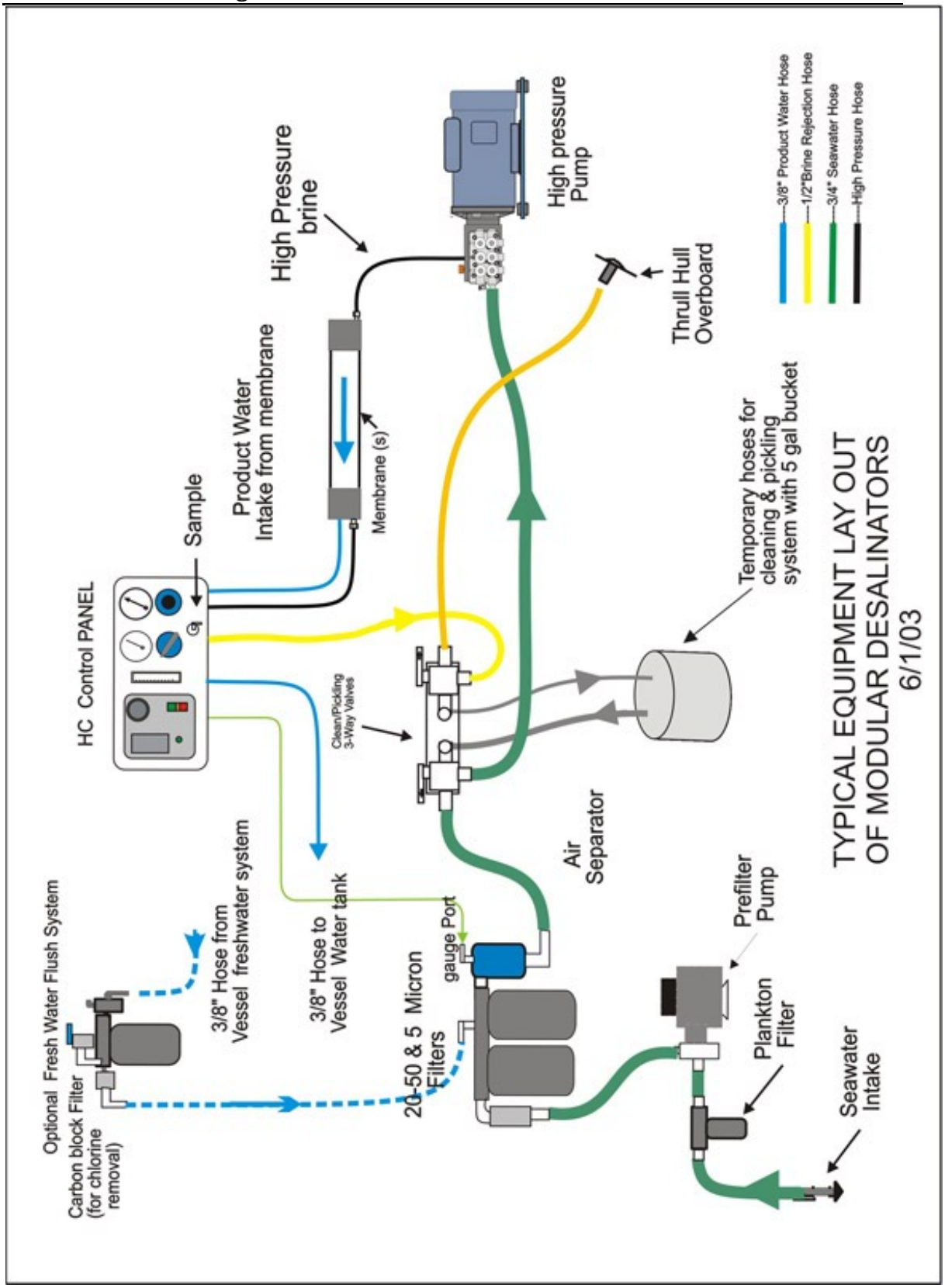
THE DO'S

- Lower pressure before stopping and starting
- Lower pressure in brackish water. (Stay within the GPH rating of the unit)
- Flush RO unit with fresh water whenever possible. **(NO CHLORINE)** A freshwater flush is available at a low cost
- Preserve RO membrane with pickling solution for long time storage. (up to 6 months)
- Monitor prefilters carefully for blockage. (a prefilter pump will extend their life many times)
- Change oil in high pressure pump. (check pump recommendations)
- Clean equipment with soap and water or alcohol. (no acetone)

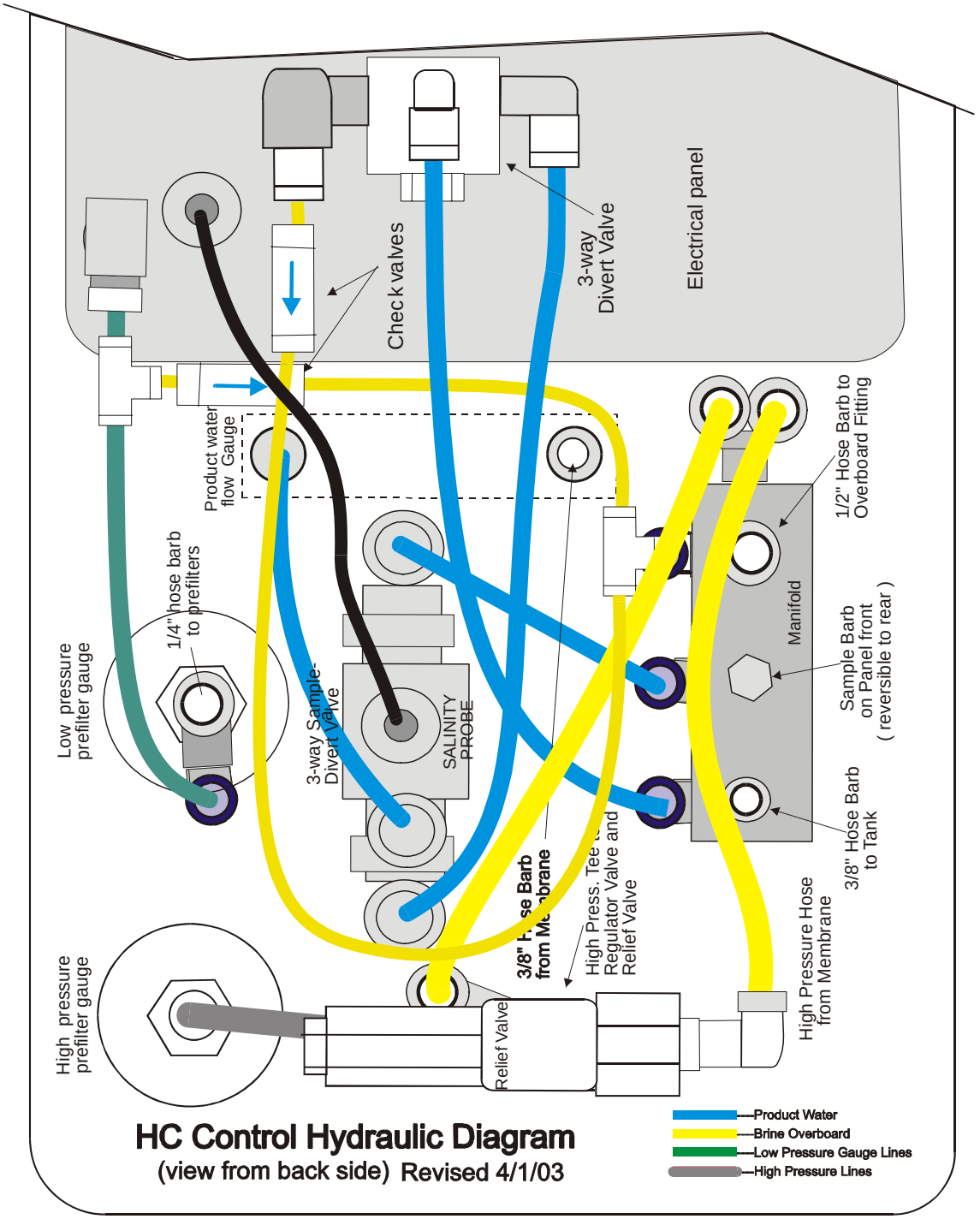
THE DON'TS

- Operate in very silty conditions, some silt is very fine and can bypass even a 5 micron filter. (this may scale membranes and require acid cleaning)
- Operate in any situation with oil in the seawater
- Let the RO membrane(s) dry out, they will be irreversibly damaged
- Share a thru hull with any other devices aboard. **(EXCEPTION!!** Saltwater wash down pump)
- Operate under low voltage conditions
- Operate in choppy or at high speed. (unit will automatically shut down when a large block of air reaches the prefilter pump)

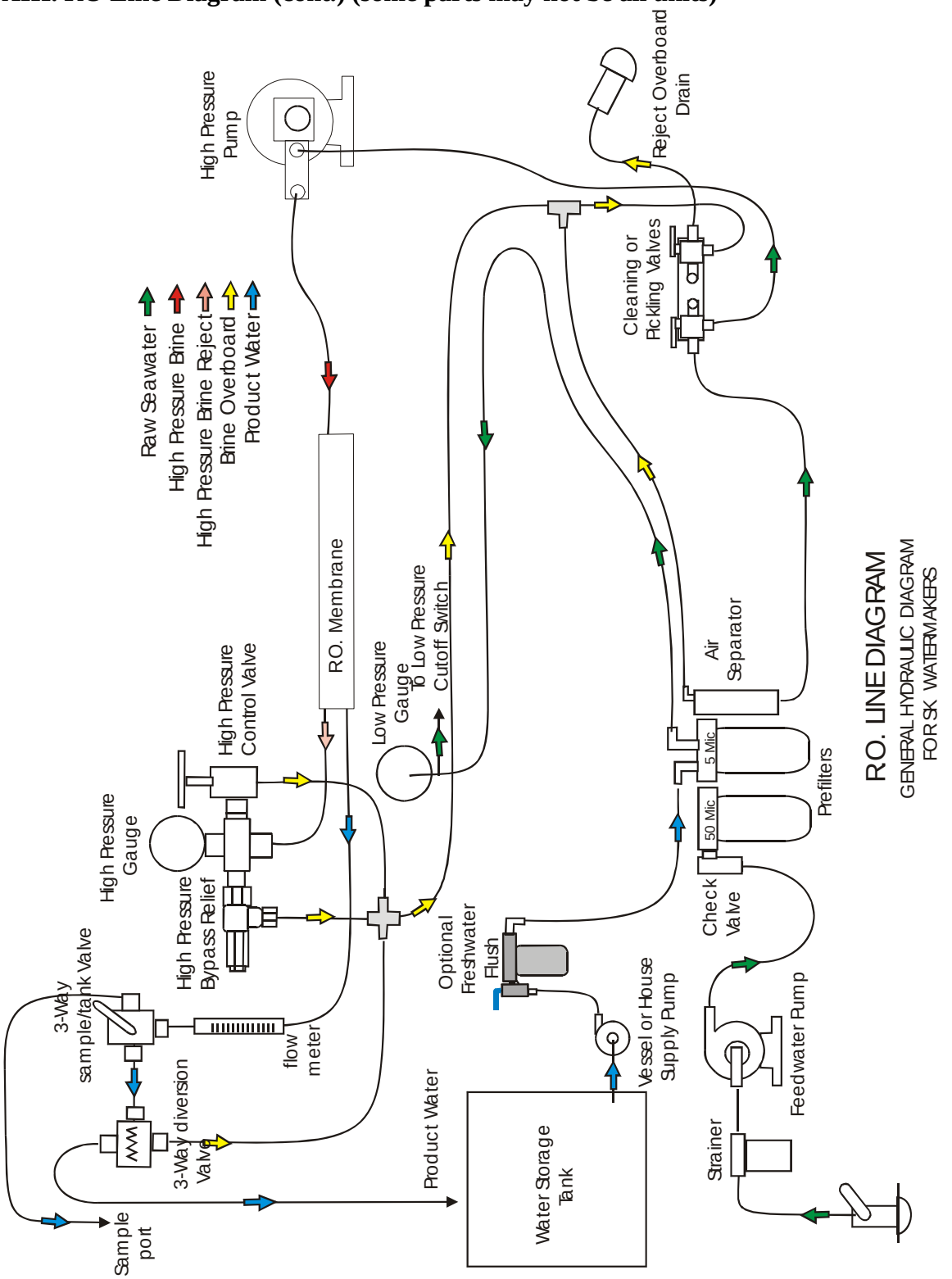
XII. Panel Mount Diagram



XIII. HC Hydraulic Diagram

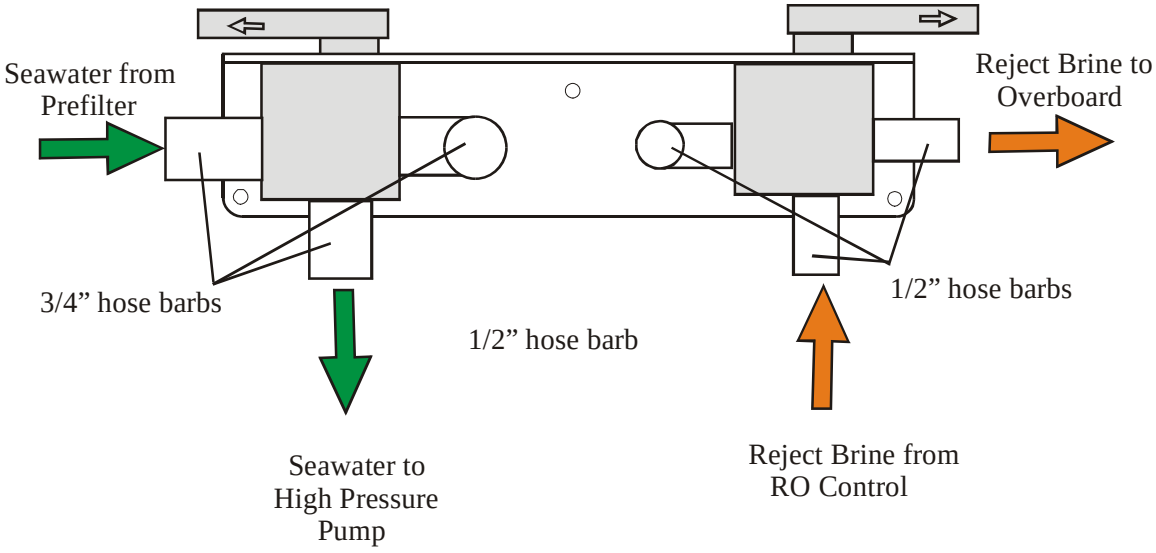


XIII. RO Line Diagram (cont.) (some parts may not be all units)

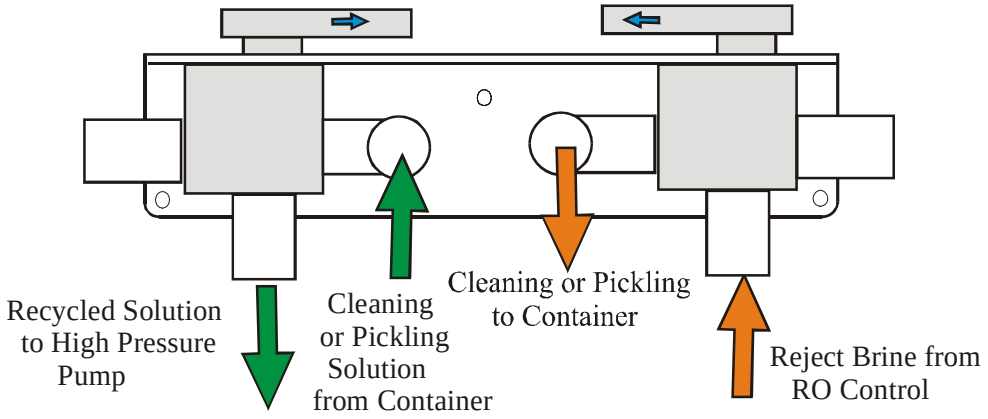


Operation and Installation of wall-mounted Cleaning and Pickling Valves

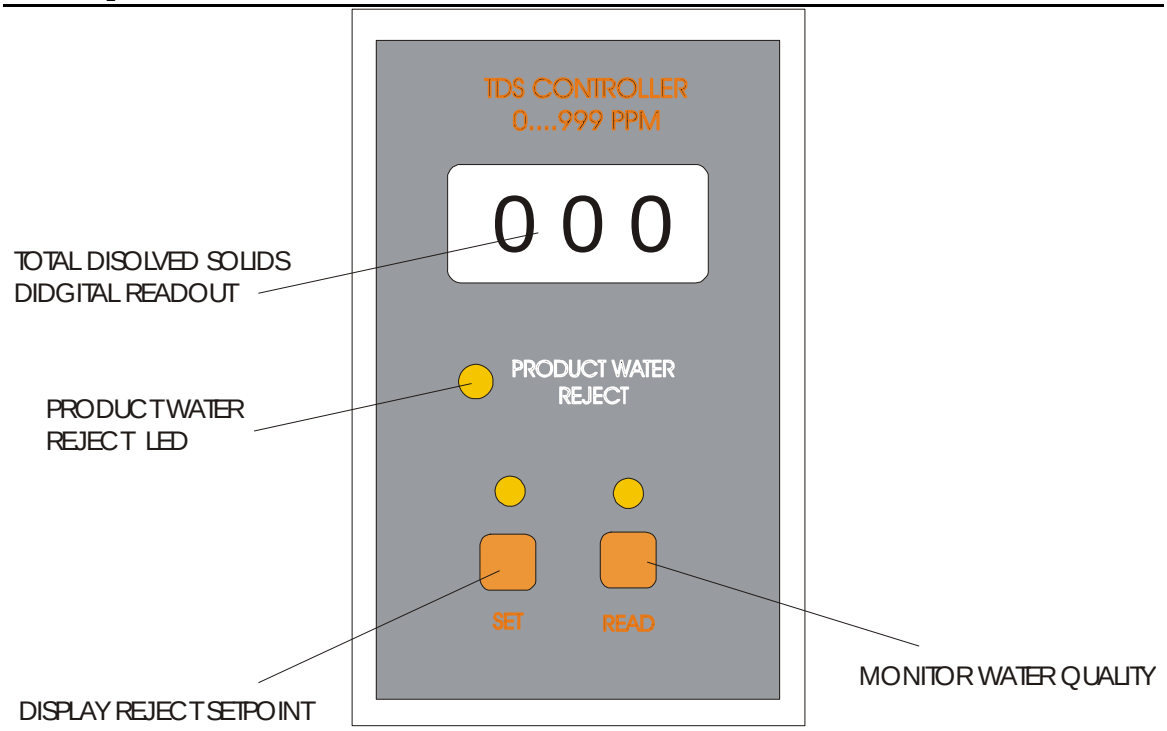
Normal RO Operation



Cleaning or Pickling Operation

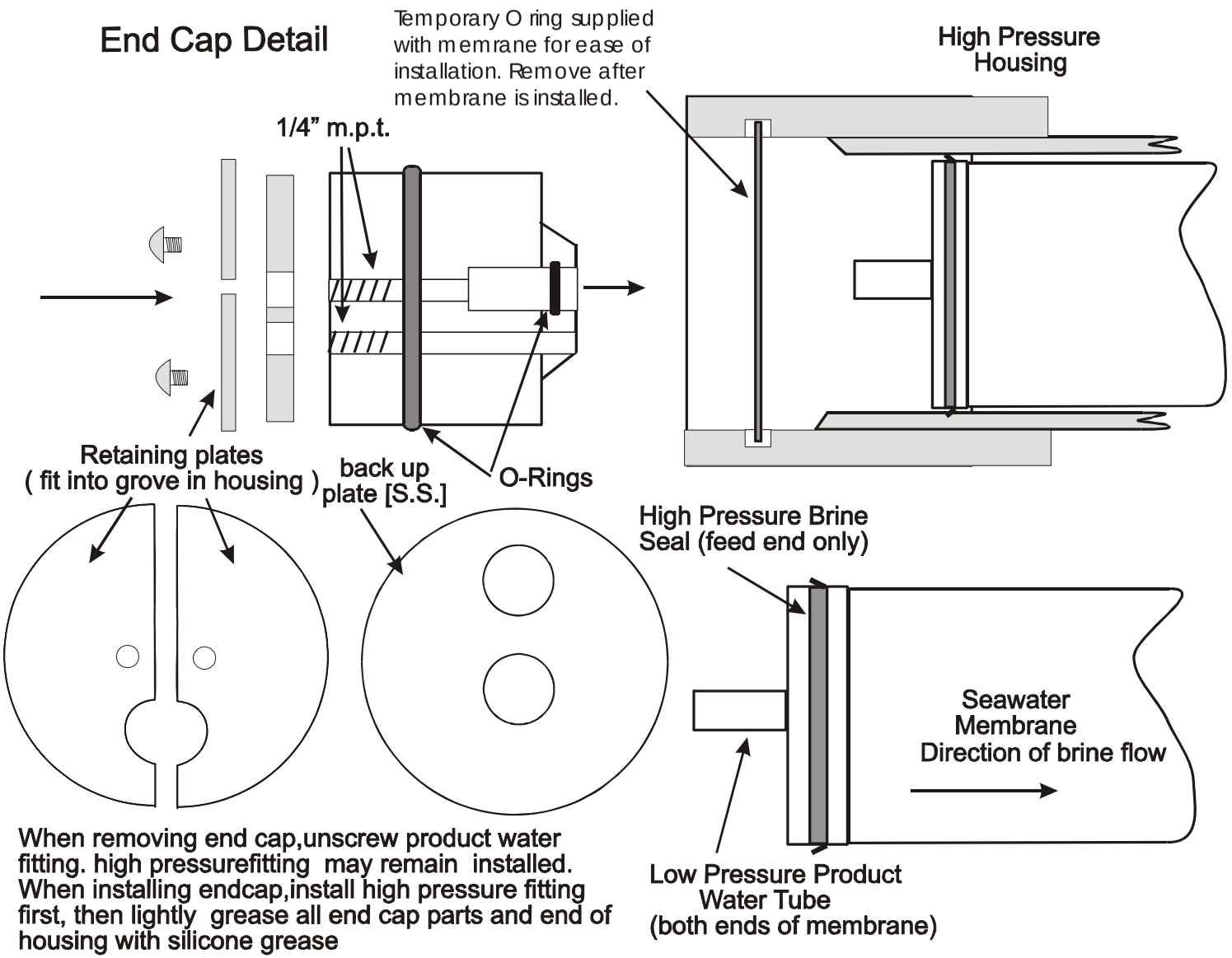


XV. Explanation of TDS Controller



TOTTAL DISOLVED SOLIDS
MONITOR AND CONTROLLER

XVI. End **Cap Detail**


End Cap Detail
Temporary O ring supplied with memrane for ease of installation. Remove after membrane is installed.
High Pressure Housing
1/4" m.p.t.
Retaining plates (fit into grove in housing)
back up plate [S.S.]
O-Rings
High Pressure Brine Seal (feed end only)
Seawater Membrane Direction of brine flow
When removing end cap,unscrew product water fitting. high pressurefitting may remain installed. When installing endcap,install high pressure fitting first, then lightly grease all end cap parts and end of housing with silicone grease
Low Pressure Product Water Tube (both ends of membrane)

LIMITED WARRANTY

SK Watermakers (from herein called SKW) warrants each new reverse osmosis unit/system to be free from defects in materials and workmanship under normal use, if installed and operated under SKW's design specifications, under the conditions listed below.

HARDWARE LIMITED WARRANTY: For a period of 1 year from initial use, SKW will repair and replace, at its option, any part of the HARDWARE which we find to be defective due to faulty materials or workmanship. Shipping charges shall be the responsibility of the purchaser.

This warranty shall only cover the original purchaser. Any damage caused by alteration, physical damage, installation, or operation contrary to our written specifications or instructions are not covered by this warranty.

IN ADDITION: it is the responsibility of the owner/user to change crankcase oil in pumps every 500 hours after the initial 50 hour oil change, also change prefilters as advised in the manual and furnish an AIR FREE supply of feedwater to the unit. Failure to comply or evidence of failure to comply with these requirements shall also void this warranty**.**