



## **MODULAR AC SERIES**

**390-AML-1 / 430-AML-1 / 690-AML-2 / 780-AML-2  
1200-AML-2 / 960-AML-2S / 1300-AML-3S / 1500-AML-4  
310-AMS-2 / 510-AMS-3 / 910-AMS-4**

## **OWNERS MANUAL**

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## INTRODUCTION

Congratulations on the purchase of your ECHOTec Watermaker. We trust that you will be completely satisfied with our product. We thoroughly bench test every desalination system before shipping and are confident that we have manufactured the finest watermaker on the market.

Your watermaker will provide you with clean and safe drinking water for many years to come if you follow the simple instructions in this owners' guide. The purpose of this manual is to allow you to become familiar with each component of your new ECHOTec Watermaker.

By understanding the function, importance and normal operation of each part in the system, the operator can readily diagnose problems when they first develop. Such problems are easily corrected and require minor adjustments. If left unattended, a small problem in one component may affect the rest of the system and can lead to an expensive repair.

If you have any questions regarding the installation, operation or maintenance of your watermaker please contact us. We are always happy to assist!

### **ECHO MARINE LTD.**

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## SPECIFICATIONS

### RATED PERFORMANCE:

ECHOTec Model	Gallons per hour	Liters per hour
390 – AML – 1	18	70
430 – AML – 1	20	76
690 – AML – 2	29	110
780 – AML – 2	31	120
960 – AML – 2S	38	145
1200 – AML – 2S	50	190
1300 – AML – 3S	55	210
1500 – AML – 4	70	260
310 – AMS – 2	17	65
510 – AMS – 3	25	95
910 – AMS – 4	37	140

Reverse Osmosis performance varies with the feed water temperature and salinity. The rated performance is tested at 26°C / 80°F water temperature and 33g NaCl/ltr.

### RO MEMBRANE TYPE:

Standard size high rejection TFC Polyamide, thin film composite, spiral wound, single pass reverse osmosis element.

**PRODUCT WATER QUALITY:** minimum 500 ppm TDS

**FEED WATER SALINITY RANGE:** up to 50,000 ppm TDS ( NaCl )

**CHLORINE TOLERANCE:** 1000 ppm hours

**FEED WATER PRESSURE:** 5"Hg to 60 psi

**OPERATING PRESSURE:** 800 to 850 psi

**FEED WATER TEMPERATURE RANGE:** min. 33°F / 0.5°C, max 113°F / 45°C

### ELECTRICAL POWER REQUIREMENTS:

ECHOTec Model	amps @ 115V /60Hz	amps @ 230V/60Hz	amps @ 230V/50Hz
390 – AML – 1	n/a	n/a	4.2
690 – AML – 2	n/a	n/a	4.2
430 – AML – 1	8.4	4.2	n/a
780 – AML – 2	8.4	4.2	n/a
960 – AML – 2S	12.9	6.5	8.0
1200 – AML – 2	16.4	8.4	9.5
1300 – AML – 3S	12.9	6.5	8.0
1500 – AML – 4	16.4	8.4	9.5
310 – AMS – 2	8.4	4.2	4.2
510 – AMS – 3	8.4	4.2	4.2
910 – AMS – 4	12.9	6.5	6.5

## STANDARD SYSTEM FEATURES

- 1) **PVC sea strainer** with bracket and barbed hose connections
- 2) **Pre-Filter/s** complete with service valve and bracket/s, 20 micron cartridge (5 and 20 micron with Optional boost pump)  
Filter wrench
- 3) **High-pressure pump unit**
- 4) **Pressure vessel/s with reverse osmosis membrane element/s** on mounting bracket
 

390 – AML – 1	one	40" vessel
430 – AML – 1	one	40" vessels
690 – AML – 2	two	40" vessels
780 – AML – 2	two	40" vessels
960 – AML – 2S	two	40" vessels
1200 – AML – 2	two	40" vessels
1300 – AML – 3S	three	40" vessels
1500 – AML – 4	four	40" vessels
310 – AMS – 2	two	21" vessels
510 – AMS – 3	three	21" vessels
910 – AMS – 3	four	21" vessels
- 5) **Stainless steel control panel** completely assembled with
  - 1 Pressure control valve
  - 1 High pressure gauge
  - 1 Product flow meter
  - 1 Diverter (3-way) valve
  - 1 Low-voltage breaker (without boost pump) or
  - 2 Low-voltage breakers (with boost pump) wired with
  - 6 feet cable to pump motor controller box
- 6) **Pump motor controller box** for main power and pump connections
- 7) **Hardener / pH neutralizer kit** with mineral element with stainless bracket and fittings
- 8) 15 feet / 4.5 meter high pressure hose with 2 x stainless steel high pressure fittings attached  
2 x stainless steel field attachable high pressure fittings
- 9) 20 feet / 6 meter 3/8" blue product water tubing  
10 feet / 3 meter 5/8" wire coil reinforced hose (without boost pump only)  
10 feet / 3 meter 1/2" braided hose + 3 feet 5/8" wire coil reinforced hose (with boost pump)  
10 feet / 3 meter 1/2" braided reject hose
- 10) 8 x 3/4" Stainless steel hose clamps and  
9 x 5/8" Stainless steel hose clamps (with boost pump) or  
9 x 3/4" Stainless steel hose clamps and  
3 x 5/8" Stainless steel hose clamps (without boost pump)
- 10) **Handheld TDS Meter**
- 11) 1 Membrane storage solution  
2 Membrane cleaning solutions

## OPTIONS AND ACCESSORIES

If the high-pressure pump is installed less than 1 foot below the waterline or an additional 5micron pre-filter is added, the installation of an optional boost pump is recommended. The boost pump also extends pre-filter element life, reduces maintenance and assists in priming the system after pre-filter changes.

**Boost pump** with intake hose barb, outlet hose barb, 4 feet / 1.2 meter wire reinforced intake hose, 10 feet / 3 meter braided feed hose, 5 micron pre-filter option.



**Fresh water flush kit for installation with boost pump** (filter housing, charcoal cartridge, stainless steel bracket, 8 screws, shut off valve, 2 x 5/8" hose barb connectors, 5/8" tee, 10ft 5/8" braided hose, 5 x 5/8" hose clamps)

**Fresh water flush kit for installation without boost pump** (filter housing, charcoal cartridge, stainless steel bracket, 8 screws, shut off valve, 2 x 5/8" hose barb connectors, 3/4" x 1/2" tee, 10ft 1/2" braided hose, 3 x 5/8" hose clamps, 2 x 3/4" hose clamps)

### Low pressure gauge

The low pressure gauge indicates when the pre-filters have to be changed. Select pressure range according to freshwater pressure.



**5 Micron Pre-filter Housing** (1 filter housing, 1 pre-filter cartridge, 1 bracket, 1 3/4" NPT nipple)

An additional 5 micron pre-filter is only recommended in connection with the optional boost pump.

**Note:** The 5micron filter must be installed as a second filter in flow direction

### Maintenance Kit

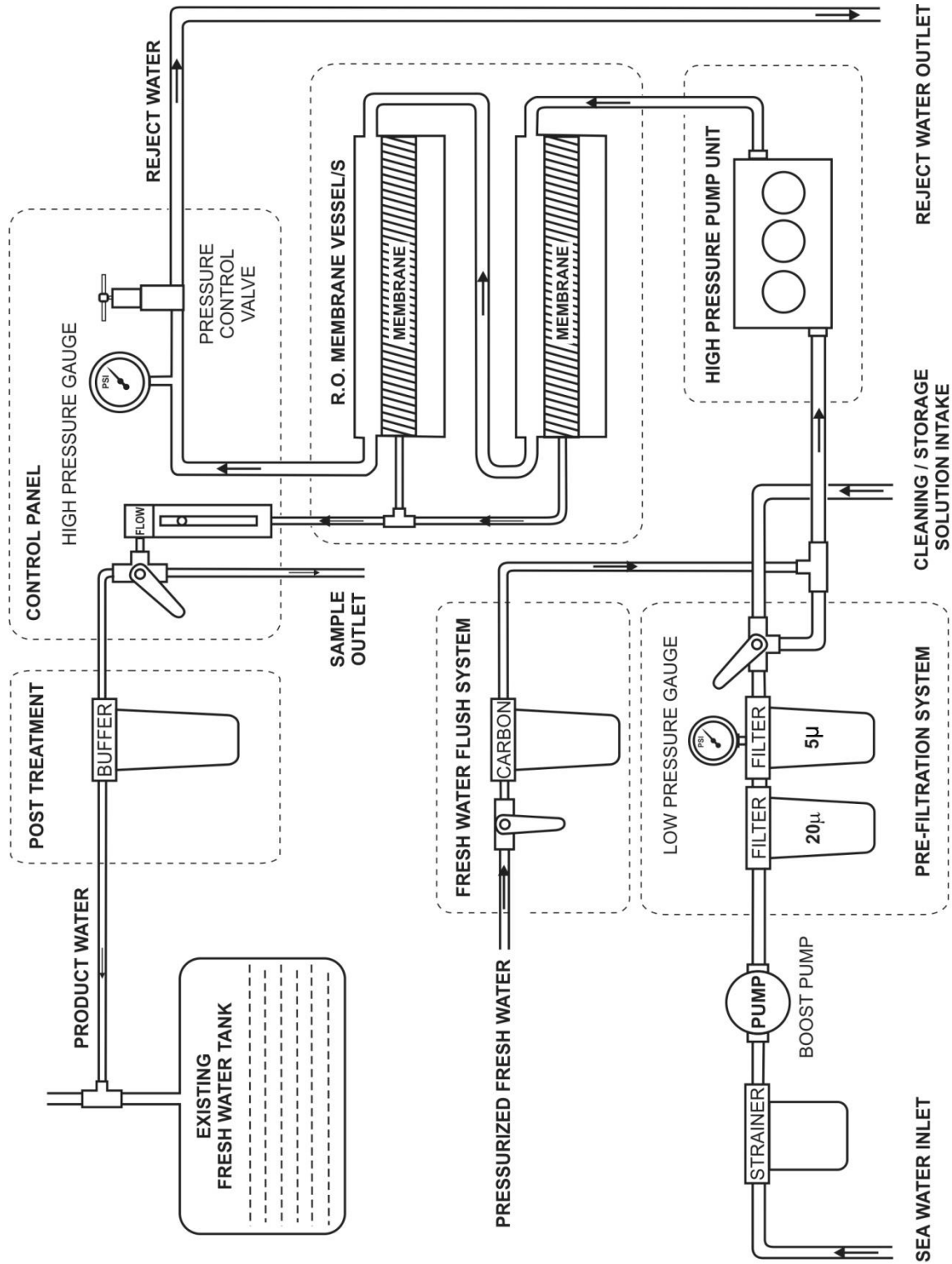
- 10 Pre-filters, 5 and/or 20 microns
- 1 Spare sea strainer screen
- 2 Active carbon filters (fresh water flush)
- 1ltr. High pressure pump oil

### Extended Maintenance Kit

- 1 Acid cleaning compound
- 1 Alkaline cleaning compound
- 2 Storage compounds (Biocide)
- 1 Complete spare seal and O ring kit (except high pressure pump)

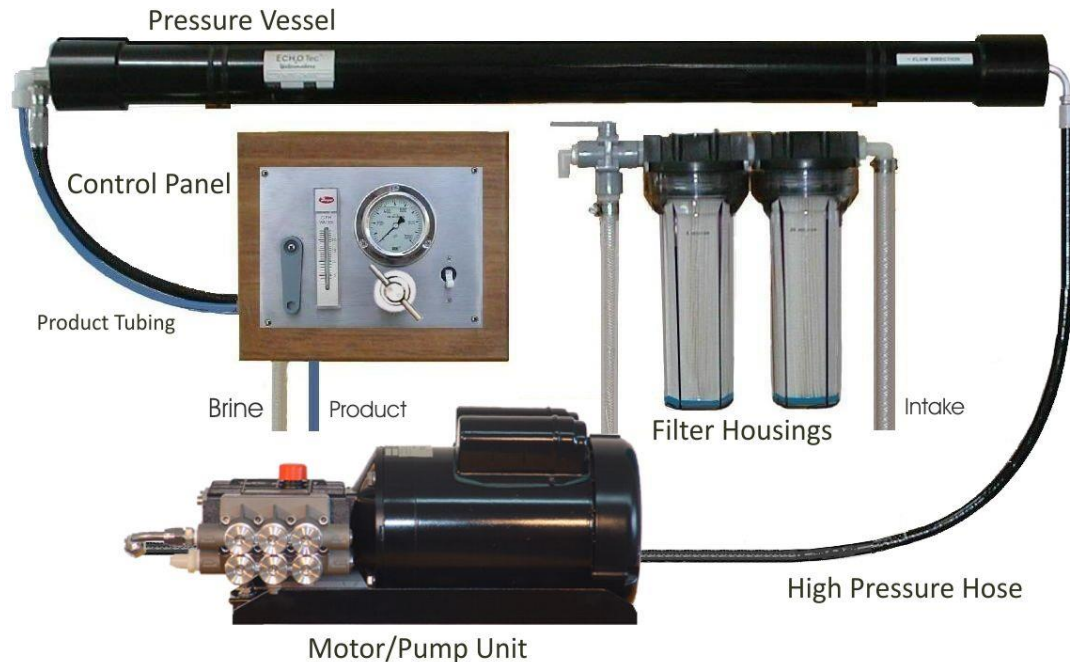
# FLOW DIAGRAM

Shown with Optional Equipment



ECH <sub>2</sub> O Tec. <i>Watermakers</i>	SYSTEM	DATE	REV.	DRWN
	MODULAR-SERIES	19/11/2012	3.4	MS

# INSTALLATION INSTRUCTIONS



## HIGH PRESSURE PUMP/MOTOR UNIT

Mount the high pressure pump/motor unit horizontally in a dry and ventilated location. Maximum ambient temperature for continuous duty is 40°C / 104°F.

**CAUTION: Motor gets hot during prolonged operation.**

## PRESSURE VESSEL (MEMBRANE HOUSING)

Mount the pressure vessel(s) with the provided brackets vertical (with the flow upwards) or horizontal in a convenient location away from the heat of the engine as close as possible to the high pressure pump.

The membrane is sealed within its housing by plugs at both ends. Inside the housing is a small amount of preservative to keep the membrane moist and prevent bacterial growth. The shelf life of the preservative, under best conditions, is one year.

When all other components and hoses/tubes are completely assembled, remove the caps on the high pressure fittings and the sealed tube from the product water outlet on the membrane housing/s and then finish making all final hose/tube connections. This will insure that the membrane is kept moist.

## CONTROL PANEL

Mount the control panel preferable through a bulkhead or on any panel in an easily accessible location as close as practical to the membrane housing(s).



## SEA STRAINER



Mount the sea strainer with the provided 3/4" NPT nylon nipple directly to the intake of the 20 micron pre-filter housing. If an optional boost pump is required (refer to "Available Options and Accessories"), mount the sea strainer under the waterline in a serviceable location in between the sea-cock of your choice and the boost pump.

**CAUTION:** To avoid excessive mechanical stress, do not mount the sea strainer directly to the sea-cock.

Connect the barbed fittings with the supplied coil reinforced intake hose and secure all hoses below water level with two hose clamps. **Avoid air pockets in the hose run.** For boost pump installation refer to the "Installation Instructions" (Optional equipment).

## FILTER HOUSINGS

Mount the pre-filter in a serviceable location and connect the bottom port of the cleaning / storage valve with the 5/8" reinforced vinyl hose to the bottom intake hose fitting of the high-pressure pump. Secure the hose with hose clamps.

If the optional 3/4" nylon tee with flush/storage valve is supplied, connect the 3/4" hose fitting on the nylon tee to the bottom intake fitting of the high pressure pump.

**CAUTION:** Install all plumbing to eliminate any air pockets in the system.

**CAUTION:** Use a maximum of three wraps of Teflon tape on all threads to prevent leakage, if you have to re-seal fittings. Always keep the tape back from the end of the fittings (at least two threads). Do not allow any tape to enter the system.

## HIGH PRESSURE HOSE

The high pressure hose has factory mounted high pressure couplings on each end (also included are two field attachable fittings). This hose comes in a 15 feet / 4.5 m length, so it may be cut to suit your needs. Leave a little extra length of hose to avoid stress on the system components.

**CAUTION:** Never bend the high pressure hose tighter than a 6"/15 cm radius.

### Assembly instructions for the stainless steel field attachable high-pressure couplings

- 1) Cut the hose in a clean 90° angle preferably with a cutting disc or fine tooth hacksaw.
- 2) Un-assemble the coupling (remove threaded inner part from outer part).



- 3) Rotate the socket (outer part) anti clock wise on to the hose until hose bottoms. Back the hose out ½ turn to allow for expansion of the hose during assembly.
- 4) Apply dishwashing liquid mixed 1:1 with water on to the nipple (inner part) of the high-pressure fitting and the inside of the hose.
- 5) Hold the socket preferably in a vice and screw the nipple all the way into the hose. The straight fitting is supplied with a hexagonal plug as an assembly tool.

Run one of the high-pressure hoses from the output of the HP pump (O ring sealed fitting) to the O ring sealed fitting at the end of the membrane that is marked IN.

**CAUTION: A minimum hose length of 3 feet / 1 m is required for pulsation dampening. The hose can be coiled where needed.**

Run the second high-pressure hose from the outlet of the RO membrane housing to the pressure control valve in the control panel. Do not over tighten the high pressure fittings. They are O-ring sealed and need little torque to lock only.

**CAUTION: When connecting the high pressure hose to the membrane housing (s), avoid over tightening. The fitting is O-ring sealed and does not require much torque.**

## PRODUCT WATER TUBING

Connect the blue product water tubing or the 1/2" vinyl hose from the center fittings of the membrane housing(s) to the bottom inlet of the flow meter, in the control panel. Connect the tubing or hose from each output port of the 3-way valve to your water tank and to the taste/test station of your choice.

**CAUTION: Under no circumstances should the product water line be allowed to become blocked while the system is running. Do not install shut-off valves anywhere in this line.**

**CAUTION: Do not allow chlorinated water from your storage tank to flow back into the R.O. membrane.**

You may directly "T" your product water line into the tank vent (Refer to the Flow Diagram). This avoids chlorinated water to back flow from your water tanks into the R.O. membrane and does not require a new fitting in your tank. This solution requires a vent of sufficient diameter as the product water will have to flow against the escaping air. If the product line must be installed below tank water line, an optional non- return valve should be installed.

An existing hand pump style spigot, with a check valve only can be used as test station. If using this type of spigot for two sources (tank and test), install low-pressure non-return valves in the tank- and product line and "T" both into the existing hand pump spigot.

## HARDENER / PH NEUTRALIZER KIT



The ECHOTec post treatment element contains a mixture of minerals that returns bicarbonate alkalinity, correcting pH only enough to reach a neutral equilibrium. This dramatically reduces corrosion on metal tanks, boilers, washing machines and plumbing due to acidic product water.

Install the hardener / pH neutralizer housing at a serviceable location in line with the product water tubing from the diverter valve on the control panel to the freshwater storage tank. (Refer to flow diagram on page 6)

**Note:** Observe the flow direction indicated on the housing.

## REJECT WATER TUBING / HOSE (BRINE)

Connect the outlet of the pressure control valve on the control panel with a reject thru-hull of your choice (preferably above the water line as an indication for proper operation of the system).

## THROUGH-HULL FITTING (not supplied)



The boat's designated intake thru-hull should be located in an area that will always be in the water when the boat is used under normal running conditions,

A trough hull fitting with strainer scoop could be helpful. Installed with the opening facing the bow, it typically generates a small amount of pressure while moving through the water. It is important not to place the thru-hull fitting directly forward of a speedometer pickup. It is also wise not to place the intake thru-hull slightly aft or outboard of a holding tank, head or galley sink overboard discharge.

## ELECTRICAL INSTALLATION

The electrical installation should only be done by a professional electrician according to the local regulations with regards to safety. Connect the main power supply, the high pressure pump and if installed, the optional boost pump according to the attached labels.

## INSTALLATION INSTRUCTION – OPTIONAL EQUIPMENT

### BOOST PUMP

Install the boost pump with the electric motor sideways (horizontal) in a dry location (submersible pumps are also available) below the water line, in between the sea strainer and the pre-filter(s). The intake is at the center of the pump. The outlet should ideally point upwards to prevent air pockets.

Avoid elbows/90° fittings in your plumbing if possible. The complete pump head can be turned in case the outlet direction is not suitable for your installation. Avoid air pockets in the hose run.

The ECHOTec “Orbital” Magnetic Drive Pumps eliminate the conventional shaft seals found in most pumps. This means that there is no rotating seal to wear and allow the liquid being pumped to leak out.

We rely on the liquid being pumped to lubricate the impeller-magnet assembly spinning on the stationary spindle. If the pump is run dry for longer than 10 minutes, the assembly may “freeze” onto the spindle.

All pumps can be serviced with the use of a screwdriver. The only moving part in the pump other than the motor is the impeller-magnet assembly. This assembly rotates on a stationary spindle and up against a thrust washer.

### 5 MICRON PRE-FILTER HOUSING

Connect the filter housing with the supplied ¾” nylon nipple to the standard filter housing and reconnect the reinforced vinyl hose (assembled when delivered with the optional boost pump). The 5 micron cartridge has to be installed as the second filter in flow direction.

### 5 MICRON PRE FILTER HOUSING WITH LOW PRESSURE GAUGE

The optional 5 micron pre filter housing with low pressure gauge has to be installed as a second filter in flow direction.

### FRESHWATER FLUSH SYSTEM

Install the active carbon filter housing at an easily accessible location close to your seawater intake line and any pressurized water line. Connect the fitting on the shut off valve on the carbon filter housing to your boats’ pressurized water line.

Connect the filter outlet to the supplied T-connector. Connect the two remaining ports of the T-connector to the outlet of the storage/cleaning valve on the pre-filter housing and to the intake of the high pressure pump (refer to the flow diagram).

**Note:** The active carbon cartridge has to be exchanged every six month to guaranty removal of chlorine from the tank water. If only product water is used for the flush procedure, the element can be removed temporary.

## SYSTEM OPERATION INSTRUCTIONS

**CAUTION:** The reverse osmosis membrane contains a preservative solution to prevent microbiological growth. If ingested, it may cause irritation of the gastro-intestinal tract. Therefore, discard all the product water for at least thirty minutes of initial operation or after system storage before drinking or before use in food preparations!

**CAUTION:** Do not operate the system using contaminated feed water sources (oil, chlorine or other chemicals).

**CAUTION:** Check proper oil level with dipstick or show glass (center of show glass).

**CAUTION:** Have you removed the shipping plug from the high pressure pump and replaced with the enclosed breather oil cap? Failure to do so may damage the crankshaft oil seals of the pump.

- 1) Open the seawater intake valve (sea cock).
- 2) Open the pressure control valve, on the control panel, all the way counter-clockwise.

**CAUTION:** Never start the system with the high-pressure control valve closed.

- 3) Set the cleaning/storage valve to the pre-filter position (towards the filter).
- 4) Set the diverter valve to sample position (left).
- 5) Switch on the boost pump (optional).
- 6) Switch on the high pressure pump.
- 7) Flush the air out of the system. Crack open pre- filter housings if needed.

Check for brine discharge at the output location.

**CAUTION:** Never allow any leaks in your hose or tube connections.

**CAUTION:** Do not attempt to re-seal the stainless steel product water outlet fitting on the membrane vessel end cap by further tightening as this could damage the thread of the plug. Remove the fitting, apply new Teflon tape, insert the fitting and hand tighten plus ¼ turn.

- 8) Close the pressure control valve slowly clockwise to allow air bubbles to work themselves out of the system.
- 9) Adjust the water pressure to achieve the specified product output with a maximum reading of 850 PSI on the pressure gauge in the control panel. If you operate the watermaker in brackish or lake water, adjust the working pressure not to exceed the specified product water rate.
- 10) Taste the product water at your sample station or check the quality with the supplied TDS meter. If the water is pure, switch the diverter valve to fill your storage tank.

## SYSTEM SHUT DOWN PROCEDURE

- 1) Switch the diverter valve to sample station.
- 2) Open the pressure control valve all the way counter-clockwise.
- 3) Switch off the electric motor and the boost pump (if installed).
- 4) Close the seawater intake valve.

## FRESH WATER FLUSH PROCEDURE

The fresh water flush prepares your watermaker for a shut down period of ten days. It can be repeated indefinitely as an alternative to the chemical long term storage of the membrane element.

**CAUTION:** The boats fresh water pressure should not exceed the range of the low pressure gauge.

- 1) Open the pressure control valve all the way (two full rounds after the spring releases) counter clockwise.
- 2) Close the sea water intake valve or switch the cleaning/storage valve to the closed position.
- 3) Open the fresh water flush valve.

Your boats' fresh water supply pump should now turn on (larger fresh water pumps will cycle on and off). Allow fresh water to flow until all salt water is flushed out of the RO System. For the next flush procedure, test how long it takes until the brine at the outlet becomes fresh.

## PRE-FILTER BACKWASH PROCEDURE

As part of a long term storage, you may remove the pre-filter cartridges from the housings or perform a pre-filter backwash procedure. If there is no momentary shortage of fresh water, the back wash may also be useful to reduce product water discharge time until the product is free of odor after each start up.

- 1) Open the seacock and switch the cleaning/storage valve to the sea water position.
- 2) Allow fresh water to flow until all salt water is flushed out of the pre-filter(s), boost pump and the sea strainer (approximately 30 seconds, depending on the flow rate of your vessel's fresh water pump).
- 3) Close the seacock.

## MEMBRANE STORAGE PROCEDURE

If you intend to store your watermaker for more than ten days, growth of micro-organism may degrade the RO membrane(s) performance and the RO membrane(s) should be flushed with a biocide solution. This will preserve the membrane for long-term storage of up to ten months.

If you have installed the optional fresh water flush system, it is recommended to back flush the pre-filter(s), the boost pump and the sea strainer with fresh water (see above). Close the seawater intake valve (sea cock) and remove the pre-filter cartridge(s).

- 1) In a clean plastic container, mix 2.5 gallons / 10 liters of un-chlorinated fresh water with 100 grams (1/3 container) of ECHOTec membrane preservative # 3 (Metabisulfite) for one and two 40" membrane systems. Mix 4 gallons / 15 liters of water with 150 grams (1/2 container) of preservative for three and four 40" membrane systems.
- 2) Switch the three-way valve to the cleaning/storage position.
- 3) Switch the diverter valve to the sample position.
- 4) Open the pressure control valve all the way counter clockwise (two full rounds after the spring releases).
- 5) Use a funnel (avoiding air to enter the system) to pour the solution into the cleaning/storage hose or lead the hose into an elevated plastic container while running the high-pressure pump. When the solution has been infused, switch off the watermaker.

Your watermaker is now prepared for a shut down period of ten months.

**CAUTION:** After storage, discard the product water for at least thirty minutes of initial operation before drinking or before use in food preparations.

## MEMBRANE CLEANING PROCEDURE

ECHO Tec membrane element/s may be chemically cleaned when the product water output drops by 15% of the specified amount. The frequency of this occurring will vary greatly depending upon feed water quality. Fouling of the membrane will naturally occur during normal usage. Increased amounts of fouling without proper cleaning of the membrane will reduce the performance of your water maker. A drop in production of approximately 10% is normal and expected during the first year of operation.

**Note:** Do not clean when TDS reads high. Clean only to restore output!

**CAUTION:** The use of chemicals or cleaning methods other than those outlined in the cleaning instructions will void the ECHO Tec Warranty.

**CAUTION:** Cleaning chemical #1 is an alkaline detergent. See warning label on side of the container and observe all safety precautions on label.

**CAUTION:** Cleaning chemical #2 is an acid, a mineral scale remover. See warning label on side of container and observe all safety precautions on label.

**CAUTION:** Do not mix different cleaning chemicals together. Do not use different cleaning chemicals together at the same time.

To clean the ECHO Tec. reverse osmosis membrane mix a solution of 1.5 to 2 % by weight with warm non-chlorinated water (113° F / 45° C) in a clean plastic container. Use 10 ltr / 2.5 gal (with 200 g or 2/3 container cleaning agent) for one 40" membrane. Use 4 ltr / 1 gal (with 40 g cleaning agent) for every additional membrane.

For safety reasons we do not recommend to install a 3 way re-circulating valve to accommodate the service. Disconnect the intake and reject water hose and lead them in the plastic container. Re-circulate the solution intermittent without pressure for up to 60 min. There will be no flow at the fresh water outlet.

**CAUTION:** Observe the maximum operating temperature of 113° F / 45° C. The high-pressure pump might over heat the solution on re-circulating.

It is important that most of the fresh water remaining from the last flush is dumped before the reject hose is led in the cleaning bucket for re-circulation in order to avoid diluting the solution. Use cleaning chemical #1 first. Only if the performance does not improve, use the acid cleaner #2 at the same ratio and instruction.

## MAINTENANCE TIMETABLE

The following maintenance timetable is an estimate of the time intervals at which maintenance may be required only. This schedule must be adjusted to the regularity of usage, the condition of the intake water, the length of time the system is exposed to seawater and the total running time following each system cleaning.

COMPONENT	MAINTENANCE REQUIRED	TIME INTERVAL (INTERMITTENT DUTY)
Sea Strainer	Inspect and clean screen and housing...	every 200 hrs. or when clogged. Observe low pressure gauge if installed.
Pre filters(s)	Replace or clean element(s) and clean housing(s)...	Boost pump: when pressure is lower than 0 PSI. No Boost pump: pressure lower than 5"Hg
Hardener / pH neutralizer	Replace or refilled with the mineral mix of another cartridge...	when 25% of the content has been dissolved to guaranty sufficient contact surface
Carbon flush filter	Replace element...	every 6 months
High pressure pump	Change crankcase oil... 12oz./0.35L SAE 30Wt non-detergent	Initial change after 50 hrs. every 300 operating hours or 12 months
High pressure pump	Change seals and O-rings...	every 5000 hrs. or 3 years.
R.O. Membrane	Clean with acid and/or alkaline cleaning compound...  Replace...  <b>Note:</b> Do not clean when TDS reads high. Clean only to restore output!	when production decreases by 15%.  when cleaning does not increase production.
Flow meter	*Infuse muriatic acid and rinse well...	when discolored/dirty

\* Set the diverter valve to the sample position. Disconnect the product water tubing from the product port at the membrane vessel and carefully infuse Muriatic acid, KR1 or Ospho with a syringe into the product water tubing. Once the discoloring has cleared, re-connect the tubing, run the system and rinse the flow meter with the product water. **CAUTION:** Adhere to the safety advises of the cleaning agents



## TROUBLESHOOTING GUIDE

MALFUNCTION	CAUSE	REMEDY
Inability to build up pressure...	Air enters intake plumbing. Air in intake system	Tighten all hose clamps.  Allow more time to prime. If no boost pump is installed, perform freshwater flush to assist priming.
...with high pressure gauge fluttering.	High pressure pump valve stuck after long storage time.	Open one by one all six hexagonal valve covers. Inspect valves for movement.
...with loud noise from HP-pump. (Low pressure gauge reads below 10" Hg)	Seacock closed Seacock clogged (Barnacles?) Strainer, filter/s fouled	Open seacock Clean seacock Clean strainer, change/clean filter/s.
...during navigation	Through hull fitting in wrong location (suction trough movement).	Use strainer scoop (page 11).
Pressure drops frequently with change of noise...	Air enters intake plumbing.	Tighten all hose clamps. Reseal NPT fittings.
...during navigation	Air enters sea water intake during navigation.	Move through hull fitting to lower location.
Excessive leakage between the high pressure pump head and crankcase...	Worn high pressure seals Cracked ceramic plunger	Replace high pressure seals  Inspect for hairline crack. Replace plunger and HP seals (page 20).
...with water in crankcase	Cracked ceramic plunger and/or worn HP/oil seals	Inspect for hairline crack. Replace plunger (if needed), high pressure seals and oil seals.
Product salinity reads above 500 ppmTDS.	Membrane element has reached its service life time.	Replace membrane element. See instructions on page 17.
Product output below specification.	Membrane element clogged or reached its service life time.	Clean membrane element (page 14). Replace membrane element (page 17).
Leak on pressure vessel end cap from - salt water...	O-ring worn	Remove and inspect plug (page 17). Change O-ring/s as needed.
...fresh water	Product port Teflon seal worn	Remove port, re-seal, install hand tight + ¼ turn

## MEMBRANE ELEMENT AND END PLUG SERVICE INSTRUCTIONS

- 1) Remove the high pressure hoses and product tubing from the pressure vessel
- 2) If needed remove the complete vessel/s
- 3) Remove the three M6 bolts with a 5 mm allen key on both sides of the vessel.
- 4) Remove the three locking plates (locks) on both sides.
- 5) Holding the product port, pull the product port end plug in one fast pull out of the vessel.

Note: Should the plugs O-ring (PL01) get stuck in the locks groove of the pressure vessel, it will be more difficult to pull the plug. Tap the plug in and pull more vigorously.

If the product port is mounted on the high pressure **OUT** side:

- 6) Using a needle nose pliers, pull the membrane element on the product tube in flow direction.
- 6b) Push out the remaining end plug from the opposite side with a pipe, boat hook, etc.

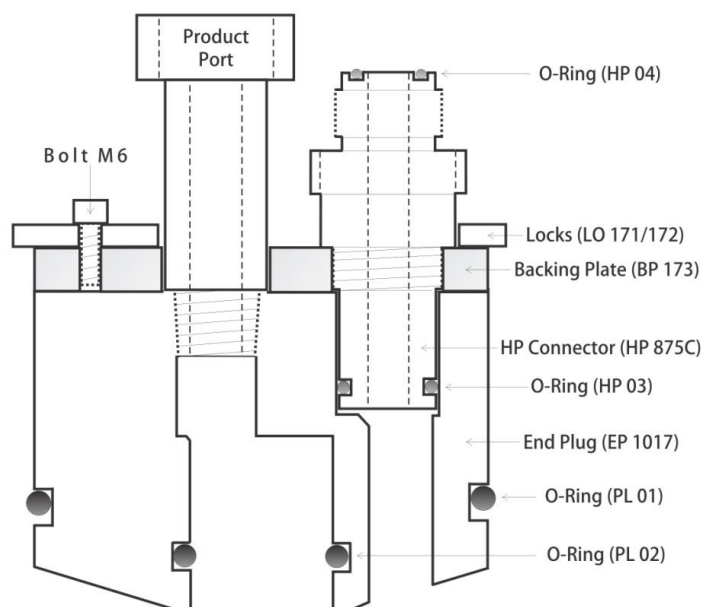
If the product port is mounted on the high pressure **IN** side:

- 6) Using a short pipe or wooden support, push out the membrane element together with the remaining end plug.

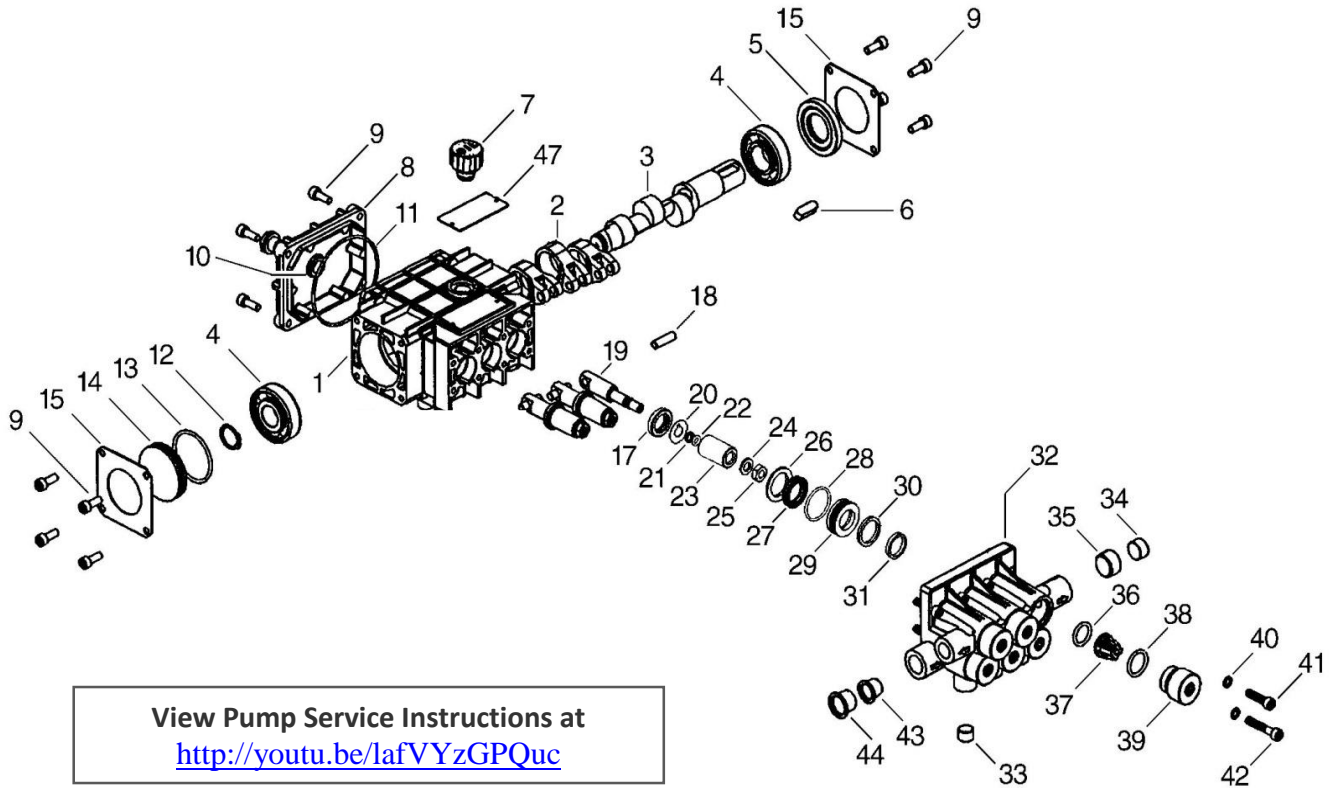
Inspect the end plugs for hairline cracks or damages on the O-rings and O-ring grooves.

- 7) Insert the new membrane element, observing the correct position and direction of the lipped seal ring: High pressure entry side of the membrane, lip against flow direction.
- 8) If needed, clean the product port and end plug threads from remaining Teflon sealant and re-apply 3 wraps only.
- 11) Insert the end plugs and reassemble all components visa versa.

**CAUTION:** Do not over tightening the product port/s. Hand tide plus  $\frac{1}{4}$  turn. Thread may damage!



# HIGH PRESSURE PUMP PARTS AND SERVICE INSTRUCTIONS



Item	Part No.	Description	Qty.	Item	Part No.	Description	Kit No.	Qty.	Item	Part No.	Description	Kit No.	Qty.
1-29.	195022	Crankcase Case Assembly	1	16.	650031	Oil drain plug	1		32.	520055	Pump head manifold	1	
1.	650000	Crankcase	1	17.	710002	Oil seal plunger	3		33.	520061	1/4 NPT plug	3	
2.	650024	Connecting rod	3	18.	650023	Wrist pin	3		34.	520063	3/8 NPT plug	1	
3.	650042	Crankshaft (specify ECHOTec model)	1	19.	650020	Plunger rod	3		35.	520062	1/2 NPT plug	1	
4.	147004	Bearing	2	20.	650021	Slinger	3		36.	701115	O-ring valve spacer	V-02	6
5.	710022	Seal, Oil, Crankshaft	1	21.	660024	Anti-extrusion ring	3		37.	103042	Valve	V-02	6
6.	640059	Key	1	22.	701501	O-ring plunger	3		38.	701002	O-ring valve cap	V-02	6
7.	650032	Oil Cap	1	23.	650018	Plunger, 18mm	3		39.	520057	Valve plug		6
8.	650026	Rear cover	1	24.	203401	Washer, plunger rod	3		40.	203510	Washer, ribbed lock		8
9.	200003	Screw, SHCS 20mm	12	25.	203000	Nut, plunger rod	3		41.	200025	Screw, SHCS, 25mm		4
10.	650025	Sight Glass	1	26.	660053	Seal retainer	HP-02	3	42.	200026	Screw, SHCS, 35mm		4
11.	701610	O-Ring, rear cover	1	27.	710012	Low pressure seal	HP-02	3	43.	145029	Plug, cap #7		1
12.	650043	Snap ring	1	28.	701023	O-ring seal case	HP-02	3	44.	145030	Plug, cap #9		1
13.	701133	O-ring, oil seal retainer, side cover	1	29.	660054	Seal case	HP-02	3	45.	540049	Rail (optional)		2
14.	650010	Side cover	1	30.	710011	Square ring, HP seal	HP-02	3	46.	200047	Screws, M8x1.25X10mm		4
15.	650009	Side plate	2	31.	710010	Glide ring, high press. Seal	HP-02	3	47.	604040	Serial #		1

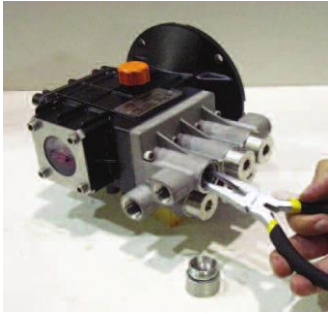
## REPAIR KITS

KIT NO.	ECHOTec HP-02	ECHOTec V-02
ITEM NO.s INCLUDED IN KIT	26, 27, 28, 29, 30, 31 *	36, 37, 38
NUMBER OF ASSEMBLIES IN KIT	3	6

\*Includes 660062 and 660063 seal installation tools.

## TORQUE SPECS

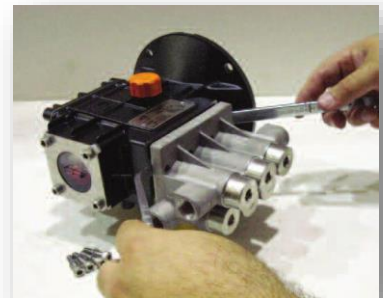
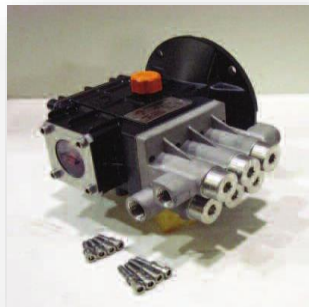
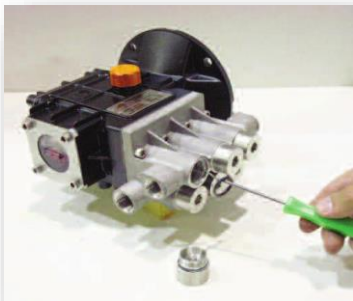
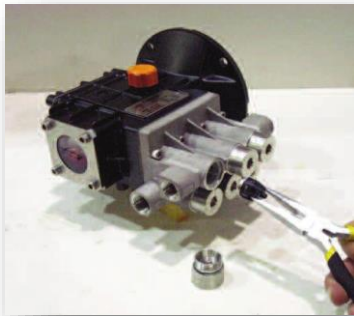
Position	Ft.- lbs.
9	7.3
25	7.3
39	8.0
41	8.0
42	8.0



## SERVICING THE VALVES

- 1) Using a 3/8" allen wrench, remove valve cap. Examine threads and o-ring. Replace o-ring if there is any evidence of cuts, abrasions, distortion or wear.
- 2) Remove valve assembly (retainer, spring, valve, valve seat) from valve cavity using a needle nose pliers.
- 3) Remove valve seat o-ring from valve cavity.
- 4) Inspect pump head for contamination or debris.
- 5) Install new o-ring in valve cavity.
- 6) Insert valve assembly into valve cavity.
- 7) Coat the threads of the valve cap with silicone grease and reinstall valve cap. Torque to 10.8 Nm (8.0 Ft-Lbs).

**NOTE:** Only one valve kit is necessary to repair all the valves in the pump. The kit includes new o-rings, valve seat, poppet, spring and retainer. All are pre-assembled.



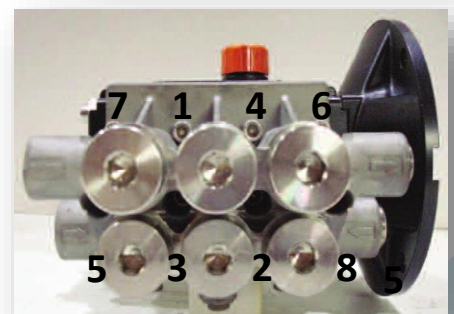
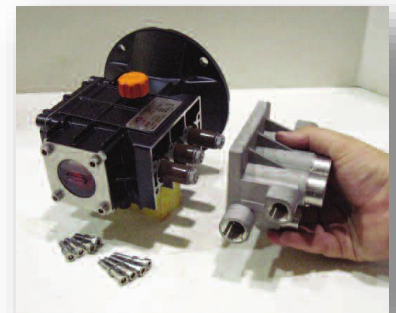
## REMOVING/INSTALLING THE MANIFOLD

- 1) Remove the 8 bolts on the high pressure pump head manifold using a 5 mm allen wrench.
- 2) Separate manifold from crankcase.

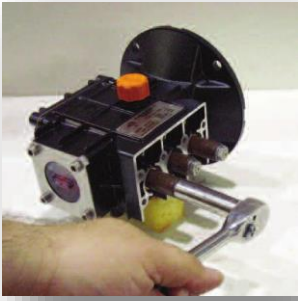
**Note:** It may be necessary to rotate the crankshaft, or use pry bars to remove the manifold from crankcase (image 5).

**CAUTION:** When sliding head from crankcase use caution not to damage plungers.

- 3) The seal assemblies may come off with the manifold. At this point examine the ceramic plungers. Plunger's surface should be smooth and free from scoring, pitting, or cracks; if not, replace.
- 4) Coat each plunger with silicone grease.
- 5) Align outside plungers in the forward position (image 6).
- 6) Reinstall manifold and torque manifold bolts to 10.8 Nm (8.0 Ft-Lbs) per sequence shown on image 7.





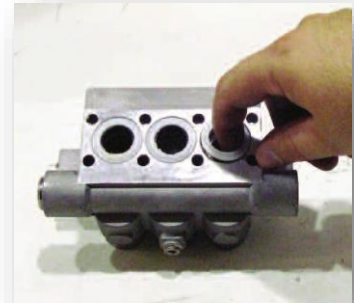
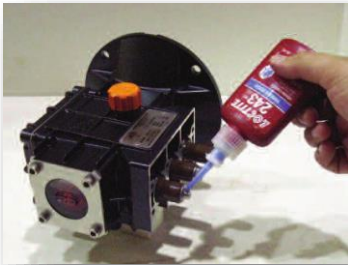
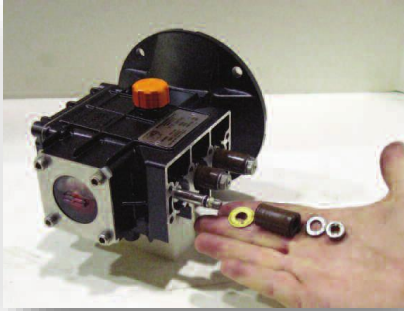


## REPLACING CERAMIC PLUNGERS

- 1) Using a 1/2" wrench or socket, remove the stainless steel fasteners retaining the plungers.
- 2) Remove stainless steel washer and ceramic plunger from piston rod.
- 3) If copper slinger washer comes off with plunger, be certain this is replaced before new plunger is installed.
- 4) Install new o-ring and Teflon back-up ring on piston rod.

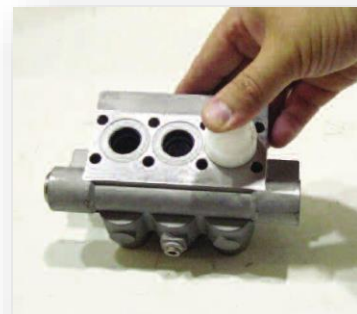
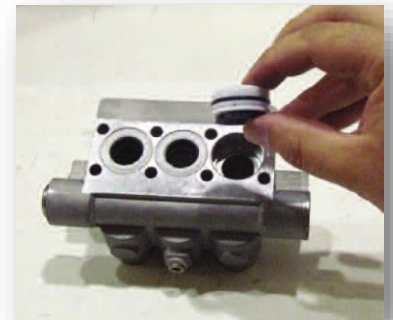
**Note:** A film of silicone grease on the outside of the o-ring insures a better installation.

- 5) Slide new plunger over the piston rod, install stainless steel washer.
- 6) Apply a drop of removable anaerobic (Loctite 243 or similar) thread sealant to threads of piston rod.
- 7) Install the stainless steel fasteners retaining the plungers and torque to 9.9 Nm (7.3 Ft-Lbs).



## REPLACING HIGH PRESSURE SEALS

- 1) Remove pump head manifold from crankcase.
- 2) Insert 18 mm extractor collet through main seal retainer. Tighten collet and extract retainers and packings. For field repairs push seals out from outside.
- 3) Apply silicone grease to the seal assembly before installing in cylinders.
- 4) Place supplied insertion tool in cylinder and install seal assembly and low pressure seal retainer using the supplied insertion tool.
- 5) Repeat this sequence for each cylinder.
- 6) Align outside pistons in forward position (image 6).
- 7) Coat each plunger with silicone grease.
- 8) Install manifold and torque retainers to 10.8 Nm (8.0 Ft-Lbs).



## ECHOTEC WATERMAKERS LIMITED WARRANTY

Echo Marine Ltd. warrants for a period of 3 years (1 year for commercial applications) from the date of shipment that the ECHOTec watermaker is free of defects in material and workmanship and performs according to specifications. The triplex plunger high-pressure pump head and the high pressure vessel/s (except end plugs, O-rings and fittings) are warranted for life (10 years for commercial applications) to the original purchaser.

Echo Marine's liability under this warranty shall be limited to repair or replacement of the ECHOTec watermaker at Echo Marine's option. Under no circumstances shall Echo Marine Ltd. 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, malfunction, or failure during the warranty period, Echo Marine Ltd. will repair or replace, at its option, the product or component therein which, upon examination by Echo Marine, shall appear to be defective, or not up to factory specifications.

To obtain warranty service, the defective product or part must be returned to Echo Marine's Service Center. The purchaser must pay any transportation or labor expenses incurred in removing and returning the product. A return authorization must be obtained before any part or component is shipped.

The limited warranty does not extend to any system component that has been subjected to misuse, neglect, accident, improper installation, or used in violation of instructions furnished by Echo Marine Ltd. The warranty does not extend to components on which the serial number has been removed, defaced or changed.

Echo Marine Ltd. 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. Echo Marine 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.

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

Sea Strainer Element	Pump Valve Assemblies
Pre-filter Cartridges	Gauge/Instrument Calibration
Auxiliary Tubing	Pump Crankcase Oil
Pump Seals and Packings	V or Timing Belt
Pump Bushings and Bearings	

The ECHOTec Membrane Element is warranted to be cleanable for a minimum of one year from date of shipment, provided that cleaning instructions are adhered to and foulant is acid soluble metal hydroxides and calcium carbonates or alkaline soluble organic, inorganic substances and microbiological slimes. The ECHOTec Membrane Element is not warranted against iron fouling (rust), chemical attack, extreme temperatures (over 120° F/49°C and under 32°F/0°C), drying out, or extreme pressures (over 1000 psig/68 bar).

**CAUTION:** Use of parts not supplied directly by Echo Marine (generic parts), including but not limited to maintenance parts, pre-filter elements, cleaning and storage chemicals, pump oil, spare parts, replacement parts, system components and or system accessories, shall void all warranties expressed or implied unless agreed in writing.

ECHOTec desalination systems are shipped complete with reverse osmosis membrane element(s) installed. However, if the ECHOTec system will not be put to use within 10 months of shipment, there is a potential danger of the membrane element(s) fouling. Therefore, we offer to ship your system without the membrane element(s). This allows installing the desalination system at the appropriate refurbishing or production schedule without risk to the membrane element(s). Echo Marine Ltd. will ship the reverse osmosis membrane element(s) when notified that the ECHOTec desalination system is ready for commissioning. This service is available upon request only.

The warranty on the ECHO Tec Watermaker is activated upon shipment of the system with the reverse osmosis membrane element(s) installed. However, by shipping the watermaker without the reverse osmosis membrane element(s), the warranty period will start upon shipment of the membrane element(s), with a maximum delay of 12 months from the date of purchase.

## **ECHO MARINE LTD.**

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