Village Marine LTM-500

Part Number: 95-0023

LTM Series Modular Watermakers

500-1,800 GPD

Installation, Operation & Maintenance

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

Parker

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The following are the types of flags used in this technical manual. They designate safety related items and important operational instructions and should be given special attention when they appear in the text:

WARNING Text formatted in this manner concerns an operating procedure or practice that, if not strictly observed, can result in injury to personnel or loss of life.

CAUTION Text formatted in this manner concerns an operating procedure or practice that, if not strictly observed, can result in damage to or destruction of equipment.

NOTE Text formatted in this manner concerns an operating procedure or condition that warrants special attention

MODEL: _____

SERIAL NUMBER: _____

DATE OF PURCHASE: _____

PURCHASED FROM: _____

INVOICE #: _____

VESSEL NAME: _____

INSTALLED BY: _____

DATE OF INITIAL STARTUP: _____

LTM Series Modular Watermakers

500-1,800 GPD
(1.9 to 6.8 m^3/day)

For Sail Boat and Motor Boat Applications

The LTM Series offers high quality Racor Village Marine engineered components with straightforward manual operation. Driven by AC motors (from genset power), the modular configuration comes in ready to mount modules for flexible installation options. Integral to every LTM unit are a stainless steel pressure regulator and bypass valve.

Racor Village Marine LTM-500

Contact Information:

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www.villagemarine.com

www.parker.com/racor

Key Feature:

Optional salinity monitor and diversion valve system for water quality assurance.

Salinity monitor and diversion valve

Parker Racor

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LTM Series

500-1,800 GPD
(1.9 to 6.8 m^3/day)

Standard Features:

- Available for 110/1/60, 220/1/60 or 230/1/50 power supplies as shown
- Powder coated mounting brackets included
- 5 micron cleanable prefilter
- 316 stainless steel pressure regulator ensures consistent pressure and prevents over or under pressurization of the unit. Adjustable to allow operation in brackish or fresh water
- High quality spiral wound TFC reverse osmosis membranes
- Magnetic drive boost pump
- Stainless steel glycerin filled pressure gauges
- High pressure plunger pump with stainless steel 316 head
- Acrylic flowmeter to monitor production

Model	Part Number	Electrical Supply Volts/Ph/Hz/Amps	Capacity GPH/LPH	Weight lbs./kg
LTM-500	90-6019 90-6047 90-6048	110/1/60/18 220/1/60/8 230/1/50/8	21/79	92/42
LTM-800	90-6049 90-6050 90-6051	110/1/60/18 220/1/60/9 230/1/50/8	33/125	100/45
LTM-1000	90-6052 90-6053	220/1/60/12 230/1/50/12.5	42/158	133/60
LTM-1300	90-6054 90-6055	220/1/60/12 230/1/50/12.5	54/205	153/70
LTM-1800	90-6056	220/1/60/12	75/284	168/76

Spare Parts

Part No.	Description	Part No.	Description
85-0050	Pump Oil	33-0271	Filter Housing O-Ring (model 1000 and up)
33-0117	5 Micron Filter (up to model 800)	90-2512	Membrane O-Ring Kit
33-0052	5 Micron Filter (model 1000 and up)	40-0241	Salinity Probe
33-0311	Carbon Flush Filter	85-0102	Cleaning Kit
33-0238	Membrane Element	85-0103	Preservation Kit
90-0005	Filter Housing O-Ring (up to model 800)		

To maintain peak performance always use genuine Parker Racor Village Marine replacement parts.
We reserve the right to change our specifications or standards without notice.

Print Reorder Number 7986 Rev- 03-21-2011

Parker Racor

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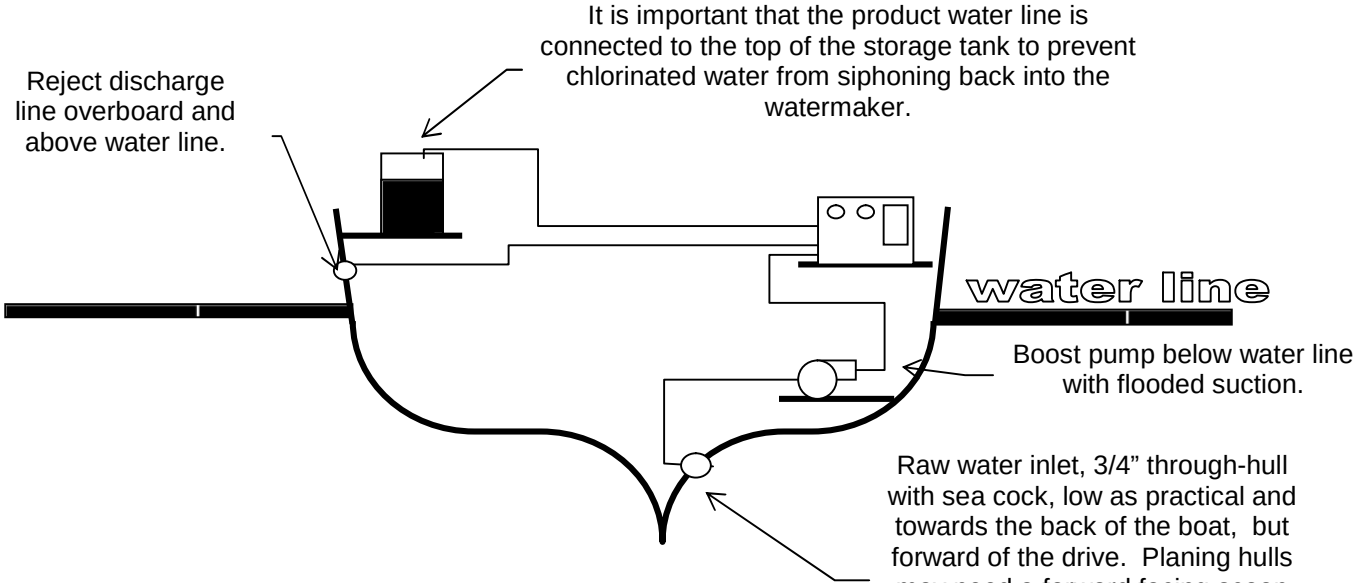
The Offshore Marine Labs (OML) LTM series Seawater Desalinator is a single-pass purification system that uses reverse osmosis (RO) to produce potable water from seawater. Product water with salt concentrations of < 500 ppm are achieved by removing approximately 99% of the dissolved salt in seawater.

INSTALLATION

The RO unit should be installed in a dry, sheltered location protected from direct weather. Drainage should be provided beneath the RO unit to allow standing water to drain when performing maintenance or repair.

Refer to the Plumbing Diagram for arrangement and connection hose sizes. All connections up to and including the boost pump must be below water line. If necessary, the three way flushing valve may be disconnected from the flushing filter to get the valve below waterline. The prefilter, the HP pump and the membrane rack can all be above waterline as indicated in the diagram below.



Installation Diagram

CAUTION

Inlet and discharge interconnecting lines should be constructed of a NON-FERROUS material. Examples of some suitable materials are PVC, copper-nickel, 316 stainless steel pipe or a reinforced non-collapsing hose. Ferrous piping introduces iron that will foul the membranes prematurely.

NOTE

Avoid connecting the seawater source to a water line that services any other piece of equipment. Air could be drawn through the RO unit causing damage to the RO unit's pumps. Cross contamination is also possible. The best practice is a dedicated through hull for the watermaker, with a separate seacock and strainer.

Connect electrical power to the watermaker. Select the circuit breaker size of at least 50% more than the operating amps shown on the serial number tag. 110 VAC 60 hertz units need a three wire supply, black, white and green for hot, common and ground respectively. 220 VAC 60 hertz units need a four wire supply, black, blue, white and green for hot, hot, neutral and ground respectively - bring a separate neutral from the generator if necessary. 230 VAC 50 hertz units need a three wire supply, black, white and green for hot, hot, and earth respectively. Connect power to the main terminal block in the electrical enclosure following the above wire colors.

CAUTION

Strictly observe all applicable electrical codes and regulations governing the installation and wiring of electrical equipment. Typical codes specify the type and size of conduit, wire diameter and class of wire insulation depending upon the amperage and environment. The power supply should always be of a greater service rating than the requirements of the RO unit. Never connect the RO unit to a line that services another electrical device, the RO unit should have its own breaker.

WARNING

Disconnect electrical power to RO unit prior to servicing the watermaker.

STARTUP AND OPERATING PROCEDURE

1) Check the HP pump oil level by observing sight gauge located on the pump. Open the raw saltwater supply to the unit at the through-hull. Also ensure that the flushing valve is in the saltwater position with the valve handle pointing away from the carbon flushing filter. The product sample valve should be in the "sample" position, not directed to tank.

2) Verify the bypass valve (black handle) is open, counterclockwise.

3) Start the LP pump, verify the filter pressure gauge shows > 5 psi indicating the system is primed with water.

4) Start the HP pump. Water should now be flowing through the system and discharging through the overboard reject line. Often installations will connect both pumps to the same circuit breaker. That arrangement is OK, however it is still prudent to confirm the pumps are primed and running correctly. Remember there is no safety switch for low flow, and pump damage will occur if running dry.

5) Slowly close the bypass valve, and confirm that the membrane pressure gauge registers 800 psi. The high pressure setting can be adjusted by the allen screw on the high pressure regulator behind the instrument panel.

6) After about 2 minutes operation, confirm the salinity by taste test or by hand meter at the sample valve. Once it is OK, turn the sample valve to direct water to your storage tank.reading, on the water monitor. A digital salinity monitor and automatic diversion valve is available as an option.

7) Now would be a good opportunity to make an operation log of the pressures, flow and salinity.

8) For shutdown, reverse the steps. First open the black bypass valve. Then shut down the HP and LP pumps. Turn the product sample valve back to sample position. If you are unsure if the watermaker will be restarted in a day or so, now is time to flush the watermaker to keep the membranes fresh while idle, please see the next section. Bacteria and biologic growth increases the longer stagnant water is in contact with the membranes, so the flushing is advised whenever the unit will be idle. Once flushed, the flush should be repeated once every one or two weeks if the idle period continues. For extended periods, see the section on pickling or preserving the watermaker.

FRESH WATER FLUSH PROCEDURE

Make sure the black bypass valve is open (counter clockwise), and then turn the three way flushing valve so the handle is pointing towards the carbon flushing filter. The carbon filter scrubs chlorine that might be in your tank water, so the membranes are not exposed to any chlorine. Now fresh water is running through the system, you can start the pumps and run for two minutes. After two minutes, stop the pumps and turn the flushing valve back so the handle is pointing away from the flushing filter.

MAINTENANCE INSTRUCTIONS

Adapt the following suggested routine maintenance schedule as required to your installation and operating conditions:

	Each Start	Weekly	Monthly	Quarterly	Semi-Annually	Annually	As Required	Labor Hours (approximate)
Clean and inspect micron filter							•	0.5
Replace filter element when filter pressure is 5 psi lower than clean element							•	0.5
Check pump oil level	•							0.1
Change pump oil after first 50 hours and then every 500 hours or annually						•		1.0
Lubricate HP pump motor at grease nipple with one stroke bearing grease						•		1.0

MEMBRANE CLEANING AND PRESERVATION

During normal operations, mineral scale and biological matter will foul the RO membranes. These deposits build up over time and will eventually cause a loss of product water output, salt rejection capability, or both. The RO elements should be cleaned when product water output drops by 15% from the initial baseline established during the first hours of operation with new membranes. Chemical cleaning is usually not effective if fouling has dropped production below 80% of the original condition. Chemical cleaning can recover lost flow rate, but often does not recover lost salt rejection.

Preservation or pickling is done to protect the membranes during long term storage. A properly pickled system will stay fresh for 6 months in temperate climates or 4 months in the tropics, after which it needs to be flushed and the preservation process repeated. To preserve and also freeze protect in winter climates, use a propylene glycol solution in the bucket instead of the preservative cartridge. Mix a concentration per the instructions on the propylene glycol for the coldest temperature expected.

The basic procedure for all cleaning and preservative treatments is the same - a specific chemical solution is circulated through the system for 20 minutes and then flushed out. Cleaner #1 is an alkaline detergent is used to remove biological matter and grime from the surface of the RO membranes. Cleaner #2 is an acid cleaner is used to remove mineral scale deposits. Use #1 first. The preservative or pickling chemical is labeled as Chemical #3. The chemicals are conveniently available as cartridges p/n 85-0102 and 85-0103 (see the filter bulletin at the back of the manual). The 2.5" diameter cartridges fit into both 2.5" and 5" filter housings, however take extra care to make sure they stay vertical in the 5" housings when the bowl is tightened.

Use the following procedure for cleaning or preservation:

1) Flush the watermaker, so that the chemical works in fresh water not saltwater.

2) Remove the 5 micron filter, and replace with the appropriate cartridge. When screwing the filter bowl back in place top up with water to minimize the air inside.

3) Place a 5 gallon bucket ½ full of fresh water near the watermaker. Connect a temporary hose from the reject outlet at the watermaker to the bucket. Connect a temporary hose from the inlet of the LP pump to the bucket.

4) Make sure the black bypass valve is open, counter clockwise. Make sure the product sample valve is in the sample position.

5) Start the watermaker pumps. Make sure the LP pump catches prime (by raising the bucket, or by temporarily lifting the inlet hose). Once primed, you will see water returning to the bucket.

6) Run the pumps for 20 minutes, circulating the chemcials. Then turn off both pumps.

7) If you are preserving, you are done. Reconnect the regular hoses to reject overboard and the LP pump inlet. On the initial restart after preservation, run the unit for 10 minutes prior to switching sample valve to the tank position to purge any preservative from the system.

8) If you have just finished circulating cleaner #1, reconnect the regular inlet pump hose, and flush the watermaker for 5 minutes. Empty the bucket as necessary. Then go back to step 1 and repeat with cleaner #2.

9) If you have just finished circulating cleaner #2, reinstall the regular 5 micron filter element and reconnect the regular hoses. Flush the watermaker for 5 minutes to clear out the chemical. Run the watermaker with seawater and record the performance in your log to determine the effectiveness of the cleaning.

If chemical cartridges are not available, then powder chemical can be used dissolved in the bucket (leave the regular 5 micron filter in place during cleaning).

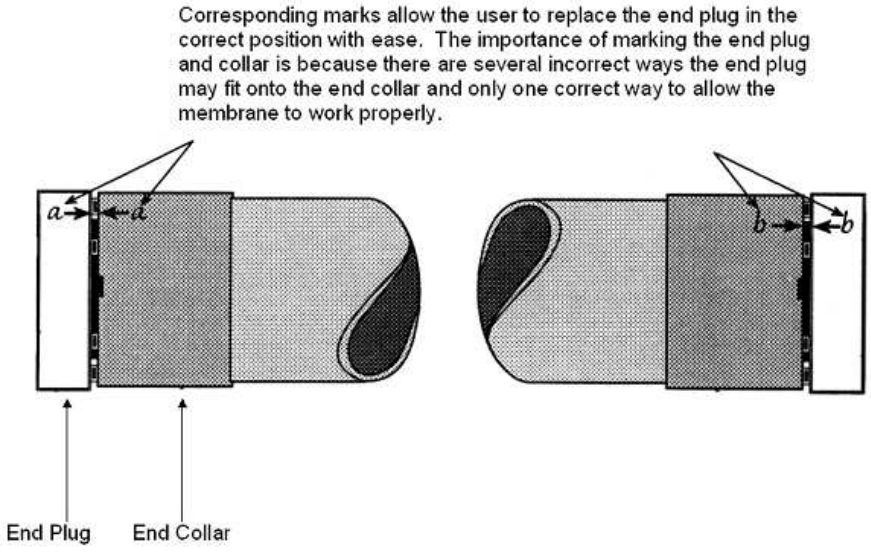
	Models up to 800 GPD	**Models 1000 GPD and up**
Cleaner #1, p/n 85-0036	400 grams	600 grams
Cleaner #2, p/n 85-0037	400 grams	500 grams
Preservative #3, p/n 85-0038	150 grams	200 grams

Chemical Requirements when Powder is Used

PRESSURE VESSEL AND MEMBRANES - DISASSEMBLY

Step 1: Disconnect plumbing from pressure vessel for disassembly. Remove the pressure vessels to a workbench to continue.

Step 2: Remove the six fasteners and cap ring holding each end plug with an Allen wrench. Place a mark on each end plug to be removed, place a corresponding mark on each end collar. This will ensure proper orientation during assembly. See bulletin at the back of the manual for part numbers of the individual components.



Step 3: Locate the screwdriver slots located on opposite sides of the pressure vessel end collar. Place an appropriate sized slot screwdriver in each slot. Twist both screwdrivers until the end plug breaks loose from the pressure vessel. A prying motion on both sides of the end plug with the screwdrivers will quickly remove it. Use this procedure for both end caps. Push or pull the membrane element out of the pressure vessel tube.

⚠ CAUTION **NEVER FORCE A MEMBRANE OUT OF A PRESSURE VESSEL BY APPLYING PRESSURE ON THE PRODUCT WATER TUBE (CENTER TUBE), AS THIS WILL DAMAGE THE MEMBRANE. IF MEMBRANE IS DIFFICULT TO REMOVE, USE A 2" DIAMETER PLASTIC PIPE (PVC) TO APPLY PRESSURE ON THE PROTECTED END OF THE MEMBRANE.**

Step 4: Note which end of the pressure vessel the brine seal was installed at. The brine seal is a black u-cup seal on the membrane outer diameter near one end. This is the feed end of the pressure vessel. When reinstalling the RO

membrane the brine seal must be located at the feed end of the pressure vessel.

PRESSURE VESSEL AND MEMBRANES - REASSEMBLY

Step 1: Inspect all O-Rings; product O-Rings, end plug O-Rings, and Brine seal. Replace seals if there is visible damage. The product water O-Rings are internal O-Rings, inside the center hole in the end cap.

Step 2: Lubricate O-Rings and entrances to pressure vessel with glycerin or silicone lubricant. Locate discharge end of pressure vessel. Install discharge end plug by lining up with the holes of the pressure vessel, paying attention to the reference mark. Position end cap ring and insert fasteners by hand.

⚠ CAUTION **NEVER USE ANY TYPE OF LUBRICANT CONTAINING PETROLEUM OIL. OIL CAN DAMAGE YOUR UNIT AND REDUCE MEMBRANES PERFORMANCE.**

Step 3: Align the membrane so the end **without** the brine seal enters the feed end of the pressure vessel first. Slide membrane into pressure vessel until resistance is felt. Continue applying pressure until the product water tube sits into the end plug.

Step 4: Install the remaining end plug (align end plug holes with mounting holes properly), use the reference mark made in step 2 for correct assembly. Tighten the six fasteners for each end cap. Install the vessels and reconnect plumbing.

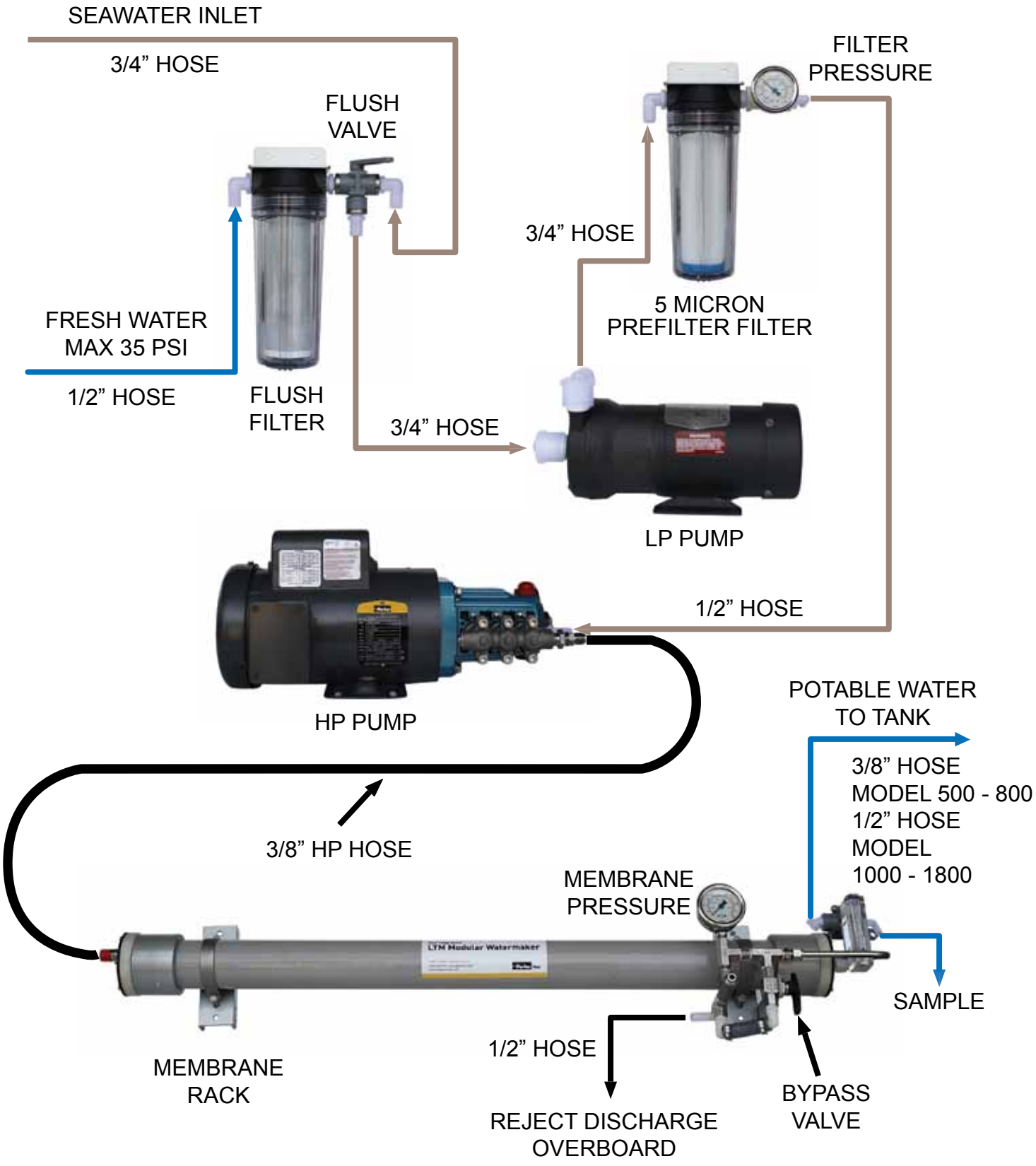
NOTE: Do not apply Teflon tape or sealant to straight thread fittings such as those used on High Pressure Hose ends.

OPERATION LOG

We encourage operators to keep a simple operation log for the watermaker. Even occasional entries will help in troubleshooting. It is especially important to record performance after the first 3 hours after installation so the baseline is known.

Date	Filter Pressure	Membrane Pressure	Product Flow	Water Quality TDS (ppm)	Water Temp,	Comments

LTM-500 TO LTM-1800
PLUMBING DIAGRAM

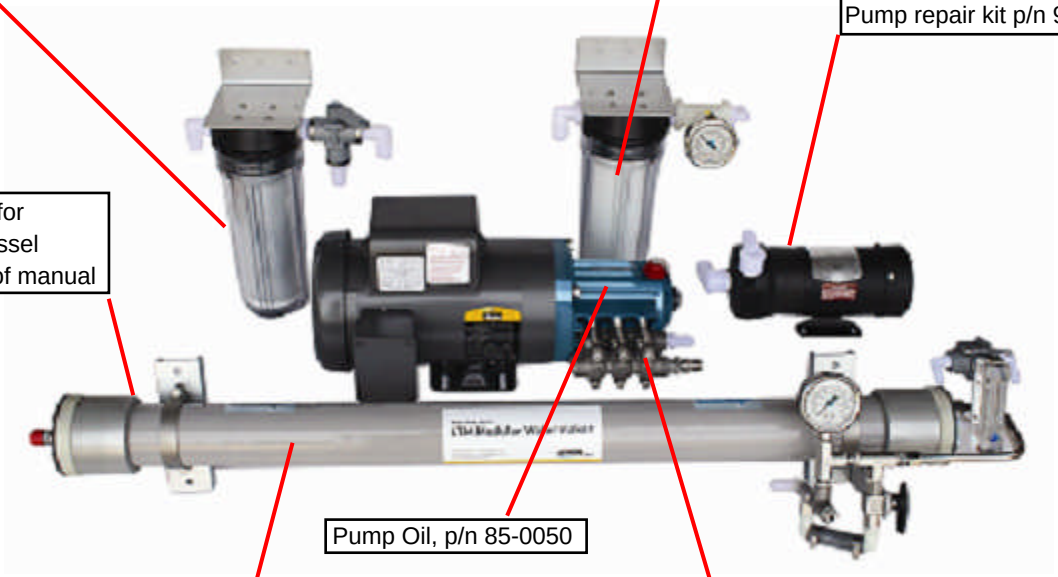


PARTS DIAGRAM - SEE ALSO SPARES LIST AT FRONT OF MANUAL

Prefilter Assembly
Replacement Element
Models 500, 800 p/n 33-0117
Models 1000 and up, p/n 33-0052
Filter Pressure Gauge, p/n 40-0300

Flushing Filter Assembly
Replacement Element p/n 33-0311
Flush Valve p/n 60-0014

LP Pump
Models up to 800 at 110 V, p/n 70-7504
Pump repair kit p/n 70-7506
Models up to 800 at 220 V, p/n 70-7505
Pump repair kit p/n 70-7506
Models 1000 and up, p/n 70-1550
Pump repair kit p/n 90-0617



See bulletin for
Pressure Vessel
Parts, back of manual

Pump Oil, p/n 85-0050

Membrane Element
Model 500, one 33-0238
Model 800, two 33-0238
Model 1000, two 33-0238
Model 1300, three 33-0238
Model 1800, four 33-0238

HP Pump
Model 500, p/n 70-1253
Model 800, p/n 70-1255
Models 1000 & 1300 at 50 hz, p/n 70-1254
Models 1000 & 1300 at 60 hz, p/n 70-1256
Model 1800 Pump, p/n 70-1254

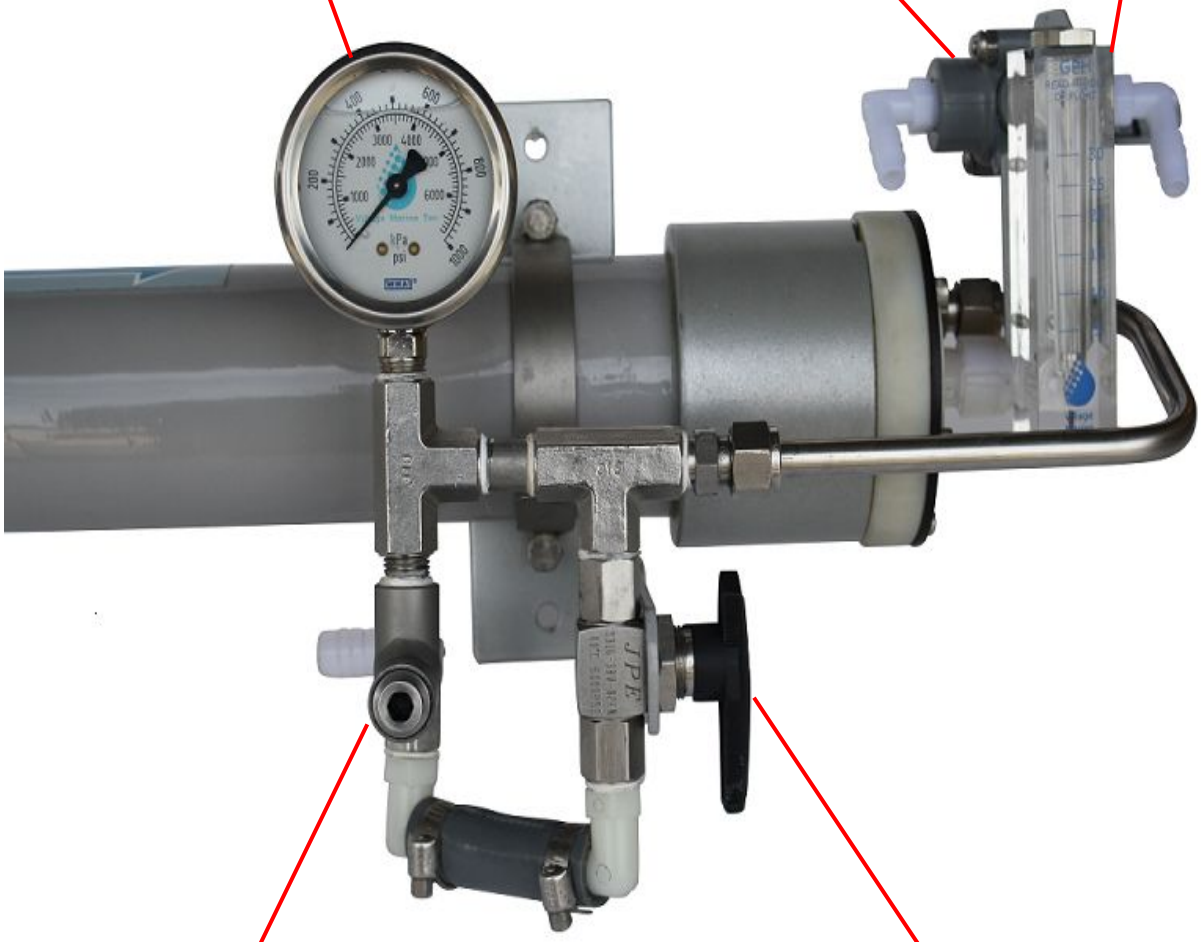
Pumps 70-1253/5/6, HP Pump outlet valve kit, p/n 70-6135
Pumps 70-1253/5/6, HP Pump inlet valve kit, p/n 70-6136
Pumps 70-1253/5/6, HP Pump seal service kit, p/n 70-6134
Pump 70-1254 only, HP Pump outlet valve kit, p/n 70-6138
Pump 70-1254 only, HP Pump inlet valve kit, p/n 70-6139
Pump 70-1254 only, HP Pump seal service kit, p/n 70-6137

PARTS DIAGRAM - INSTRUMENTS

Product Flowmeter
Model 500, p/n 40-1006
Models 800, 1000, 1300, p/n 40-1018
Model 1800, p/n 40-0240

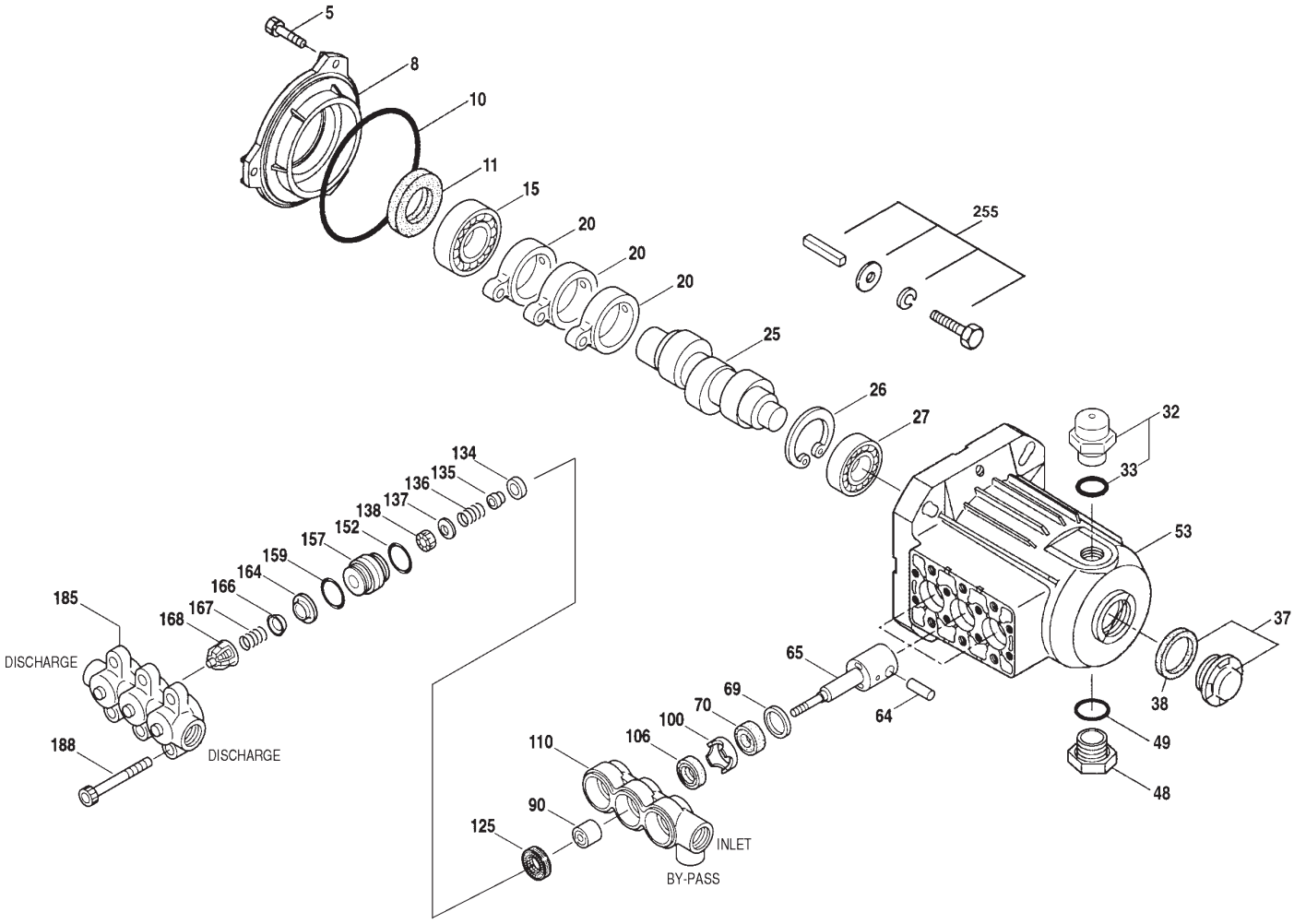
Sample Valve
Models 500, 800, p/n 60-0140
Models 1000 and up, p/n 60-0014

Membrane Pressure Gauge p/n 40-0599



HP Regulating Valve, p/n 60-0088

Bypass Valve, p/n 60-0064
Counter-clockwise for priming, starting, flushing or cleaning.
Clockwise for making water.



High Pressure Pump, Parts and Service Guide

WaterMaker Model	60 Hertz Power Pump ID	50 Hertz Power Pump ID
LT-400	2SF25SEEL	2SF25SEEL
LT-500	2SF25SEEL	2SF25SEEL
LT-600	2SF25SEEL	2SF25SEEL
LT-800	2SF29SEEL	2SF29SEEL
LT-1000	2SF35SEEL	2SF42SEEL
LT-1300	2SF35SEEL	2SF42SEEL
LT-1800	2SF42SEEL	Not Available

PARTS LIST

ITEM	P/N	MATL	DESCRIPTION	MODEL USED	QTY
15	547445	S	Screw, HHC Sems (M6x14) [3/03]	All	3
8	547153	AL	Cover, Bearing [3/03]	All	1
10	14041	NBR	O-Ring, Bearing Cover - 70D [3/03]	All	1
11	55337	NBR	Seal, Oil, Crankshaft - 70D [3/03]	All	1
15	14488	STL	Bearing, Ball - Inner	All	1
20	547046	TNM	Rod, Connecting	All	3
25	543135	FCM	Crankshaft, 1.7mm	05SEEL	1
	46109	FCM	Crankshaft, 3.1mm	10SEEL	1
	44931	FCM	Crankshaft, 4.5mm	15SEEL	1
	544693	FCM	Crankshaft, 7.3mm	25SEEL	1
	45426	FCM	Crankshaft, 8.5mm	29SEEL	1
	544694	FCM	Crankshaft, 10.2mm	35SEEL, 42SEEL	1
26	12385	STL	Ring, Retaining, Bearing	All	1
27	15710	STL	Bearing, Ball - Outer	All	1
32	547961	RTP	Cap, Oil Filler w/O-Ring	All	1
33	14179	NBR	O-Ring, Oil Filler Cap - 70D	All	2
37	92241	–	Gauge, Oil w/Gasket - 80D	All	1
38	44428	NBR	Gasket, Flat, Oil Gauge - 80D	All	1
48	44842	NY	Plug, Drain	All	1
49	14179	NBR	O-Ring, Drain Plug - 70D	All	1
53	547285	AL	Crankcase [3/03]	All	1
64	16948	CM	Pin, Crosshead	All	3
65	544695	SSZZ	Rod, Plunger	All	3
69	126259	STCP R	Washer, Oil Seal	All	3
70	25461	NBR	Seal, Oil Crankcase	All	3
90	544697	CC	Plunger, Ceramic (M18x18)	05-35SEEL	3
	831290	CC	Plunger, Ceramic (M20x18)	42SEEL	3
100	44869	PVDF	Retainer, Seal	All	3
106	547683	NBR	Seal, LPS w/SS-Spg	All	3
110	547704	SS	Manifold, Inlet	05-35SEEL	1
	831288	SS	Manifold, Inlet	42SEEL	1
125	44652	SNG	Seal, HPS w/SS	05-35SEEL	3
	44649	SNG	Seal, HPS w/SS	42SEEL	3
134	543691	SS	Valve, Inlet [4/02]	05-35SEEL	3
	831400	SS	Valve, Inlet	42SEEL	3
135	543689	SS	Spacer	All	3
136	543690	SS	Spring, Inlet Valve	All	3
137	88575	S	Washer, Conical (M6)	All	3
138	543692	SS	Nut (M6)	All	3
152	† 26089	NBR	O-Ring, Adapter Spacer, Inner-80D	05-35SEEL	3
	549539	NBR	O-Ring, Adapter Spacer, Inner	42SEEL	3
157	544700	SS	Adapter, Valve	05-35SEEL	3
	831289	SS	Adapter, Valve	42SEEL	3
159	† 26089	NBR	O-Ring, Adapter Spacer, Outer-80D	All	3
	11377	FPM	O-Ring, Adapter Spacer, Outer-80D	All	3
	46647	EPDM	O-Ring, Adapter Spacer, Outer-80D	All	3
164	544293	SS	Seat	All	3
166	543669	SS	Valve	All	3
167	543700	SS	Spring	All	3
168	44565	PVDF	Retainer, Spring	All	3
185	547705	SS	Manifold, Discharge	All	1
188	544701	S	Screw, HSH (M8x80)	All	6
255	30517	STZP R	Assy, Bolt Mount	All	1

OPTIONAL PARTS

ITEM	P/N	MATL	DESCRIPTION	MODEL USED	QTY
106	545192	FPM	Seal, LPS w/SS-Spg	All	3
	546507	EPDM	Seal, LPS w/SS-Spg	All	3
125	46652	HT	Seal, Hi-Temp, 2-Pc w/S-Support	05-35SEEL	3
	44936	FPM	Seal, HPS w/SS	42SEEL	3
	46667	HT*	Seal, Hi-Temp, 2-Pc w/S-Support	42SEEL	3
134	33873	NY	Valve, Inlet [4/02]	05-35SEEL	3
152	11377	FPM	O-Ring, Adapter Spacer, Inner-80D	05-35SEEL	3
	46647	EPDM	O-Ring, Adapter Spacer, Inner-80D	05-35SEEL	3
	129977	FPM	O-Ring, Adapter Spacer, Inner	42SEEL	3
	129978	EPDM	O-Ring, Adapter Spacer, Inner	42SEEL	3
159	11377	FPM	O-Ring, Adapter Spacer, Outer-80D	All	3
	46647	EPDM	O-Ring, Adapter Spacer, Outer-80D	All	3

STANDARD AND OPTIONAL KITS

ITEM	P/N	MATL	DESCRIPTION	MODEL USED	QTY
300	**34973**	**NBR**	Kit, Seal (Incld: 106, 125, 152, 159)	05-35SEEL	1
	33453	FPM	Kit, Seal (Incld: 106, 125, 152, 159)	05-35SEEL	1
	30536	EPDM	Kit, Seal (Incld: 106, 125, 152, 159)	05-35SEEL	1
	76973	**NBR**	Kit, Seal (Incld: 106, 125, 152, 159)	42SEEL	1
	76955	FPM	Kit, Seal (Incld: 106, 125, 152, 159)	42SEEL	1
	76996	EPDM	Kit, Seal (Incld: 106, 125, 152, 159)	42SEEL	1
310	**34972**	**NBR**	Kit, Valve (Incld: 152,159,164,166,167,168)	05-35SEEL	1
	33454	FPM	Kit, Valve (Incld: 152,159,164,166,167,168)	05-35SEEL	1
	30546	EPDM	Kit, Valve (Incld: 152,159,164,166,167,168)	05-35SEEL	1
	76972	**NBR**	Kit, Valve (Incld: 152,159,164,166,167,168)	42SEEL	1
	76445	FPM	Kit, Valve (Incld: 152,159,164,166,167,168)	42SEEL	1
	76446	EPDM	Kit, Valve (Incld: 152,159,164,166,167,168)	42SEEL	1
311	**39668**	**NBR**	Kit, Inlet Valve w/SS-IV (Incls:134-138,152,159)	05-35SEEL	1
	34974	NBR	Kit, Inlet Valve w/NY-IV (Incls:134-138,152,159)	05-35SEEL	1
	33460	FPM	Kit, Inlet Valve w/NY-IV (Incls:134-138,152,159)	05-35SEEL	1
	30556	EPDM	Kit, Inlet Valve w/NY-IV (Incls:134-138,152,159)	42SEEL	1
	76668	**NBR**	Kit, Inlet Valve w/SS-IV (Incls:134-138,152,159)	42SEEL	1
	76465	FPM	Kit, Inlet Valve w/SS-IV (Incls:134-138,152,159)	42SEEL	1
	76466	EPDM	Kit, Inlet Valve w/SS-IV (Incls:134-138,152,159)	42SEEL	1

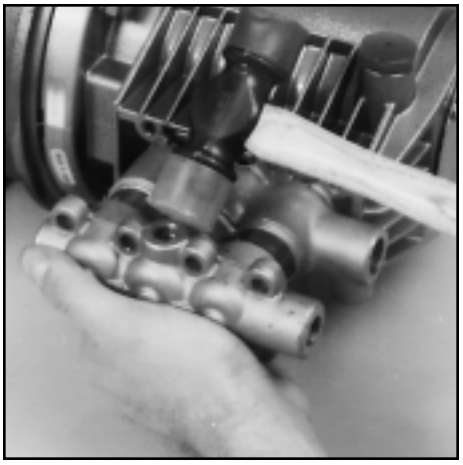
OPTIONAL EQUIPMENT

ITEM	P/N	MATL	DESCRIPTION	MODEL USED	QTY
283	990394	–	Kit, Oil Drain	05-35SEEL	1
285	80228	STL	Screw (M8-1.25x80) (Motor Removal)	05-35SEEL	2
352	44050	STPZ	Tool, Oil Gauge Removal	All	1
–	6107	–	Oil, Bottle (21 oz) ISO-68 Hydraulic	All	1
		–	(Fill to specified crankcase capacity prior to start-up)		
–	6575	–	Plunger Pump Service DVD	All	1
–	6119	–	Lubricant, Antiseize (1 oz.)	All	1

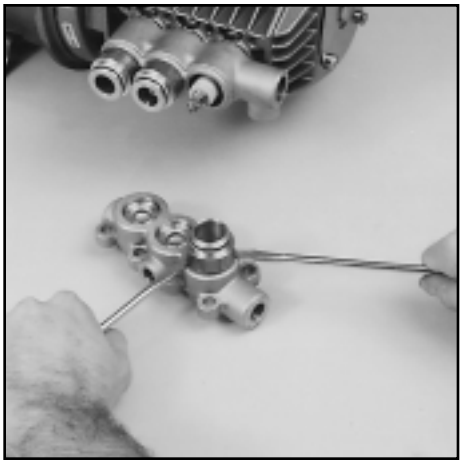
Bold print part numbers are unique to a particular pump model.

Veiw other system accesseries on-line at
http://www.catpumps.com/accessories-valves-selector-by-specification.cfm

[ ] Date of latest production change. † Production parts are different than repair parts. R Components comply with RoHS Directive.
*Review individual parts in each kit for material code identification.
See Tech Bulletins 002, 036, 043, 055, 064, 070, 073, 074, 091, 092 and 095 for additional information.
NOTE: Discard Key that may come standard with most motors and engines and use only the key included in Bolt kit. MATERIAL CODES (Not Part of Part Number): AL=Aluminum CC=Ceramic CM=Chrome-Moly EPDM=Ethylene proplenedienemonamer FCM=Forged Chrome-moly FPM=Fluorocarbon HT=Hi-Temp (EPDM Alternative) NBR=Medium Nitrile (Buna-N) NY=Nylon PVDF=Polyvinylidene Fluoride RTP=Reinforced Composite S=304SS SNG=Special Blend (Buna) SS=316SS SSZZ=316SS/Zamak STL=Steel STCP=Steel/Chrome Plated STZP=Steel/Zinc Plated TNM=Special High Strength



Removal of Discharge Manifold



Removal of Adapter from Discharge Manifold

Removal of Adapter from Inlet Manifold

SERVICING THE VALVES

Disassembly of the Discharge Valve Assembly

1. Disconnect all plumbing and remove unloader for ease in servicing.

   NOTE: CEE and SEEL models do not come with standard unloader.

2. Inspect oil for proper level, presence of water or discoloration and replace as needed.

3. Using a standard M6 allen wrench remove the six (6) (2SF) or eight (8) (4SF) Socket Head Screws from the manifold. Remove the outer screws first, then the center screws.

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

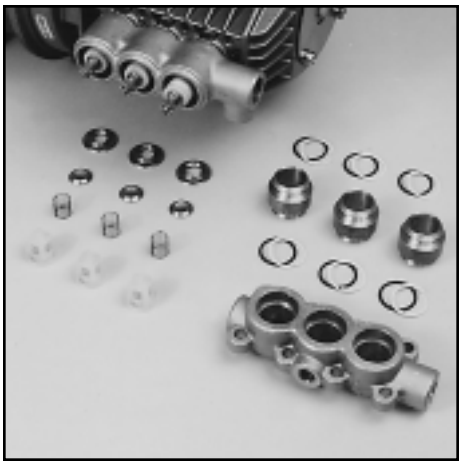
5. Grasp the Discharge Manifold from the from underside and gradually lift manifold while you pull away from the Crankcase.

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

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

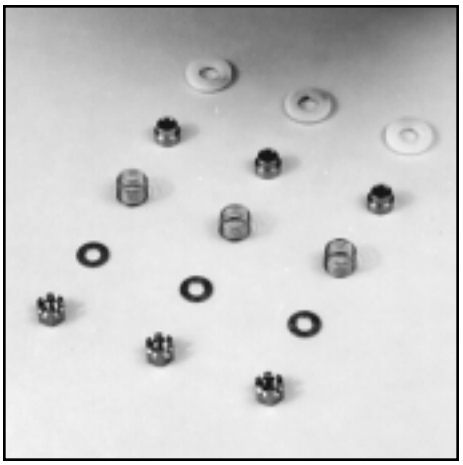
   NOTE: On "X" models the Adapter and Seat are one-piece.

   NOTE: The "GZ" models use the standard "SF" Valve Kit.

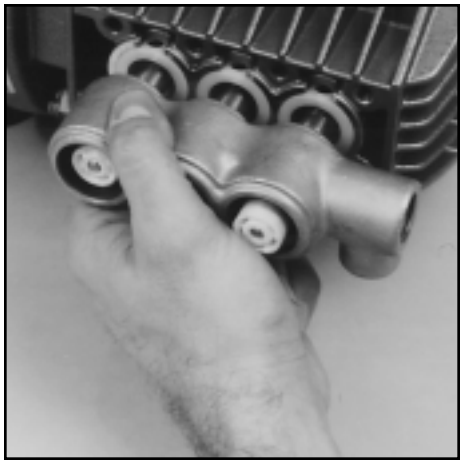


Discharge Valve Assembly (4SF)

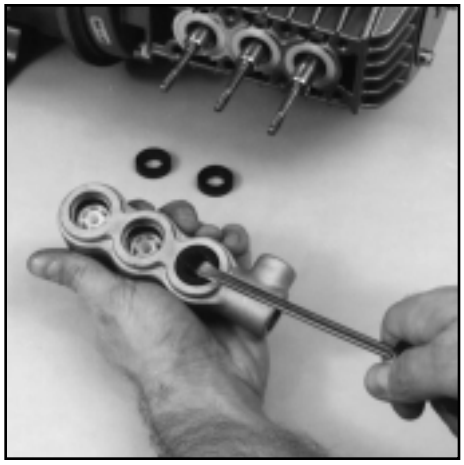
Adapter and Discharge Valve Assembly (2SF)



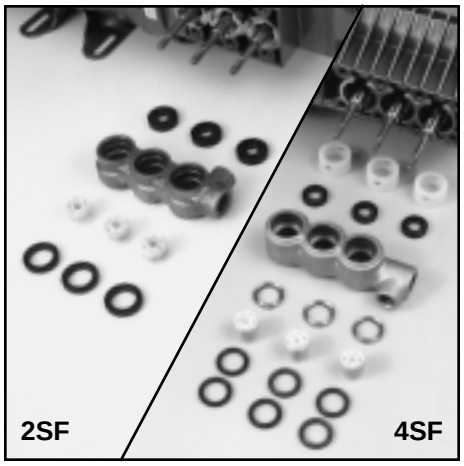
Inlet Valve Assembly



Removal of Inlet Manifold



Removal of Lo-Pressure Seal

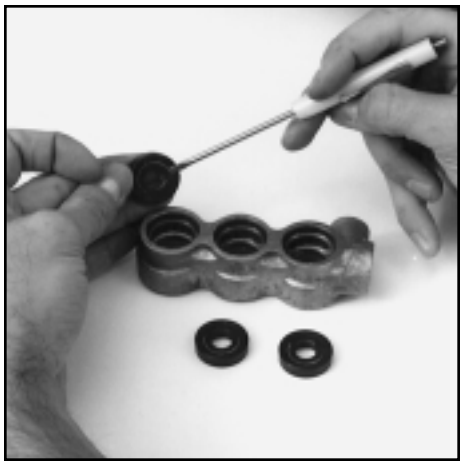


Plunger, Seals and V-Packing Arrangement

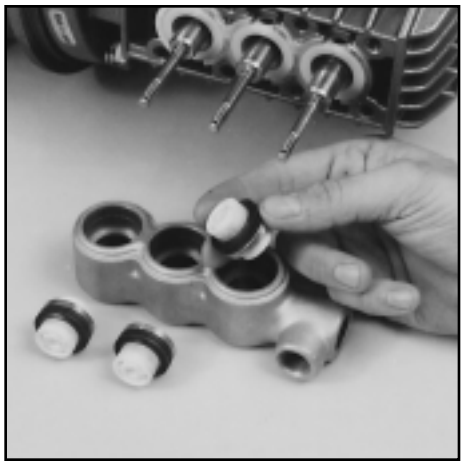
Reassembly of the Discharge Valve Assembly

1. Examine Adapter Spacer O-Rings and replace if worn. Lubricate and install O-Rings and Back-up-Rings **on both front and rear of the Adapter Spacer.**
2. Examine the Valve Retainers for scale buildup or wear and install into each Discharge Manifold port with tab down into the manifold chamber.
3. Replace worn or damaged Springs and place into Retainers.
4. Examine Valve and Seats for pitting, grooves or wear and replace as needed.
5. Place Valves over Springs with **concave side down.**
6. Place Valve Seats on Valves with **concave side down.**

   NOTE: On "X" Models, the Adapter and Seat are one-piece.
7. Lubricate O.D. of Adapter Spacer and insert **smaller I.D. into Discharge Manifold ports**. Snap into position. Exercise caution not to cut or pinch o-rings.
8. Carefully guide Discharge Manifold with Spacers over Plunger Rod ends and press into Inlet Manifold.
9. Replace Socket Head Screws and torque per chart. Use torque sequence chart.
10. If oil was not changed, be certain oil is to mark on Oil Gauge before resuming operation.



Installation of Lo-Pressure Seals



V-Packing Positioning

Installation of V-Packings

SERVICING THE SEALS

Disassembly of the Seal Assembly

1. Remove the Inlet Valve Assembly from the exposed plunger rod ends, including Cotterpin, Nut, Washer, Spring, Spacer and Inlet Valve.
2. Grasp the Inlet Manifold from the front and underside and pull to remove from Plunger Rods.
3. Carefully examine back side of Lo-Pressure Seal before removing from the Inlet Manifold as it will be damaged during removal. If worn, insert screwdriver into I. D. of seal and pry out from the backside of the I.M. Exercise caution to avoid damage to the Inlet Manifold.
4. Press ceramic Plunger with thumb or soft tool from **back side of Inlet Manifold.**

   On the Model 2SF the Hi-Pressure Seal may stay with the plungers or remain in the Inlet Manifold. If on the plungers, slide off by hand. If in the manifold, use a reverse pliers to remove.

   On the Model 4SF the V-Packing and Female Adapters may stay with the plungers or remain in Inlet Manifold. If on the plungers, slide off by hand. If in the manifold, use a reverse pliers to remove.
5. Remove Seal Retainers from Crankcase by grasping tab with pliers and pulling out.
6. Examine Crankcase Oil Seal to determine if Crankcase servicing is needed.
7. Examine Ceramic Plunger, Lo-Pressure Seals, V-Packings for scoring, cracks and wear and replace.

   NOTE: The "S" versions of the 4SF pumps have a replaceable Sleeve.
8. Examine the Sleeve for grooves for scale buildup and replace as needed. Grasp the Sleeve by hand and pull from the Plunger Rod.
9. Examine the O-Ring and Back-up-Ring under the Sleeve for cuts or wear and replace.
10. Examine the Barrier Slinger for wear and replace as needed. Install the Barrier Slinger with the concave side facing away from the Crankcase.

Reassembly of Seal Assembly

1. With Inlet and Discharge Manifold removed, examine Seal Retainers and replace if worn or damaged. Install on Plunger Rod and press into Crankcase **with tab out.**
2. Place Inlet Manifold on work surface with **Crankcase side up.**
3. Lubricate new Lo-Pressure Seals and press into position with **garter spring down.** Be certain the seal is seated squarely on the shoulder in the inlet manifold chamber.
4. Place Inlet Manifold on work surface with **Crankcase side down** (larger I.D. ports up)**.**
5. On the Model 4SF place new Female Adapter into Inlet Manifold chamber with **v-groove facing up.**
6. Carefully examine the Plungers for scoring or cracks and replace if worn.
7. On the Model 2SF lubricate Ceramic Plungers and new Hi-Pressure Seals. Press the plunger into the seal and position seal in middle of plunger.

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

   NOTE: The "Hi-Temp" 2SF models use a special Hi-Pressure Seal and Hi-Temp Seal Kit.

   On the Model 4SF lubricate Ceramic Plungers and new V-Packings. Press Plunger into the V-Packings and position in the middle of plunger.

   NOTE: The deeper recessed end of the plunger should face the same direction as the v-groove on the V-Packing.
8. On the Model 4SF lubricate the Plunger Rod O-Ring to avoid cutting during installation. Install the Back-up-Ring first then the O-Ring into the groove on the Plunger Rod.
9. Install the Sleeve with the tapered end facing out. Gently press towards the Plunger Rod shoulder until flush with the Barrier Slinger.
10. Carefully install Inlet Manifold over Plunger Rod ends and slowly press into Crankcase.
11. Install the Plungers onto the plunger rods. Press into position using the **larger I.D. end of Valve Spacer.**

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

    NOTE: The "Hi-Temp" 2SF models use a Nylon Inlet Valve (order individual parts, not standard Inlet Valve Kit).

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

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

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

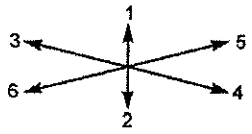
16. Install Nuts and torque per chart.

17. On 2SF and 4SF models **always install new Cotterpins** and turn ends to secure in position.

    NOTE: "X" and S.S. Models do not use Cotterpins.

18. Refer to steps 7-10 under Servicing Valves-Reassembly to replace the Discharge Manifold.

2SF Torque Sequence



4SF Torque Sequence

Torque diagonally in order shown. The outer four (4) screws then center screws all hand tight. Then repeat series to specifications in torque chart.

1. While Inlet Manifold, Plungers and Seal Retainers are removed, examine Crankcase Seals for wear.
2. Check oil level and for evidence of water in oil.
3. Rotate Crankshaft by hand to feel for smooth bearing movement.
4. Examine Crankshaft Oil Seal externally for drying, cracking or leaking.
5. Consult CAT PUMPS or your local distributor if Crankcase service is required.

    See section VIII of the Plunger Pump Service Video for additional information.

TORQUE CHART

Pump Item	Thread	Tool Size [Part No.]	Torque in.lbs.	ft.lbs.	Nm
Outer Bearing Case Screw	M6	M10 Hex/Phil. [25082]	50	4.0	6
Inner Bearing Case Screw	M6	M10 Hex/Phil. [25082]	50	4.0	6
Manifold Screw	M8	M6 Allen [30941]	115	9.4	13
Plunger Rod Nut	M6	M10 Hex [25082]	55	4.4	6
Bubble Oil Gauge	M28	Oil Gauge Tool [44050]	45	3.6	5
Mounting 2SF					
Adapter Plate to Gas Engine	5/16-24	1/2" Hex	90	7.2	10
Pump to Adapter Plate	3/8-16	9/16" Hex	110	9.0	12
Pump to Electric Motor	3/8-16	9/16" Hex	110	9.0	12
Mounting 4SF					
Adapter Plate to Gas Engine	3/8-16	9/16" Hex	110	9.0	12
Pump to Adapter Plate	1/2-13	3/4" Hex	150	12.5	17
Pump to Electric Motor	1/2-13	3/4" Hex	150	12.5	17

Pressure Vessel Assemblies

For Seawater Elements

Contact Information:

Parker Hannifin Corporation
Racor Division/Village Marine Tec.
2000 W. 135th St.
Gardena, CA 90249

phone 310 516 9911
fax 310 538 3048
racor@parker.com
www.villagemarine.com

www.parker.com/racor

Key Features:

Racor Village Marine RO membrane pressure vessels feature non-metallic wetted surfaces for excellent corrosion resistance.
Simple end plug design allows quick removal for element servicing.
If the size you require is not shown please contact us for custom builds.

- Operating Pressure: 1000 psi/68 bar
- Shell: Filament Wound fiberglass
- Collars: 6061 T-6 Powdercoated aluminum
- End Plugs: Thermoplastic
- End Ring:
  6061 T-6 Anodized aluminum on **2.5”** and **4”** size
  SS316 on **6”** size
- Fasteners: SS316

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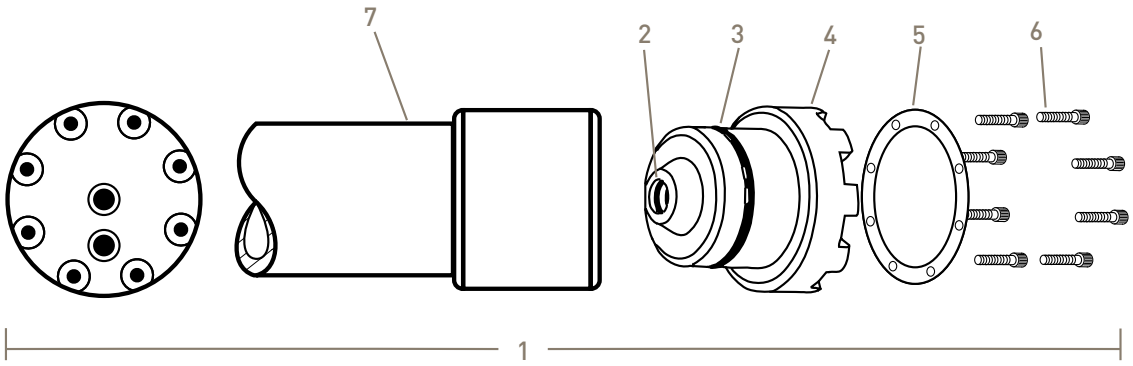
Pressure Vessel Assemblies

For Seawater Elements



Part Numbers:

Item	Description		Quantity per Assembly	2.5" x 19"	2.5" x 38"	4" x 40"	6" x 40"
1	Vessel Assembly**			32-2519	32-2537*	32-0444	32-6040
2	Product O-ring		4	32-2116	32-2116	32-2116	32-2229
3	End Plug O-ring		2	32-2228	32-2228	32-4342	32-0640
4	End Plug		2	32-2513*	32-2513*	32-4012	32-6012
5	End Ring		2	32-4013	32-4013	32-4014	32-0096
6	Capscrews		***	86-0106	86-0106	86-0123	86-0136
7	Shell	White	1	32-0025	32-0026	Please Call	Please Call
		Gray	1	32-0098	32-0099	32-4001	32-0001
	Weight (lbs/kg)			5/2	7/3	22/10	45/20

Notes:

*End Plug 32-2517 is also available for 2.5" vessels, which offers straight, coarse thread feed/reject port used on some VMT PW watermakers. Use of coarse thread end plug changes the vessel assembly p/n to 32-2538

**Membrane not included. For applicable membrane elements see bulletin No. 7897 (Aqua Pro RO Membranes)

*** Capscrews:
Order 6 per end plug on 2.5" size
Order 8 per end plug on 4" size
Order 10 per en plug on 6" size

To maintain peak performance always use genuine Parker-Racor/Village Marine Tec. replacement parts.
We reserve the right to change our specifications or standards without notice.

Print Reorder Number **7898** Rev-A 1-8-2010

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Aqua Pro® Sea Water RO Membranes

Contact Information:

Parker Hannifin Corporation
Racor Division/Village Marine Tec.
2000 W. 135th St.
Gardena, CA 90249

phone 310 516 9911
fax 310 538 3048
racor@parker.com
www.villagemarine.com

www.parker.com/racor

Aqua Pro® thin film composite reverse osmosis membranes deliver high salt rejection while maintaining high production rates to obtain the energy efficiency demanded by plant operators.

By selecting the highest grade of materials and thoroughly testing performance, Racor Village Marine Tec. is able to offer the highest quality products.

Aqua Pro® membranes are designed for use in Parker Village Marine Tec. pressure vessel housings as well as other brand housings.

Parker Racor

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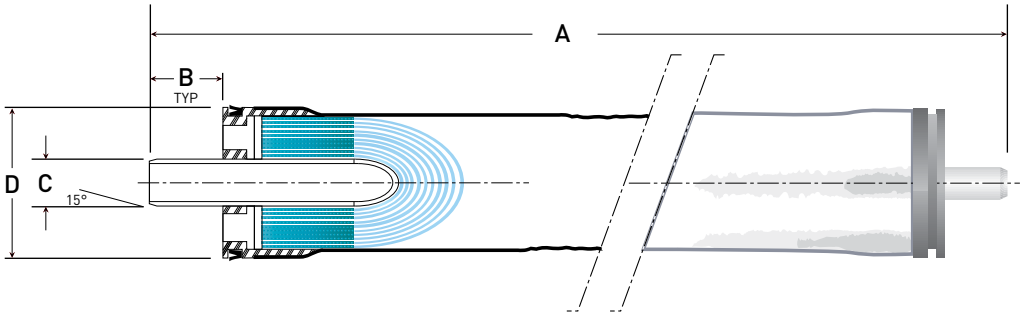
Aqua Pro® Sea Water RO Membranes

Recommended Operating Limits:

- Maximum Operating Pressure: **1000 psi**
- Maximum Operating Temperature: **113°F (45°C)**
- Maximum Feed Turbidity: **1 NTU**
- Free Chlorine Tolerance: **0 PPM**
- Maximum Feed Silt Density Index: **SDI 5**
- pH Range: **Continuous Operation:** 4-11 **Short-term for Cleaning:** (30 minute duration) 2.5-11



VMT Part No.	Nominal Size	Product Flow GPD m³/day	Typical Salt Rejection %	Dimensions inches/cm			
				A*	B	C	D
33-2519	2519	220 - 0.83	99.4	19/48	1.1/2.8	0.75/1.9	2.4/6.1
33-3000 **	2519	150 - 0.57	99.2	19/48	1.1/2.8	0.75/1.9	2.4/6.1
33-3001**	2519	105 - 0.40	99.2	19/48	1.1/2.8	0.75/1.9	2.4/6.1
33-0238	2538	550 - 2.08	99.4	38/96.5	1.1/2.8	0.75/1.9	2.4/6.1
33-3002**	2538	210 - 0.80	99.2	38/96.5	1.1/2.8	0.75/1.9	2.4/6.1
33-0440	4040	1200 - 4.54	99.4	40/101.6	1.0/2.5	0.75/1.9	3.96/10.1
33-0036	6040	2500 - 9.47	99.4	40/101.6	1.27/3.2	1.5/3.8	5.98/15.2

* All 19" and 38" elements come with a 2" removable extender so that the stocked size also fits 21" and 40" housings
** Elements are specially designed for low feed flow applications. Use only with certain Sea Quencher and Little Wonder watermakers.

Notes:

- Keep elements moist at all times
- Permeate obtained from first two hours of operation should be discarded
- To prevent biological growth during storage, shipping, or system shutdowns it is recommended that elements be immersed in a protective solution. The standard solution for long or short term storage should contain 1.0 percent (by weight) sodium metabisulfite (available as VMT p/n 85-0103, 85-0038, 85-0044 or 85-0049)
- Standarized test conditions are 32,000 ppm NaCl at 77° F (25° C), with 800 psi feed. Production rates for individual elements may vary +/- 20% and rejection may vary +/- 0.4%

To maintain peak performance always use genuine Parker-Racor/Village Marine Tec. replacement parts.
We reserve the right to change our specifications or standards without notice.

Print Reorder Number 7897 Rev- 11-25-2009

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Pleated Filters and Filter Cartridge Kits

Contact Information:

Parker Hannifin Corporation
Racor Division/Village Marine Tec.
2000 W. 135th St.
Gardena, CA 90249

phone 310 516 9911
fax 310 538 3048
racor@parker.com
www.villagemarine.com

www.parker.com/racor

The Village Marine Tec. line of pleated filters are designed specifically for the RO watermaker industry and are superior to wound or polyspun cartridges to give you a longer filter life as well as increasing flow rates and keeping cartridge size down.

Available in a wide arrange of sizes and micron ranges to ensure that every type of watermaker filter need is taken care of. Stock sizes fit most standard filter housings, if the size you need is not shown please contact us with the dimensions required.

Single use Cleaning and Preservative Cartridge Kits are designed specifically for small RO Systems. The Cartridges allow for easy and effective membrane maintenance.

The Cleaning and Preservative Cartridge Kits eliminate the trouble and mess of measuring powdered chemicals and ensuring correct chemical concentrations. The Chemical cartridges fit directly into 2.5” x 10” housings and contain the correct amount of chemical for a single use.

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Pleated Filters and Filter Cartridge Kits

Features:

Pleated Filters

- Polypropylene pleated construction
- Longer service life over wound or polyspun cartridges
- Easily cleaned and reused
- Chemically compatible with a wide range of alkalies, most acids and saline solutions
- 0.5, 1, 5, and 20 micron ranges available
- Pliable plastisol ends ensures filter seal to eliminate bypass
- High packing density reduces filter size while keeping flow rates up
- Filter bands on large diameter elements keep filter shape during system pulsations

Filter Cartridge Kits

- Cartridge with Blue stripe contains cleaner #1, a biological cleaner to remove algae, fungi and bacteria
- Cartridge with Red stripe contains cleaner #2, an acidic cleaner to remove scale from the membrane
- Cartridge with Green stripe contains the preservative. This chemical is used for pickling the membranes
- Cartridges are capable of being used in any housing that takes a standard 2.5" (64mm) x 10" (254mm) filter cartridges

Pleated Sediment Elements

Part Number	Microns	Filter Area ft^3/m^3	Diameter inch/cm	Length inch/cm
33-0118	20	10/0.93	2.75/7	9.75/25
33-0117	5	10/0.93	2.75/7	9.75/25
33-0053	20	18/1.67	4.5/11.4	9.75/25
33-0052	5	18/1.67	4.5/11.4	9.75/25
33-0020	20	30/2.79	8.63/22	7.75/20
33-0005	5	30/2.79	8.63/22	7.75/20
33-0058	20	35/3.25	4.5/11.4	20/51
33-0057	5	35/3.25	4.5/11.4	20/51
35-0020	20	35/3.25	6.12/15.5	11.9/30
35-0001	5	35/3.25	6.12/15.5	11.9/30
33-0172	100	100/9.29	8.63/22	24.3/62
33-2100	20	100/9.29	8.63/22	24.3/62
33-5100	5	100/9.29	8.63/22	24.3/62
33-1100	1	100/9.29	8.63/22	24.3/62
33-1105	0.5	100/9.29	8.63/22	24.3/62

Carbon Flushing Filters

Part Number	Diameter inch/cm	Length inch/cm
33-0311	2.75/7	9.75/25
33-0315	4.5/11.4	9.75/25
33-0083	4.5/11.4	20/50.8

Cartridge Filter Kits

Description	Part Number	Contents
Cleaning Kit	85-0102	One Blue stripe cleaner #1 plus One Red stripe cleaner #2
Preservation Kit	85-0103	Two Green stripe preservative

To maintain peak performance always use genuine Parker-Racor/Village Marine Tec. replacement parts.

Print Reorder Number 7905 Rev- 10-28-2009

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