



marine watermaker

PSM SERIE OPERATING AND MAINTENANCE MANUAL



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1. GENERAL INFORMATION

1.1. Introduction

The manual provided to you includes useful information about components of watermaker. It is important and strongly advised that this information is read carefully before the operation of the watermaker.

Only by reading and understanding all the information on the manual, it can be ensured the watermaker will operate safely and efficiently for a long time. The technical drawings, pictures and details in the manual are guidelines for users.

When you have encountered a problem with the device, please contact us for any support or spare part request. The labels identifying the model of the watermaker are stamped on the device by clinching. Serial number and date of production of the watermaker are indicated on the mentioned label.

2. DEFINITION OF WATERMAKER AND USAGE PURPOSES

2.1. Definition of Watermaker And Operating Principles

Reverse Osmosis (RO) systems, which are being used worldwide today, are one of the rapidly growing technologies. Osmosis can be observed in nature, like vegetables absorbing the water from the soil or kidneys distinguishing blood from urine. In the RO systems, fresh water is gained by percolating minerals from the sea water getting through membranes with pinholes in size of 1/1000 of micron, that is a molecular sieve, under high pressure (55-60 bars). Totally dissolved solids (TDS) are thrown out of the system with a salty solution that can not get through the membranes. The system is designed to reduce the salinity by 99%. The water procuded on figure of 380 ppm in the Aegean Sea (salinity rate: 38000 ppm) is potable. The water procuded is disinfected from any microbe or viruses. According to World Health Organization standards water with a TDS level of less than 700 ppm is drinkable. Tap waters in many of the Aegean Sea cost regions are higher than 1000 ppm.

2.2. How does the System Operate?

Sea water reaches the feed pump by being filtered after it gets sucked into the sea water inlet valve in the craft. Filtered through 20 and 5 micron pre-filters, the sea water flows through membranes via high pressure pump. In the meantime, operating pressure is calibrated through pressure control valve (55-60 bar). Some fresh water is recovered from the sea water that is pressurized. Depending on the specifications of the device, the salinity level of the water which has been produced is measured. If the water meets the desired characteristics, it is directed into the fresh water tank but if it does not, it is

dumped back to sea. Amount of the fresh water that has been produced is monitored with the flowmeter.

2.3. Membranes (H)

The membranes are the most sensitive parts of the system and should be protected carefully. It is important to read the directions of maintenance and operate carefully in order to prevent membranes from being damaged and not to void the contract of warranty. The device reaches its highest production level when the temperature of sea water is 25°C. The production capacity changes depending on the temperature of the sea water. The production rate decreases by 2.5 % - 5% for each degree under 25°C. Membranes should not be exposed to temperatures lower than 0°C and higher than 45°C. Every time after they have been used membranes should be flushed by using chlorine-free fresh water. Membranes should never be allowed to dry, therefore they should be protected with sterilizer liquid if they are not going to be used for a long period of time (more than 2 weeks). Sterilizer liquid should be replaced once every 6 months. Membranes should not be exposed to rapid pressure shock. The pressure should be increased gradually. Otherwise, membranes can get torn. The device should not be mounted in an environment with high temperature level. The high temperature accelerates the bacterial growth in membranes. The quality of sea water and its salinity rate affect the membrane efficiency and operation of devices. It is not advised to use the device in muddy or fouled waters. Sea water should be filtered thoroughly from solid materials before it has reached to the membranes.

Watermaker has been produced according to directives and standards of CE. It is important that you indicate the following information in every kind of correspondence about the watermaker between you and the producing company or dealers so that the actions to be taken can be minimized

- Watermaker type:
- Watermaker Serial No
- Explanation of the existing failure
- Daily average operation time

2.4. Technical Specifications

PSM SERIES WATERMAKERS	
TECHNICAL SPECIFICATIONS	
Capacity of High Pressure Pump	4 liters / minutes
Operating Pressure	60 bar
Maximum Feed Pump Pressure	3 bar
Salt Reject Rate	99,5 %
Temperature of Sea Water	min 0,5 c-max 45 c

Chlorine Tolerance	0,1 ppm
Membrane Type	TFC FILMTEC
PH	4-11
Standard Voltage	220 V ~ / 50 Hz / 1PH / 4,5 A

Type of Device	Water Production liters / hour	Power Kw/hour	Power Consumption (A)	Membrane Type and Number	LxWxH (cm)	Weight (kg)
PSM-030	30	0,55	4,5 A	1 in number 2.5"X21"	80x42x 38	40
PSM-060	60	0,55	4,5 A	2 in number 2.5"X21"	80x42x 38	45

The figures above have been calculated under 35000 TDS and 25°C temperature of sea water and 60 bar pressure. ±% 15 tolerance exists.

SEE ATTACHMENT 1 FOR PSM TECHNICAL DRAWINGS

2.5. Pictures



Pre-filter



Feed Pump



Carbon filter

2.6. System Components

➤ **Pre-filters (E)**

1 piece of 2.5"x10" 5 micron filter prevent solid materials from reaching the membranes. The pressure decreases and the device stops when filters are clogged. Replace the filters once in 2 weeks or when there is an unexpected decrease in the pressure.

➤ **Low Pressure Gauge (P)**

It indicates the pressure between filters and high pressure pump.

➤ **Low Pressure Switch (Q)**

Operating the high pressure pump without water is extremely dangerous for the device. Therefore, when the pressure falls under 1.2 bars, the system will stop automatically.

➤ **High Pressure Pump (G)**

It pumps pressurized sea water into the membranes. It is resistant to corrosion. Its pistons are made of ceramic. Its oil should be replaced in the first operation after 50 hours and once for each 500 hours in the following operations.

➤ **High Pressure Gauge (N)**

It indicates the sea water pressure in membranes.

➤ **High Pressure Control Valve (K)**

If you turn it clockwise, the valve will close and the pressure will increase and it will decrease if turned the opposite direction. The pressure should be increased gradually otherwise membranes can be damaged. Pay attention that this valve is open before operating the device.

➤ **By-pass Valve (I)**

It regulates the pressure level in the system and throws out the sea water. It is preset to 60 bar.

➤ **Flow meter (M)**

It indicates flow rate of fresh water in terms of gallon and liter per minute.

➤ **Salinity Monitor and Probe (R) (L)**

It indicates the quality of fresh water in terms of microcymene/centimeter. By using salinity monitors you can set the quality of the water that you want transferred to the fresh water tank in terms of $\mu\text{s}/\text{cm}$.

➤ **Fresh Water Diverter Valve (S)**

It is a three way solenoid valve. Depending on the quality of fresh water that has been set on the salinity monitor, it dumps back unwanted water into the sea.






➤ **Active Carbon Filter (F)**

Membranes should be flushed with fresh water so that they may have a long operation life. For this purpose, membranes are cleaned by getting the fresh water taken from the fresh water tank through carbon filters. Carbon filter eliminates the chlorine and smell in the water. It should be replaced whether it is used regularly or not.

3. SECURITY

3.1. Safety Instructions

Following symbols are related with security and should be read carefully. Otherwise users can cause damage to equipments or themselves corporally.

	IMPORTANT: This symbol warns you move carefully and do activities more attentively in order not to harm yourself.
	WARNING: This symbol warns you to follow the directions otherwise there is a risk for damage..
	ATTENTION: This symbol indicates there is a risk that may cause injuries or damage of equipments unless users are careful.
	DANGER: This symbol indicates there is high risk that people may get injured. It indicates the rules should always be followed strictly.
	DANGER: This symbol warns against the risk that people may get injured or die because of electric shock.

Safety instructions for the user are defined above. Please read security informations throughly and always keep them in mind in order to prevent physical injuries to yourself or damage to the equipment. If the user does not follow security instructions the warranty is void and the producing company can not be held responsible for material and moral hazard..

Accident Prevention

▲ Producing Company has produced these devices in compliance with safety standards of EN 60204-1 and EN 12100-2 including international and national directives and methods for watermakers.

▲ Watermaker should be used by only the personnel who has read the manual and understood the content

▲ All directives, advices and general safety instructions included in this manual should be followed and obeyed. Using a device or components purchased from the producing company without following these instructions may cause a high risk for working accident. The producing company holds no legal responsiblity for this kind of conduct. Such conduct will cause void of warranty.

⚠ Qualified and certified personnel should be charged for lifting and installing the watermaker and its electrical operations.

⚠ Routine maintenance operations should be done after power sources have been inactivated.

⚠ Make sure the watermaker has been cleaned and maintained before operating it.

⚠ Please check safety equipments, power cable and portable parts routinely. If you have observed a trouble on safety equipments or parts that may cause the unit to not work properly, please do not operate the watermaker until you replace them with new ones.

⚠ Never replace the parts without inactivating electric power source.

3.2. General Safety Information

⚠ Power cable should be placed in such a way that it will not be stepped on and any object is not put on it. The socket where the cable is plugged and where it connects with the watermaker should be paid attention to.

⚠ If network interface cable has been damaged during operation, do not touch it, unplug the network switch. Never use a damaged connection cable.

⚠ Always keep the operation area tidy and clean. Untidiness in operation area may cause accidents.

⚠ Always keep the device clean as if you will use it any moment so that they can operate safely. Please, follow the instructions on maintenance and replacing parts. Check plugs and cables orderly.

⚠ Cut the power source connections while it is not in use or before maintenance

⚠ Be sure that aligners have been removed before operating the watermaker

⚠ Repairs should be performed only by technicians. Otherwise, danger of accident may occur.

⚠ Before starting a new operation, check if protector apparatuses or lightly damaged parts can work properly or not. All parts should be placed correctly and all conditions should be fulfilled so that the device can operate correctly. The damaged protector apparatuses and parts should be repaired or replaced regularly (by producing company or by service workshops).

⚠ Please, do not use the devices if their breaker or switches do not work

⚠ Keep flammable liquids exc. away from the watermaker and power connections.

4. INSTALLATION OF WATERMAKER

4.1. Preparation

- a. Size and technical specifications of watermaker has been indicated on the related page. The floor on which watermaker will be placed should be smooth and hard and it should have the characteristics to be able to carry the weight of watermaker.
- b. Where the device will be installed, electric line, in the condition of minimum 3x1,5 mm² (1 phase 1 ground 1 neutral), should be placed above the watermaker. Connection must have the suitable fuse .
- c. At least 16 mm² grounds should be used for body grounding of watermaker.
- d. Operation grounding should exist in the area the watermaker will be installed. If it does not, ground should be installed.
- e. On the power connection of watermaker there should be a ground fault detector that is about 30 mA.

4.2. Installation

- a. Determining Source of Sea Water: For low capacity watermakers sea port can be shared with shower and toilet suctions. For 80 liters/hour and above units, a private sea water suction should be established for the device. Water sea port should not be shorter than 20 mm. Suction should be near to the bottom of the vessel. Pay attention that the port is away from outlet of toilet and bilge and there is not any obstacle that may prevent suction. Or, in sailboats place the port as near as possible to the bottom so that it does not absorb air during heeling. It is advised to use inlet valve **(A)** and sea water strainer **(B)** on entrance. Air bubbles and negative pressure are big danger for high pressure pump.



The sea water discharge line **(Z)** should certainly be above the sea level, if the device is placed inside the craft.



Watermaker should not be operated in a sea water temperature that is lower than 0 degrees and higher than 45 degrees.

- b. Selecting Location for Feed Pump **(D)**: Feed pump must be placed under the sea level, in a place that is as dry as possible and near to the sea water entrance. Its function is to carry sea water to the inlet of high pressure pump.

- c. Selecting Location for The Units Producing Water: Units can be under or above sea level. Dry and cool places are advised.
- d. Throwing out Reject Water (Z): Concentrated reject water should flow out above the sea level. Diameter of pipe should not be less than 12 mm. While sea water is flowing out, it should never be exposed to a backpressure.
- e. Fresh Water Pipe Connection (X): Connect flow of fresh water to top of tank with a pipe that is 10 mm at least. Pay attention that there is not any obstruction or crack. Otherwise it can damage the device. Inlet of tank should be as high as possible so that the water will not flow back. There should be surge in the tank.
- f. Inlet Valve Connection with Feed Pump: Connect inlet valve to feed pump with a pipe that is suitable for 20 mm suction and pay attention that the pipe is clean.



Be sure that connection and seal rings are shut tight against percolation of water or air.

5. STARTUP

SEE ATTACHMENT 2 FOR PSM FLOW CHART

- a. Electric power connection should be checked. It should be ensured that power has reached to the watermaker.
- b. Open sea water inlet valve. (A)
- c. Swamp sea water inlet pipes and filters with sea water.
- d. Make sure the pressure regulating valve is counter clockwise full blast.
- e. Press start button (V) of feed pump (D) and check if water gets through the pipe or not. Water must start to flow and the feed pump pressure must increase in one minute (1,2 bar and above).



If the pressure does not increase in 10 second, system will be turned off automatically.

WARNING: If the system does not operate for more than 2 times, do not try to operate it. Call technical service immediately.

- f. Press the start button (W) of high pressure pump
- g. If the water continues flowing, slowly turn high pressure control valve (K) clock wise until the high pressure gauge (N) shows 60 bar.



Never operate the watermaker under pressure higher than 60 bar (850 PSI)

- h. Check that the fresh water which has been produced is flowing into the tank.



Every time before operating the system make sure that high pressure valve is open. If you turn the valve counter clockwise, it will open.

- i. Check fresh water flow from fresh water flowmeter (**M**). The device starts to make water after 45 bar. You can see the salinity rate of water from the digital salinity monitor.
- j. You can see the salinity rate of water from the digital salinity monitor (**R**) on the control panel. The device is preset to 1300 $\mu\text{s}/\text{cm}$. It rejects the product water that is above this figure back to the sea through the three way valve (**S**).



In case of emergency never touch the watermaker with wet hands. Keep people away from the watermaker and press the emergency switch (**ES**) that is in form of a cork on the control panel. Call the service immediately.

6. SHUTTING DOWN THE DEVICE

- a. Turn the high pressure valve (**K**) counter clockwise until high pressure reaches 0 (zero).
- b. Press the feed pump button (**V**) and high pressure pumps button (**W**) on the control panel simultaneously.
- c. Turn off the main switch and sea water valve (**A**).

7. OPERATING FRESH WATER FLUSH

Membranes should be flushed by using fresh water in certain periods and when the quality of product has decreased. During flushing, the system must be in the **“STOP”** position and high pressure valve should be turned counter clockwise to the end. Turn on the valve on the carbon filter (**F**). Check that fresh water is flowing into the system for 5-10 minutes and then turn off the valve.

BEFORE OPERATING THE DEVICE, BE SURE THAT YOU HAVE TURNED OFF THE VALVE.

This action is a precaution for possible troubles that may occur in membranes and increases the lifespan of the device. This process can be utilized anytime when the device is turned off. If you do not use the watermaker everyday, you can repeat this process after each time you have used it. Carbon filter should be replaced periodically (each 6 months) whether it has been used or not.

In the automatic systems, 30 seconds after the system has been shut down, the valve is kept open for 3 minutes and fresh water flows into the system.

8. MAINTENANCE



The power to the device should certainly be cut before any maintenance or part replacements

8.1. Safety Rules in Maintenance

- All repair and maintenance procedures should be performed after the watermaker has been turned off and its connection to the electric power source is cut.
- Any personnel who are not authorized to maintain the watermaker should not be allowed to maintain and repair.
- The repair and maintenance environment should be dry and clean.
- The parts of the watermaker that are considered as dangerous have been security blocked. However, the other parts should also be paid attention to in order prevent physical damage.
- Petroleum solvent or other flammable liquids should not be used for cleaning the watermaker; instead you may use water and detergents for parts that require it.
- Sea water inlet valve (A) should certainly be turned off before maintenance
- Membrane modules should not be exposed to 45°C directly.
- Membranes should always be kept wet. If it will not be used after its package has been opened, it should be stored in a such way that it will always be wet.



Do not use chlorinated water for maintenance and internal flushing of the watermaker.



It is not advised to keep the device turned off for a long period of time. Instead; it is recommended to operate it for least 10 minutes everyday. This way, both membranes are flushed and bacterial growth is prevented.



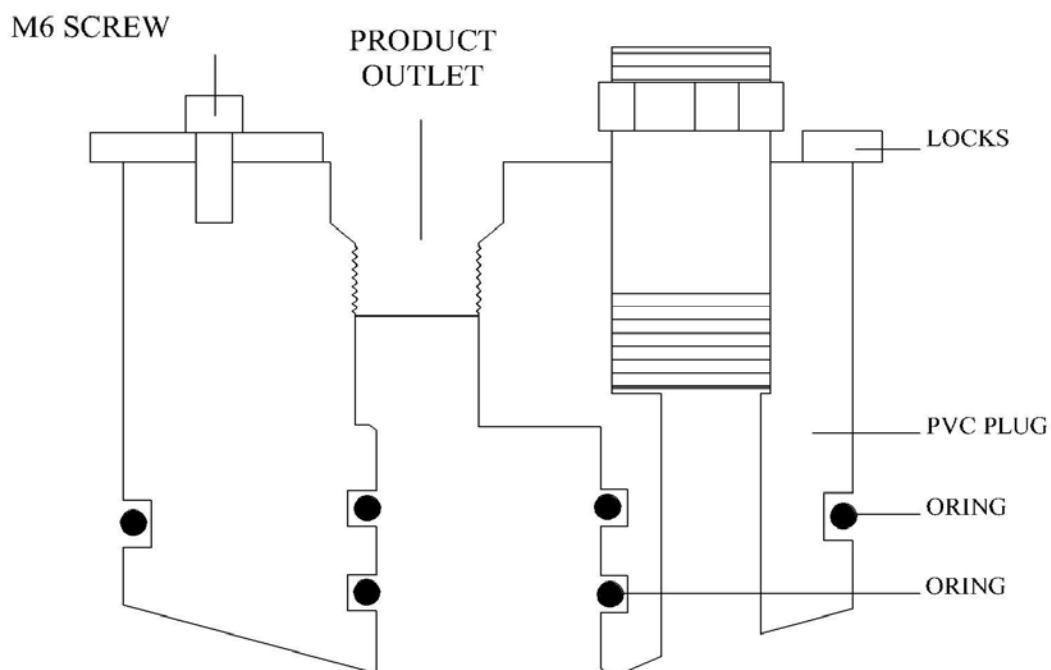
Definitely protect membranes from icing.

COMPONENTS	REQUIRED MAINTENANCE	MAINTENANCE PERIOD
Sea strainer (B)	Check the filter and clean it	In each 1000 hours, or whenever it has been clogged
Pre-filters (E)	Clean or replace filter cartridges and clean the sump	When the low pressure gauge (P) falls below 1.2 bar
Carbon filter (F)	Replace the part.	Once for each 6 months
High pressure pump (G)	Change oil.	First change: after 50 hours of operation; then after every 500 hours of operation..
	Replace Gasket and O-Ring	Once for each 1500 hours. Or whenever it is seeping.
Flowmeter (T)	Clean inside of transparent tube	Whenever it is fouled
Salinity monitor (R)	Clean electrodes (L)	Once for each 12 months

8.2. Membrane Replacing Procedure

- a. Remove the fittings of fresh water.
- b. Remove the two M6 screws
- c. Remove the two locking plates (locks).
- d. Remove the end plug in one move quickly by holding the high pressure fitting.
O-rings may get wedged by locking grooves. In this situation, it is really hard to pull the end plug. If the o-ring has been stuck, gently tip the plug. If this does not work, apply silicon grease on the inside of locking grooves.
- e. Check if there is any damage on the end plug, o-rings and their grooves.
- f. Pull out the membranes or push them out by removing both plugs. (**Towards the flow direction!**)
- g. Place new membranes after checking that the o-ring on high pressure inlet is on the right direction.
- h. Wipe plug and membrane ports with a clean clothe.
- i. Place the plug and replace the components by following the first 5 steps backwards from the last to the first.

MEMBRAN HOUSING

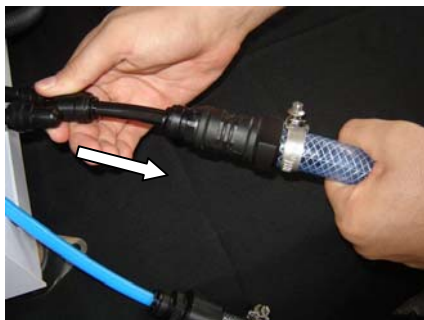


8.3. Protection of Membranes

If the watermaker does not operate for more than 10 days, micro organisms will be formed inside the membranes and the capacity of watermaker will decrease. Therefore,

membranes should be protected with a preserver solution. This solution helps preserve the membranes for 6 months.

1. Flush the membranes by using fresh water for 10 minutes.
2. Fill a plastic container with 20 liters of chlorine free water and add 350 grams of preserver to it, and stir them until the preserver has dissolved in the water completely.
3. Turn the three way valve (C) on the feed pump to the pickling position and plunge the pickling hose nozzle into the plastic container.
4. Remove the brine hose from quick connection fitting (Picture A) and place the fitting with the outlet hose that has been provided together with the device (Picture B). Plunge the hose nozzle into another plastic container (the container capacity should be 20 liters at least)
5. Turn the high pressure valve counter clockwise full blast
6. Press the START button of feed pump and keep it working until all the solution in the container has been absorbed.
7. Replace the hoses back to their initial position and turn off the valve.



(Picture A)



(Picture B)



Avoid from exposing your skin, eyes and mouth to the solution while stirring. If there is skin contact, wash the part of your body which has been in contact with the solution. Do not inhale it.

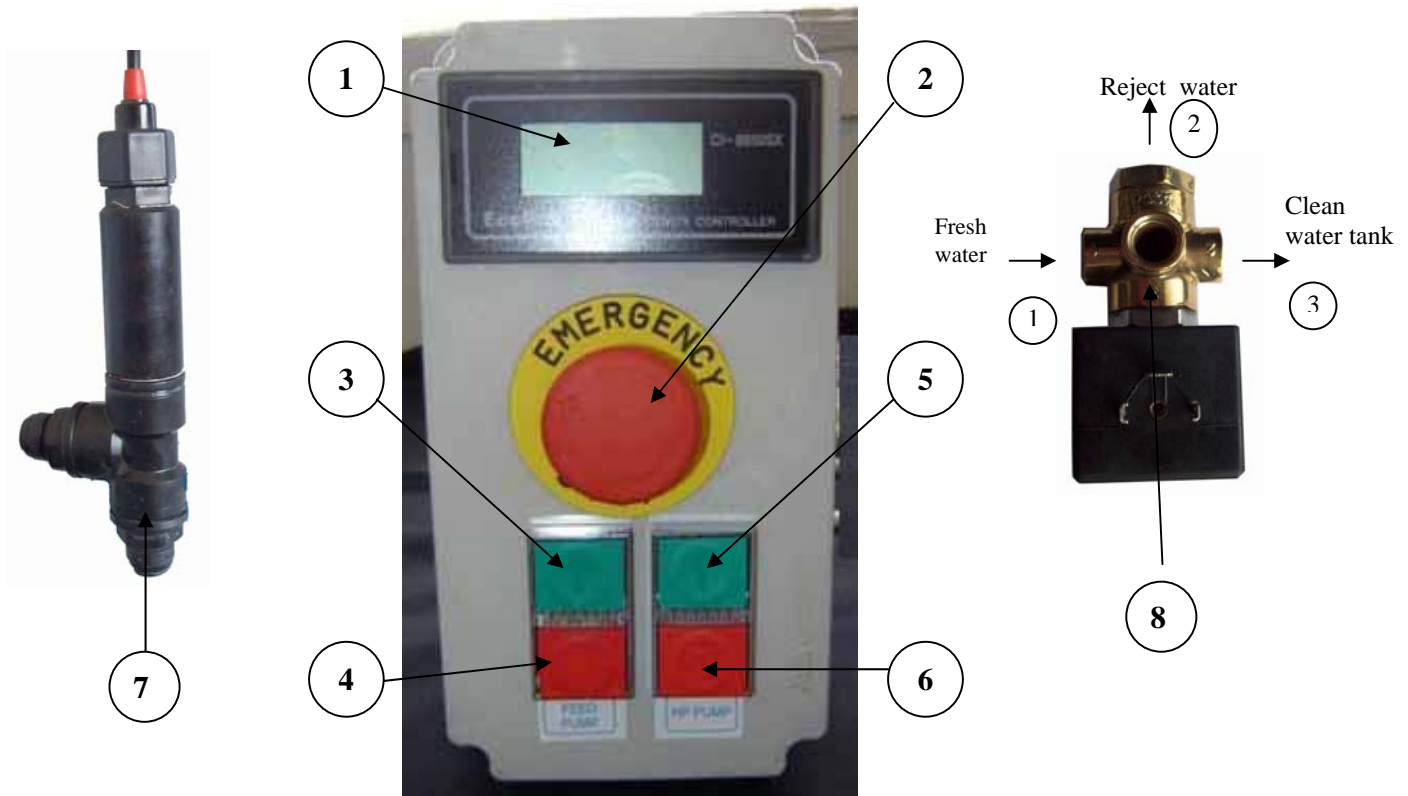
SEE ATTACHMENT 4 FOR MEMBRANE INFORMATION CATALOGUE
SEE ATTACHMENT 5 FOR HIGH PRESSURE PUMP DRAWING

9. POSSIBLE TROUBLES AND TROUBLESHOOT

CONDITION	CAUSES	REMEDY
Pressure drop on pre-filter outlet	Blocked water flow	Check for any blocking
	Hose coming from the inlet has been bended or clogged	Clean the cloggage or replace the hose.
	Fouled strainer or pre-filter	Clean the strainer or replace the filter
High pressure gauge will not come up to 60 bar	No intake water	Check the pre-filter and pressure gauge. Check intake. Replace the filter if it necessary.
Low product water	Fouled or worn RO membrane	Clean or replace the membrane.
High product water flow	Failed RO membrane	Replace the membrane.
	Decrease of salinity level in the sea	Decrease the pressure.
High pressure pump does not work.	Low feed pump pressure	Check for defective feed pump and the filters
	Defective relay switch or fuse	Check or replace the fuse or/and push button
Quality of product water is higher than 1300µs.	Fouled membrane	Clean the membranes or replace them.
TROUBLESHOOTING GUIDE FOR HIGH PRESSURE PUMP SYSTEM		
CONDITION	CAUSES	REMEDY
Pressure and/or the product amount drops	Worn seal ring	Replacing the seal ring
	Broken valve spring	Replacing the spring
	Fouled inlet strainer Fouled pre-filters Cavitations	Clean the strainer Replace filter refills Check if lead in pipe has been clogged

The water in the crankcase	High humidity Worn seal rings	Decrease the frequency of oil replacement. Replace the seal rings
Noisy operation	Worn bearings	Replace the bearings. Refill the oil according to the advised oil level.
	Cavitations	Check if the inlets have been clogged or not. Check for strainers and filters.
Inability to build up pressure	Discharge valve chamber has air trapped within it	Allow more time to prime and ensure there is no air suction leaks. Open the valve circle and evacuate the air inside.
Rough/Pulsating operation with pressure drop	Worn seal rings Inlet restriction	Replace the seal rings Check system for restrictions or air leaks
	Cavitations	Check inlet lines for restrictions
Excessive leakage between the high pressure pump manifold and rear crankcase section	Worn plunger(s) Worn seal seals	Replace plunger(s) Replace the seal rings
	Cracked plunger(s)	Replace plunger(s)
High crankcase temperature (higher than 78°C)	Wrong grade of oil Improper amount of oil in crankcase	Use specified type of oil Adjust oil level to proper amount

10. CONTROLS



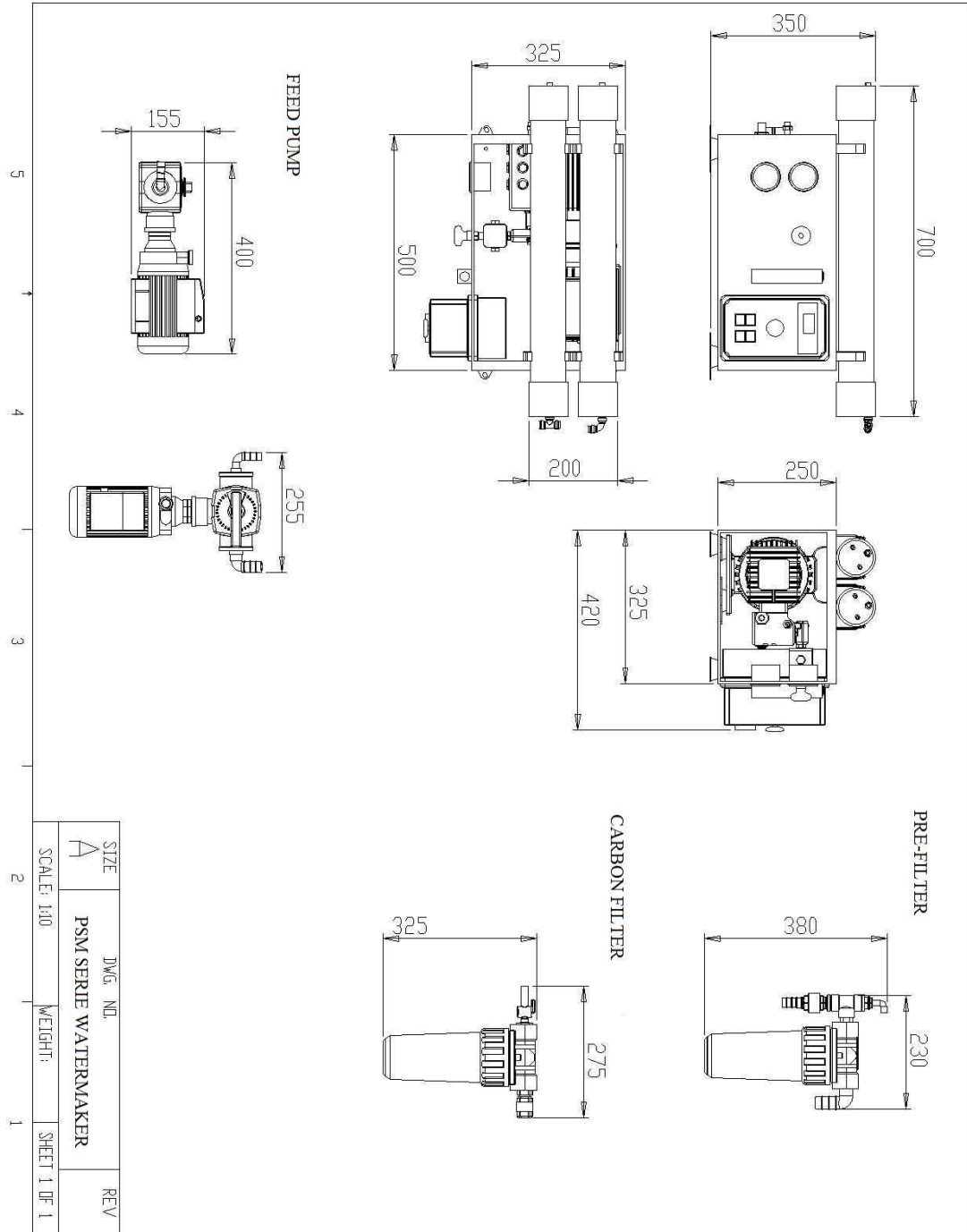
NO	COMPONENT	FUNCTION
1	Salinity monitor	It indicates salinity rate
2	Emergency STOP button	It cuts the electric power in case of emergency
3	Start Button3	It operates the feed pump
4	Stop Button4	It stops the feed pump
5	Start Button5	It operates high pressure pump
6	Stop Button6	It stops high pressure pump
7	Salinity monitor probe	It functions as electrode of salinity monitor
8	Three ways valve	It rejects poor fresh water

SEE ATTACHMENT 3 FOR THE ELECTRIC CHART

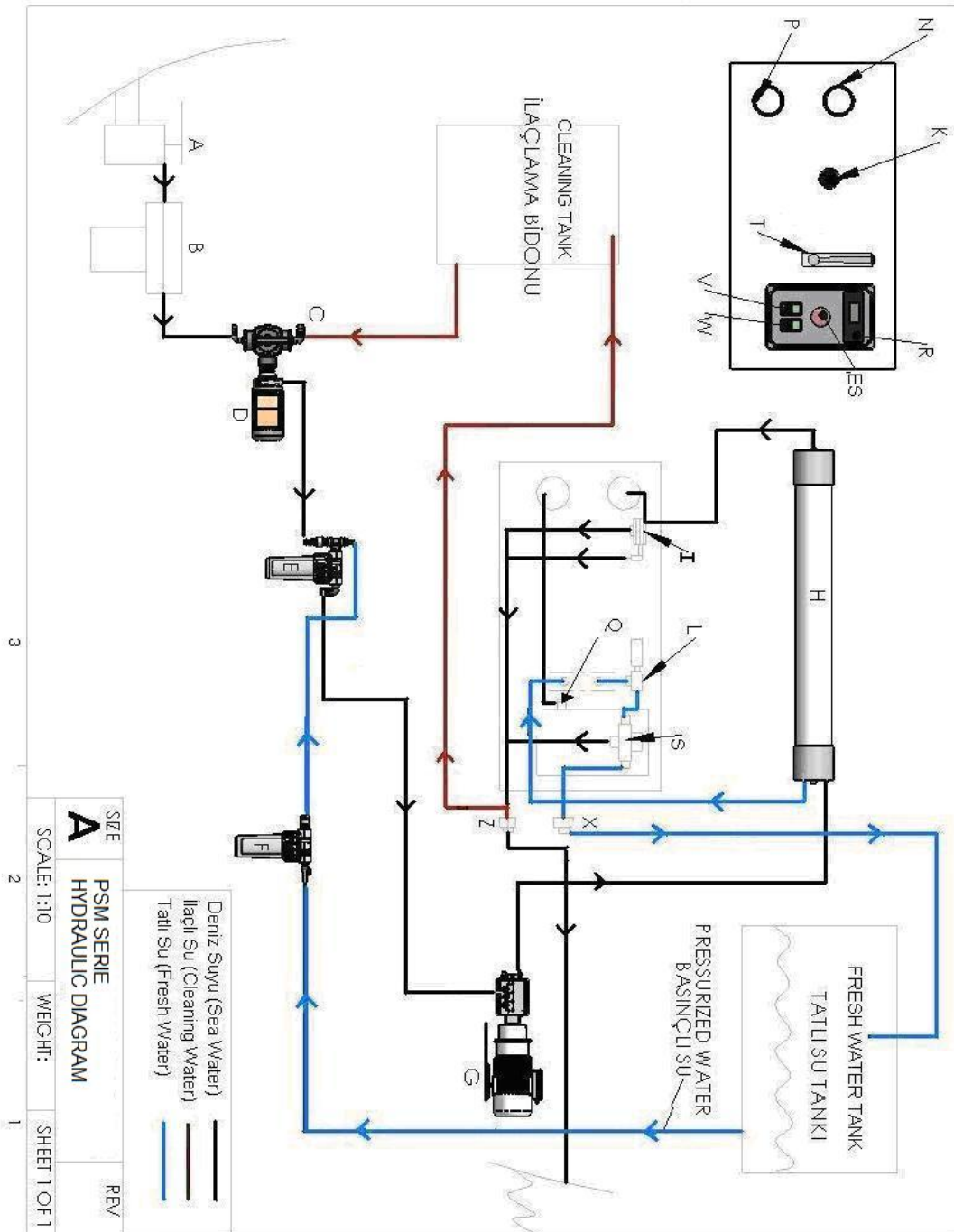
11. LIST OF SPARE PARTS

	MATERIAL NAME	CODE
1	MOTOR	VOLT 0.55
2	HP PUMP	INTER04
3	HIGH PRESSURE GAUGE	WIKA 10
4	LOW PRESSURE GAUGE	WIKA 100
5	FRESH WATER FLOWMETER	LZM-15
6	PRESSURE REGULATING VALVE	SS-1RM4-A
7	BY-PASS VALVE	DELP01
8	THREE WAY VALVE	T-GM.3W 101.3.5
9	MEMBRANES	SW302521
10	MEMBRANE PORT	DEL2521
11	HIGH PRESSURE HOSE	
12	QUICK CONNECTION FITTINGS	
13	LOW PRESSURE SWITCH	CEME
14	SALINITY MONITOR	CI-8850X
15	FEED PUMP	2HM3
16	PRE-FILTERS	10-05
17	CARBON FILTER	
18	SALINITY MONITOR PROBE	PRB01

ATTACHMENT 1 Technical Drawing (Dimensions)



ATTACHMENT 2 Flow Chart



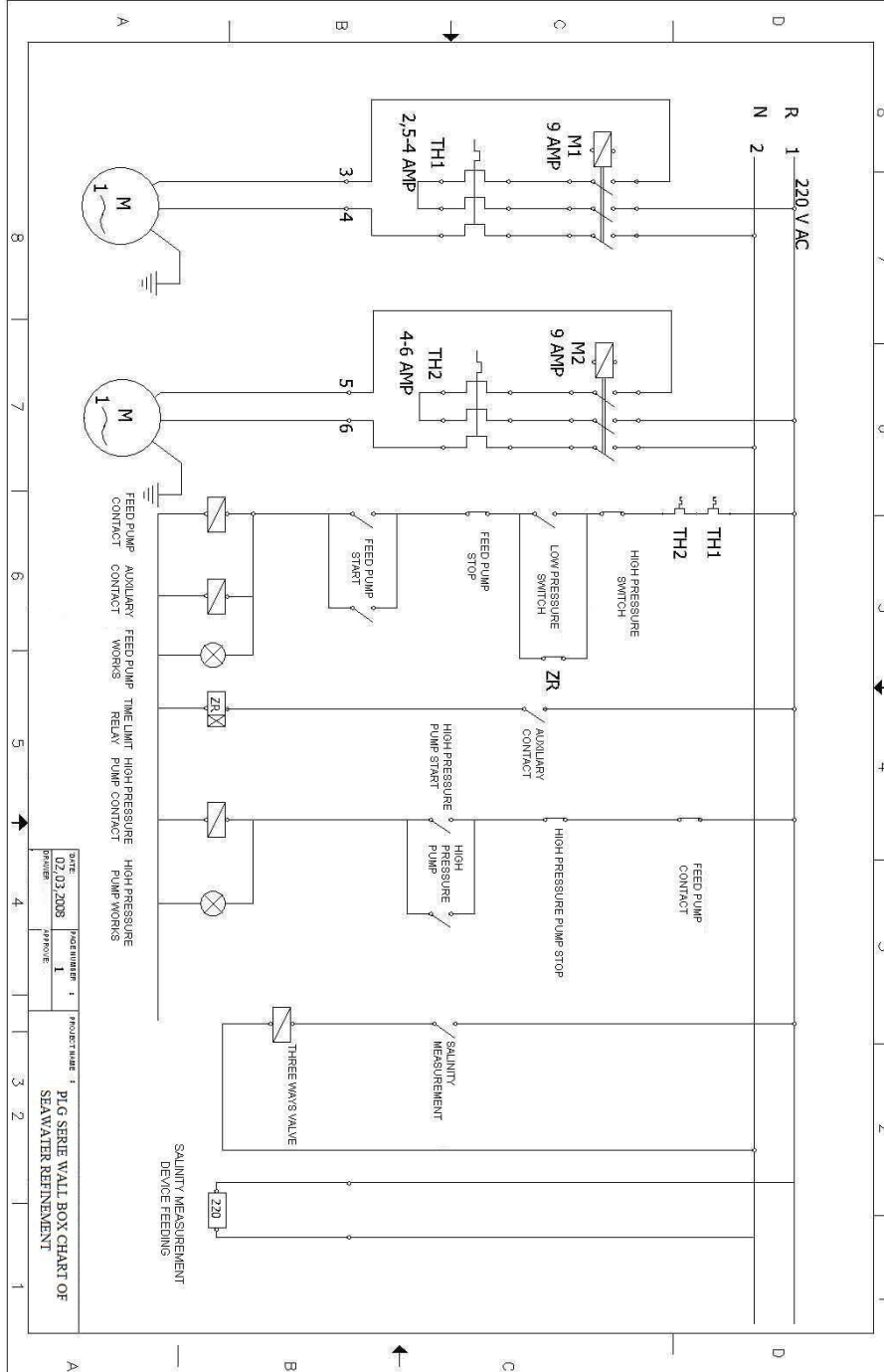
SIZE	PSM SERIE	REV
A	HYDRAULIC DIAGRAM	

SCALE:	WEIGHT:	SHEET 1 OF 1
1:10		1

Deniz Suyu (Sea Water)
 İlaçlı Su (Cleaning Water)
 Tatlı Su (Fresh Water)



ATTACHMENT 3 Electric Chart



DATE: 02.03.2008
 DRAWN BY: [Signature]
 APPROVE: [Signature]

PROJECT NAME: PIG SERIE WALL BOX CHART OF SEAWATER REFINEMENT

ATTACHMENT 4 Membran Information Catalogue

Product Information



FILMTEC™ Membranes

FILMTEC Seawater RO Elements for Marine Systems

Features

Improved FILMTEC™ seawater reverse osmosis elements offer the highest productivity while maintaining excellent salt rejection.

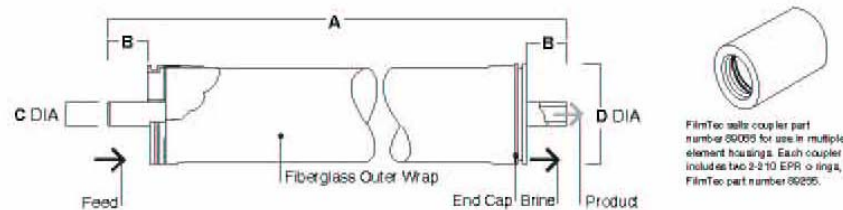
- FILMTEC SW30 membrane elements have the highest flow rates available to meet the water demands of both sea-based and land-based desalinators.
- FILMTEC SW30 elements may also be operated at lower pressure to reduce pump size, cost and operating expenses.
- Improved FILMTEC seawater membrane combined with automated, precision element fabrication result in the most consistent product performance available.

Product Specifications

Product	Part Number	Active Area ft ² (m ²)	Applied Pressure psig (bar)	Permeate Flow Rate gpd (m ³ /d)	Stabilized Salt Rejection (%)
SW30-2514	80733	6.5 (0.6)	800 (55)	150 (0.6)	99.4
SW30-2521	80734	13 (1.2)	800 (55)	300 (1.1)	99.4
SW30-2540	80737	29 (2.8)	800 (55)	700 (2.6)	99.4
SW30-4021	80740	33 (3.1)	800 (55)	800 (3.0)	99.4
SW30-4040	80741	80 (7.4)	800 (55)	1,950 (7.4)	99.4

1. Permeate flow and salt rejection based on the following test conditions: 32,000 ppm NaCl, pressure specified above, 77°F (25°C) and the following recovery rates, SW30-2514 – 2%, SW30-2521 & SW30-4021 – 4%, SW30-2540 & SW30-4040 – 8%.
2. Permeate flows for individual elements may vary +/-20%.
3. For the purpose of improvement, specifications may be updated periodically.

Figure 1



Product	Maximum Feed Flow Rate gpm (m ³ /h)	Dimensions – Inches (mm)			
		A	B	C	D
SW30-2514	6 (1.4)	14.0 (356)	1.19 (30.2)	0.75 (19)	2.4 (61)
SW30-2521	6 (1.4)	21.0 (533)	1.19 (30.2)	0.75 (19)	2.4 (61)
SW30-2540	6 (1.4)	40.0 (1,016)	1.19 (30.2)	0.75 (19)	2.4 (61)
SW30-4021	16 (3.6)	21.0 (533)	1.05 (26.7)	0.75 (19)	3.9 (99)
SW30-4040	16 (3.6)	40.0 (1,016)	1.05 (26.7)	0.75 (19)	3.9 (99)

1. Refer to FilmTec Design Guidelines for multiple-element systems.
2. SW30-2514, SW30-2521 and SW30-2540 elements fit nominal 2.5-inch I.D. pressure vessels.
SW30-4021 and SW30-4040 elements fit nominal 4-inch I.D. pressure vessel.

1 inch = 25.4 mm

Operating Limits

• Membrane Type	Polyamide Thin-Film Composite
• Maximum Operating Temperature	113°F (45°C)
• Maximum Operating Pressure	1,000 psi (69 bar)
• Maximum Pressure Drop	15 psig (1.0 bar)
• pH Range, Continuous Operation ^a	2 - 11
• pH Range, Short-Term Cleaning ^b	1 - 13
• Maximum Feed Silt Density Index	SDI 5
• Free Chlorine Tolerance ^c	<0.1 ppm

^a Maximum temperature for continuous operation above pH 10 is 95°F (35°C).

^b Refer to Cleaning Guidelines in specification sheet 609-23010.

^c Under certain conditions, the presence of free chlorine and other oxidizing agents will cause premature membrane failure. Since oxidation damage is not covered under warranty, FilmTec recommends removing residual free chlorine by pretreatment prior to membrane exposure. Please refer to technical bulletin 609-22010 for more information.

Important Information

Proper start-up of reverse osmosis water treatment systems is essential to prepare the membranes for operating service and to prevent membrane damage due to overfeeding or hydraulic shock. Following the proper start-up sequence also helps ensure that system operating parameters conform to design specifications so that system water quality and productivity goals can be achieved.

Before initiating system start-up procedures, membrane pretreatment, loading of the membrane elements, instrument calibration and other system checks should be completed.

Please refer to the application information literature entitled "Start-Up Sequence" (Form No. 609-02077) for more information.

Operation Guidelines

Avoid any abrupt pressure or cross-flow variations on the spiral elements during start-up, shutdown, cleaning or other sequences to prevent possible membrane damage. During start-up, a gradual change from a standstill to operating state is recommended as follows:

- Feed pressure should be increased gradually over a 30-60 second time frame.
- Cross-flow velocity at set operating point should be achieved gradually over 15-20 seconds.
- Permeate obtained from first hour of operation should be discarded.

General Information

- Keep elements moist at all times after initial wetting.
- If operating limits and guidelines given in this bulletin are not strictly followed, the limited warranty will be null and void.
- To prevent biological growth during prolonged system shutdowns, it is recommended that membrane elements be immersed in a preservative solution.
- The customer is fully responsible for the effects of incompatible chemicals and lubricants on elements.
- Maximum pressure drop across an entire pressure vessel (housing) is 50 psi (3.4 bar).
- Avoid static permeate-side backpressure at all times.

FILMTEC™ Membranes
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Notice: The use of this product in and of itself does not necessarily guarantee the removal of cysts and pathogens from water. Effective cyst and pathogen reduction is dependent on the complete system design and on the operation and maintenance of the system.

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ATTACHMENT 5 High Pressure Pump Technical Drawing

