

**INSTRUCTIONS FOR THE INSTALLATION, USE AND MAINTENANCE OF
TECNICOMAR WATERMAKER SERIE SAILOR COMPACT :**

Model – SAILOR C 600
Tiny

NOTE

The indications contained in this Manual must be strictly followed during installation, operation and maintenance of the watermaker in order to warrant the operators' safety and the equipment maximum efficiency.

Identification

The Tecnicomar watermaker carries a plate with the following data:

- a) Manufacturer: TECNICOMAR SRL C/da Berbaro n.78 - 91025 Marsala -ITALY- Tel.0923-969409 Fax 0923-960235;
- b) CE logo;
- c) Type: SAILOR COMPACT mod. Sailor C600 - Tiny
- d) Serial number: xxxxxxxxx
- e) Year of manufacture: 2006
- f) Voltage : 230V/50HZ/1PH/11A

Dear Customer,

We would like to thank you for choosing a TECNICOMAR WATERMAKER.

This watermaker has been designed by expert technicians and manufactured with care for all its aspects and in respect of the European standards.

Our widespread commercial organization guarantees accurate and prompt assistance and maintenance service to our Customers.

This Manual provides the User with the illustrated, step-by-step instructions on how to install and use the watermaker. It also contains all the necessary information for the maintenance.

WARNING !

TECNICOMAR S.R.L. declines any and all liability for failure to observe the safety and accident prevention standards described in this manual, for damage dued to the improper use of the equipment and for modifying it without the authorization of Tecnicomar S.r.l.

Contents of the Instruction Manual:

- ◇ Section 1 contains information for storage before unpacking.
- ◇ Section 2 contains the process description and system components identification.
- ◇ Section 3 contains information about installation.
- ◇ Section 4 contains information about first start-up procedure.
- ◇ Section 5 contains information about routine operation.
- ◇ Section 6 contains the emergency operation and the long period shutdown information.
- ◇ Section 7 contains maintenance and setting instruction of the safety components.
- ◇ Section 8 contains useful troubleshooting information.
- ◇ Section 9 contains the technical characteristics of the equipment.

Signs used throughout the Manual



Warning

These instructions should be followed carefully to operate the watermaker correctly.



Danger

These instructions should be followed carefully to avoid damage to the watermaker or to the operator.



Note or Information

The notes contain important information and useful hints for the watermaker operation.

If not specified otherwise, the letters used in the text refer to the functional diagram shown in the drawings situated at the end of this Manual.

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What is Reverse Osmosis

Osmosis is the diffusion of two mixable solutions through a semipermeable membrane in such a manner to equalize their concentration. A water with less salt naturally diffuses into a water with higher salt.

Sea water or brackish water cannot naturally diffuse through a semipermeable membrane to provide potable water.

A man-made process, REVERSE OSMOSIS, overcomes this natural phenomenon. By forcing sea or brackish water (under high pressure) through a semipermeable membrane, potable water can be realized !

SECTION 1

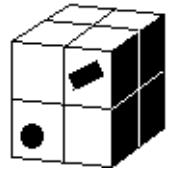
1 Storage prior to unpacking and packaging content

1.1 Storage prior to unpacking

- ⇒ Do not store in direct sunlight.
- ⇒ Do not freeze (see paragraph 6.4).
- ⇒ Do not store above 50°C (122°F).
- ⇒ Store only on base with arrows up.

1.2 Checking packaging content

In the package there are the following components:



Installation kit

- Clamps - Manual -
- Tank connection fitting - Inlet hose -
- Filters wrench -
- Discharge and Fresh water hoses -
- Discharge fitting

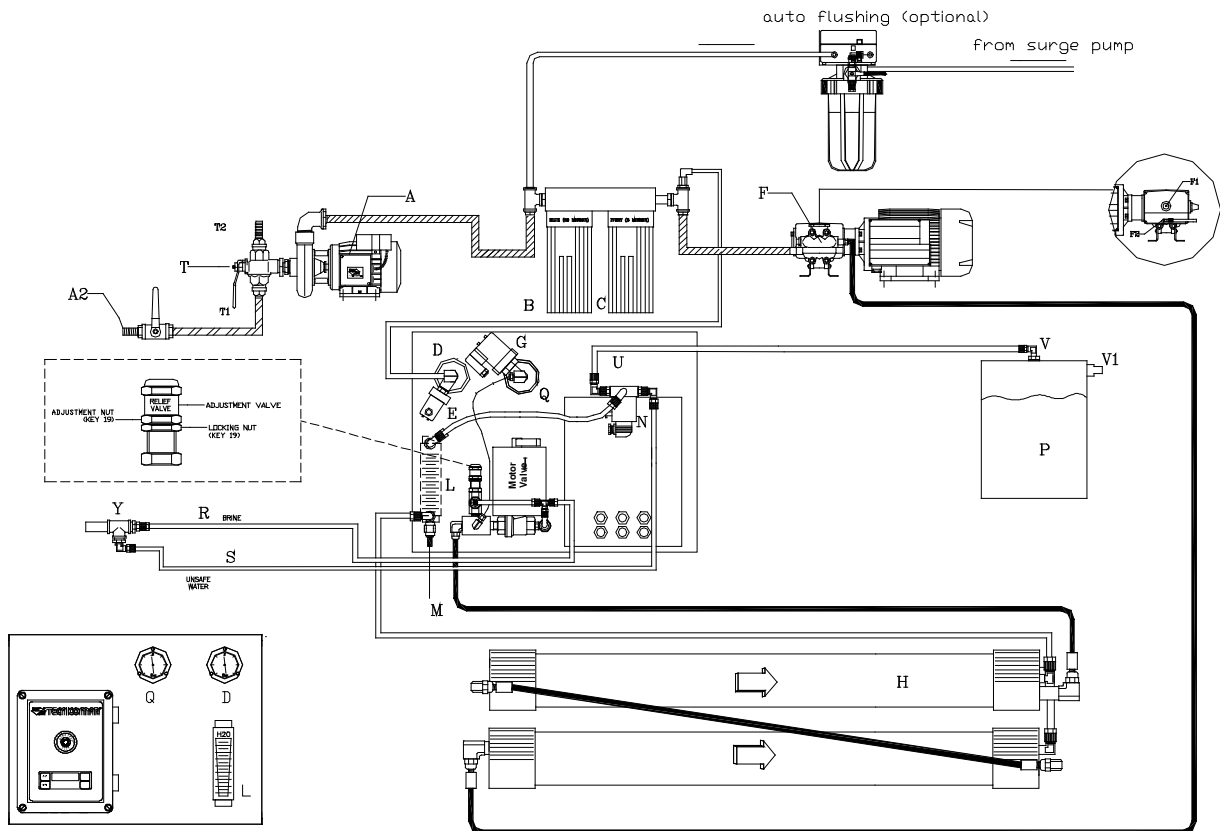


SECTION 2

2 Process description and system components identification

The watermaker has four main sections :

- ⇒ **Prefiltration section** where salt water, supplied by the *low pressure pump* (A), is filtrated passing through the two *prefilters* (B and C). Feed water pressure is indicated by the *low pressure gauge* (D) and taken by the *low pressure switch* (E);
- ⇒ **High pressure section** in which sea water is pressurized by the *high-pressure pump* (F). The *high-pressure switch* (G), electrically connected to the electric box, shuts down the system automatically if the operating pressure exceeds the preset level (the display shows E02). The unit is equipped with a *motorized valve* for auto-regulation of the pressure. Only in “manual” mode the pressure is adjustable by operator with a *manual pressure regulator valve* (I). The *high-pressure switch* (G), high-pressure tubes and their fittings require periodic maintenance for the sake of safety (refer to the MAINTENANCE section).
- ⇒ **Salt water (BRINE) discharge section.** In this section the brine is discharged. The fresh water is also discharged out of board if it does not have the drinking-water quality. Through the *three-way solenoid valve* (N), the electric box automatically switches the water coming from membranes either to the discharge or to the fresh water tank. The water quality is checked by the *salinity sensor* (M). The salinity sensor requires periodic maintenance (refer to maintenance section).
- ⇒ **Freshwater section.** This is the most important section of the system, the section where the physical process of reverse osmosis takes place. The main components of this section are the semipermeable membranes which separate sea water in two flows: one with concentrated salts which goes to the discharge (R) and the other with fresh water (U) which goes to the fresh water tank. The fresh water flow is measured by the *flowmeter* (L) before reaching the *three-way solenoid valve* (N) which switches it, depending on its salinity, to the discharge or to the tank. The semipermeable membranes are very sensitive components and require strict observance and care (see PROTECTION AND CARE OF SEMIPERMEABLE MEMBRANES in Maintenance section).



Flow diagram

SECTION 3

3 Installation Procedure

3.1 Components supplied by owner

Some plumbing and electric components are to be supplied by owner. These components are listed below:

- a) 3/4" inlet valve with a terminal for the 20 mm hose (A2);
- b) Tank for produced water (P). The tank should have a *safety overflow valve* (V1);
- c) 3/4" male thread discharge to the sea. A discharge fitting (Y) is supplied by Tecnicomar where lines BRINE (R) and UNSAFE WATER (S) have to be connected;



In case of installation aboard a vessel, the discharge must be installed above the water line.

- d) power supply line, protected by an automatic all-pole thermal and differential protection/ disconnection device. The differential circuit breaker must be set to act with the dissipation current of 30 mA. For setting of the thermal circuit breaker and for the sizing of the power supply line the values from the POWER REQUIREMENT TABLE should be respected.

3.2 Plumbing connections

CONSIDERATIONS :

- **Lenght of connection lines** : the watermaker will work most efficiently with short plumbing connections. When the suction line is long the feed pressure decreases. When the discharge line is long the back pressure increases in that line. There should be no back pressure on the discharge line or on the product line.
- **Feed water** : be sure that the inlet thru-hull fitting is installed in a way that the watermaker receives an uninterrupted supply of air-free feed water.
- **Membranes** : the membrane vessels must not be exposed to temperature higher than 50°C (122°F) or lower than 5°C (41°F). For preservation of membrane modules in very cold areas see par. 6.4



For correct installation of SAILOR COMPACT in compact version:

- Connect the SEA WATER INLET (A2) with the T1 side of the *manual three-way valve* (T) using the supplied hose of dia. 20 mm.
- Connect the outlet of the *low pressure pump* (A) with the inlet of the *prefilters* (B).
- Connect the *Auto-Flushing system* (if supplied) to the tee fitting on the *prefilters*.
- Connect the BRINE (R) and UNSAFE WATER (S) lines to the discharge connector (Y).
- Install the supplied *fresh water fitting* (V) onto the fresh water tank (P). Connect outlet of *three-way solenoid valve* (U line) to the *fresh water fitting* (V). Be sure that fresh water tank has an overflow valve (V1).

For correct installation of SAILOR COMPACT in splitted version (control panel, membranes module, low pressure pump and prefilters):

- Connect the SEA WATER INLET (A2) with the T1 side of the *manual three-way valve* (T) on the low pressure pump using the supplied hose of dia. 20 mm.
- Connect the outlet of the *low pressure pump* (A) with the inlet of the *prefilters* (B).
- Connect the *Auto-Flushing system* (if supplied) to the tee fitting on the *prefilters*.
- Connect outlet of *prefilter* (C) to inlet of the *high pressure pump* (F) and to the *low pressure gauge* (D).
- Connect the outlet of the *high pressure pump* (F) to the first membrane.
- Connect the discharge from membranes to the *manual pressure regulation valve* (I) located behind the control panel.
- Connect the produced water from membranes to the *flowmeter* (L)
- Connect the BRINE (R) and UNSAFE WATER (S) lines to the discharge connector (Y).

- Install the supplied *fresh water fitting* (V) onto the fresh water tank (P). Connect outlet of *three-way solenoid valve* (U line) to the *fresh water fitting* (V). Be sure that fresh water tank has an overflow valve (V1).



Be sure to tighten well gaskets and fittings to avoid air infiltration or water leaks.

3.3 Power connection

- Unscrew the four plastic bolts on the front panel of the electric box and lift the cover.



When opening the electric box front panel, do not pull on the cable bunch connecting it to the box itself. Do not pull the leads as they might break .

MAKE SURE THAT THE POWER SUPPLY IS OFF AND THAT NOBODY CAN SWITCH IT ON DURING THIS OPERATION.



control box inside

- Connect the power supply line to the electric control box. Use terminals Nos. 1 and 3 if the watermaker is **single-phase** type (refer to the id plate on the watermaker motors and main frame) and terminals Nos. 1, 2 and 3 for the **three-phase** systems.
- Close the electric box cover by tightening well the four bolts on its front.
- Connect the watermaker steel structure to the ground using the grounding lug identified by the appropriate symbol (the point is on the steel structure or in the control panel).
- Open the pressure control valve (I) (turn counterclockwise) to avoid starting the system under pressure.
- Power on the supply line and check that the display is illuminated and shows “---“.



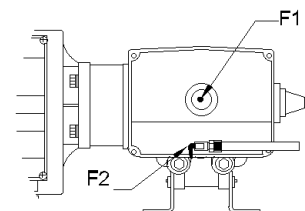
single and three phase connections (example)



control box front panel



Be sure that the high pressure pump (F) has enough oil for correct operation. The correct oil level must reach the red point on the glass bezel (F1) in the rear of the pump. Use the valve (F2) to change oil (refer to the MAINTENANCE section). Remove the sticker from the pump oil plug



oil valve and level mark



To ensure good lubrication the PUMP must be installed in an horizontal base. Use oil supplied by Tecnicomar only!

SECTION 4

4 First Start-up procedure

Before the first start-up it is necessary to check that no component of the system was damaged during transport or handling; this is especially important for the high-pressure circuit components.

If all steps for the correct installation of the watermaker have been followed (Section 3), the first start-up procedure can be done:

- Open the filters (B) and (C) and fill them with pure non-chlorinated water. Check that filter cartridges are inside.
- Re-install the filters.
- Open the inlet valve (A2).
- Open the valves along the discharge line, if installed.
- Open the valve on the fresh water tank, if installed.
- Switch on the power supply and check that the display is illuminated and shows “---“.
- Remove the sticker from the *high pressure pump* cap (F).
- Push START.



If after about 20 seconds the feed water pressure does not rise, the system shuts down automatically. WARNING - Do not repeat the start-up more than twice if the system does not start.

- Check that no air is sucked in and that there are no water leaks in the whole system.
- Check that on the *low pressure gauge* (D) the pressure is around 1 bar.
- After a while (1 minute) the high pressure on the gauge (Q) gradually will increase up to 60 bar. If there are any leaks, push STOP. Correct the problem and start the system again by repeating the above procedure.
- As soon as the system is pressurized the production of fresh water begins (RUNNING light on) and is checked by the electronic salinity control system which will automatically switch the flow to the tank when it is desalinated.

This unit is equipped with a motorized valve to auto-regulate the pressure. We recommend to run and stop the unit ONLY by the START and STOP keypads. If by chance you have pushed the EMERGENCY STOP red button, we recommend first to unlock the button by turning it counter-clockwise but NOT TO RUN immediately the unit. WAIT AT LEAST 2 MINUTES BEFORE PUSHING START. This is to prevent the unit from starting when the valve is still closed and the plant is pressurized which can damage SERIOUSLY the membranes and the motor.

4.1 Shut down procedure

- Push STOP on the electric box.
- Switch off the power supply.
- Close the sea water inlet valve (A2).

4.2 TINY control box. Description and operation



Hereafter are described the operation modalities and functions of the different messages on the display of the TINY control box:

- In normal condition and when the system is on, the display shows the salinity of the produced water (microsiemens).
- --- System powered and in stand-by
- *E01* – low pressure failure stop.
- *E02* – high pressure failure stop.
- *E03* – high salinity warning.

START – to start the system. While the sytem is on you can view the temperature of the produced water by pushing *START*.

STOP – to stop the sytem.

Running – the system is producing fresh water.

Unsafe – the produced water is not good to use and is discharged.

SECTION 5

5 Routine operation

After having carried out the first start-up (section 4), the everyday start-up and operation of the watermaker will be simple and fast.

Follow the START-UP steps listed below:

- Open the sea water inlet valve (A2).
- Push START.
- Check that the feed water pressure is correct: the value indicated on the *low pressure gauge* (D) must not get below 30% of the reading as it was with new filter cartridges. If necessary, clean or replace the filter cartridges. The electric box will automatically shut down the system if the feed water pressure is below the minimum level needed for the correct operation (0.3 bar).
- After few minutes the RUNNING led lights on and the system is producing fresh water.

If the produced water salinity increases, contact the Tecnicomar Service center.

Follow the SHUT DOWN steps for a correct and safe system power-off:

- Push STOP.
- Switch off the power supply.
- Close the sea water inlet (A2).

5.1 “Manual” running mode

If a “manual” running mode is required, follow this procedure:

Start

- move auto/manual selector on the *motorized valve* in “manual” position (when the system is off).
- Push START and turn slowly the *manual pressure regulator valve* (I) till reading 60 bar on the gauge (Q).

Stop

- Push STOP and turn back the *manual pressure regulator valve* (I).
- Move back auto/manual selector on the *motorized valve* in “auto” position

5.2 Operation in low- or high-salinity areas

Tecnicomar watermakers may also operate in areas with unknown feed water salinity, like lake or river waters.

In low-salinity areas the applied operating pressure should be less than 60 bar. In such cases the *flowmeter* (L) should be monitored when applying the operating pressure.



The fresh water production must never exceed the system maximum.

5.3 Operation in cold areas

In very cold areas and in high salinity areas there will be a decrease in the fresh water production. In such conditions the operating pressure must always be kept at 60 bar (850 PSI).



Never operate the watermaker at a pressure exceeding 60 bar (850 PSI)

SECTION 6

6 Special procedures

6.1 System normal operation.

The watermaker electric box checks continuously the system operation. The watermaker does not constitute any risk for the user since the electric box automatically checks the equipment correct operation through the appropriate sensors,. However the system can operate also in EMERGENCY conditions. In this operation mode the electric box cannot in any way shut down the system even in conditions of danger.



It is extremely **IMPORTANT** that the watermaker is operated in emergency mode only by personnel trained in matters of electricity. It is also advisable that during the **EMERGENCY** operation nobody stay near the watermaker because an unexpected rise of pressure may cause hosings or fittings explosion. The **EMERGENCY STOP** breaker is always active and the system can be powered down at any time by using this switch (the emergency stop pushbutton is installed on the control panel and is identified by its mushroom form, red color and the **EMERGENCY** text).

6.2 Emergency operation



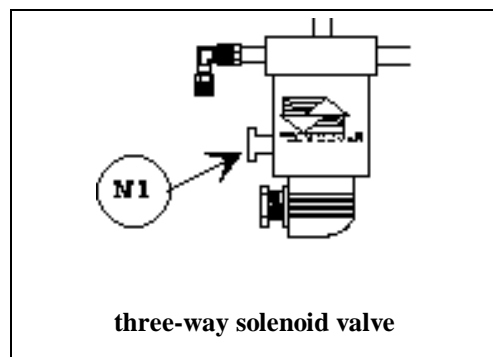
WARNING: HIGH VOLTAGE SHOCK RISK!
DO NOT CARRY OUT THE OPERATIONS DESCRIBED BELOW WITH WET HANDS. DO NOT TOUCH THE INSIDE PARTS OF THE ELECTRIC BOX.

If there is a problem on the electric box, the system can be operated in EMERGENCY conditions, without the support of automatic electronic controls. This mode of operation is normally not recommended. Only in cases of extreme necessity and strictly following the instructions given below it is possible to operate the system.

- Prepare the system to run in manual mode (see section 5.1)
- Open the sea water inlet valve (A2).
- **Switch off the power supply.**
- Remove the electric box front panel by unscrewing the four plastic bolts.
- Using an insulated-handle screwdriver move the switch S1 in the ON position.
- Using an insulated-handle screwdriver move the switch S2 in the ON position.
- Close the electric box front panel by screwing the four bolts.
- Power the unit. The system will start automatically.
- Check the system and be sure that the minimum pressure does not fall below the operating minimum value and that the maximum value does not exceed 60 bar (850 psi).
- In case of danger shut down the system using the emergency stop pushbutton.
- Operate manually the *three-way solenoid valve* (N) by pressing and turning the pushbutton on the valve (N1) counterclockwise.



S1 e S2 in detail on the mother board



To **shut down** the system during emergency operation follow the steps below:

- Switch off the power supply.

- Move back auto/manual selector on the *motorized valve* in “auto” position
- Remove the control box front panel by unscrewing the four plastic bolts .
- Using an insulated-handle screwdriver bring the switch S1 in the OFF position.
- Using an insulated-handle screwdriver bring the switch S2 in the OFF position.
- Close the electric box front panel by screwing the four bolts.
- Close the sea water inlet valve (A2).

6.3 Long-period shut down procedure

If the system is not used for a long period of time, membranes may get seriously damaged by a bacteriological attack. If the system must be out of operation for more than a week, the LONG-PERIOD SHUT DOWN procedure should be performed. If the environment is very hot or humid, this procedure must be carried out when the watermaker is not used for more than three days.

Referring to drawing 2 (washing/storage) follow the steps below:

- Close the sea water inlet valve (A2).
- Move auto/manual selector on the motorized valve in “manual” position (when the system is off).
- Empty the prefilters (B and C) and wash them using a normal dish-washing detergent.
- Reinstall the filter cartridges.
- Prepare a container (X) with 20 liters of fresh, non-chlorinated water or water produced by the watermaker.
- Turn the manual *three-way valve* (T) in the FLUSHING position (T2) and connect to the container (X) with a piece of hose.
- Run the system and let the water be intaken, then stop the system.
- Prepare the biocide solution by dissolving 20 grams of the "FL403 Tecnicomar Membrane Preservative" in 20 liters of fresh water produced by the watermaker.



Do not use chlorinated water.

- Disconnect the BRINE (R) and the UNSAFE WATER lines from the sea discharge fitting (Y) and connect with the container (X) in which the solution has been prepared.
- Start and circulate the solution inside the closed loop for 5 to 10 minutes and then leave the solution in the watermaker.
- Empty the prefilters and replace the cartridges.
- Turn the manual three-way valve (T) into the SEA WATER INILET position.
- Connect the BRINE (R) and the UNSAFE WATER (S) lines to the discharge fitting (Y).



Due to the high sensibility of membrane modules, we advise the exclusive use of flushing chemicals and filter cartridges supplied by Tecnicomar.

To resume operation after prolonged shutdown, fill the prefilters with clean, nonchlorinated water. Move back auto/manual selector on the *motorized valve* in “auto” position. Open the sea water intake valve (A2). Make sure that the manual three-way valve be in the SEA WATER INLET position.



The LONG-TERM SHUT DOWN may be avoided by operating the system for 10 minutes at least once every two days. Membranes will be flushed and bacteria will not grow inside. However, in all cases the membranes must be kept from freezing.

6.4 Preservation of membrane modules in very cold areas

When the temperature may fall below 5 degrees Centigrade, it is necessary to add 20% of glycerine to the biocide solution (SEE LONG SHUTDOWN PROCEDURE).

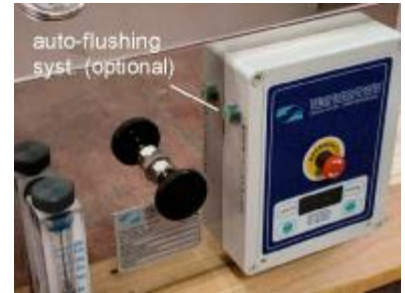


In any case the membranes should not freeze.

6.5 Optionals

6.5.1 Automatic flushing system

An automatic membrane flushing system is available as option. This system will automatically flush membranes modules with fresh non-chlorinated water. This device will avoid corrosion and will longer membranes life. To run it you can push the appropriate button on the side of the control panel. After a while it will stop automatically.



6.5.2 Remote control

The watermaker operation may be monitored from the boat pilot bridge using a remote control panel available as option.

6.5.3 UV sterilizer

The ultraviolet sterilizer is needed to eliminate the bacteria which may be in the stored fresh water. The UV sterilizer supplied by Tecnicomar can be installed in any watermaker and guarantees the sterilization of the stored water. The UV sterilizer may be installed at the tank outlet to ensure purity of the fresh water. Models available : 4, 8, 30 liters per minute.

SECTION 7

7 Maintenance

The watermaker requires some maintenance. The most sensitive component is the reverse osmosis membrane module. Some safety components, such as low- and high-pressure gauges and switches, three-way solenoid valve, high pressure piping and fittings must be checked periodically for the safe use of the watermaker.

7.1 Ordinary Maintenance

7.1.1 Preservation and care of the semipermeable membrane modules

The following precautions are recommended:

- ⇒ The membrane module must not be exposed to high temperatures above 50 deg. Centigrade (the membrane container gives sufficient protection from the engine room high temperatures).
- ⇒ At low temperatures the water inside membranes may freeze damaging the membrane beyond repair; in such conditions 20% of glycerine must be added to the flushing water.
- ⇒ Excessive operating pressure causes the membrane clogging; it is not advisable to operate the system at pressure exceeding 60 bar.
- ⇒ The membrane must always remain wet as drying damages it; if membrane is removed from its packaging, it should be kept in a container where the membrane can be completely soaked.
- ⇒ If the system should not operate for more than one week, follow the long-term shut down procedures (6.3).



The feed water should be always clear; avoid starting the system in harbours or in waters containing oil or chlorine.

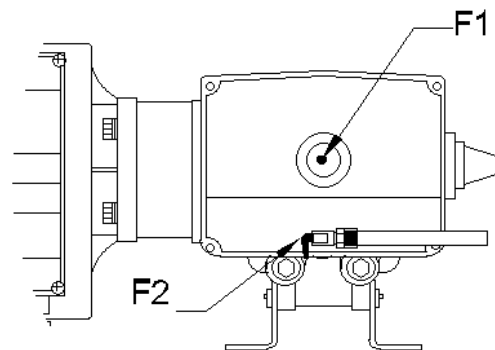
7.1.2 High-pressure circuit

From time to time it is advisable to check the high pressure fittings and hoses. The user may carry out a first inspection of the system checking the integrity of the piping and the fittings. It is important to check for leaks in fittings or piping when the system is in full operation. An accurate maintenance work must be carried out periodically by the Tecnicomar servicing personnel to ensure efficient and safe system operation. The high-pressure pump oil level should be checked periodically: the level must coincide with the red dot at the rear of the pump (F1).

7.1.3 Oil changing in the high-pressure pump

The microprocessor control box is programmed to advise when to change the oil in the high pressure pump. When the “oil change” light illuminates, follow this procedure:

- ⇒ Disconnect the watermaker power supply.
- ⇒ Unscrew, without removing it, the red cap on the high-pressure pump.
- ⇒ Prepare a container to collect the used oil.
- ⇒ Open the oil drain valve (F2) and drain the oil in the used-oil container. Make sure that the pump oil has drained thoroughly.
- ⇒ Unscrew and remove the red cap, close the oil drain valve and fill with new oil up to the red dot level. **Use only oil supplied by Tecnicomar.**
- ⇒ Reinstall the cap and start up the system.
- ⇒ **Do not discharge the used oil in environment.**



high pressure pump

7.1.4 Prefilters maintenance

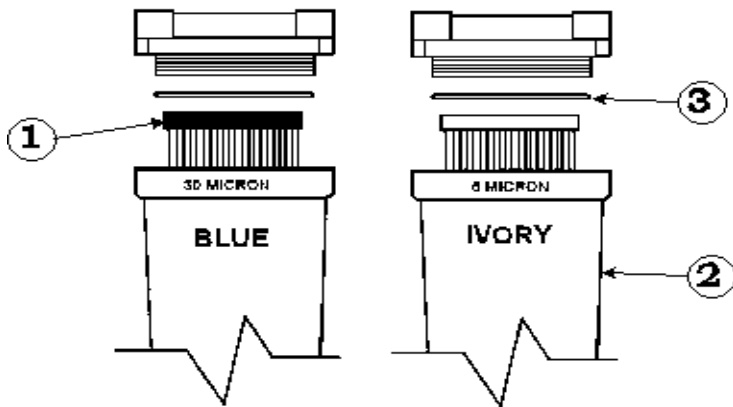
The prefilters require maintenance when :

- The watermaker shows alarm for low pressure.
- The low-pressure gauge reads less than 30% of the pressure reading with new filter cartridges (0.8 ... 1 bar).
- The high pressure pump makes a strange noise.
- The system starts up, but shuts down after few seconds.
- The operating pressure does not stabilize.



Use only Tecnicomar replacement cartridges. It is advisable to keep on board a stock of replacement filter cartridges (see maintenance kit, par. 7.4).

The cartridge replacement procedure is given below:



Prefilters

- ⇒ Shut down the unit and close the sea water inlet.
- ⇒ Unscrew the filter sump B (30 micron - BLUE) using the special wrench supplied, until they come off. Hold the sump from the lower part.
- ⇒ Empty the sump and take out the filter cartridge (part 1).
- ⇒ Clean the sump inside. USE NEUTRAL DETERGENTS (PH=7) TO PREVENT DAMAGE TO THE SUMP.
- ⇒ Replace the filter cartridge and make sure that the O-ring (part 3) is well setted and lubricated (use silicon grease).
- ⇒ Reinstall the cup tightening it manually. DO NOT USE THE WRENCH FOR TIGHTENING !
- ⇒ Use the same steps for the C filter (5 micron -IVORY).

7.1.5 Carbon filter replacement

The activated carbon filter should be replaced at least once a year. Follow the steps given in the previous paragraph.

7.2 Extraordinary maintenance

7.2.1 Setting the high-pressure switch (manual mode)

If the system shuts down before having reached the working pressure, the high-pressure switch needs adjustment. The setting can be done by the user strictly following the steps given below.

- ⇒ Prepare the system to run in manual mode (see section 5.1)
- ⇒ Take out the rubber plug situated on the *high-pressure switch* (G);
- ⇒ Using a screwdriver tighten slightly the screw inside the switch, clockwise;
- ⇒ Depressurize the system by rotating the *pressure control valve* (I);
- ⇒ Start up the watermaker by pushing START;
- ⇒ Pressurize the system by turning slowly the *pressure control valve* (I);
- ⇒ If the system shuts down before reaching the pressure of 70 bar, tighten again the pressure switch screw and repeat the steps starting from depressurizing the system on this list.
- ⇒ Bring the system to the pressure of 70 bar and turn the pressure switch screw counterclockwise until the system shuts down.
- ⇒ Repeat the procedure for further adjustment of the pressure switch threshold.
- ⇒ At this point the high pressure switch is set to shut down the system at the pressure of about 70 bar.
- ⇒ Move back the auto/manual selector on the motorized valve in “auto” position

7.2.2 Low pressure switch

The Low pressure switch signals the pressure fall in the sea water inlet circuit.

If the system shuts down because of low pressure when the low pressure gauge reads a value exceeding 0.3 bar, the pressure switch may need adjustment. The same may be true if the system does not shut down even with inlet pressure

constantly below 0.3 bar. In both cases the pressure switch needs checking by a technician. An overall check can be performed by the user by following the steps listed below.

- With the system powered off remove the low pressure switch plastic cap.
- Using a tester, check if there is short circuit between the two wires leading to the pressure switch and that they are connected correctly. If there is a short circuit, it means that the pressure switch should be replaced. If the test is positive, proceed with the steps that follow.
- Hold the tester probes on the pressure switch output contact and start up the watermaker following the normal procedure. Make sure that the output contact closes when the pressure gauge reading exceeds 0.3 bar. If that is the case, the pressure switch is working normally and the origin of the trouble is elsewhere. If the contact does not close, the pressure switch should be replaced with a new one supplied by Tecnicomar.

7.2.3 Replacement of membrane modules.

- Switch off the power supply.
- Disconnect the low and high-pressure piping from the membrane containers (pressure vessels).
- Unscrew the two bolts using an appropriate tool (see exploded view attached).
- Press towards the inside of the membrane to take out the end-plug.
- Take out the membrane from the feed side (refer to the flow direction arrow on the membrane container).
- Use silicon grease to lubricate outer parts of the freshwater collecting tube of the membrane and the O-rings.
- Insert a new membrane taking care to respect the insertion direction of the old one, and especially the O-ring of the membrane must always be on the feed side.
- Assemble all components in the reverse order.
- Restart the system without pressure and check if there are leaks.

7.2.4 Flowmeter

The flowmeter installed on the watermaker is only an indicator of fresh water production and it cannot be considered an instrument of precision. At times, however, it may be necessary to perform simple maintenance on it following the steps indicated below.

- * Switch off the power supply.
- * Unscrew the upper part of the flowmeter.
- * Using a soft piece of cloth and a rigid stick, clean the interior without scratching the parts inside.
- * Reinstall the upper part of the flowmeter.

7.2.5 Pressure gauges maintenance

- * Switch off the power supply.
- * Unscrew the pressure gauge.
- * Using a small stick clean the intake bore.
- * Take care not to leak the liquid from inside the gauge as this would deteriorate its operation.
- * Reinstall the gauge on its seat and tighten after having applied new teflon tape on the threads.

7.3 General maintenance plan

7.3.1 Prefiltering circuit

Components	Required maintenance	Maintenance Period
Prefilters	Clean or replace filter cartridges and clean the sump ⁽¹⁾	When the low pressure gauge (D) reading falls below 0.5 bar
Low pressure gauge	Clean the entry bore	When it does not indicate pressure or every 15 months
Low pressure switch	Adjust (0.3 bar)	When the inlet pressure gauge reading exceeds 0.3 and the watermaker shuts down because of low pressure

7.3.2 Pressurizing circuit

High pressure pump	Change oil ⁽¹⁾	First change: after 3 months or 50 hours of operation; then every year or after every 500 hours of operation.
Membrane	Replace the membrane ⁽²⁾ module	When the UNSAFE WATER pilot light does not go off and the produced water is not fresh.
Membrane	Cleaning procedure ⁽²⁾	When the fresh water production is less than 30% of the production with new membranes.

7.3.3 Controls and produced water circuits

Produced water flowmeter	Clean the inner parts of the transparent cover	When it appears dirty
Salinity sensor	Clean the conductivity electrodes	24 months
Salinity meter	Calibrate using a conductivity meter with a scale in microSiemens/cm	After replacing or cleaning the salinity sensor

7.4 Maintenance kit

The maintenance kit allow to have on board a sufficient stock of filter cartridges and other parts that may be required for the ordinary system maintenance.

A complete Maintenance Kit contains:

- No.8 prefilter cartridges 30 micron
- No.8 prefilter cartridges 5 micron
- No.2 active carbon cartridges
- No.1 FL/403 membrane storage solution
- No.1 FL/411/A Type A membrane cleaning solution
- No.1 FL/412/B Type B membrane cleaning solution
- No.1 high-pressure hose
- No.2 containers of pump oil
- No.2 O-rings for prefilters

To order a complete Maintenance Kit, please specify the series and the model of your watermaker (ex. series MODULAR model MD 600).

⁽¹⁾ Use only TECNICOMAR original oil and filter cartridges

⁽²⁾ Contact a TECNICOMAR Authorized Center

SECTION 8

8 Common problems and troubleshooting

A list of most frequent problems is given below.

8.1 First start-up

Problem: there is no water in the low-pressure circuit.

Effect: After approximately 20 seconds of operation the system shuts down activating the low-pressure alarm.

Check that:

- ⇒ The sea water inlet valve is open;
- ⇒ The low-pressure piping is tightened correctly;
- ⇒ The filter sumps are tightened correctly;
- ⇒ The prefilter O-rings are correctly placed;
- ⇒ The three-way valve is set correctly;
- ⇒ The sense of rotation of the *low pressure pump* is correct (for three-phase systems only).

If, after having checked the above, the problem continues, it is advisable to pressurize the sea water inlet circuit (through a surge pump or with tap water under pressure), using the flushing connection of the three-way valve (turn the handle in the flushing position, refer to drawing 3).

This operation will help to eliminate the infiltrated air.

8.2 Start-up after the replacement of filter cartridges

Problem: there is no water in the low-pressure circuit.

Effect: After about 20 seconds in operation the system shuts down activating the low-pressure alarm. Do not repeat the start-up more than twice.

If the problem persists, check that:

- ⇒ The filter sumps are tightened correctly;
- ⇒ The O-rings are in well setted;
- ⇒ The filter sumps are filled with water.

Problem: the watermaker starts up, but it shuts down after several seconds with the HIGH PRESSURE alarm on.

Check: make sure that the pressure control valve is open (turn counterclockwise).

8.3 High-pressure failure during pressurizing

Problem: during the closing of the pressure control valve the system shuts down with the HIGH PRESSURE alarm on.

Check: the high-pressure switch have to be setted to shut down the system at 70 bar. Unscrew the pressure switch adjustment screw (refer to paragraph 7.2.1) and restart the watermaker.

8.4 Low pressure failure

Problem: the watermaker starts up and shuts down after about 20 seconds with the LOW PRESSURE alarm on.

Checks:

- ⇒ if the low-pressure circuit pressure is less than 0.3 bar filtering cartridges should be replaced.
- ⇒ if the low-pressure circuit pressure exceeds 0.3 bar the minimum pressure switch needs adjustment (refer to paragraph 7.2.2).
- ⇒ If the low pressure gauge reads 0 (zero) bar check that:
 - sea water inlet is open
 - sense of rotation of low pressure pump is correct (for three-phase systems only)
 - the inlet pipe is clean.

8.5 Low pressure failure during normal operation

Problem: during normal operation the watermaker shuts down with the LOW PRESSURE alarm on.

Checks: if the inlet pressure is less than 0.3 bar, filtering cartridges should be replaced.

If the inlet pressure is 0 (zero) bar, check the inlet pipe.

8.6 Operation with vessel in navigation, rough sea and LOW PRESSURE alarm on

Check the inlet pressure; if it is regular (approx. 0.8 bar), air may have entered the inlet pipe.

The same problem may cause also the HIGH PRESSURE alarm to go on because of the presence of air in the plumbing and of the consequent variations in the operating pressure.

8.7 During normal operation the UNSAFE pilot light turns on

Check the quality of produced water. If it is fresh, the salinity sensor requires maintenance. To deliver the produced water to the accumulation tank with the UNSAFE light on, it is necessary to act manually on the three-way solenoid valve as indicated in Section 6 in case of emergency operation (paragraph 6.2). If the produced water is salted (in case of a multi-membrane system), check the produced water quality of each membrane.

8.8 The watermaker operates normally, the produced water does not reach the accumulation tanks

Check:

⇒ the correct operation of the three-way solenoid valve.

⇒ if there are any obstructions in the tank-supply piping.

8.9 The low and/or high pressure gauge do not indicate pressure

Follow the pressure gauge maintenance procedure outlined in paragraph 7.2.5.

SECTION 9

9 Technical characteristics and spare parts

9.1 Electrophysical characteristics

TYPE (GpD) ⁽¹⁾	Max. power rating	Operating voltage (V)	Production with new membranes ⁽²⁾ (liters per hour ±15%)	Noise at a 1 m distance (dBA)
SAILOR C600 (600)	11A	230V/50HZ	100	79.5
Low pressure pump	1.8KW	230V	-	-

9.2 A typical analysis of produced water

Component	Raw water	Desalinated water
Ammonia (mg/l)	no traces	no traces
Bicarbonate (mg/l)	63	4.9
Boron (mg/l)	4.0	0.4
Bromide (mg/l)	85	0.85
Calcium (mg/l)	315	0.8
Carbonate (mg/l)	no traces	no traces
Chloride (mg/l)	17.600	183
Fluoride (mg/l)	0.8	< 0.1
Hydroxide (mg/l)	no traces	no traces
Iron (mg/l)	0.3	< 0.1
Magnesium (mg/l)	1.300	2.6
Manganese (mg/l)	< 0.1	< 0.1
Nitrate (mg/l)	< 2.0	< 2.0
Potassium (mg/l)	418	6.4
Silicon as SiO ₂ (mg/l)	10.7	< 5.0
Sodium (mg/l)	11.000	105
Strontium (mg/l)	13.8	0.4
Sulfate (mg/l)	2.436	2.3
Total sulfides (mg/l)	< 0.1	< 0.1
Turbidity (FTU ₂)	0.28	0.13
Conductivity (mhs/cm)	45000	550
Hardness as CaCO ₃ (mg/l)	6.140	28
P-Alcalinity as CaCO ₃ (mg/l)	0	0
T-Alcalinity as CaCO ₃ (mg/l)	104	8
pH (units)	7.7	7.4
TDS at 180 oC (mg/l)	36.073	250

⁽¹⁾ Nominal production expressed in gallons per day.

⁽²⁾ Test condition: 1. Operating pressure 60BAR (850psi)
 2. prefilter feed pressure 0.8BAR (15psi)
 3. feed water temperatur 25°C
 4. feed water salinity 35000 ppm
 5. feed water pH-value 3-11.

9.3 Spare part list

9.3.1 High pressure pump

See drawing 6 at the end of this manual

9.3.2 Other spare parts

Part code	Description	Note
S.S./010	Salinometric cell	
E.V./12V.50- 1/4	Three-way valve 12 V, 50 Hz 1/4	
VRP/014	Pressure control valve	
M.E./2.5HP	Electric motor 2.5HP - 230V	
MHP/006	High pressure gauge 0-100 Bar	
MLP/011	Low pressure gauge 0-4 Bar	
P.M./006	High pressure switch	
P.M./007	Low pressure switch	
FL/A. ASS/5	Flowmeter R/1 plex 3/8 0-300 t/h	
TINY	Electric box 230V mod. TINY	
BCM20E	Low pressure pump 230V	
TB/11/12/007	Plastic Hose Dia. 8X10	
TB/009	Plastic Hose Dia. 20	
M-2521	Membrane 200 Gpd	
PV2521	Vessel 1000 PSI	
PVS 2.5" / KIT-SS	End Plug Kit	
OR/01	O-Ring inner	
OR/02	O-Ring outer	
PS/015	O-Ring rubber	
BS/03	Brine Seal (membrane)	
PHP/3CP1241	High pressure pump	
MTK	Maintenance kit	
MC2AB	Membrane flushing chemicals	
THP/1/4	High pressure hose 540 mm 1/4"	
THP/1/4	high pressure hose 580 mm 1/4"	

9.4 Warranty for Tecnicomar equipments

TECNICOMAR warrants the good design and quality of materials for 1 (ONE) YEAR from the date of delivery to the Buyer in the sense that TECNICOMAR will repair or replace the parts which during the warranty period become unusable due to the defects in materials or workmanship. However TECNICOMAR will not be liable to reimburse direct or indirect damages. The warranty does not include expenses for assembly/disassembly of the defective system and/or part nor shipping or personnel travel expenses. All these expenses shall be charged to the Buyer even when the listed activities are carried out by TECNICOMAR, their Dealers, distributors and authorized technical service outlets. **THE WARRANTY REGISTRATION CARD MUST BE RECEIVED BY TECNICOMAR BEFORE ANY WARRANTY SERVICE WILL BE RENDERED.**

To use the warranty, the Buyer must immediately communicate in writing to TECNICOMAR the detected failure, indicating type, model and serial number of the equipment.

The warranty will not be extended to those parts where serial number is missing or erased.

Corrosion due to galvanic current is not covered by the warranty.

Membranes are not warranted against iron fouling (rust), chemical attack, extreme temperatures (<0°C/>+48°C), drying out, or extreme operating pressures (> 1000 PSI/70 bar).

The warranty will become void during the first year after the purchase if The Buyer:

- had the system installed using different procedures and materials other than those described in this Manual, without a written authorization by TECNICOMAR;
- had the system repaired or modified by personnel not authorized by TECNICOMAR;
- did not respect the maintenance standards suggested by TECNICOMAR;
- had required the system to deliver superior or different performance than the one for which it was supplied;
- did not use the TECNICOMAR replacement parts or accessories.

The warranty will anyway become void due to any failure to comply on the Buyer's part toward TECNICOMAR.

WARRANTY CLAIM

- A claim shall be made by delivering the part for inspection to an authorized dealer or by giving notice to Tecnicomar (fax +39.0923.960235) that shall then arrange for the necessary inspection and repair or replacement (which may be conducted at the facilities of Tecnicomar) provided such service is covered under this warranty. **RETURN PRODUCT TO TECNICOMAR ONLY AFTER RECEIVING FACTORY AUTHORIZATION INCLUDING THE ASSIGNMENT OF A RETURN MATERIAL AUTHORIZATION NUMBER. THIS NUMBER MUST BE CLEARLY MARKED ON THE OUTSIDE OF THE BOX WHEN SHIPPING.** Buyer shall pay for all related labor and materials and any shipping, transportation and other expenses associated with the service.

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