INSTRUCTIONS FOR THE INSTALLATION, USE AND MAINTENANCE OF TECNICOMAR WATERMAKERS

Models

MINIMAR PLUS

SAILOR

BICOMPACT

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 SpA, C/da Berbaro n.145/D – 91025 Marsala – ITALY – Tel.0923-969409 / Fax 0923-960235;
b) CE logo;
c) Type
d) Serial number
e) Year of manufacture
f) Voltage

Revision	1	2009	
Revision	2	07/2011	
Revision	3	03/2012	
Revision	4	03/2013	
Revision	5	12/2014	
Revision	6	08/2015	CONTROL BOX TINY2 DESCRIPTION UPDATED

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.p.A. 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.p.A.

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, 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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Drawing 2 CLEANING/STORAGE
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Drawing 4 AUTOMATIC PRESSURE REGULATOR
Drawing 5 ELECTR. CONNECTIONS
Drawing 6 AUTOMATIC FLUSHING SYSTEM
Drawing 7 PRESSURE VESSEL

- HIGH PRESSURE PUMP (Parts list – exploded view)
- LOW PRESSURE PUMP (Parts list – exploded view)
- Test certificate

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 !

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 6.3).
⇒ 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:



SAILOR (compact version)



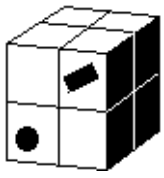
SAILOR (slim version)



SAILOR (modular version)



MINIMAR PLUS (compact version)



Installation kit

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

2 Process description and system components identification

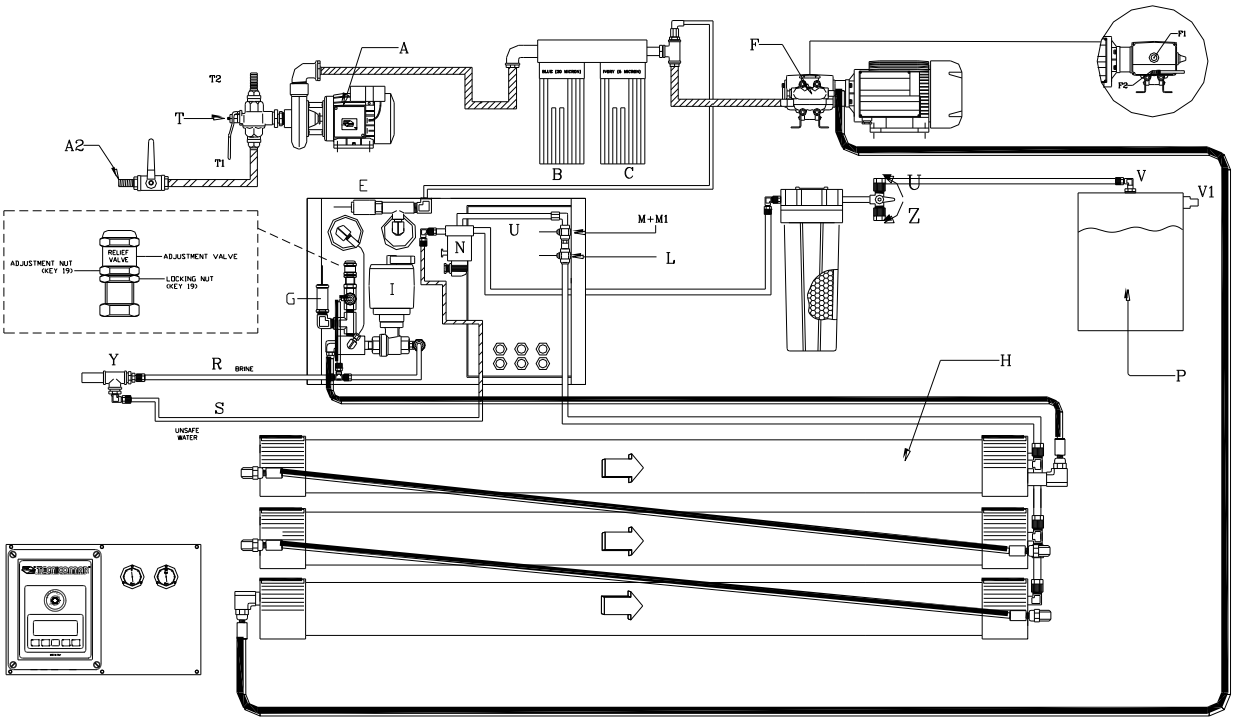
The watermaker has four main sections:

⇒ **Prefiltration section** where salt water, supplied by the *booster pump* (A), is filtrated passing through the two *prefilters* (B and C). Feed water pressure is taken by the *low pressure sensor* (E) and shown on the display of the electric box (Lbar);

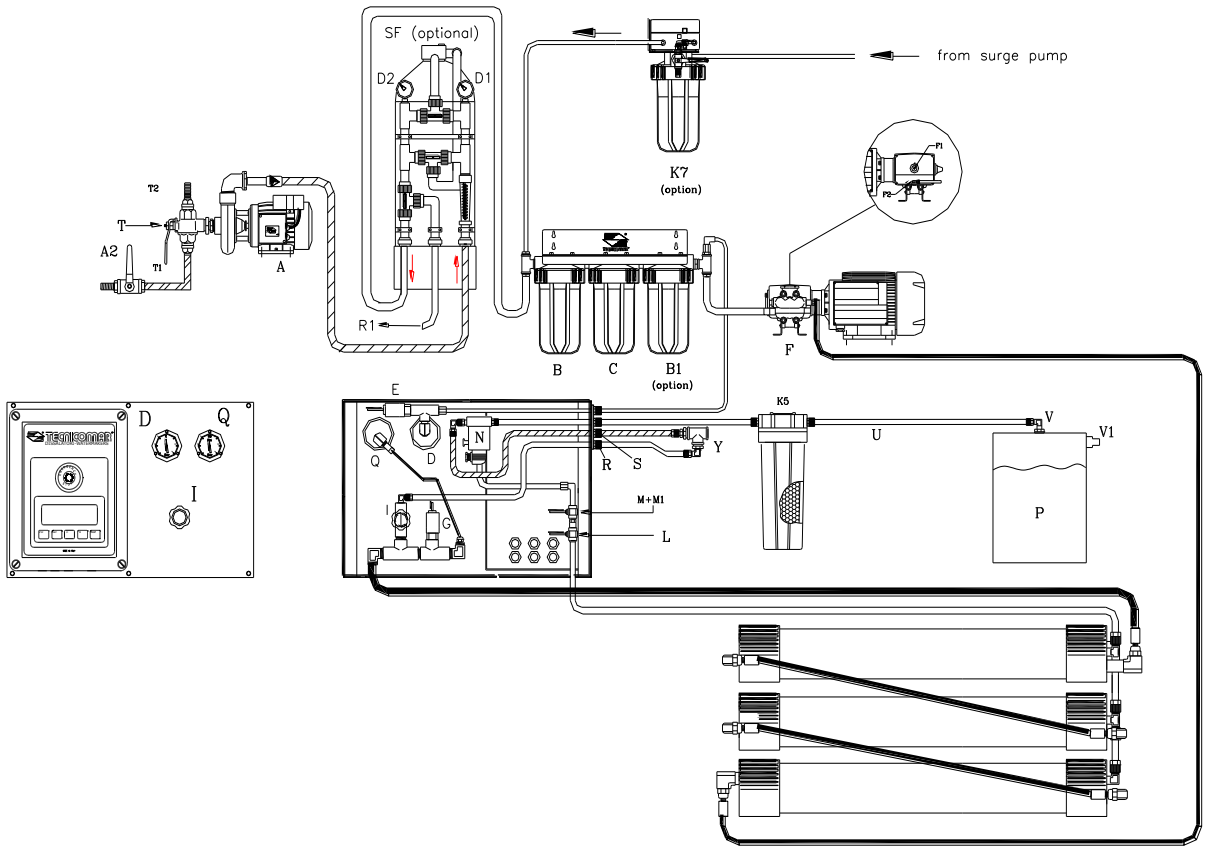
⇒ **High pressure section** in which sea water is pressurized by the *high-pressure pump* (F). The *high-pressure sensor* (G), electrically connected to the electric box, shuts down the system automatically if the operating pressure exceeds the preset level. The unit can be equipped with *automatic pressure regulator valve* (I) or can be run also in manual mode and the working pressure adjusted manually by the *pressure regulator valve* (I) located on top of the *motorized valve*. The high-pressure tubes and their fittings require periodic (see 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 *temperature sensor* (M1) compensates the reading according to temperature. The salinity and temperature sensor require periodic maintenance (see 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 taken by the *flow sensor* (L) before reaching the *three-way solenoid valve* (N) and shown on the display. The *three-way solenoid valve* (N) switches the flow, 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 (in case of supply c/w automatic pressure regulator)-see also attached drawing-



Flow diagram (in case of supply c/w manual pressure regulator) -see also attached drawing-

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" or 1" inlet valve with terminal (A2, drawing 1);
b) Tank for produced water (P). The tank should have a *safety overflow valve* (V1);
c) 3/4" female thread discharge to the sea. A discharge fitting of 3/4 female (Y) is supplied by Tecnicomar where lines BRINE (R) and UNSAFE WATER (S) are connected (refer to drawing 1);



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 (ref. Section 9).

3.2 Plumbing connections

CONSIDERATIONS:

- **Lenght of connection lines**: the watermaker will work most efficientely 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. 6.3

For correct installation of SAILOR in compact and modular 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 UNSFE 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 in splitted (slim) 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 dischrge from membranes to the *pressure regulation valve* (I) located behind the control panel.
- Connect the produced water from mebranes to the *flowmeter* (L)
- Connect the BRINE (R) and UNSFE 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 (Fig. 2).

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 (refer to the Fig. 1).
MAKE SURE THAT THE POWER SUPPLY IS OFF AND THAT NOBODY CAN SWITCH IT ON DURING THIS OPERATION.

- 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 (fig.3).
- Close the electric box cover by tightening well the four bolts on its front (Fig. 2).
- 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).
- Power on the supply line and check that the display is illuminated.

WARNING - Do not press the START key before having done the first start-up procedure (section 4).

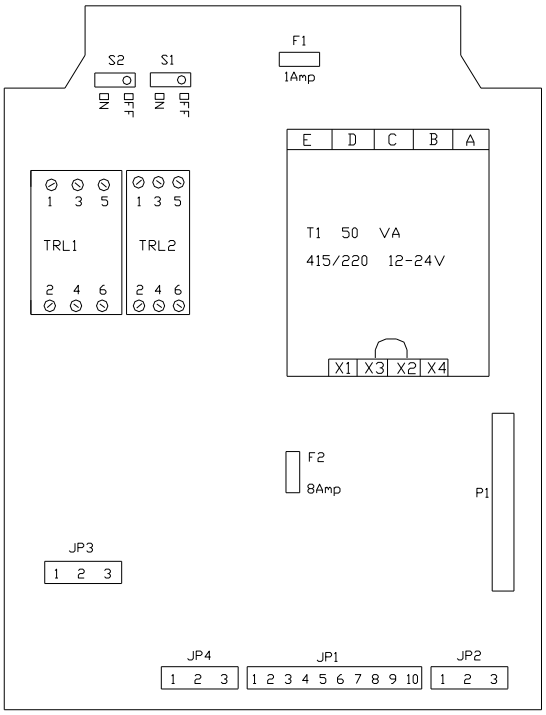


Figure 1 - inside of the electric box



Figure 2 – control box

Single-phase power supply connection

Three -phase power supply connection

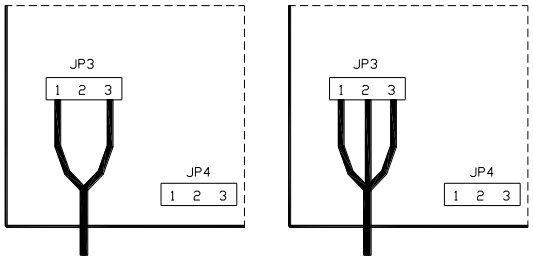


Figure 3

ONLY FOR CAT PUMP
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

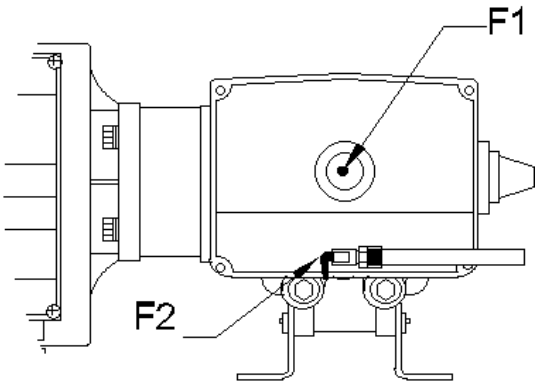


Figure 4 - oil valve and level mark on CAT pump

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

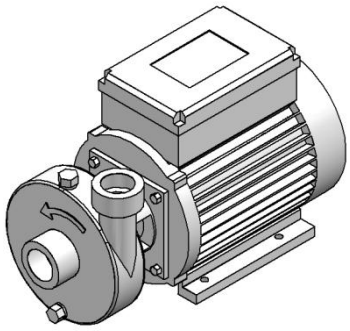
4 First Start-up procedure

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:

- Be sure that all electrical connections are correctly made.
- 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).
- Make sure that *manual three-way valve* (T) is on position T1 (operation).
- 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 on.
- If there is three-phase power supply, press F1 to start the feeding pump and, from the motor fan side, control the clockwise rotation (opposite the sense indicated in the pump body).
- Push STOP.
- Switch on the feeding pump by F1 and operate for 5-10 minutes, controlling that:
  - ♦ Salty water is discharged (BRINE)
  - ♦ **Low pressure gauge indicates steadily over 1 bar**.

  If there aren't this two conditions the feeding pump is not correctly primed (i.e. problems in installation: feeding pump above the sea cock valve, air inside the system, …), therefore is not allowed to start the high pressure pump.
- Push STOP.
- Remove the sticker from the *high pressure pump* cap (F).
- Check that the EMERGENCY STOP push-button is not activated (turn clock-wise).
- Start the system by pressing START.



Feeding Pump

If the 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 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.



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.
- **In case of *automatic pressure regulator* device**

  After some minutes of operation, the system pressure (Hbar) gradually increases up to 60 bar. Check the pressure for a few minutes. If there are any leaks, stop the system by pressing the STOP key. Correct the problem and start the system again by repeating the above procedure.
- **In case of *manual pressure regulator* device**

  After at least 5 minutes of operation, gradually increase the system pressure by slowly turning the pressure control valve (I) clockwise. Keep doing it until the reading of the high pressure on the display is 60 bar (850 psi). Check the pressure for a few minutes. If there are any leaks, stop the system by pressing the STOP key. Correct the problem and start the system again by repeating the above procedure.



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

- As soon as the system is pressurized the production of fresh water begins and is monitored by the electronic salinity control system which will automatically switch the flow to the tank when it is desalinated.

4.1 Shut down procedure

In case of *automatic pressure regulator* device

- Push STOP.
- After the de-pressurizing phase the system stops.
- Switch off the power supply.
- Close the sea water inlet valve (A2).

In case of *manual pressure regulator* device

- Depressurize the system by turning the *pressure control valve* (I) counterclockwise (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Push the STOP key on the electric box.
- Switch off the power supply.
- Close the sea water inlet valve (A2).

4.2 TINY 2 microprocessor control box. Description and operation

Hereafter are described the operation modalities and functions of the different keys on the front panel:



The alphanumeric display can show the following information:

- **HObar = high pressure**
- **HIbar = high pressure** (if the unit is equipped also with a sensor before the membranes)
- **Lbar = low pressure**
- **T = water temperature**
- **L/m = lt/minute of product water**
- **LP = total product water since last starting**
- **H = hours/minutes of running**
- **AMP = System electrical consumption** in Amps
- **SAL = product water salinity** (microsiemens/cm)
- **AVV = start counter**

When the system is in stand-by the display shows the following:

HObar=0	H=0.00
Lbar=0.08	SAL=88
T=15.3 °C	AMP=0.0
SYSTEM STAND-BY	

The STOP key allows to switch-off the watermaker. When the system is running the display shows the following:

HObar=0	Lm=0.0
Lbar=0.08	SAL=88
T=15.3 °C	AMP=0.0
SYSTEM RUNNING	

START

The START key allows to start the watermaker. When the system is ON push it to show the start-counter (AVV) and the product water LP (liter/minute) readings (see picture below).

HObar=0	L/m=0.0
Lbar=0.08	SAL=88
T=15.3 °C	AMP=0.0
LP=0.0	AVV=0

F1

When the system is OFF, by holding this key for 4 seconds is possible to start only the *low pressure pump* (A). This function is useful to backwash the Sand Filter (if the model installed is with manual valves) or to circulate the membranes cleaning chemicals.

F2

When the system is OFF, this key can start the automatic membrane flushing system - if installed - (push for 4 seconds). When the " lamp change" warning appears, this key allows to cancel it (push for 4 sec.).

RESET

When a failure occurs the RESET key allows to switch-off the acoustic alarm and to reset the control box.

WARNINGS ON THE DISPLAY

Unsafe Water
The unit is producing unsafe water that is being discharged outboard.

VISUAL and SOUND ALARMS

High Pressure
The unit stops for high working pressure. Push RESET to re-start it. Check section 8 "Troubleshooting" for possible causes.

Low Pressure
The unit stops for low working pressure. Push RESET to re-start it. Check section 8 "Troubleshooting" for possible causes.

Overload
The unit stops for overload. Push RESET to re-start it. Check section 8 "Troubleshooting" for possible causes.

5 Routine operation

5.1 Routine operation (c/w *automatic pressure regulator* device)

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).
- Start up the system by pressing START.
- Check that the feed water pressure is correct: the low pressure value showed on the display should 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).

Prefiltrated, clean sea water is extremely important for correct operation of the watermaker. It is also a good help to longer life of membranes. We recommend the exclusive use of replacement cartridges supplied by Tecnicomar.

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).

5.2 Routine operation (c/w *manual pressure regulator* device)

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).
- Make sure that the pressure control valve (I) is open (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Start up the system by pressing START.
- Check that the feed water pressure is correct: the low pressure value showed on the display should 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).

Prefiltrated, clean sea water is extremmely important for correct operation of the watermaker. It is also a good help to longer life of membranes. We recommend the exclusive use of replacement cartridges supplied by Tecnicomar.

- Apply gradually the operating pressure (850 psi = 60 bar) by slowly turning the pressure control valve (I) clockwise (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Check that after a few minutes of operation the UNSAFE warning disappears.

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

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

- Depressurize the system by turning the pressure control valve (I) counterclockwise (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Push STOP.
- Switch off the power supply.
- Close the sea water inlet (A2).

5.3 Manual running mode (c/w *automatic pressure regulator* device)

In case you need to pressurize the unit manually:
Start procedure

- Turn the selector automatic/manual located onto the motorized valve (I) in "manual" position (when the unit is off).
- Start the unit and turn the handle located top of the motorized valve (I) until reading 60 bar on the display (HObar).

Stop procedure

- Push STOP and turn back the handle top of the motorized valve (I).
- Move back the selector automatic/manual located onto the motorized valve (I) in "automatic" position.

5.4 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 produced water flow rate should be taken under control when applying the operating pressure.



The fresh water production must never exceed the system maximum production (refer to system technical characteristic, Section 9).

5.5 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)

6 Special procedures

6.1 System normal operation.

The watermaker electric box checks continuosly the system operation. The watermaker does not represent any risk for the user since the electric box automatically checks, by the appropriate sensors, the equipment correct operation. However the system can operate also in EMERGENCY conditions. In this operation mode the electric box cannot shut down the system anyway even in case 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.

In case of *automatic pressure regulator* device

- Open the sea water inlet valve (A2).
- **Switch off the power supply**.
- Turn the selector *automatic/manual* located onto the motorized valve (I) in "manual" position (when the unit is off).
- Remove the electric box front panel by unscrewing the four plastic bolts.
- Using an insulated-handle screwdriver bring the switch S1 (fig. 5) in the ON position.
- Using an insulated-handle screwdriver bring the switch S2 (fig. 5) in the ON position.
- Close the electric box front panel by screwing the four bolts.
- Switch on the power supply.
- Check that the *low pressure* be at least 0.5 bar.
- 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 (fig. 6).

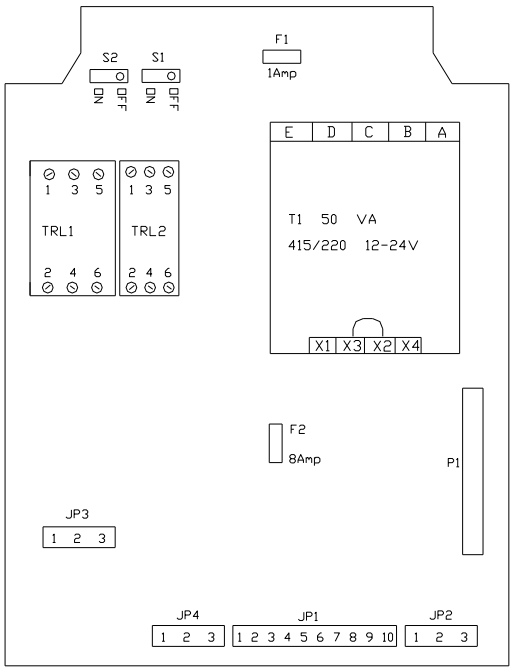


Figure 5 - S1 and S2 switches in emergency

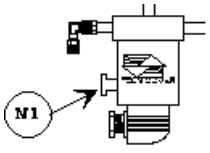


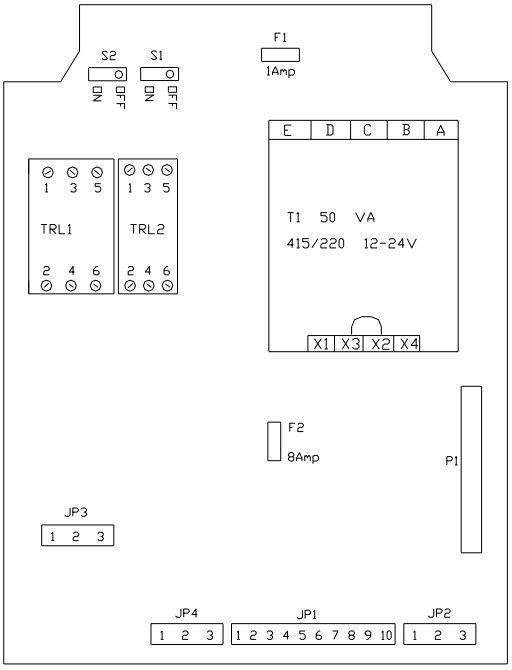
Figure 6 - three-way solenoid valve

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

- Move back the selector automatic/manual in "automatic" position.
- Switch off the power supply.
- Remove the control box front panel by unscrewing the four plastic bolts .
- Using an insulated-handle screwdriver bring the switch S1 (fig. 5) in the OFF position.
- Using an insulated-handle screwdriver bring the switch S2 (fig. 5) in the OFF position.
- Close the electric box front panel by screwing the four bolts.
- Close the sea water inlet valve (A2).

In case of *manual pressure regulator* device

- Open the sea water inlet valve (A2).
- Make sure that the pressure control valve (I) is open (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- **Switch off the power supply**.
- Remove the electric box front panel by unscrewing the four plastic bolts.
- Using an insulated-handle screwdriver bring the switch S1 (fig. 5) in the ON position.
- Using an insulated-handle screwdriver bring the switch S2 (fig. 5) in the ON position.
- Close the electric box front panel by screwing the four bolts.
- Switch on the power supply.
- Check that the *low pressure* be at least 0.5 bar.
- Pressurize the system by turning clockwise the *pressure control valve* (I) (ignore this step if the unit is equipped with the *automatic pressure regulator* device) until the pressure reaches 60 bar (850 psi).
- 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 (fig. 6).



- **Figure 5 - S1 and S2 switches in emergency**

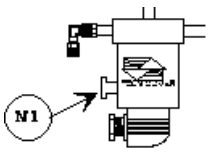


Figure 6 - three-way solenoid valve

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

- Depressurize the system by turning the *pressure control valve* (I) counterclockwise (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Switch off the power supply.
- Remove the control box front panel by unscrewing the four plastic bolts .
- Using an insulated-handle screwdriver bring the switch S1 (fig. 5) in the OFF position.
- Using an insulated-handle screwdriver bring the switch S2 (fig. 5) in the OFF position.
- Close the electric box front panel by screwing the four bolts.
- Close the sea water inlet valve (A2).

6.3 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.

6.4 Optionals

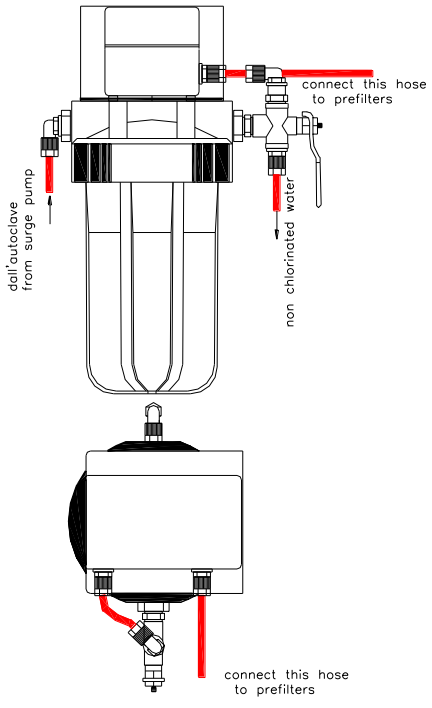
6.4.1 Automatic flushing system

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.
This system will flush automatically the membranes whenever the operator wants. The Automatic Membrane Flushing System has a special electronic control unit connected to the mother board (see AMF drawing).
Follow this procedure to operate it:

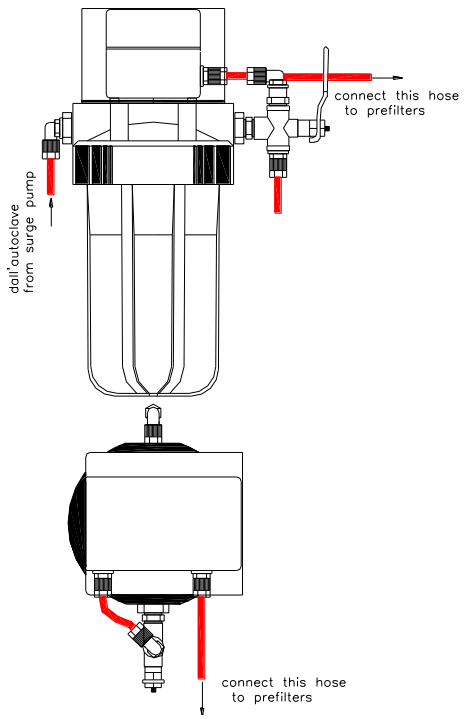
- Shut off the system by pressing the STOP key;
- Start the automatic flushing system by pushing the button F2 for 4 seconds;
- The system will be automatically flushed for 7 minutes.

If the Remote Control (CD MAR 2) is installed, the Automatic Flushing System can be started by pressing two times the STOP key situated on the Remote Control (when the motorized valve is completely open).
If the Remote Control (Touch screen) is installed, the Automatic Flushing System can be started by pressing at first the "F2" situated on the main page and then pushing "ON".

Automatic flushing system in position to obtain non chlorinated water



Automatic flushing system in operating position of flushing



6.4.2 Remote control



The watermaker operation may be monitored from a remote location as the boat pilot bridge using a remote control panel available as option. The remote panel has START, STOP and RESET keys, the acustic alarm and a liquid cristal display with all the information as in the control box. From the Remote Control panel is also possible to start the Automatic Flushing System.

6.4.3 Touch screen



The touch screen can monitor, manage and program all phases for operation and maintenance, thanks to interactive menus. It can display all the same information of the control box and can be used as remote control.

6.4.4 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.

6.4.5 Multimedia sand filter or TFD filter

Waters containing impurities which cannot be filtered out by the normal prefilters supplied with the watermaker require a first filtration treatment to eliminate the gross particles and to prepare the water for the prefiltration treatment.
The installation of a multimedia sand filter, or of a TFD filter, is simple and may be done on any watermaker, even if already installed.
A multimedia sand filter, or a TFD filter, is advised when the watermaker has to operate in very dirty waters or for many hours per day. The sand filter, and the TFD filter, filtrates suspended solids that are larger than 30 micron and provides protection and long life to prefilter cartridges. The sand filter, and the TFD filter, regenerates with backflush by simply operating 3 valves.



Sand Filter



TFD

7 Maintenance

The watermaker requires some maintenance. The most sensitive component is the reverse osmosis membrane module. Some safety components, such as the *three-way solenoid valve*, the 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 soacked.

⇒ If the system should not operate for more than one week, follow the long-term shut down procedures (0).

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 hosings. 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 (**only for CAT pump**) should be checked periodically: the level must coincide with the red dot at the rear of the pump (F1) (fig. 7).

7.1.3 Oil changing in the CAT high-pressure pump

The microprocessor control box is programmed to show on the display the water maker operating hours (H). When the operating hours value (H) reaches 50 hours, perfofm an itial fill “oil change”. Thereafter, perform an “oil change” every 3 months or 500 operating hour intervals. To perform an “oil change” operation 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 - fig.7) and drain the oil in the used-oil container. Make sure that the pump oil has drained thoroughly.

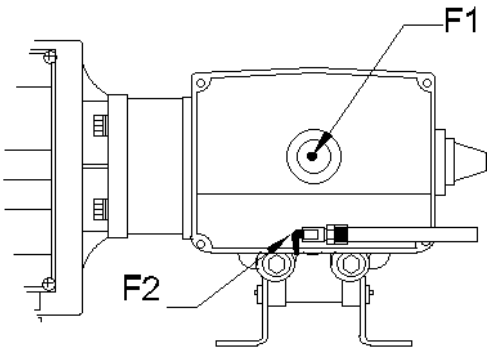


Figure 7 - high pressure CAT pump

⇒ 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.

7.1.4 Prefilters maintenance

The prefilters require maintenance when :

- The watermaker shows alarm for low pressure.
- The low-pressure is 30% lower than 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. 7.6).

The cartridge replacement procedure is given below:

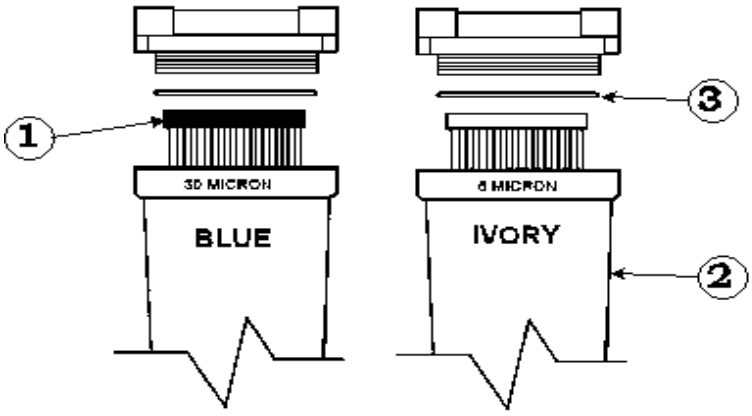


Figure 8 - Prefilters

⇒ 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 (fig.8). 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).
⇒ To restart the system follow the same steps of First start up procedure.

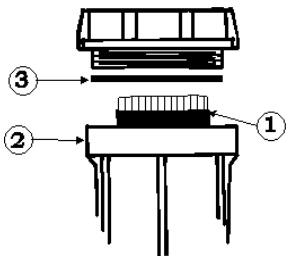


Figure 9 - Carbon filter

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 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 (fig.10), 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.

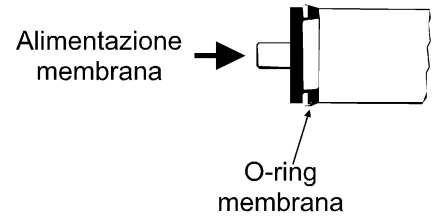


Figure 10 - membrane feed and O-ring

7.2.2 Salinity and temperature sensors (M+M1)

- Power off the system.
- Unscrew completely the salinity and temperature sensors.
- Clean the two electrodes with a fine-grain emery paper.
- Reinstall the sensors after having applied new teflon band on the threads.

7.3 Long-period shut down procedure

7.3.1 In case of automatic pressure regulator device

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).
- Turn the selector *automatic/manual* located onto the motorized valve (I) in "manual" position (when the unit is off).
- Empty the prefilters (B and C) and wash them using a normal dish-washing detergent.
- Reinstall the filter cartridges (Fig. 8).
- 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) (drawing 3) and connect to the container (X) with a piece of hose.
- Start up only the low pressure pump by pressing F1 key for 4 seconds.
- Feed the system with all the 20 liters of water, then stop it (do not let the system dry out).
- Prepare the biocide solution (0.2%) by dissolving 40 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 up the *low pressure pump* by pressing F1 key for 4 seconds.
- 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 INLET 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. Open the sea water intake valve (A2). Move back the selector automatic/manual in "automatic" position. Operate the system for 5 minutes without pressure. After that, apply the right pressure as described in section 5.



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.

7.3.2 In case of manual pressure regulator device

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:

- With the system shut down, fully open the *pressure control valve* (I) by turning it counterclockwise (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Close the sea water inlet valve (A2).
- Empty the prefilters (B and C) and wash them using a normal dish-washing detergent.
- Reinstall the filter cartridges (Fig. 8).
- 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) (drawing 3) and connect to the container (X) with a piece of hose.
- Start up only the low pressure pump by pressing F1 key for 4 seconds.
- Feed the system with all the 20 liters of water, then stop it (do not let the system dry out).
- Prepare the biocide solution (0.2%) by dissolving 40 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.
- Check that the *pressure control valve* (I) is fully opened (ignore this point if the unit is equipped with the *automatic pressure regulator* device).
- Start up the low pressure pump by pressing F1 key for 4 seconds.
- Circulate the solution inside the closed loop for 5 to 10 minutes and then leave the solution in the watermaker.
- Empty the prefilters and reinstall the cartridges.
- Turn the manual three-way valve (T) into the SEA WATER INLET 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. Open the sea water intake valve (A2). Make sure that the manual three-way valve is in the SEA WATER INLET position. Open the pressure control valve (I) by turning it counterclockwise (if installed). Operate the system for 5 minutes without applying pressure. After that, apply the right pressure as described in section 5.

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.

7.4 Membrane flushing with FL/411A and FL/412B chemicals

Important : The membranes should be flushed only when : 1) system fresh water production is lower of 30% than it was with new membranes.

- Shut down the system and fully open the *pressure control valve* (I) by turning it counterclockwise.
- Close the sea water inlet valve (A2).
- Empty the prefilters (B and C) and wash them using a normal dish-washing detergent.
- Reinstall the filter cartridges.
- Prepare a container (X) with 40 liters of fresh, non-chlorinated water or water produced by the watermaker.
- Turn the manual *three-way valve* (T) in the FLUSHING position (T2) (drawing 3) and connect to the container (X) with a piece of hose.
- Start up only the low pressure pump by pressing F1 key for 4 seconds.
- Feed the system with all the 40 liters of water, then stop it (do not let the system dry out).
- Prepare the solution by dissolving 2% (800 grams) of the FL/411A chemical into 40 liters of fresh water produced by the watermaker (dosage can be proportionally changed).



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.
- Check that the *pressure control valve* (I) is fully opened.
- Start up the low pressure pump by pressing F1 key for 4 seconds.
- Circulate the solution inside the closed loop for 60 minutes.
- Stop the *Low Pressure Pump* and leave the solution into the system for 1 hour.
- Clean the tank and fill it again with 40 lt of fresh water.
- Turn the brine valve in the “brine out” position and start the watermaker (without pressure!) to let the chemicals drain out fully off board. Stop the watermaker when the 40 lt fresh water tank is empty.
- Mix 2% (800 gr) of FL/412B in 40 liters of non-chlorinated water again and repeat the same procedure given above also for the FL/412B.
- Empty the prefilters and reinstall the cartridges.
- Turn the manual three-way valve (T) back into the SEA WATER INLET position.
- Connect the BRINE (R) and the UNSAFE WATER (S) lines back to the discharge fitting (Y).

CAUTION

FL/411A CONTAINS SODIUM HYDROXIDE and FL/412B CONTAINS CITRIC ACID : DO NOT BREATHE DUST, AVOID CONTACT WITH SKIN & EYES. CAUSES IRRITATION TO EYES AND MUCOUS MEMBRANES. HARMFUL IF SWALLOWED. IN CASE OF CONTACT FLUSH EYES OR SKIN WITH WATER AND CONTACT A DOCTOR.

7.5 General maintenance plan

7.5.1 Prefiltering circuit

Components	Required maintenance	Maintenance Period
Prefilters	Clean or replace filter cartridges and clean the sump (1)	When the low pressure (Lbar) falls below 0.5 bar

7.5.2 Pressurizing circuit

High pressure pump	Change oil (only for CAT pump)(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 warning message 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.

7.5.3 Controls and produced water circuits

Salinity sensor and temperature	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

7.6 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 1500 mm high-pressure hose
- No.2 containers of pump oil (in case of high pressure CAT pump)
- No.2 O-rings for prefilters

To order a complete Maintenance Kit, please specify the series and the model of your watermaker (ex. series SAILOR C mod. 1500).

(1) Use only TECNICOMAR original oil and filter cartridges
(2) Contact a TECNICOMAR Authorized Center

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 (fig. 8);
⇒ The three-way valve is set correctly;
⇒ The sense of rotation of the booster 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 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 (Lbar) is less than 0.3 bar the filtering cartridges should be replaced.
⇒ If the low pressure (Lbar) is 0 (zero) bar check that:
- sea water inlet is open
- sense of rotation of booster pump is correct (for three-phase systems only)
- the inlet pipe is clean.

8.4 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.

8.5 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.

8.6 Normal operation of the watermaker and overload failure shutdown

Check the consumption of the high- and low-pressure pumps.
Check the correct voltage and frequency of the power line.
If the problem persists, contact an authorized Tecnicomar Service Dealer.

8.7 UNSAFE warning message during normal operation

Check the quality of produced water. If it is fresh, the salinity sensor requires maintenance. To deliver the produced water to the accumulation tank when the UNSAFE warning is 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 runs normally but the produced water does not reach the tanks

Check:
⇒ the correct operation of the three-way solenoid valve.
⇒ if there are any obstructions in the tank-supply piping.

9 Technical characteristics and spare parts

9.1 Electrophysical characteristics

TYPE (GpD)[1][1]	Max. power rating (A)(±1A)	Operating voltage (V)	Production with new membranes[2] (liters per hour ± 15%)	Noise at 1 m distance (dBA)
MINIMAR 200-400-600 PL	6	230 V/ 50 Hz	35-70-120	79.5
SAILOR 200 – S 1/21	9	230 V/50 Hz	35 - 60	79.5
SAILOR 400 – S 2/21	9	230 V/50 Hz	70 – 100	79.5
SAILOR 600 – S 3/21	12	230 V/50 Hz	100 - 160	79.5
SAILOR 1000 – S 2/40	13	230 V/50 Hz	160 - 250	79.5
SAILOR 1500 - S 3/40	13 6	230 V/50 Hz 400 V/50 Hz	220 – 350 220 - 350	79.5
SAILOR 2000	14 7	230 V/50 Hz 400V/50Hz	300 300	79.5
See test certificate for other details (i.e. different voltages, etc…)				

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)	17600	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)	1300	2.6
Manganese (mg/l)	< 0.1	< 0.1
Nitrate (mg/l)	< 2.0	< 2.0
Potassium (mg/l)	418	6.4
Silicon as Si02 (mg/l)	10.7	< 5.0
Sodium (mg/l)	11000	105
Strontium (mg/l)	13.8	0.4
Sulfate (mg/l)	2436	2.3
Total sulfides (mg/l)	< 0.1	< 0.1
Turbidity (FTU2)	0.28	0.13
Conductivity (mhs/cm)	45000	550
Hardness as CaCO3 (mg/l)	6140	28
P-Alcalinity as CaCO3 (mg/l)	0	0
T-Alcalinity as CaCO3 (mg/l)	104	8
pH (units)	7.7	7.4
TDS at 180 oC (mg/l)	36073	250

[1] Nominal production expressed in gallons per day.
[1] Only for special series (No. of membranes/membranes type)
[2] Test condition:

1. Operating pressure 60 BAR (850psi)
2. prefilter feed pressure 1.8 BAR (26psi)
3. feed water temperature 20°C
4. feed water salinity 36000 ppm
5. feed water pH-value 3-11.

9.3 Spare part list

9.3.1 High pressure pump

model	MINIMAR	SAILOR	SAILOR	SAILOR	SAILOR Special	SAILOR Special	SAILOR Special	BICOMPACT
	200-400-600	200-400	600	1000-1500-	1/21- 2/21	S 3/21	2/40-3/40	2/40 -3/40
HP pump	2SF15SEEL	237	3CP1241	3CP1221	3CP1241	3CP1221	5CP6251	5CP6251

See annexed part list about high pressure pump.

9.3.2 Other spare parts

Part code	Description	
211VLF0014NPT0	Manual pressure regulation valve	
M.E/2.0 M.E/2.5	Electric motor 2.0 HP / 230 V Electric motor 2.5 HP / 230 V	
211CE0000TINY2 211CE0400TINY2 211CE0400TINY2 211CE0440TINY2 211CE0460TINY2	Control box Tiny 2 230V (complete) Control box Tiny 2 400V (complete) Control box Tiny 2 415V (complete) Control box Tiny 2 440V (complete) Control box Tiny 2 460V (complete)	
BC20 BCM20 BC22E BCM22E	Feeding pump 230 V – 400 V (3 phase) Feeding pump 230 V (1 phase) Feeding pump 230 V – 400 V (3 phase) Feeding pump 230 V (1 phase)	
201RPT0108PTFE	Plastic Hose HTR Dia. 8 x 10	
TB/009	Plastic Hose Dia. 20	
M-2521	Membrane 300 Gpd (*A)	Membrane 275 Gpd (*B)
M-2540	Membrane 700 Gpd (**A)	Membrane 650 Gpd (**B)
PV-2521 / PV-2540	Vessel 1000 PSI	
A14TP1F0DU0025	End plug for pressure vessel 2521/2540 1 hole in duplex stainless steel	
A14TP2F0DU0025	End plug for pressure vessel 2521/2540 2 holes in duplex stainless steel	
211PV0OR010000	O-Ring inner	
211PV0OR020000	O-Ring outer	
PS/015	O-Ring rubber	
2130000000BS03	Brine Seal (membrane)	
012MK…	Maintenance kit	
211SMMC2AB0000	MC2AB Membrane flushing chemicals kit	
211SM004030000	Membrane preservative solution FL 403	
THP 3/8	High pressure hose 3/8” (**A)+ (**B)	
THP ¼	High pressure hose 1/4” (*A)+ (*B)	
(*A) : Sailor 200-400-600 (*B) : Minimar; Sailor special 1/21 – 2/21 (**A) : Sailor 1000-1500-2000 (**B): Sailor special 2/40 – 3/40; Bicompact		

VESSEL GROUP 2540 *(fig. 1)*			
No.	PART NAME	ITEM CODE	QTY
1	Vessel 2540 1000psi	211PV025400000	1
2	End plug for vessel 1 Hole	A14TP1F0DU0025	1
3	End plug for vessel 2 Holes	A14TP2F0DU0025	1
4	Adaptor for vessel	A14RP212AD3237	2
5	Membrane SW30 2540 gpd	211SW025400000	1
6	Half moon secure plate 3mm	211LV00003TVIX	4
7	Screw M6x10 AX TE TF DIN933	202VT00610TE00	4
8	O ring for vessel 2521/2540	211PV00R020000	2
9	Elbow m/f ¼”	201RXMF014GNPT	2
10	Elbow ¼” – 9/16”	201RX91614GNJI	2
11	High pressure hose 3/8”(+fittings)	THP/…/3/8	2
12	Straight ¼” - 10	201RP01014D000	1
13	Hose HTR Ø10	201RPT0108PTFE	1
14	Tee Ø10	201RP00010T000	1
14 (*)	Equal elbow 10	201RP00010G000	1
15	O-ring internal for pressure vessel	211PV0OR010000	2
16 (**)	Swivel elbow 10-10	201RP01010GC00	2
(*) only in one vessel(if vessels>1)		(**) only in one vessel (output)	

VESSEL GROUP 2521 *(fig. 1)*			
No.	PART NAME	ITEM CODE	QTY
1	Vessel 2521 1000psi	211PV025210000	1
2	End plug for vessel 1 Hole	A14TP1F0DU0025	1
3	End plug for vessel 2 Holes	A14TP2F0DU0025	1
4	Adaptor for vessel	A14RP212AD3237	2
5	Membrane SW30 2521 gpd	211SW025210000	1
6	Half moon secure plate 3mm	211LV00003TVIX	4
7	Screw M6x10 AX TE TF DIN933	202VT00610TE00	4
8	O ring for vessel 2521/2540	211PV00R020000	2
9	Elbow m/f ¼”	201RXMF014GNPT	2
10	Elbow ¼” – 7/16”	201RX71614GNJI	2
11	High pressure hose 1/4”(+fittings)	THP/…/1/4	2
12	Straight ¼” – 8	201RPM0814DGAS	1
13	Hose HTR Ø8	201RPHTR860NAL	1
14	Tee Ø8	201RP00008T000	1
14 (*)	Equal elbow Ø8	201RP00008G000	1
15	O-ring internal for pressure vessel	211PV0OR010000	2
16 (**)	Swivel elbow 8-8	201RP00088GC00	2
(*) only in one vessel(if vessels>1)		(**) only in one vessel (output)	

MOTORIZED VALVE GROUP *(fig. 2)*			
No.	PART NAME	ITEM CODE	QTY
1	Motorized actuator 24 AC/DC	211AT0140S0000	1
2	Ball valve for motorized actuator	211VLFF014GAS0	1
3	Threaded Nipple 1/4”	201RX00014NNPT	1
4	Elbow reduction ¼”-4mm	201RXM0144GNPT	1
5 5(*)	High pressure hose 3/8”(+ fittings) High pressure hose 1/4”(+ fittings)	THP/…/3/8 THP/…/1/4	1 1
6 6(*)	Elbow ¼” – 9/16” Elbow ¼” – 7/16”	201RX91614GNJI 201RX71614GNJI	1 1
7	Stem adaptor ¼” -10	201RP01014DC00	2
8	Equal elbow Ø10	201RP00010G000	1
9	Safety valve ¼”	211VL0H9850000	1
10	Tee Ø10	201RP00010T000	1

11	Stem elbow Ø10	201RP01010GC00	1
12	Adaptor for safety valve	A14TR000VLRG00	1
Models: SAILOR C 200 - 400 - 600 -1000 - 1500 , SAILOR S 1/21 – 2/21 – 3/21 - 2/40 – 3/40 *(*)only for: SAILOR C 200 - 400 – 600; SAILOR S 1/21 – 2/21 – 3/21*			
MOTORIZED VALVE GROUP *(fig. 2)*			
No.	PART NAME	ITEM CODE	QTY
1	Motorized actuator 24 AC/DC	211AT0140S0000	1
2	Ball valve for motorized actuator	211VLFF014GAS0	1
3	Threaded nipple 1/4”	201RX00014NNPT	1
4	Elbow reduction ¼”- 4mm	201RXM0144GNPT	1
5	High pressure hose 1/4”(+ fittings)	THP/…/1/4	1
6	Elbow ¼” – 7/16”	201RX71614GNJI	1
7	Stem adaptor ¼” -8	201RP00814DC00	2
8	Equal elbow Ø8	201RP00008G000	1
9	Safety valve ¼”	211VL0H9850000	1
10	Tee Ø8	201RP00010T000	1
11	Stem elbow Ø8	201RP00088GC00	1
12	Adaptor for safety valve	A14TR000VLRG00	1
Models: MINIMAR PL 200 – 400 - 600			
PREFILTERS GROUP *(fig. 3)*			
No.	PART NAME	ITEM CODE	QTY
1	Filter container 10”slimline	2801F158208000	2
2	Filter cap 10”slimline	2801F158208000	2
3	Elbow (with nut) M ½” – 5/8”	201RX01258GNPT	1
4	(Threaded) Nipple ½”	201RO00012NC00	1
5	Nipple ½”	201RO00012NC00	1
6	Cartridge 30 µm	2801C155017030	1
7	Cartridge 5 µm	2801C255482430	1
8	Tee fff ½”	201ROFFF12TC00	1
9	Reduction ½” – ¼”	201RO01214RC00	1
10	Hose barb m ½”-20	201ROM1220PC00	1
11	Straight m 10-1/4”	201RPM1014DNPT	1
12	O-ring	280OR151121000	2
When Automatic Membranes Flushing system isn’t installed 5,8,9,11 are substituted by :			
A	Elbow mf ½”	201RXMF012G000	1
Models: SAILOR 200 - 400 - 600 -1000 - 1500 , SAILOR S 1/21 – 2/21 – 3/21 - 2/40 – 3/40			
SOLENOID VALVE GROUP *(fig. 4)*			
No.	PART NAME	ITEM CODE	QTY
1	Solenoid 3-way valve 12 VAC 50Hz ¼"	211VL2V0141250	1
2-a 2-b	Stem adaptor ¼” -10 Stem adaptor ¼” -8	201RP01014DC00 201RP00814DC00	3 3
3-a 3-b	Equal elbow Ø10 Equal elbow Ø8	201RP00010G000 201RP00008G000	3 3
4-a 4-b	Hose HTR Ø10 Hose HTR Ø8	201RPT0108PTFE 201RPHTR860NAL	3 3
5	Solenoid 3-way valve 12 VAC 50Hz ¼" (cable connector)	211VL2V0141250	1
(a) for models: SAILOR C 1000 – 1500 – 2000 – 2/40 -3/40 ; BICOMPACT *(b) for models: SAILOR C 200 - 400 – 600 - 1/21 – 2/21 – 3/21 ; MINIMAR PL 200 – 400 – 600*			
FLOWMETER and SALINITY PROBE GROUP *(fig. 5)*			
No.	PART NAME	ITEM CODE	QTY
1-a	Reducer Ø12 - Ø10	201RP01210R000	1
2-a 2-b	Female adaptor 3/8” – Ø12 Female adaptor 3/8” – Ø8	201RPF1238D000 201RPF0838DBSP	1 1
3	Flowmeter transducer $Ø_i$=8, 1-15 l/min	211TF0011508MM	1
4	Tee fff 3/8”	201RP00038T00F	1
5-a 5-b	Stem adaptor 3/8” - Ø10 Stem adaptor 3/8” – Ø8	201RP01038DC00	1

6-a 6-b	Equal elbow Ø10 Equal elbow Ø8	201RP00010G000 201RP00008G000	1 1
7	Salinity and temperature probe 3/8”	A14SS000000000	1
(a) for models: SAILOR C 1000 – 1500 – 2000 – 2/40 -3/40 ; BICOMPACT *(b) for models: SAILOR C 200 - 400 – 600 - 1/21 – 2/21 – 3/21 ; MINIMAR PL 200 – 400 – 600*			
ELECTRONIC BOARDS *(fig. 6)*			
No.	PART NAME	ITEM CODE	QTY
1	Tiny2 mother board (230V)	A14SB0000TINY2	1
1	Tiny2 mother board (400-415V)	A14SB0400TINY2	1
1	Tiny2 mother board (440 V)	A14SB0440TINY2	1
1	Tiny2 mother board (460V)	A14SB0460TINY2	1
2	Tiny2 cover board	A14COTINY20000	1

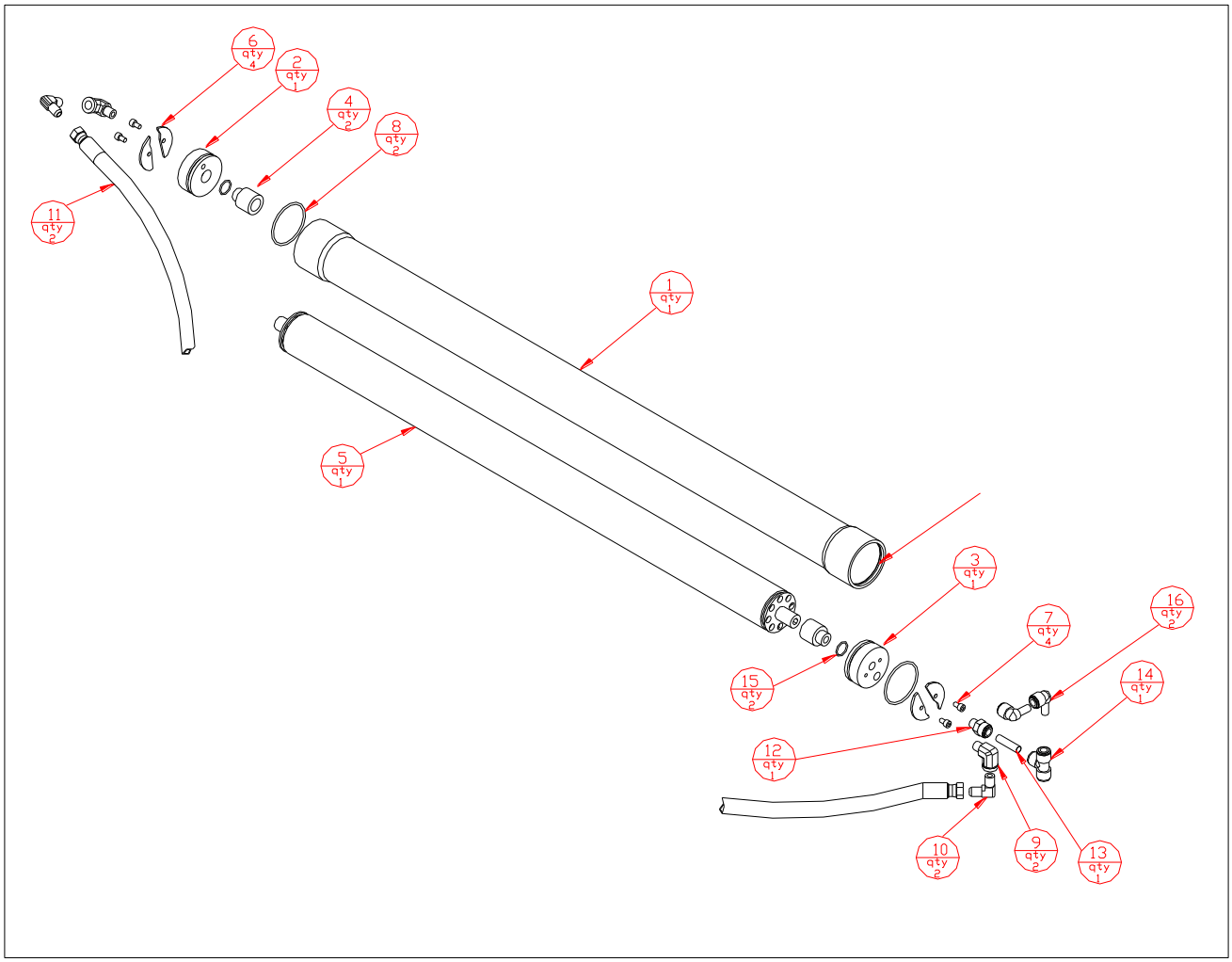


fig. 1: Pressure vessel group

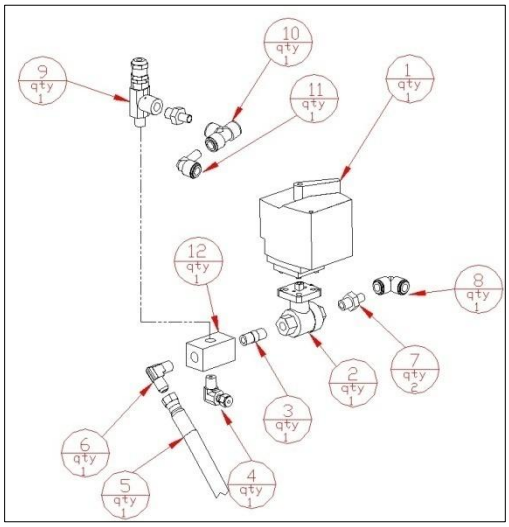


fig. 2: Motorized valve group

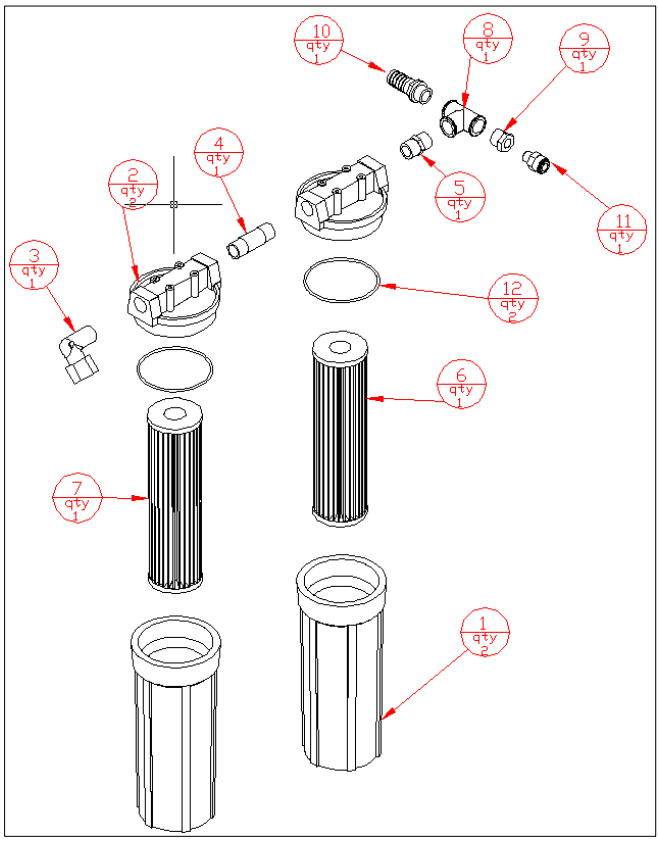


fig. 3: Prefilter group

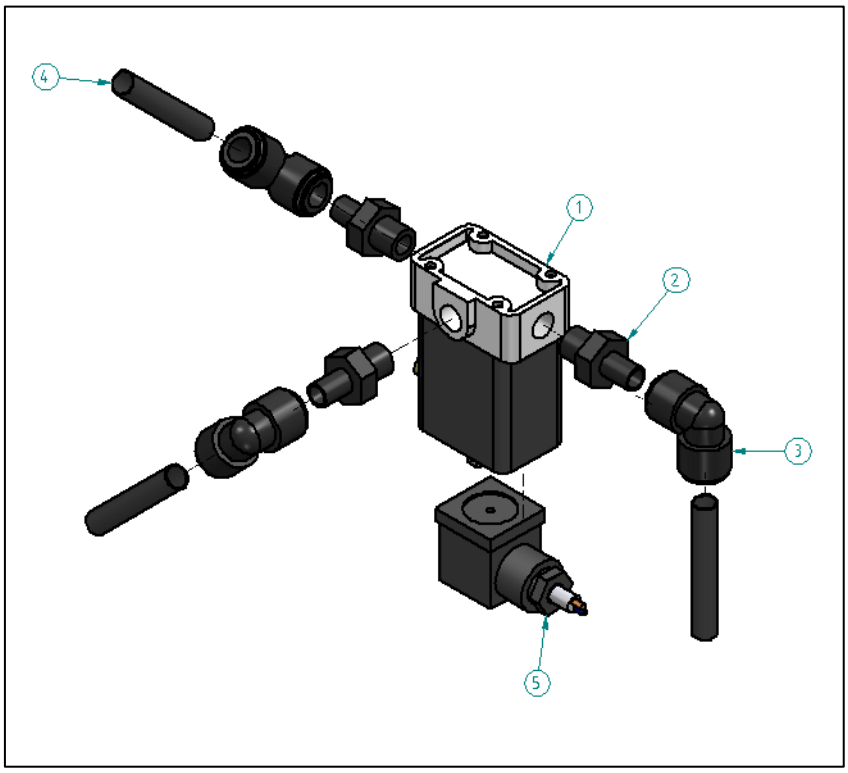


fig. 4: Solenoid valve group

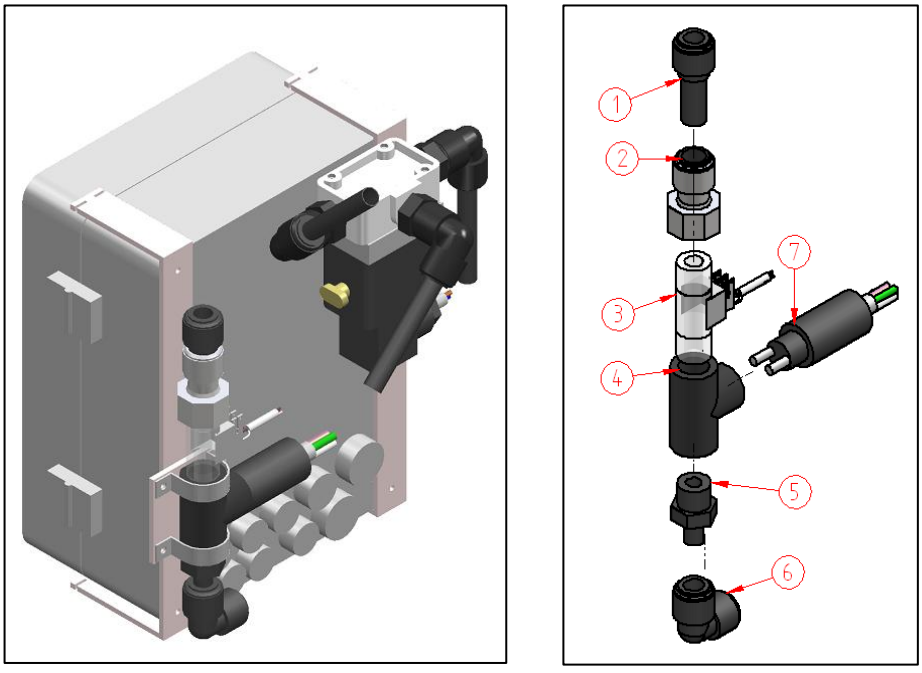
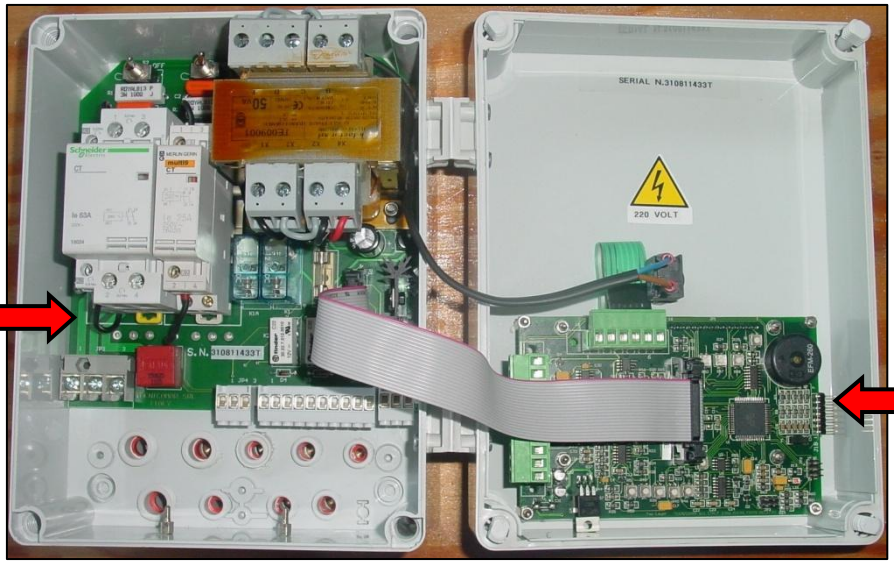


fig. 5: Flowmeter and salinity probe group (control box rear view)

1. TINY2 mother board



2. TINY2 cover board

fig. 6: Control box Tiny2(mother board and cover board)

9.4 Warranty for Tecnicomar equipments

The Manufacturer undertakes to remedy any non-conformity due to the defects in materials or workmanship of the Products for which he is liable, occurring within twelve (12) months from the start-up date. Under no circumstances will the warranty period exceed eighteen (18) months from the date of shipment from Tecnicomar. It is condition of warranty that the start-up registration card has been filled in and sent to Tecnicomar within thirty (30) days from the start-up.

To make use of 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.

The warranty does not cover:

a) The natural wear and tear of the equipment and damage resulting therefrom.
b) Consumables, such as gaskets, fittings, fillers etc.
c) Corrosion due to galvanic current.
d) Parts which can be repaired or corrected with minimum action, such as changing of seals, tightening or adjusting etc.
e) Spare parts.
f) Damage due to the purchaser's failure to properly store, maintain or operate the equipment, or due to overloading or failure to pay regard to service and operating instructions, or due to an accident.
g) Any defects in materials provided by the purchaser or a third party or any defects caused by design stipulated by the purchaser, purchaser's authorized representative or a third party.
h) Any costs such as work for assembly/disassembly of the defective system and/or part, travel and similar costs even when the listed activities are carried out by Tecnicomar, their Dealers, distributors and authorized technical service outlets. Such expenses shall be charged to the purchaser.
i) Any transportation, freight, importation or insurance costs, downtime costs etc.

No claim shall be considered, and warranty shall be considered null and void, if:

a) other than the parts supplied by Tecnicomar have been used within the system components as replacement parts or accessories;
b) the system has been installed using different procedures and materials other than those described in the User's Manual, without a written authorization by Tecnicomar;
c) the system has been repaired or modified by personnel not authorized by Tecnicomar;
d) the maintenance standards suggested by Tecnicomar have not been respected;
e) the system has been required to deliver superior or different performance than the one for which it was designed and supplied.

The obligation under this warranty is limited, at Tecnicomar's option to
a) Replacing the inoperative item free of charge EXW Tecnicomar (Incoterms 2010) or
b) Repairing the inoperative item free of charge EXW Tecnicomar (Incoterms 2010).
The warranty of the replaced or repaired part expires at the same time as the original warranty of the supplied equipment or part.

The purchaser shall retain the claimed part or equipment for three (3) months for Tecnicomar's inspection and on request the damaged part shall be sent to a destination designated by Tecnicomar at the purchaser's cost. Following warranty handling, the replaced part becomes the property of Tecnicomar.

Under no circumstances and in no condition shall Tecnicomar's liability within these warranty terms exceed the original value of the supplied equipment. TECNICOMAR will not be liable to reimburse direct or indirect damages.

This is the only warranty applicable to the equipment and expressively replaces any other warranties, expressed or implied, including any other warranties or liabilities against vices or defects, hidden or otherwise and any other obligation or liability whether in contract or in law.

WARRANTY CLAIM

A claim shall be made by delivering the part for inspection to an authorized dealer or by giving notice to Tecnicomar (info@tecnicomar.it - 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.