

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

Model – MINIMAR 400/12V

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: MINIMAR mod. MINIMAR 400
- d) Serial number: xxxxxxxxx
- e) Year of manufacture: 2006
- f) Voltage : 12Vdc

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.

* * * * *

This Manual is intellectual property of Tecnicomar Srl. Any reproduction of contents or drawings – unless authorized by Tecnicomar Srl – is not permitted and will be prosecuted.

©Tecnicomar

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 6.2).
- ⇒ Do not store above 50°C (122°F).
- ⇒ Store only on base with arrows up.

1.2 Checking packaging content

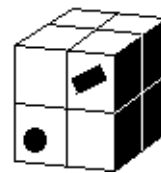
In the package there are the following components:



WATERMAKER



**Booster pump
(optional)**



Installation kit

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



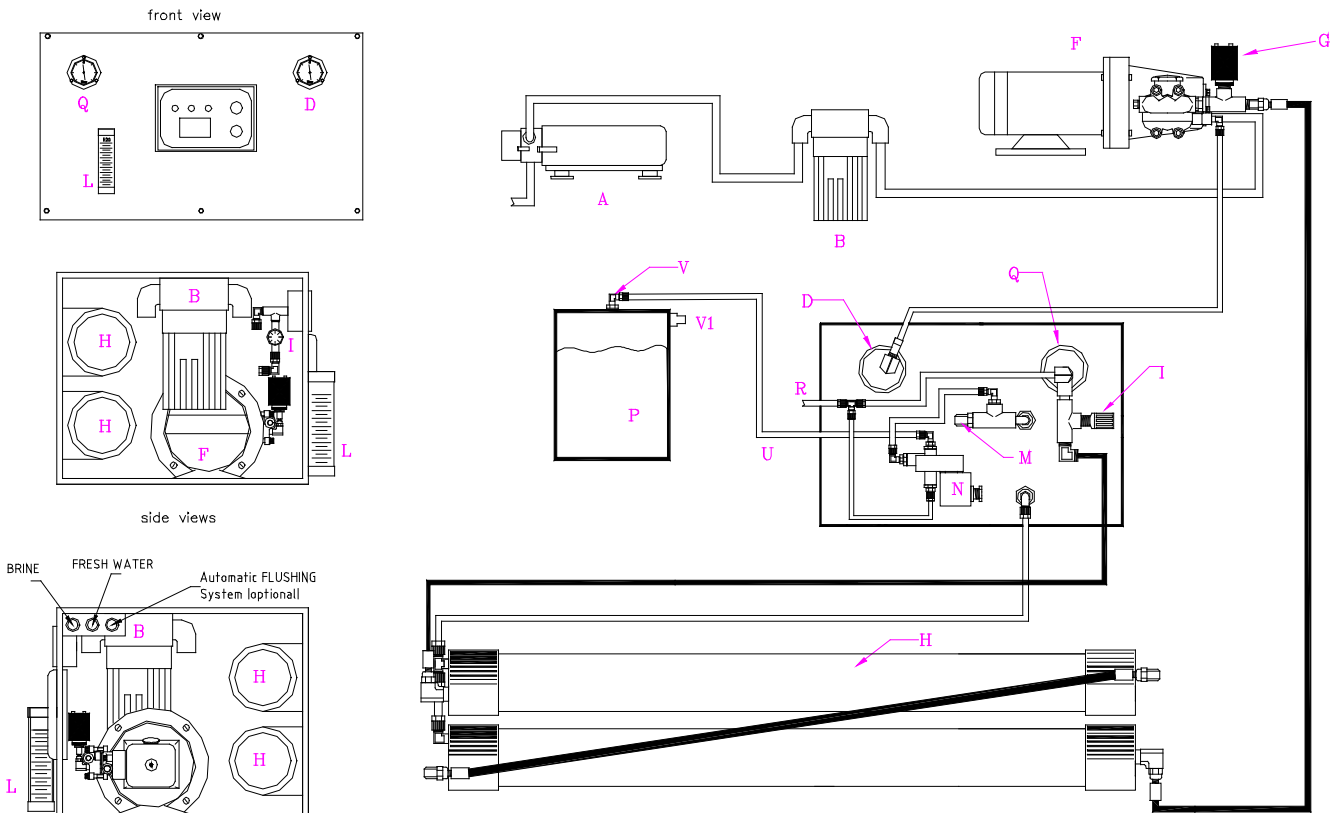
**Automatic
flushing system
(optional)**

SECTION 2

2 Process description and system components identification

The watermaker has four main sections :

- ⇒ **Prefiltration section** where salt water, supplied by the *booster pump* (A) (optional), is filtrated passing through the *prefilter* (B). Feed water pressure is indicated by the *low-pressure gauge* (D);
- ⇒ **High pressure section** in which sea water is pressurized by the *high-pressure pump* (F) and can reach the maximum pressure of 1000 psi (65 bar). 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 *high-pressure switch* (G), high-pressure tubes and their fittings require periodic maintenance (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 needs 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 into 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 to the discharge or to the tank depending on its salinity. The semipermeable membranes are very sensitive components and need strict observance and care (see PROTECTION AND CARE OF SEMIPERMEABLE MEMBRANES in Maintenance section).



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) Sea Water inlet valve;
- b) Tank for produced water (P). The tank should have a *safety overflow valve* (V1);
- c) Discharge line to the sea. A discharge fitting is supplied by Tecnicomar;



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

- d) 12/24 Volts power supply line.

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. 6.2



The equipment must be installed by expert personnel using piping, fittings and cabling supplied by Tecnicomar; if the installation of additional components is required, these must comply with the branch technical standards. In such cases it is advisable to contact an authorized Tecnicomar technical service.



The technician must wear individual protection on hands and feet (gloves, metallic cap shoes or similar) to avoid accidents due to a fall of a heavy component of the system.

For correct installation follow the steps listed below:

- Individuate a solid horizontal base where to fix the *booster pump* (A) (if supplied) and the main frame (see “Consideration” above).
- Connect the SEA WATER INLET to the *booster pump* (A) inlet using the supplied hose.
- Connect the outlet of the *booster pump* (A) to the inlet on the prefilter (B) using a piece of the supplied hose.



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

- Connect the lines BRINE, FRESH WATER (and AUTOMATIC FLUSHING SYSTEM - if supplied) to the appropriate fittings on the side panel.
- Install the supplied *fresh water fitting* (V) to the upper part of fresh water tank (P). Be sure that fresh water tank has an overflow valve (V1).



Discharge fitting

3.3 Power connection



Do not pull the flat cable when opening the electric box. MAKE SURE THAT THE POWER SUPPLY IS OFF AND THAT NOBODY CAN SWITCH IT ON DURING THIS OPERATION.



Tank connection fitting

- Connect the 12/24 Volt power supply line to the electric control box.
- Connect the low pressure pump (if supplied unplugged) to the power supply.
- Open the pressure control valve (I) (turn counterclockwise) to avoid starting the system under pressure.
- Power on the supply line and check that the SYSTEM STOP leds are ON.



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



Be sure that the high pressure pump (F) has enough oil for correct operation. The correct oil level must reach the red dot on the glass bezel (F1) in the rear of the pump. Remove the black cap from the bottom to change the oil (refer to the MAINTENANCE section). Remove the sticker from the top.

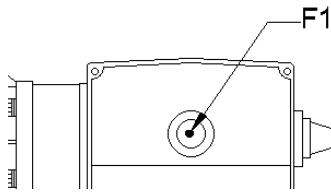


Figure 1 - oil level mark

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 filter (B) and fill it with pure non-chlorinated water. Check that the filtering cartridge is inside.
- Re-install the filter.
- Open the sea water inlet.
- 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 SYSTEM STOP leds on the electric box are ON.
- Make sure that the *pressure control valve* (I) is fully open; if not, turn it counterclockwise.
- Remove the sticker from the *high pressure pump* cap (F).
- Start the system by pressing 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.
- 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 *high-pressure gauge* (Q) indicates 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.

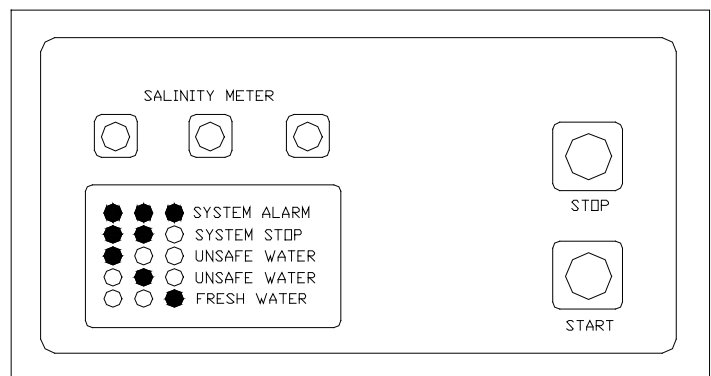
4.1 Shut down procedure

- Depressurize the system by turning the *pressure control valve* (I) counterclockwise.
- Push the STOP key on the electric box.
- Switch off the power supply.
- Close the sea water inlet.

4.2 Control box

The control box permits to manage the system by a simple interface. The three different coloured LEDs (red-yellow-green) are for a quick and easy visual control of the operational status of the system, depending on the sequence of the LEDs which are ON:

- ● ● SYSTEM ALARM
- ● ○ SYSTEM STOP
- ○ ○ UNSAFE WATER (first step)
- ● ○ UNSAFE WATER (half step)
- ○ ● FRESH WATER



To stop the unit. Also to reset the system after the SYSTEM ALARM warning.



To start the system.

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.
- Make sure that the pressure control valve (I) is open.
- Start up the system by pressing 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 filtering cartridges. If necessary, clean or replace the filtering cartridge.



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 to use only cartridges supplied by Tecnicomar.

- Apply gradually the operating pressure (850 psi = 60 bar) turning the pressure control valve (I) clockwise.
- After a few minutes the “UNSAFE WATER” LEDs go off.
- When the “FRESH WATER” LEDs are ON the unit is correctly 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:

- Depressurize the system by turning the pressure control valve (I) counterclockwise.
- Push STOP.
- Switch off the power supply.
- Close the sea water inlet.

5.1 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 production (refer to system technical characteristic, Section 9).

5.2 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 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.

Follow the steps below:

- Shut down the system and fully open the *pressure control valve* (I) by turning it counterclockwise.
- Close the sea water inlet.
- Empty the prefilter (B) and wash it using a normal dish-washing detergent.
- Reinstall the filter cartridge (Fig. 3).
- Prepare a container (X) with 5 liters of fresh, non-chlorinated water or water produced by the watermaker.
- Connect the *booster pump* (A) to the container (X) with a piece of hose.
- Start-up the watermaker.
- Feed the system with all the 5 liters of water, then stop it (do not let the system dry out).
- Prepare the biocide solution by dissolving 5 grams of the "FL403 Tecnicomar Membrane Preservative" in 5 liters of fresh water produced by the watermaker.



Do not use chlorinated water.

- Connect the discharge line (BRINE) to the container (X) in which the solution has been prepared.
- Check that the *pressure control valve* (I) is fully opened.
- Start up the watermaker.
- Circulate the solution in the closed loop for 5 to 10 minutes and then leave the solution in the watermaker.
- Empty the prefilters and replace the cartridge.
- Fit back the discharge line.



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 prefilter with clean, nonchlorinated water. Open the sea water inlet. Open the *pressure control valve* (I) by turning it counterclockwise. Run the system for 5 minutes without applying pressure. Then 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 in two days. Membranes will be flushed and bacteria will not grow inside. However, in all cases the membranes must be kept from freezing.

6.2 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).

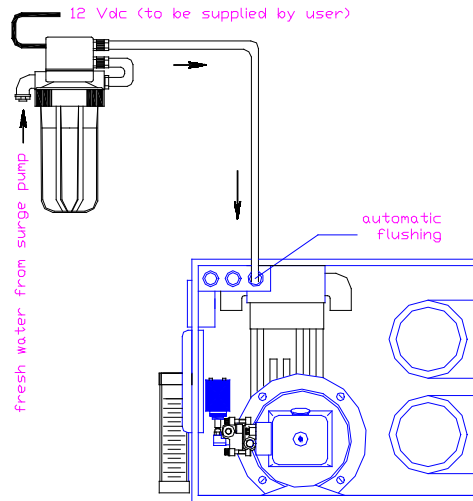


In any case the membranes should not freeze.

6.3 Optionals

6.3.1 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.



auto-flushing system installation (optional)

6.3.2 Remote control

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

SECTION 7

7 Maintenance

The watermaker requires some maintenance. The most sensitive component is the reverse osmosis membrane module. Some safety components, such as 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; 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 (6.1).



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 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) (fig. 2).

7.1.3 Oil changing in the high-pressure pump

To change oil in the high-pressure pump 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.
- ⇒ Remove the black cap from the bottom and drain the oil in the used-oil container. Make sure that the pump oil has drained thoroughly.
- ⇒ Unscrew and remove the red cap. Screw back the oil drain cap and fill with new oil up to the red dot level (F1). **Use only oil supplied by Tecnicomar.**
- ⇒ Reinstall the red cap and start up the system.

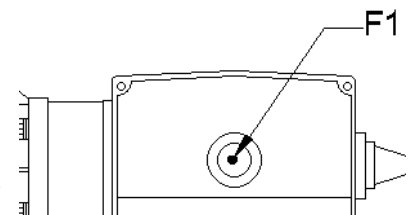


Figure 2 - high pressure pump



Do not discharge the used oil in environment.

7.1.4 Prefilter maintenance

The prefilter requires maintenance when :

- 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:

- ⇒ Shut down the unit and close the sea water inlet.
- ⇒ Unscrew the filter sump (B).
- ⇒ Empty the sump and take out the filtering cartridge.
- ⇒ Clean the sump inside. **USE NEUTRAL DETERGENTS (PH=7) TO PREVENT DAMAGE TO THE SUMP.**
- ⇒ Replace the filtering cartridge and make sure that the O-ring is well set and lubricated (use silicon grease).
- ⇒ Reinstall the cup, tightening it manually. **DO NOT USE THE WRENCH FOR TIGHTENING !**

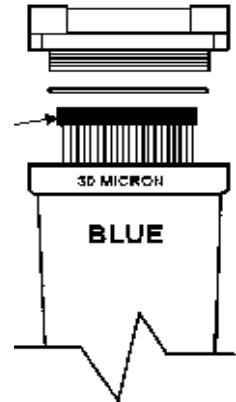


Figure 3 - Prefilter

7.2 Extraordinary maintenance

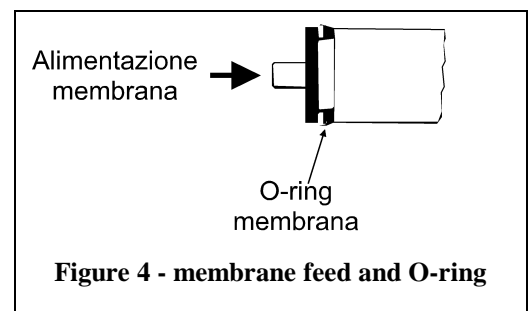
7.2.1 Setting the high-pressure switch

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

- ⇒ Take out the rubber plug situated among the 3 bolts of 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 counterclockwise;
- ⇒ Start up the watermaker by pushing the START pushbutton;
- ⇒ Pressurize the system by turning slowly the pressure control valve;
- ⇒ If the system shuts down before reaching the pressure of 65 bar, tighten again the pressure switch screw and repeat the steps starting with step No. 3 of this list.
- ⇒ Bring the system to the pressure of 65 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 65 bar.

7.2.2 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.
- Press inward the membrane to take off the two locking segments.
- Take out the end-plug from the pressure vessel.
- 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 caring to respect the insertion direction of the old one (fig.4), 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.



7.2.3 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 below:

- * Disconnect from the power supply.
- * Unscrew the top of the flowmeter.
- * Using a soft piece of cloth and a rigid stick, clean the interior without scratching the parts inside.
- * Reinstall the top of the flowmeter.

7.2.4 Salinity sensor

- Power off the system.
- Unscrew completely the salinity sensor.
- Clean the two electrodes with a fine-grain emery paper.
- Refit the sensor after applying new teflon band on the threads.

7.2.5 Pressure gauges maintenance

- * Disconnect from 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.
- * Refit the gauge on its seat and tighten after applying new teflon tape on the threads.

7.3 General maintenance plan

7.3.1 Prefiltering circuit

Components	Required maintenance	Maintenance Period
Prefilter	Clean or replace filter cartridge 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

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	Cleaning procedure ⁽²⁾	When the fresh water production is lower than 30% of the production with new membranes.

7.3.3 Controls and produced water circuits

Flowmeter	Clean the inner parts of the transparent cover	When it appears dirty
Salinity probe	Clean the conductivity electrodes	24 months

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.

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

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 (fig. 3);

If, after having checked the above, the problem is still alive, it is advisable to pressurize the sea water inlet circuit by a surge pump or with water under pressure. 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 SYSTEM ALARM on.

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

8.3 High-pressure failure during pressurizing

Problem: during regulation of operating pressure the system shuts down before reaching 60 Bar.

Check: the high-pressure switch have to be setted to shut down the system at 65 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.

Check:

- ⇒ if the low-pressure circuit pressure is less than 0.3 bar filtering cartridges should be replaced.
- ⇒ If the low pressure gauge reads 0 (zero) bar check that:
 - sea water inlet is open
 - the inlet pipe is clean.

8.5 Low pressure failure during normal operation

Problem: during normal operation the watermaker shuts down.

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 or rough sea

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

The problem may be dued to 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. If the produced water is salty check the water produced by 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	Max. power rating (A)	Operating voltage (V)	Production with new membranes(2) (liters per hour ± 15%)	Noise at 1 m distance (dBA)
MINIMAR 200	27/19	12/24V	25	<79.5
MINIMAR 400	27/19	12/24V	45	<79.5
MINIMAR 600	27/19	12/24V	75	<79.5

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

⁽²⁾ Test condition:

1. Operating pressure	60 BAR (850psi)
2. prefilter feed pressure	0.8 BAR (15psi)
3. feed water temperature	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	
BC12	Booster pump (optional)	
VRP/014	Pressure control valve	
M.E/12V	Electric motor 12V	
MHP/004	High pressure gauge	
MLP/005	Low pressure gauge	
P.M./006	High pressure switch	
P.M./007	Low pressure switch	
FL/A. ASS/5	Flowmeter R/1 plex 3/8 0-300 l/h	
THP/1/4	High pressure hose 1/4"	
TB/11/12/007	Plastic Hose Dia. 8 x 10	
TB/009	Plastic Hose Dia. 20	
M-2521	Membrane 200 Gpd	
PV-2521	Vessel 1000 PSI	
PVS 2.5" / KIT-SS	End Plug Kit	
OR/01	O-Ring inner	
OR/02	O-Ring outer	
BS/03	Brine Seal (membrane)	
MTK	Maintenance kit	

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 (> 850 PSI/65 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.

TABLE OF CONTENTS

1	Storage prior to unpacking and packaging content	1-4
1.1	<i>Storage prior to unpacking</i>	<i>1-4</i>
1.2	<i>Checking packaging content.....</i>	<i>1-4</i>
2	Process description and system components identification	2-5
3	Installation Procedure	3-6
3.1	<i>Components supplied by owner.....</i>	<i>3-6</i>
3.2	<i>Plumbing connections.....</i>	<i>3-6</i>
3.3	<i>Power connection.....</i>	<i>3-6</i>
4	First Start-up procedure	4-8
4.1	<i>Shut down procedure</i>	<i>4-8</i>
	<i>Control box.....</i>	<i>4-8</i>
5	Routine operation.....	5-9
5.1	<i>Operation in low- or high-salinity areas.....</i>	<i>5-9</i>
5.2	<i>Operation in cold areas.....</i>	<i>5-9</i>
6	Special procedures.....	6-10
6.1	<i>Long-period shut down procedure</i>	<i>6-10</i>
6.2	<i>Preservation of membrane modules in very cold areas</i>	<i>6-10</i>
6.3	<i>Optionals.....</i>	<i>6-11</i>
6.3.1	<i>Automatic flushing system.....</i>	<i>6-11</i>
6.3.2	<i>Remote control.....</i>	<i>6-11</i>
7	Maintenance	7-12
7.1	<i>Ordinary Maintenance</i>	<i>7-12</i>
7.1.1	<i>Preservation and care of the semipermeable membrane modules</i>	<i>7-12</i>
7.1.2	<i>High-pressure circuit.....</i>	<i>7-12</i>
7.1.3	<i>Oil changing in the high-pressure pump</i>	<i>7-12</i>
7.1.4	<i>Prefilter maintenance</i>	<i>7-12</i>
7.2	<i>Extraordinary maintenance</i>	<i>7-13</i>
7.2.1	<i>Setting the high-pressure switch.....</i>	<i>7-13</i>
7.2.2	<i>Replacement of membrane modules</i>	<i>7-13</i>
7.2.3	<i>Flowmeter.....</i>	<i>7-13</i>
7.2.4	<i>Salinity sensor.....</i>	<i>7-14</i>
7.2.5	<i>Pressure gauges maintenance</i>	<i>7-14</i>
7.3	<i>General maintenance plan.....</i>	<i>7-14</i>
7.3.1	<i>Prefiltering circuit.....</i>	<i>7-14</i>
7.3.2	<i>Pressurizing circuit</i>	<i>7-14</i>
7.3.3	<i>Controls and produced water circuits.....</i>	<i>7-14</i>
7.4	<i>Maintenance kit.....</i>	<i>7-14</i>

8	Common problems and troubleshooting	8-15
8.1	<i>First start-up</i>	8-15
8.2	<i>Start-up after the replacement of filter cartridges.....</i>	8-15
8.3	<i>High-pressure failure during pressurizing</i>	8-15
8.4	<i>Low pressure failure</i>	8-15
8.5	<i>Low pressure failure during normal operation.....</i>	8-15
8.6	<i>Operation with vessel in navigation or rough sea</i>	8-15
8.7	<i>During normal operation the UNSAFE pilot light turns on.....</i>	8-15
8.8	<i>The watermaker operates normally, the produced water does not reach the accumulation tanks.....</i>	8-16
8.9	<i>The low and/or high pressure gauge do not indicate pressure</i>	8-16
9	Technical characteristics and spare parts	9-17
9.1	<i>Electrophysical characteristics.....</i>	9-17
9.2	<i>A typical analysis of produced water</i>	9-17
9.3	<i>Spare part list.....</i>	9-18
9.3.1	<i>High pressure pump</i>	9-18
9.3.2	<i>Other spare parts.....</i>	9-18
9.4	<i>Warranty for Tecnicomar equipments.....</i>	9-19