ITALIAN TECHNOLOGY ALL OVER THE WORLD

TECNICOMAR
DISSALATORI - WATERMAKERS

Reverse Osmosis Watermakers

SCOPE OF SUPPLY

REVERSE OSMOSIS PLANT
SEA WATER

STDC SY 9000
32.4 m^3/day

TECNICOMAR S.p.A.
Stabilimento ed Uffici: 91025 MARSALA (TP), ITALIA - C.da Berbaro, 145/D
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SCOPE OF SUPPLY

Pos.	*Code*	*Quantity*	*Description*
1	012FIBR1140000	1 set	STRAINER 1”1/4, bronze
2	012SF0TFD17000	1 set	TFD Prefilter, 50 micron (alternative to Multimedia Sand Filter)
3	010SY0900F4463	1 set	STDC SY 9000 WATERMAKER, 32.4 m^3/day, c/w FEED PUMP and p&pv gauges
4	012SD10VFT210A	1 set	ANTISCALANT DOSING SYSTEM, c/w dosing pump, 60 L tank and sensor level probe
5	A14SE000220AMF	1 set	CLEANING/FLUSHING SYSTEM (tank 220 L)
6	012FC0TCC03000	1 set	RE-HARDENING FILTER, TCC/3, 3 m^3/h
7	040UV050000000	1 set	U.V. STERILIZER TC 5000, 5 m^3/h
8		1 set	SPARE PARTS, SPECIAL TOOLS AND CONSUMABLES FOR COMMISSIONING AND START-UP

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TECNICOMAR
DISSALATORI - WATERMAKERS

TECHNICAL SPECIFICATION

Watermaker type:	Reverse Osmosis
Fresh water production:	1350 l/h [32.4 m^3/day]
Temperature, nominal (range):	20°C (10°C ÷ 35°C)
Recovery factor:	22.2%
Feed rate:	6.08 m^3/h
TDS (feed water):	40338.73 mg/l
TDS (permeate, 5 years):	about 120 mg/l
Feed pressure:	0.1-1 bar (positive)
Operating pressure:	57 bar
Membrane type:	Polyamide Thin-Film Composite
Membrane size:	8” x 40”
Configuration:	Assembled on a stainless steel frame
Installed power:	18.5 kW, high pressure motor-pump set
	1.8 kW, low pressure motor-pump set
Total electric power consumption:	13,5 kW (low and high motors)
Voltage:	440V-60Hz-3 phase
Sea water inlet:	1”1/4 ASME B16.5 #150 Flanged - inox 316L
Discharge out of board (BRINE):	3/4” ASME B16.5 #150 Flanged - inox 316L
Produced water outlet (SAFE):	3/4” ASME B16.5 #150 Flanged - inox 316L
Produced water outlet (UNSAFE):	3/4” ASME B16.5 #150 Flanged - inox 316L
Country of origin:	ITALY

The watermaker is complying with rules in force and it is provided with CE mark.

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FEED and FILTERING SPECIFICATIONS

Strainer

Bronze water strainer 1-1/4", ISO UNI 7/1-RP, marine type, to prevent clogging of sand filter & prefilter cartridges with marine debris:

- Corrosion resistant
- Flow rate at 0,1 bar (clean filter): 9,900 l/h
- Flow rate at 1 bar (clean filter): 33,900 l/h
- Connection: INLET 1-1/4" flanged ASME B16.5 #150 inox 316L, OUTLET 1-1/4" x dia. 40 mm to sea water pump inlet.

Flushing valve

Three way valve, T type, in inox 316L to deviate the water from the sea or from a tank for manual unit flushing.

Connections: 1"1/2 FFF

Mounting position: on inlet sea water pump.

Low pressure pump

Make:	CALPEDA
Model:	MXHL 803-60
Number of stages	3
Construction:	Horizontal multi-stage centrifugal pump;
External jacket:	AISI 316L (1.4404 EN 10088)
Suction casing:	AISI 316L (1.4404 EN 10088)
Delivery casing:	AISI 316L (1.4404 EN 10088)
Stage casing:	AISI 316L (1.4404 EN 10088)
Impeller:	AISI 316L (1.4404 EN 10088)
Lower cover:	AISI 316L (1.4404 EN 10088)

Upper cover:	AISI 316L (1.4404 EN 10088)
Spacer sleeve:	AISI 316L (1.4404 EN 10088)
Pump shaft:	AISI 316L (1.4404 EN 10088)
Plug:	AISI 316L (1.4404 EN 10088)
Mechanical seal:	Ceramic alumina, carbon, EPDM
Wear ring:	PTFE

Maximum working pressure:	8 bar
Liquid temperature range:	from -15°C to +110°C
Maximum environment temp.:	+50°C
Motor:	2-pole induction motor, continuous duty
Installed power:	1.8 kW
Speed of rotation:	n ≈ 3450 rpm (60Hz)
Insulation class of the motor:	F
Protection of the motor:	IP 54

Motor constructed in accordance with IM V1 (IEC 34-7)

TFD semi-automatic Sediment prefilter *(within watermaker frame)*

Semi-automatic self-cleaning prefilter based on a swirl effect obtained by means of a propeller at the filter inlet.

Preserves the prefilter elements on the R.O. system from marine debris.

The TFD filter needs less washing cycles compared to the standard sand filter and helps to save energy, water and time.

- Characteristics:
- 18 m^3/h at 50 micron filtration
- Made of reinforced nylon with glass fibre.

- Light and small coarse filtration solution.
- Modular, versatile and easy to maintain.
- High resistance to clogging.
- Easy and quick connection.
- Fittings:
  - 1”1/4 x Ø40 mm, to be connected from sending side of feed pump to inlet of sand filter by hose (our supply 5 m)
  - 1”1/4 x Ø40 mm, to be connected from outlet of filter to inlet of prefilters by hose (our supply 5 m, if necessary)
  - 1”1/4 x Ø40 mm for discharging
  - Drain: 1/2” x Ø20 mm (hosebarb)
- pipes in non-toxic PVC
- pressure drop: 0,8 bar
- no.2 I/O manometers
  - material: inox, glycerin filled, Ø63 mm
  - pressure gauges range: 0-6 bar;
  - pressure gauges, mounting points on the system: prefilter outlet / membrane discharge
  - pressure gauges, connection: post. 1/4”
- valves, in EPDM, for *SERVICE/BACKFLUSH* operations
- flow meter on inlet water (l/h), mechanical type

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Antiscalant dosing system

Efficient system to prevent the formation of scale on the membrane surfaces and membrane fouling avoiding premature membrane replacement.

Effective in removal of turbidity and bacteria.

Components:

- Membrane dosing pump for antiscalant chemical, auto-proportional, programmable, microprocessor based model.
    - Flow rate: 2 l/h@10 bar
    - Housing: glass fibre reinforced polypropylene
    - IP 65 protection
    - Control panel protection assured by a transparent polycarbonate cap with gasket.
    - Voltage: 230V-50/60Hz-1 phase (power supply from WM's control box)
- 60 litres tank, in polyethylene
- 25 kg antiscalant chemical
- Level switch to stop automatically the dosing pump in case of lack of antiscalant chemical.
- Connection point: between sand filter and "B" cartridge filter.

Cartridge prefilters (within the watermaker frame)

Prefilter with reusable polyester cartridges.

Characteristics:

Make:	EUROTROL
Filtration rate	5 micron
Cartridges no.:	5
Filter height:	20"
Filter housings material:	PVC
Connection to coarse pre-filter	1"1/2 x Ø50mm

HIGH PRESSURE SPECIFICATIONS (within the watermaker frame)

High pressure motor-pump set

Direct motor-pump coupling system with anti vibration mounts composed of:

- *Motor*

Tropicalized	
Installed Power	18.5 kW [25 HP]
Voltage	440V-60Hz-3 phase
Insulation class	F
Protection degree	IP55
Maximum environment temp.:	+50°C
Type:	squirrel cage 8-pole induction motor, continuous duty

- *Variable speed drive*

Variable speed drive for asynchronous motor
IP55
Motor Power: 22 kW
Three-phase 50/60 Hz
Power supply range: 380-440V (with EMC filter integrated)
Directly installed into the frame

- *Pump*

Make	CAT
Model	3531
Materials	Stainless steel for pump body
	Die cast aluminium crankcase
	Chrome-moly crankshaft

Crankcase capacity	4 l
Weight	63 kg
Special features:	special concentric, high density, polished, graphite impregnated, solid ceramic plungers
Performance:	from 7 to 85 bar
Inlet:	1”1/2 NPTF
Outlet:	1” NPTF

- *Coupling*

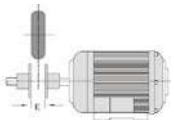
  Coupling to the motor with elastic joint to avoid transmission overload.

  The Gummi Flexible Couplings provides this essential needed protection. Their dampening capacity and circumferential elasticity allows them to handle radial, axial, angular and combined misalignments. The technical development of a solid one piece rubber element, as well as their proven field performance under extreme working conditions have made the Gummi Flexible Coupling a favorite in a variety of industries worldwide.

  Coupling to the motor with elastic joint, covered by a carter for safety.

Rubber mounts in inox.

Noise level < 90 dB.



RO Membranes

N. 2 Reverse Osmosis membranes

Model:	**SW30HRLE-440i**
Make:	Filmtec
Size:	8” x 40”,
Type:	Polyamide Thin-Film Composite, spiral wound
Permeate flow, each:	31 m^3/d (8200 Gpd)

Stabilized salt rejection:	99.8%
Minimum salt rejection:	99.65%
Stabilized boron rejection:	92%
Max. operating pressure:	83 bar (1200 psi)
Max. operating temperature:	45°C (113 °F)
Chlorine concentration:	< 0.1 ppm
Maximum feedwater SDI:	5
pH range:	2-11

NIPH/WHO, FDA, NSF.

Vessel

No. 2 pressure vessels

Make:	Codeline
Size:	8”
Type:	reinforced fiberglass
Max pressure:	1000 Psi
Number elements of each vessel	1
Approved:	A.S.M.E.

The vessels are coupled with flexible hoses and fittings in 316L stainless steel.

Working pressure

Operating pressure:	57 bar

High pressure regulation valve in 316L stainless steel for manual pressure regulation.

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PERMEATE SPECIFICATIONS (within the watermaker frame)

Permeate

Produced water: 1350 l/h [32.40 m^3/day]

TDS (total dissolved solids): About 120 mg/l < 400 mg/l

- Automatic motorized three-way valve in PVC for the automatic deviation of the produced water out of board when quality of produced water does not reach the preset values.

Connections: DN40 – d32 FFF, PVC

Protection: IP 65

Power supply from control box: 24V AC - 50Hz - single phase

Connected to control box

Hoses and fittings in non-toxic PVC.

CHARCOAL CARTRIDGE FILTER

Activated carbon cartridge to remove bad taste from water, with **1800 l/h flow rate** allowing a reduced maintenance.

Model NCP-BB 10", filtration rate 10 micron.

Connections: 3/4" flanged ASME B16.5 or NPT (safe), 3/4" flanged ASME B16.5 or NPT (brine & unsafe).

CONTROL PANEL SPECIFICATIONS (within the watermaker frame)

Control panel

Electromechanical control panel with protection class IP 55 and the following characteristics:

- Buttons with the following functions:

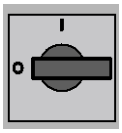
- Power Switch
- Start, green lighted button
- Stop, red lighted button
- Differential starting of feed pump and high pressure pump
- Starting the cleaning/flushing system with green lighted selector
- Turn on the space heaters with the white lighted space heaters selector
- Reset failure warnings
- Seven segment LED display with reading of the quality of produced water: salinity [µS/cm] and temperature [°C]
- High pressure and low pressure controls (by pressure switches)
- High pressure on fresh water or on brine line controls (by pressure switches)
- Operating hours meter
- Display of failures
- Mushroom-head button for emergency stop
- Case in Steel
- cable glands in chrome –plated brass

Visual alarms

- Maintenance signals for unsafe water with yellow indicator light
- Green indicator light for correct operation of both feed pump and high pressure pump (START BUTTON)
- White indicator light for power on
- Red indicator light for failure of variable speed drive

- Red indicator light for failure of feed pump
- Red indicator light for failure of high pressure pump
- The control box shuts down the desalinator automatically in case of high pressure and low pressure, with visual alarm (red indicator light).
- The control box shuts down the desalinator automatically in case of high pressure on the fresh water line or on the brine line, with visual alarm (red indicator light).
- Red indicator light for space heaters operation (SPACE HEATERS SWITCH)
- Red indicator light for high pressure on the fresh water line or on the brine line
- High salinity of the fresh water: yellow indicator light, with discharge out of board
- Motor protection high pressure pump: yellow indicator light, with stop of the circuit
- Motor protection feed pump: yellow indicator light, with stop of the circuit
- Feed pump / high pressure pump: red indicator light with stop of the circuit
- Brine line / fresh water line high pressure: red indicator light with stop of the circuit

- **Buttons functions:**



- Power Switch: a general switch to activate/deactivate the entire control panel
- System Start: green lighted button, allows a differential starting of feed pump and high pressure pump
- System Stop: red lighted button
- Manual start of feed pump switch.

1. automatic start of feed pump

2. manual start of feed pump

- Manual start of cleaning/flushing pump switch.

1. Space Heaters Off

2. Space Heaters On

- Mushroom-head button for emergency stop

- **Alarms descriptions:**

- Maintenance signals for unsafe water with yellow light indicator: when there is an high salinity value ,fresh water is discharged out of board
- Motor protection cleaning pump: yellow light indicator, with stop of the circuit
- Green light indicator for correct operation of both low and high pressure pump (START BUTTON)
- Red light indicator for failure of feed pump
- Red light indicator for failure of high pressure pump
- Red light indicator for high pressure on the fresh water line or on the brine line
- Motor protection high pressure pump: yellow light indicator, with stop of the circuit
- Motor protection feed pump: yellow light indicator, with stop of the circuit
- Red light indicator for failure of variable speed drive
- Red light indicator for system stop (STOP BUTTON)
- Green light indicator for correct operation of cleaning pump (CLEANING PUMP SWITCH)
- Red light indicator for correct operation of space heaters (SPACE HEATERS SWITCH)
- White light indicator for power on

ONE GENERAL COMMON ALARM FOR HIGH PRESSURE, LOW PRESSURE, HIGH SALINITY AND OVERLOAD (N.O./N.C. free-potential contacts available into control box).

Instruments

- **High pressure switch**

  Make: THE NASON COMPANY

  Circuit: SPDT (single pole double throw)

  Rating: gold plated contacts for low current

  Operation: circuit to transfer at 1090 ± 55 PSI rising pressure

  Adjusting range: 750 to 2400 PSI

  Max operating pressure: 5000 PSI

  Set point: 70 bar

  Material: base in 316 Stainless Steel; housing in G/F Nylon.

  Termination: DIN connector 43650-A

  Mounting points on the system: membrane discharge

- **Low pressure switch**

  Make: THE NASON COMPANY

  Circuit: SPST-N.O. (single pole single throw-N.O.)

  Rating: gold plated contacts for low current

  Operation: circuit to open at 3 ± 1 PSI falling pressure

  Adjusting range: 1,5 to 5 PSI

  Max operating pressure: 250 PSI

  Set point: 0,3 bar

  Material: base plastic; housing in G/F Nylon.

  Termination: DIN connector 43650

Mounting points on the system: prefilter outlet.

- **High pressure switches**

Make: THE NASON COMPANY

Circuit: NO (open on fall)

Rating: gold plated contacts for low current

Operation: circuit to open at 3 ± 1 PSI falling pressure

Adjusting range: 1,5 to 100 PSI

Max operating pressure: 250 PSI

Set points: 1,5 bar / 4,5 bar

Media connection material: Delrin.

Termination: DIN connector 43650A

Mounting points on the system: fresh water line / brine line.

- **Mechanical low and high pressure gauges**

Make: WIKA

Material: inox, glycerin filled.

DN65

Operating Temperature

Ambient: -20 ... +60 °C

Fluid: +100 °C

IP 65 per EN 60 529 / IEC 529

ATEX Ex II 2 GD c

Range: 0-6 bar for low pressure; -1/0 for vacuum pressure; 0-100 for high pressure.

Mounting points on the system: prefilter outlet, inlet (pressure vacuum type) and outlet of feed pump.

Analog reading.

- **Salinity and temperature probe**

  Make: TECNICOMAR

  Mounting points on the system: between fresh water outlet and motorized 3-way valve;

  Digital reading on the display of the control panel.

- **Flow meters**

  Make: Blue White

  Type: mechanical

  Mounting points on the system:

  No.1 between fresh water outlet and motorized 3-way valve

- **Operating hours meter**

  Analogical reading of the system's operating hours on the display of the control panel.

- **Ammeters**

  Analogical reading of the electrical consumption on the display.

Grounding

Skid base plate with no.2 earthing bosses, at opposite base plate locations.

Motors with external earthing terminal.

CLEANING/FLUSHING SPECIFICATIONS

System for membranes flushing, using produced fresh water (not chlorinated).

It is composed of:

Tank:	220 litres in polyethylene
Floating probe:	installed on tank, mechanical type
Two-way ball valve - drain:	1/2" F threaded

Inlet from brine line:	¾" F threaded
Inlet from produced FW line:	1/2" F threaded
Outlet to T2 valve	1" F threaded
Air vent:	1" F threaded

INSTALLATION KIT

- Pipe in spiral rubber for "from feed pump to pre-filter" (5 meters), complete with fittings *(if necessary)* and clamps.
- Use, maintenance and installation manual.

IN/OUT MAIN CONNECTIONS

- Sea water inlet:	1"1/4 ASME B16.5 #150 Flanged - inox 316L
- Discharge out of board (BRINE):	3/4" ASME B16.5 #150 Flanged - inox 316L
- Produced water outlet (SAFE):	3/4" ASME B16.5 #150 Flanged - inox 316L
- Produced water outlet (UNSAFE):	3/4" ASME B16.5 #150 Flanged - inox 316L

ACCESSORIES

RE-HARDENING FILTER

De-acidifying filter, model TCC/3 to add calcium to the water, to decarbonate the water and to regulate the pH value. The filter is complete with:

- Tank in reinforced fiber glass PARK made, type 14x43
- Tank volume: 96 liters
- Operating pressure range: 0 - 10 Bar
- Tank with threaded opening: 4” on the top
- Tree-way head In/Out: 1” F/F
- Minimum flow rate: 950 l/h
- Maximum flow rate: 3000 l/h
- No. 62.5 kg of calcite
- No. 12.5 kg of coarse sand
- Approx. dimensions: see drawing
- Approx. weight: 85 kg dry - 110 kg wet

Operation

The water to be treated enters into the tank through the INPUT connection the top.

The distribution allows a homogeneous distribution, on the filtering surface.

The filtration processes takes place from the top downwards through the filtering beds placed above the diffusion plate.

The treated water is then conveyed to the OUTPUT connection placed on the top.

UV STERILIZER – TC 5000

Flow rate: 5000 liters/hour

Power supply: 230 V - 50/60 Hz - single phase, with 24 VDC transformer

Electrical power consumption: 90 Watt

Maximum operation pressure: 8 bar

n.2 UV lamps 38 W each of them - 24 V.

UV Dose: > 30.000 µW s/cm^2

In/out: 1" M bsp (available flanged ASME B 16.5 on request)

Control box complete with hoursmeter, led current "on", led for lamp "on".

Low pressure mercury vapor lamps with protective extruded ultrapure quartz bulbs with 95% minimum permeability at 2537 x 10^{-10} m.

Visual performance control of the UV sterilizer:

Minimum environment temperature: 5°C

Maximum environment temperature: 50°C

Minimum water temperature: 5°C

Maximum water temperature: 35°C

Maximum relative humidity: 95%

Electronic ballast at low voltage.

All the parts in touch with the fluid are made of stainless steel 316L, with **sanitary finish**, or quartz, granting hygienic security.

Body in Stainless steel AISI 316 L

Average UV lamp life: 9000 hours

Control box

⏻ On/Off button Ⓡ Reset buttons

H:00000 = Indicates the lamp life hours

HTOT:00000 = Indicates the total system life hours (cannot be reset)

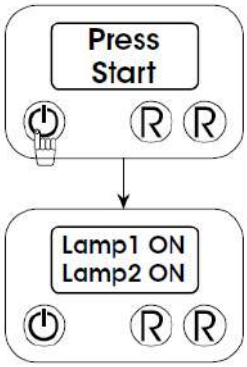
Lamp1: ON= Indicates that lamp no. 1 is on

Lamp2: ON= Indicates that lamp no. 2 is on

Lamp1: OFF= Indicates that lamp no. 1 is switched off or burnt out

Lamp2: OFF= Indicates that lamp no. 2 is switched off or burnt out

Lumin: 100%= Indicates the lamp irradiation intensity



The electrical part of the system has been designed and built in observance of standard CEI EN 60204/1on the safety of machinery and electrical equipment of machines.

Electromagnetic compatibility 89/336/EEC, 93/68/EEC

Low voltage 73/23/EEC, 93/68/EEC

Compliance with the following standards is observed:

EN 50081-1 General standard on emission (part 1): residential, commercial and light industry environment

EN 50082-1 General standard on immunity (part 1): residential, commercial and light industry environment

EN 607742 Standard related to insulation transformers and safety

Parts of the appliance destined for contact with alimentary substances are compliant to:

EEC Dir. 89/109 and Lgs. Decree no. 108 of 25/01/92

Min. decree 443 of Ministry of Health of 21/12/90

Regulation no. 174 of 6 April 2004 on the release of materials in contact with water.

COMPONENTS SUPPLIED AS STANDARD SEPARATE PARTS

25 kg	Antiscalant FLOCON 135 (211PEFL135KG01) (part of antiscalant dosing unit 012SD10VFT210A)
No. 1	Membrane preservative solution FL/403 (0.5 kg) (A14SM004030000)
62.5 kg	Calcite (part of 012FC0TCC03000)
12.5 kg	Coarse sand (part of 012FC0TCC03000)

CONSUMABLES FOR COMMISSIONING AND START-UP

no. 10	Prefilter cartridges 5 micron- 20” (2802CFC0610005)
no. 2	Carbon Cartridge NCP-BB10 (2801C155398043)
no. 1	Membrane preservative solution FL/403 (1 kg) (A14SM00403KG01)
no. 2	Pump oil box (0.5 l) (211OP000001200)
no. 2	O-ring for BB filters (280OR151122270)
no. 1	Wrench for BB filters (280SW150296000)
no. 1	Conductibility tester kit, model DIST3, 1990µs/cm (211TEHI9830300)

LIST OF SPARE PARTS, SPECIAL TOOLS

no. 90	Prefilter cartridges 5 micron- 20” (2802CFC0610005)
no.2	MEMBRANE SW30 HRLE-440i FILMTEC (211SW00440HRLE)
25 kg	Antiscalant FLOCON 135 (211PEFL135KG01)

NOTE

Each plant will be supplied with the following certificates and documents:

- Certification of Conformity
- Hydrostatic test
- Functional test of the complete plant
- FAT certificate
- Material certificate
- Maintenance manual
- Operation manual and spares manual
- General arrangement drawing
- Electrical wiring drawing
- P & ID diagram

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Test Certificate for Watermakers

Certificate Nr. 049 **- Date:** 28/04/2015

Serial Number: 280415049	
Customer: **GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH MINISTRY OF DEFENCE**	**Purchase Order:** **No. 249.145.13 DTD 26-JUN-2014**
Watermaker model: STDC SY 9000	

Voltage – frequency- phases: **440V-60Hz-3ph**

Low pressure

☐ Motorized Valve: - V - -		Serial number:	
Valve inlet: type: ☐ hose barb; ☐ flange ; ☐ speed fit; ☐ other:			
Valve outlet: type: ☐ hose barb; ☐ flange ; ☐ speed fit; ☐ other:			
☒ Feeding pump – low pressure (model): **MXHL803-60**		Serial number: **2015152445**	
Pump inlet: 1"1/4 type: ☐ hose barb; ☒ flangeASME B16.5; ☐ speed fit; ☐ other:			
Pump outlet: 1"1/4xϕ40mm type: ☒ hose barb; ☐ flange ; ☐ speed fit; ☐ other:			
Pump voltage 440 V-60 Hz-3 phase	Motor Power 1.8 kW	Consumption: 3.55 **A**	☐ Capacitor: μ F
Working pressure inlet: 0 bar		Working pressure outlet: 3.6 bar	

High pressure

High pressure pump (model): **3531**	High pressure pump : inlet 1"1/2 - outlet 1"	
High pressure pump speed: 667 rpm	Working pressure: 57 bar	
Electric motor maker: **CANTONI**	Motor serial nr.: **B00656**	
Motor power: 18.5 kW / 22 hp	Electric motor voltage 440 V - 60 Hz - 3 phase	Max Consumption: 34.2 **A**
☐ Capacitor: μF	☒ Space Heaters: 230 V A	Vibration dumper model: CT261
Coupling between motor and pump: ☐ bell coupling; ☒ flexible coupling – type:GUMMI A70; ☐ flange – type:		

Membranes model: SW30 HRLE - 440i WET
Membranes Serial Number :
F8419897 – **F8419980** – _____ - _____

_____ - _____ - _____ - _____

_____ - _____ - _____ - _____

Flushing membrane test: ☒ Positive ☐ Negative
Vessels model: 80E100-1H in FIBERGLASS - Vessel maximum operating pressure: 1000 psi

High pressure hoses
Length: 1870 mm – Diameter: 3/4**"** – Type: ☐ Rubber tube; ☒ Textile Braid pipe; ☐ Other: _____
Length: 950 mm – Diameter: 1**"** – Type: ☐ Rubber tube; ☒ Textile Braid pipe; ☐ Other: _____
Length: 700 mm – Diameter: 3/4**"** – Type: ☐ Rubber tube; ☒ Textile Braid pipe; ☐ Other: _____
Length: 280 mm – Diameter: 1/8**"** – Type: ☒ Rubber tube; ☐ Textile Braid pipe; ☐ Other: _____
Length: _____ mm – Diameter: _____**"** – Type: ☐ Rubber tube; ☐ Textile Braid pipe; ☐ Other: _____
Length: _____ mm – Diameter: _____**"** – Type: ☐ Rubber tube; ☐ Textile Braid pipe; ☐ Other: _____

Electric data

Control box type: ☐ Micromar 2 Plus - ☐ Tiny2 - ☒ EMC- ☐ Other:			Control box serial nr.: **290415EMC038**
Electric Consumption at 0 bar: 7 **A**		Electric Consumption at 57 bar: 21.3 **A**	
Electric Consumption at start: **A**	Overload threshold: **A**		Test report attached: ☒ Yes ☐ No
☒ Inverter: model Altivar 61 ; serial Nr. 6W1502000030		Input voltage range: 380-480 V 50-60 Hz	
Inverter power:22kW/30hp	Consumption: 31.3 **A**	Inverter parameters settings attached: ☒ Yes ☐ No	

Components installed

☒ Coarse Prefilter: Type: ☐ multimedia ☒ elicoidal - model **TFD(150lpm)**	☒ Tested
☒ filter inlet: 1"1/4xϕ40mm type: ☒ hose barb; ☐ flange ; ☐ speed fit; ☐ other:	
☒ filter outlet: 1"1/4 type: ☐ hose barb; ☐ flange ; ☐ speed fit; ☒ other: **cemented**	
☒ filter backwash outlet: 1"1/4xϕ40mm type: ☒ hose barb; ☐ flange ; ☐ speed fit; ☐ other:	
☒ filter drain: 1/2"xϕ20mm type: ☒ hose barb; ☐ flange ; ☐ speed fit; ☐ other:	

Prefilters model: hpcf/b-5dc2	Prefilters serial number:	Prefilters cartridges: **Nr.5x5micron x 20"**	
☒ Prefilter inlet: 1"1/4 - type: ☐ hose barb; ☐ flange ; ☐ speed fit; ☐ other: **cemented**			☒ Tested
☒ Prefilter outlet: 1"1/4 - type: ☐ hose barb; ☐ flange ; ☐ speed fit; ☒ other: **cemented**			

High pressure switch off calibrated at **70** bar	☒ High pressure switch ☒ Tested	☐ High pressure transducer ☐ Tested
Low pressure switch off calibrated at **1.8** bar	☒ Low pressure switch ☒ Tested	☐ Low pressure transducer ☐ Tested
☒ Pressure switch off (BRINE LINE)	calibrated at: 4.6 bar	☒ Tested
☒ Pressure switch off (FRESH WATER LINE)	calibrated at: 1.8 bar	☒ Tested

Three way valve for salinity model: 3MEVE1020L	Valve voltage: 24 VAC	In-out: ϕ32	☒ Tested

Temperature and salinity probe: 1/2“	high salinity alarm: 1500 µS/cm	alarm cable length: 3000 mm

Flow meter type: ☒ Mechanical ☐ Flow sensor transducer	Model: F410 – 36LPM	☒ Tested

Post filters model: BIG BLUE 1"-10"	In-out 1" - type: ☐hose barb; ☐ flange; ☐ speed fit; ☒ other: **cemented**	
Post filters serial number:	Post filters cartridges: **EPM 10 BB -**	☒ Tested

Inlet/outlet

Sea water inlet 1"1/4 - type: ☐ hose barb; ☒ flange A.S.M.E. B16.5 #150; ☐ other:			
Inlet for cleaning and flushing operation 1" - type: ☐ hose barb; ☒ flange A.S.M.E. B16.5 #150; ☐ speed fit; ☐ other:			
Fresh water: 1" - type: ☐ hose barb; ☒ flange ASME B16.5; ☐ speed fit; ☐ other:			
☒ Brine: 3/4" - type: ☐ hose barb; ☒ flange A.S.M.E. B16.5 #150; ☐ speed fit; ☐ other:			
☒ Unsafe: 3/4" - type: ☐ hose barb; ☒ flange A.S.M.E. B16.5 #150; ☐ speed fit; ☐ other:			
☐ Brine+Unsafe: 1" - type: ☐ hose barb; ☒ flange ASME B16.5; ☐ speed fit; ☐ other:			
☒ Outlet to cleaning tank: 1/2" - type: ☐ hose barb; ☐ flange ; ☐ speed fit; ☒ other: female threaded			
Flow meter readings: Inlet: 6600 l/h – Brine: 5250 l/h – Permeate: 1350 l/h			
Ambient temperature 20°C	Salinity Inlet: 40500 ppm - ☐ Sea water / ☒ ppm NaCl		
Salinity Brine Outlet: µS/cm	Salinity Fresh water Outlet: 120 µS/cm		

Accessories

☐ Remote control: model	cable mt	☐ Tested	
☒ UV sterilizer: model **TC5000**	serial nr.: 290415UV016	Test report attached: ☒ Yes ☐ No	
☐ Flushing system: model	cartridge	☐ Tested	
☐ Cleaning pump (model):	Pump voltage V- Hz- phase	Consumption: **A**	
Working pressure inlet: bar	Working pressure outlet: bar	☒ Cleaning Tank (**220** l)	
☐ Automatic pressure regulator: model		☐ Tested	
☒ Strainer: model **GENOVA**	In-out**1"1/4** type: ☐ hose barb; ☐ flange; ☒ other: threaded		
☒ Antiscalant Dosing pump **DLXB VFT MBB**	set: **manual** - n: **008**	☒ Antiscalant Tank (**60** l)	
☐ Chlorine Dosing pump	set: - n:	☐ Chlorine Tank (l)	
☐ Maintenance kit: model			
☒ Installation kit			
☒ **RE-HARDENING FILTER TCC3**			
☐			
☐			

Note (Specification of the used instruments, indication of NCR in case of negative result of the factory test)

Date of factory test 28/04/2015 Signature

Revisions and components afterwards changed				
date	Ref. document	Component	Ref. Annexes	note
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TECNICOMAR®
DISSALATORI - WATERMAKERS

As manufacturers of this equipment we hereby state the following :

DECLARATION OF "CE" CONFORMITY

Desalinator (Watermaker):

Model: STDC SY 9000 Serial Number: 280415049

The conformity is declared according to the following EU Directives:

a) FOR THE ELECTROMAGNETIC COMPATIBILITY: 89/336 - 93/68

- EN50081-2: *Generic rules of emissions for industrial machines* [CEI 110-13(94)]
- EN50082-2 : *Generic rules of immunity for industrial machines*

b) FOR THE MACHINERY (SAFETY) DIRECTIVE: 89/392 - 91/368 - 93/68 and for THE LOW VOLTAGE DIRECTIVE 73/23 ECC.

- EN60335-1: *Safety of electric appliances for domestic use and similar.* [CEI 61-150(95)]

DATE 28/04/2015

Francesco De Vita

TECNICOMAR S.p.A.
Stabilimento ed Uffici: 91025 MARSALA (TP), ITALIA - C.da Berbaro, 145/D
Tel. (+39) 0923 969409 - Fax (+39) 0923 960235
Filiale: 55049 VIAREGGIO (LU) - Via M. Coppino, 67 - Tel./ Fax (+39) 0584 395408
www.tecnicomar.it · E-mail: info@tecnicomar.it

TECNICOMAR DISSALATORI - WATERMAKERS	**TEST CERTIFICATE FOR UV STERILIZER**	Quality plan no. 001

UV STERILIZER model TC 5000 serial no. 290415UV016

CUSTOMER : **GOVERNMENT OF THE PEOPLE'S REPUBLIC OFBANGLADESH MINISTRY OF DEFENCE**
Order no.: **No. 249.145.13 DTD 26-JUN-2014**

VOLTAGE 230 V Frequency 50-60 Hz

TEST	Test result	
1) Power supply	Positive ☒	Negative ☐
2) UV lamp	Positive ☒	Negative ☐
3) Hydraulic test	Positive ☒	Negative ☐

Factory test result. : Positive ☒ Negative ☐

Date of factory test	Signature
29.04.2014	TECNICOMAR SpA

WARRANTY REGISTRATION CARD

(Please type or hand write in capital letter and mail or fax to +39.0923.960235)

CUSTOMER INFORMATION

Boat name :	Home harbour :
Owner/Contact person on board :	
Address :	
tel :	fax :

SYSTEM INFORMATION

Model : **STDC SY 9000**
Serial number : **280415049**
Purchase date :
Dealer :

Initial Performance Table

After installation is completed, provide the following performance data :

1. Location of tests _____
2. Date of tests _____
3. Operating pressure (PSI) _____
4. Product water concentration (umhos) _____
5. Sea water temperature (°C) _____
6. Installer's name and address _____

_____

EXTRA INFORMATION

The boat is primarily used for :

- ☐ Pleasure
- ☐ Commercial fishing
- ☐ Commercial Passenger
- ☐ Work
- ☐ Other (specify)

_____

TECNICOMAR
DISSALATORI - WATERMAKERS

OWNER'S MANUAL WATERMAKERS



www.tecnicomar.it

INSTRUCTIONS FOR INSTALLATION, USE AND

MAINTENANCE OF TECNICOMAR WATERMAKERS

MODEL STDC-SY9000/12000

Italian Tecnology All Over The World

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.

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 efficiently.

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 due to the improper use of the equipment and for modifying it without the authorization of Tecnicomar S.p.A.

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!

Contents

Appendix

1 Storage prior to unpacking and packaging content

1.1 Storage prior to unpacking

- Do not store in direct sunlight.
- Do not freeze.
- Do not store above 55°C.
- Store only on base with arrows up.
- Keep the R.O. membrane element wet at all times.
- The watermaker has been shipped new with reverse osmosis membrane elements installed, the System must be commissioned within 6 months. This is to avoid drying out or biological fouling of the R.O. membranes.

1.2 Unpacking

- Open the wood case, if any, being careful to do not hit the protruding parts of the components, such as fittings or the high pressure section, hose-barbs, flange , etc.
- Use caution in moving the W.M. with a forklift after it is removed from the shipping crate. Place wood or other material onto the metal forks of the forklift which can damage the powder coating on the underside of the skid.

1.3 Checking packaging content

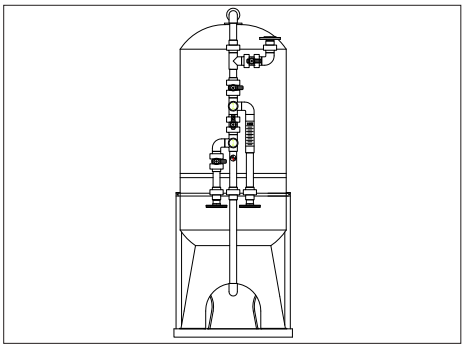
In the package there are usually the following components:

- Watermaker SW8 complete with sea water pump (if installed inside the frame)*.
- Installation Kit: Hose for the connection between the prefilt ation stage and the watermaker; hose HTR for dosing pump, clamps.
- Dosing pump equipped with level probe, tank and injector (if it is not installed on the WM frame).
- Antiscalant tank.
- SAND FILTER TFS (or as alternative filtration TFD filter)**.
- Quartzite (0.3-0.9 mm) for TFS fil er.
- Quartzite (3-5.6 mm) for TFS fil er.
- Re-Hardening filter.
- Cleaning / Flushing system.
- Other devices.

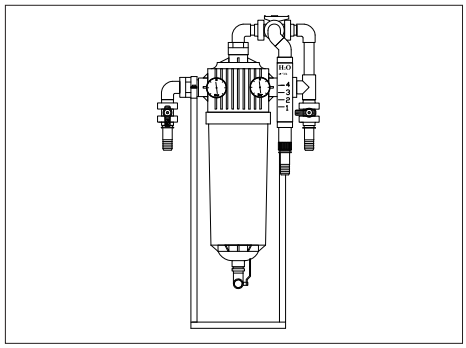
Fig. 1.1 - SW-8 Watermaker

* the feed pump can be supplied on a separate frame.

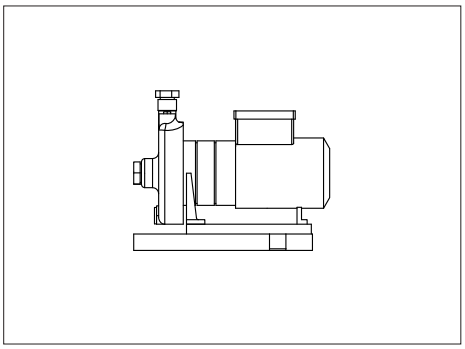
** the TFD filter can be supplied installed inside the WM frame.



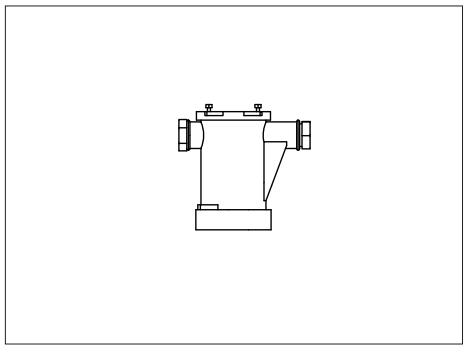
Sand Filter



TFD Filter

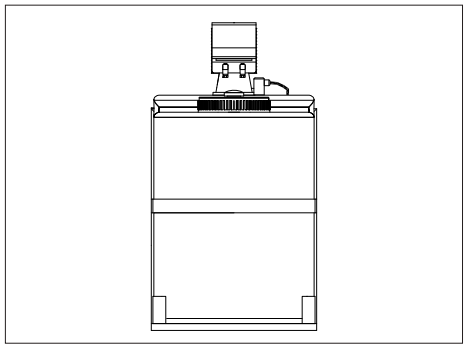


Booster Pump



Strainer

Sand for Sand Filter



Dosing Pump

1.5 Product Identification

The Tecnicomar watermaker carries a plate with the following data:

a. Manufacturer: TECNICOMAR S.p.A. C/da Berbaro n. 145/D – 91025 Marsala – ITALY – Tel. 0923-969409 / Fax 0923-960235.

b. CE logo.

c. Type: SW model.

d. Serial number.

e. Year of production.

f. Voltage.

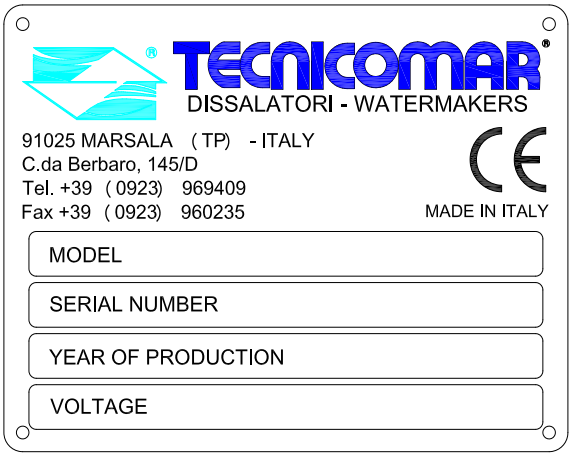


Fig. 1.4 - Watermaker identific tion plate

2 Process description and system components identific tion

2.1 Product Overview

The watermaker has four main sections:

- **Prefiltration section** where raw water, pumped by:
  - Booster pump (A) which supplies a positive pressure to the prefil ers and to the high pressure pump. This pressure allows the water to reach the high pressure pump and ensure a long life to the high pressure pump.

  Then the water is filtrated passing through the:
  - Sand Filter (SF) (or TFD filter) and through the two:
  - Cartridge prefilters (B and C).

  Do not feed the unit with water containing hydrogen peroxide, chloramines-T, chlorine dioxide, chlorine, bromine, phenolic disinfectants, chloramines, N-chlorioisocyanurates, hypochlorite iodine, bromide petroleum products.

  Feed water pressure is shown on the control panel (Lbar) taken by the:
  - Low pressure switch (E)

  and on the:
  - Low pressure gauge (D);
  - A dosing pump (DP1) mixes antiscalant chemical while the unit is operating.

  Before the booster pump it can be installed a:
  - Strainer (ST). It is a basket fil er body with a cleanable fine mesh fi ter screen designed for a quick bowl removal. The coarse strainer fil ers out large particulate matter, such as algae and marine bodies. The fine element traps suspended particles that would otherwise enter and damage the booster pump.

- **High pressure section** in which sea water is pressurized by the
  - High-pressure pump (F). The unit is shut down automatically if the operating pressure exceeds the preset level.
  - The high pressure is shown on the control panel (Hbar) taken by the:
  - High pressure switch (G) and on the:
  - High pressure gauge (Q)

  The high-pressure tubes and their fittings require periodic maintenance for the sake of safety (refer to the MAINTENANCE section).
- **Salt water (BRINE) discharge section.** In this section the brine (R line) is discharged through the brine line, in which is installed the brine pressure switch (G2). The fresh water is also discharged out of board if it does not have the drinking-water quality (S line). Through the:
  - Three-way motorized valve (N), the electric box automatically switches the water coming from membranes either to the discharge or to the fresh water tank. The electric actuator is equipped with emergency manual override, a visual position indicator and a torque limiter.

  The water quality is checked by the:
  - Salinity sensor (M) and temperature sensor (M1) compensates the reading according to temperature.

    The salinity and temperature sensor require periodic maintenance (refer to maintenance section). The probe that measures salinity and temperature is indicated on the P&Id with the name (M+M1).

- **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 raw water in two flows: one with concentrated salts which goes to the discharge (R) and the other with fresh water (U line) which can be collected in the fresh water tank. The fresh water flow rate is taken by the:
  - Flow meter (L) (installed on the front panel) before reaching the:
  - Three-way motorized valve (N) that switches it, depending on its salinity, to the discharge (S) or to the tank, through the fresh water line (U line), in which is installed the fresh water pressure switch (G1). The semipermeable membranes are very sensitive components and require strict observance and care (see PROTECTION AND CARE OF SEMIPERMEABLE MEMBRANES in Maintenance section).

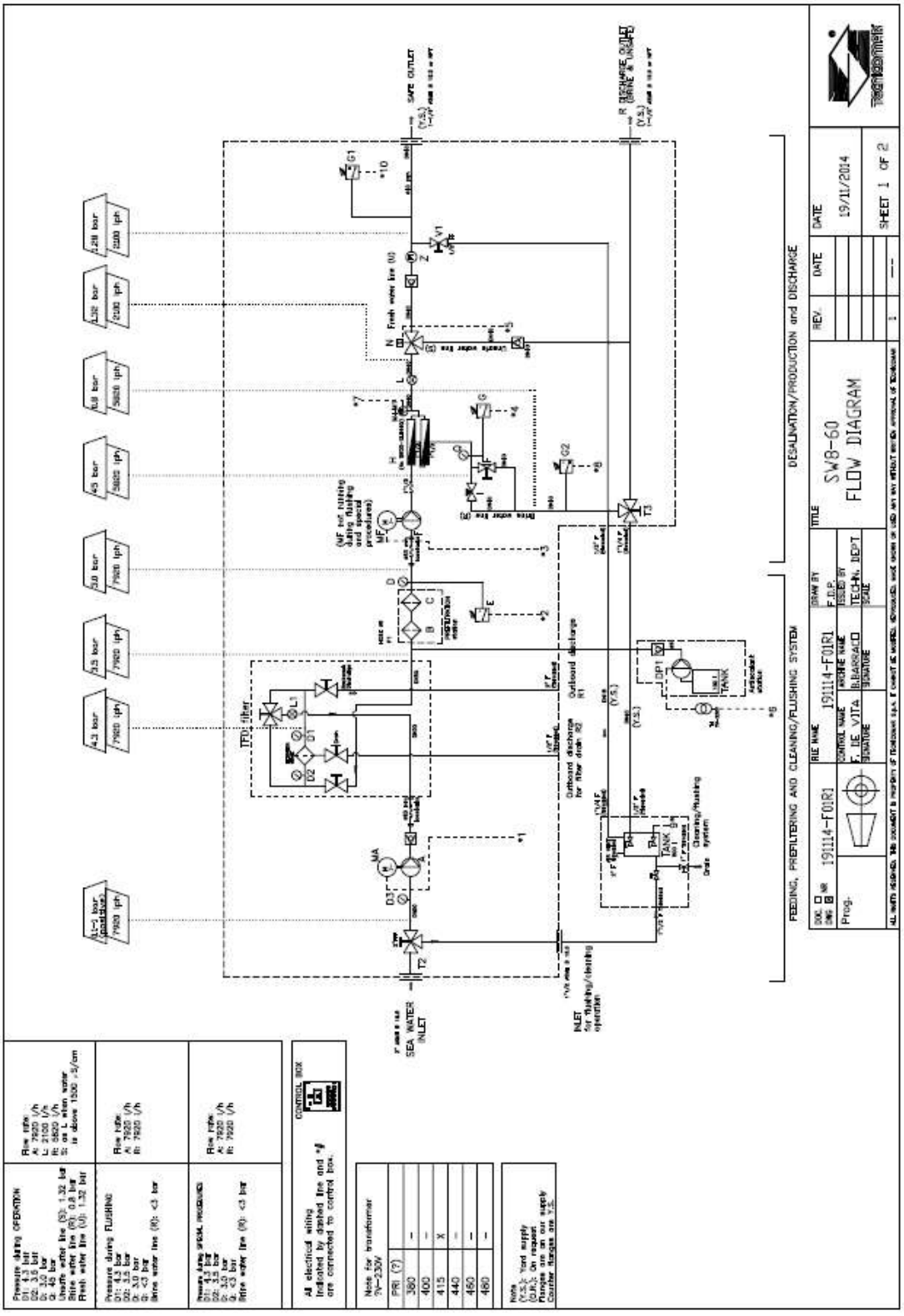


Fig. 2.1. Flow Diagram

List of components (standard and optional)

- A- low pressure pump (note: also called booster pump and feeding pump)
- MA- electric motor for Low Pressure pump
- A2- sea cock valve
- AD- water softener
- AMF- Automatic Flushing system
  - N (amf)- solenoid valve
  - SV (amf)- pressure regulator valve
- B-C prefil ers 23" 50/20 micron m - 20/05 micron m sediment cartridge fil ers
- D- LP gauge Φ 62.5 mm (0-6 bar)
- D1- pressure gauge sand fil er inlet (0-6 bar)
- D2- pressure gauge sand fil er outlet (0-6 bar)
- D3- vacuum pressure gauge feed pump inlet (-1;0 bar)
- D4- pressure gauge feed pump outlet (0;15 bar)
- D5- pressure gauge booster pump outlet (0-6 bar)
- DP1- Antiscalant dosing pump (membrane pump DLXB VFT-MBB 2 l/min at 10 bar)
- DP2- Chlorine dosing pump (membrane pump BTB VFT 2 l/min at 10 bar)
- E- low pressure switch
- F- high pressure pump
- MF- electric motor for High Pressure pump
- G- HP switch down membranes
- G1- HP switch on fresh water line
- G2- HP switch on brine line
- H- Pressure vessel group, composed by: membranes, fitting , seals, pressure vessel
- I- pressure regulator valve (needle valve)
- IF- operation/flushing alve
- K4- pulsation damper (HP pressure stabilizer)
- K5- carbon fil er on produced water: 10" cartridge
- K7- carbon fil er : 10" cartridge for Automatic Flushing System (AMF)
- KD- carbon fil er on auxiliary inlet
- KS1- sediment cartridge fil er
- KS2- carbon cartridge fil er (de-chlorination)
- L- Flow meter
- M+M1- temperature / salinity probe
- N- 3-way solenoid valve: 24 Vac
- P- booster pump
  - MP- electric motor for booster pump
- Q- HP. gauge Φ 62.5 mm (0-100 bar)
- R- brine line
- S- unsafe water line
- SF- sand fil er TFS/5 (prefilt ation station)
  - D1- Pressure gauge before filt ation φ 62.5 mm
  - D2- Pressure gauge after filt ation φ 62.5 mm
  - L1 - Flowmeter
  - R1- Outboard discharge
- ST or Strainer – Sea strainer fil er
- T2 - manual three way valve (on low pressure pump)
- T3- 3-way ball valve for cleaning procedure
- TFD- pre filt ation station
- U- fresh water line
- UV- Sterilizer
- V1- fresh water not chlorinated inlet
- V2- fresh water outlet
- V3- water inlet from tank
- V4- brine outlet
- Z- liter counter on produced water

Main items description

High pressure circuit

The heart of the watermaker system is the high-pressure pump. The pump is powered by an electric motor. The rotary motion of the electric motor it is converted to a powerful linear motion for driving the pump piston.

The pump pressurizes input seawater and forces product freshwater through the semipermeable membranes located in the vessel housings.

Vessels

Tecnicomar watermaker is equipped with fibe glass pressure vessels designed for continuous, long-term use as housings for reverse osmosis membrane elements.

The vessels are manufactured with materials that provide appropriate strength and years of continuous use in typical service when properly maintained.

Seawater feed pump

The feed pump supplies a positive pressure to the prefilters and to the high pressure pump.

This pressure allows the water to reach the high pressure pump and ensure a long life to the high pressure pump.

Prefilters assembly

The watermakers are supplied with polypropylene prefil ers that filters out most particles before the water is pumped through the reverse osmosis membrane.

Multimedia sand filter (optional)

Waters containing impurities which cannot be fil ered out by the normal prefil ers 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 fil er is simple and may be done on any watermaker, even if already installed.

A multimedia sand filter is advised when the watermaker has to operate in very dirty waters or for many hours per day. The sand filter filtrates suspended solids that are larger than 30 micron and provides

protection and long life to prefilter cartridges.
The multimedia sand fil er suits for water in which impurities are large enough to require a first treatment of filtration, which removes larger particles and get the water ready to be treated by pre-filter, with a lower mesh size. It is necessary that the filter is correctly sized for each application, both filter surface and filt ation rate need to be properly selected. The capacities of the filters are calculated at a given rate of filtration, which depends on the quality of the water to be treated according to the flow: lower speed improves the quality of filt ation, the higher the flow speed the worse the filt ation quality.
The installation of a sand filter is simple and can be adapted to any water treatment plant. We recommend the installation of sand filter when you need to treat costal water or to run equipment for several hours a day. The sand filter is regenerated by making it run in backwash mode by manually acting on 3 valves (see maintenance section).

Benefits

- Filtration quality.
- Easy maintenance.
- Long life.
- Frequency of cleaning.
- Robustness and simplicity.

The sand filter consists of a cylindrical tank containing washed silica sand, multi-layer (layers of different grain) or grain size: generally quartzite ranging from 0.3 to 0.9 mm and from 3 to 5.6 mm.
A feed pump draws water from a tank and sends it to the filter, allowing it to enter from the top. The water flows through the whole filtering layer and is collected at the bottom by "candles" or "plates " that convey it to the outlet. During the transition, the water removes suspended particles and gets clean.

TFD semi-automatic filter (optional)
Alike the sand filter, the TFD semi-automatic filter can be used for a first filt ation treatment to eliminate the gross particles and to prepare the water for the prefilt ation treatment.
The semi-automatic fil er TFD incorporate a unique helical element through which contaminated water passes on entering the fil er body. This helical element induces a spinning action in the water which through centrifugal action, forces the suspended contaminants away from the filtration disc cartridge, thereby extending the duty cycles between backwashing.

During backwash cycle, the filter housings are rapidly emptied of water and discs are separated as clean water is directed at the inner faces of the discs via tangentially positioned jets.
This process causes the discs to spin violently, dislodging contaminant particles that are flushed from the filter housings.
Longer intervals between cleaning cycles reduces backwash water losses.

Benefits

- Easily serviced without the need for special tools.
- Small head pressure loss and low pump energy costs.
- Maximum saving of water and efficiently in backwashing.

3 Safety

3.1 Important Safety Information

Owners and operators of Tecnicomar watermaker are urged to read this manual thoroughly as, by understanding the principles of osmosis, operational problems will not occur and satisfaction with your unit will be obtained. It is important to read this manual through before attempting to install, connect or run the system.

Most of accidents that happen during the watermaker use, maintenance and repair are caused by the not observance of principals rules or safety precautions.

An accident can be avoided simply by knowing the potentially dangerous situation before an accident happens. Staff must have been trained, in possess of the competence and instruments to operate in good way and take care for potential risks.

The use, lubrication, maintenance or repair executed in the wrong way can be dangerous and cause injuries of the staff or e en death.

Do not use the system or execute operations of inspection, test, cleaning or maintenance until all the information about use, inspections, test, cleaning or maintenance have been read.

This manual contains a summary of the information needed for knowledge, installation, conduct and maintenance, in safety conditions, of the watermaker. For that reason, besides being an important bibliography containing the essential rules for a good use of the system, is also a guide for the installer.

The remaining technical documentation supplied with the watermaker (wiring schemes, layout drawings, use and maintenance manuals of the subsystems items) represents integral part of this manual.

A detailed maintenance is one of the most important factors for a good working of the unit. To neglect this factor can be a source of danger for people and things and, obviously, for the system. The normal periodic maintenance and the daily controls must be carried out with a prefi ed program according to the instructions and prescriptions contained in the technical manuals of the high pressure pump, low pressure pump, vessels, membranes and all the other main components. It is good to set up a service schedule containing the operations to carry out where to note the working time, interventions, maintenance operations and repair done. Supplementary maintenance, repairs and particular calibrations and settings must be carried out only by qualified and authorised staff.

The careful reading of this manual by the installer is important for safety ends. Nevertheless, it must be considered that many of the arguments and information contained have a specialistic attribute and need a more specific knowledge in the system/electromechanical field to be understood. For that reason the user should refer to a qualified technician for the installation and maintenance of the system, following the instructions contained in the sections.

Tecnicomar disposes of a Aftermarket Service and of a Technical Office ca pable of su pply, in ev ery moment, every kind of technical information or tips needed for good installation and good use of the system.

The use and maintenance intervals refer to a normal working condition that can change with particular conditions of use. The normal working, the life, the safety use, the operative economy of the watermaker and all the subsystems depend on the observance of the recommendations and provisions contained in this manual. The neglect of that and a bad or improper use of the systems, besides to being reason for invalidate the warranty, can lower the safety and increase the operative costs.

It is important to consider that the watermaker it is not intended to be used by not professional users.

All the activities linked to the operative part and to the life cycle of the system, must be carried out by authorised and trained staff, with experience on mechanical, hydraulic and electrical systems.

3.2 Instructions and Warnings

All the warnings contained in this manual are referred to the subsystem items and to the whole watermaker. User must follows the instructions, warnings and indications contained. Authorised operators will be aware of duties and, during operative interventions, must be in perfect psychophysical conditions. Nevertheless it is to remember that this manual is necessary but not enough to complete the training of the specialists that will operate the system, Tecnicomar is excluded from any contractual or extra contractual responsibility for damage caused to people, things or pet, after the improper use of the watermaker and non-observance of the norms and instructions contained in this manual.

Every kind of opening and/or modification, as well as use of non original spare parts can compromise the system safety and cancel the warranty.

System parts that are damaged in the electrical and mechanical equipment can be reused only after an adequate check-up, carried out by Tecnicomar authorised staff.

Pay attention to this symbol when reported in the manual. It means a possible dangerous situation.

Dangers can be of three levels:

WARNING

The "WARNING" sign means that if the operations described are not well done they can cause heavy lesions, death or long term risks for health.

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

DANGER

The sign "DANGER" is the maximum sign of danger level warning that if the operations described are not well done they can cause heavy lesions, death or long term risks for health.

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

CAUTION

"CAUTION" sign means that if the operations described are not well done they can cause damage to the system and/or to the operator.

Note or Information: The notes contain important information and useful hints for the watermaker operation.

3.3 CE Declaration of Compliance

The original copy of the CE Declaration of Compliance here reported in facsimile, is delivered along with the administrative documents of the watermaker.

TECNICOMAR
DISSALATORI - WATERMAKERS

As manufacturers of this equipment we hereby state the following :

DECLARATION OF "CE" CONFORMITY

Desalinator (Watermaker):

Model: Serial Number:

The conformity is declared according to the following EU Directives:

a) FOR THE ELECTROMAGNETIC COMPATIBILITY: 89/336 - 93/68

- EN50081-2: *Generic rules of emissions for industrial machines* [CEI 110-13(94)]
- EN50082-2 : *Generic rules of immunity for industrial machines*

b) FOR THE MACHINERY (SAFETY) DIRECTIVE: 89/392 - 91/368 - 93/68 and for THE LOW VOLTAGE DIRECTIVE 73/23 ECC.

- EN60335-1: *Safety of electric appliances for domestic use and similar.* [CEI 61-150(95)]

DATE

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3.4 Targets of the Manual

This manual represents the principal instrument for the authorised staff caring for the system in its whole. Here are listed all the professional profiles

USER: The user is the person, body or firm that bought or rented the system and wants to use it for the appropriate ends. He has the responsibility of the system and of the training of the staff operating.

TECNICOMAR TECHNICIANS: Technical and authorised staff, available from Tecnicomar for system installation and staff training. He is capable of carry out complex operations on the system and in particular situations.

SYSTEM MANAGER: Authorised and expert operator, trained by Tecnicomar technician on the working and maintenance of the system. He must be present during every work on the system as the only manager and must overview the observance of the accident prevention measures. He only must have the keys for access the system and for the activation of the operative modes. He is, besides, responsible for the system maintenance. He is not authorised to carry out maintenance on the electrical system or on mechanical parts.

MECHANICAL MAINTENANCE OPERATOR: Qualified technician, with perfect mechanical knowledge of the system, capable of intervening on mechanical parts and drives to carry out all the maintenance and repairs needed.
He is not authorised to carry out maintenance on the electrical system.

ELECTRICAL MAINTENANCE OPERATOR: Qualified technical staff, capable of working in presence of voltage in cabinet, electrical boards or connecting box.
He is not authorised to carry out maintenance on mechanical parts.

DANGER

The use of operators and maintenance staff with different qualific tion other than what is required could seriously compromise the safety of all the staff involved and of all the people near the system.

DANGER

All the maintenance and setting operations must be carried out, where not specifie , with watermaker turned off and power supply off, considering that also the remote management, if provided, must be turned off. Before executing any maintenance operation it is necessary: depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

If the maintenance operations are well done, the advantage will be to the user since that at restarting of the work he will find the s stem under the best conditions.
If the operator is authorised and possess the necessary competence and capacity, he can carry out the control operations and maintenance following the instructions reported in this manual. The complex maintenance operations must be handled by qualified staff and not by the operator that is still responsible of the maintaining in good state of the system. The validity and qualific tion of the maintenance operations are determinant factors for the system efficiently. For that reason the maintenance must be adequate to avoid damage of the most stressed organs and to maintain a high system reliability.

3.5 Safety Instructions and Prevention

3.5.1 Generalities

The safety of the operator represents one of the principal issue for a manufacturer. When producing a system, the manufacturer tries to expect all the possible danger situation that can verify to adopt all the appropriate safety preventions.
There are anyway accidents caused by improper use of the system and equipment. It is good to remember that caution is necessary to prevent accidents during system working.

DANGER

It is forbidden to remove panels and protections of the module, especially during the working. Same for electrical equipment, that can also be a danger even when placed in not operative mode for having parts on permanent voltage.

Remember that to operate with partially removed boarding and protections means to be in contact with hazardous voltages, moving parts or too much hot parts that could provoking accidents even lethals.
Nevertheless, in certain cases, for inspections and/or maintenance activities it can be necessary to turn on the watermaker leaving open some board or protections. These working conditions are only allowed to qualified and authorised staff, aware of the possible danger, must adopt all the possible precautions to avoid injuries.
The electrical board and all the electrical equipment are realized according to the norms. The electrical safety is assured by all the necessary equipment and precautions. This not mean that it cannot be source of danger and lethal accidents.
It is recommended to not remove or open boards unless upon possession of the necessary experience and knowledge in electrical field and ware of the potential danger.

The protection against electrical shock, caused by open contacts is only assured with closed boards. It is not allowed to turn on the system without verification of the closure of the electrical boards.

WARNING

The use of watermaker cause the overheating of some parts of the system. So it is good that eventual controls are done with system turned off and a ter cooling.

3.5.2 Noise

Before to approach the watermaker it is necessary to equip protection instruments to protect the hearing (headphones, plugs, etc.).

3.5.3 Protections

It is necessary to consider that even if a system possess all the precautions and protections, it will never represent a zero risk level.

DANGER

This paragraph highlights some aspects linked to the risk caused by thermal factors.

One of the most important components of the watermaker is the high pressure pump. This component even if equipped with all the precautions needed to limit the dangers from contact with hot parts, will never assure the absolute harmlessness since there are parts that could reach

temperature higher than 60°C.

WARNING

The trained operator when approaching the system must observe all the warning panels.

3.5.4 General Instructions for Safety Use

WARNING

Before startup the system, it is recommended that the operator memorize the previous paragraphs and all the following informations:

- The manufacturer cannot prevent all the possible dangerous situations in use condition and watermaker use;
- The operations and/or procedures for use not recommended and/or indicated in the manual will always be notified to Tecnicomar for confirmation;
- If a not recommended procedure will be used, the user must check for the safety of people, things and pet;
- It is necessary to consider that even if a system possess all the precautions and protections, it will never represent a zero risk level. It is forbidden to remove boards and protections of the system, especially during the working;
- Same for electrical systems, they can represent a danger also when placed in not operative mode since they have parts under permanent voltage;

- The electrical board and all the electrical systems are realized according to the norms.

WARNING

For safety, it is necessary to observe the following precautions:

- Before operating the maintenance on the system it is necessary to assure that it has been turned off and no one can, accidentally, change its configu ation or turn it on.
- When turned on, the system presents moving parts, pay attention to not approach the system with flapping obje ts, smocks, jackets, ties, chains, bracelets, etc.;
- The system produces noise, the use of the headphones is necessary;
- It is forbidden to turn on the system before finishing the installation and carrying out the test with positive result. Even so, the system can represent source of danger and lethal accidents.

3.6 Before Turning on

3.6.1 Checks before turning on

Before turning on the system, it is necessary to carry out the following controls:

- Verify that every mechanical parts, included all the elements and fitting , are well installed;
- Verify that instruments and materials are not left around;
- Verify that the earthing system connections are correctly done;
- Verify the earthing system efficiently;
- In case of three-phase supply, verify the correspondence of the phase cycle between watermaker and electrical source;
- Verify that the hydraulic circuit ensures a perfect seal.

3.6.2 Useful Advice

- Familiarize yourself with the watermaker so that you know all the details and to promptly report any anomaly that, if neglected, could lead to heavy faults;
- Maintenance intervention and settings on the watermaker must be done with system turned off and with no power supply;
- Disposal of waste from maintenance operation of the system (exhausted oil, additives, etc.) and management of the life cycle, must be done according to the norms and the ambient. They must be delivered to the appropriate authorised firms or bodies for the disposal;
- Spare parts must be original ones;
- Do not carry out repair operations if not authorised and trained;
- Check the noise or vibration sources that can be cause of faults or failures;
- Immediately report leaks of oil, water or other liquid;
- Do not tamper with the components of the watermaker to obtain different performances than the ones expected from the manufacturer;
- Do not wear flut ering clothes, rings and/or chains when working near moving parts;
- Use protective gloves and glasses:

  - During the use of chemical products (FL403 sodium metabisulphite, FL412B (MC3 or similar others), FL411A (MC11 or similar others), antiscalant).
  - During replacement or refuelling of the high pressure pump lubricant oil (hot oil can cause burns when discharged). Wait until the oil has cooled down below 60° C;
- Immediately replace overalls and/or clothes wet or soaked with oil or grease;
- During work on under-voltage parts be sure to have dry hands and feet. Where necessary use isolating platforms; if not able to carry out these operations let the qualified staff o intervene;
- Do not try repairing operations if not in possess of the competence;
- Keep the watermaker clean, removing oil spots and liquids;
- Put away soaked rags in flames-proof containers;
- Do not leave rags on the watermaker;
- Equip with appropriate and safe containers for used oil.

3.7 Danger Information

Precautions and warnings for safety are in this manual and in the system, where many warning plates are present, be sure to make them readable. Every damaged plate must be replaced or cleaned with a cloth.

When replacing a component with plates, be sure that the spare part too has a plate, otherwise put a new plate before installation.

Here are listed the safety labels of the system:

Fig. 3.1 - Safety labels

Where necessary, in the maintenance procedures are reported the following warnings:

- PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF.
  Turn off the watermaker, and deactivate the remote management (if provided). Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).
- HIGH PRESSURE DEVICE:
  Operate with high pressure equipment may cause loss of life, severe bodily harm, and/or property damage if the devices are not correctly installed and maintained.

Fig. 3.2 - Warning tag

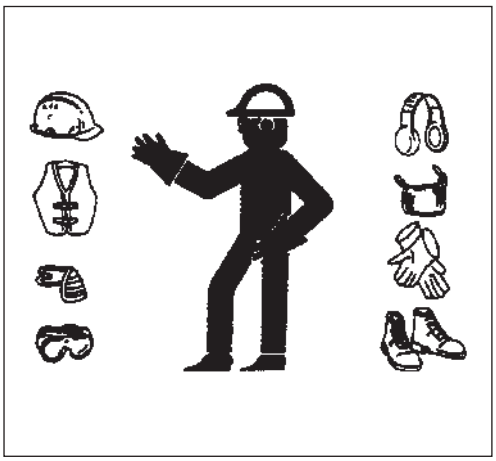


Fig. 3.3 - Individual Protection Devices (IPD)

Note: Signs and relative writings are reported in every procedure depending on necessity. When the shutdown of the watermaker is needed before an operation, place the "Do not operate" warning sign near the command and control panel (Fig. 3.2).

In general, adopt the following precautions:

- Do not wear big clothes or jewels that can get caught in moving and rotating parts;
- Wear helmet, gloves and any other protection clothes / devices needed (Fig. 3.3);
- Be sure that all the protections and covers are well fixed on the moving and rotating parts;
- Remove from the watermaker any unrelated material;
- Remove rubbles, oil, instruments and other objects from platform, passages and steps;
- Do not keep maintenance liquids in glass containers;
- Discharge all liquids in an appropriate container;
- Use carefully all the cleaning solution;
- Ensure that no liquids come out when carry out an operation. Be prepared to gather the fluid in appropriate containers when opening a compartment or disassembling components containing fluid . Under pressure liquid can cause splashes and liquid projections causing heavy lesions;
- Always use a piece of cardboard or a panel to check for leak from a hole. A leak from an hole, even if little, can cause heavy lesions;
- Dispose the exhausted materials observing the ambient norms in force.

3.8 Fire and Explosion Prevention

Most of the lubricants and some refrigerant mixtures are inflammabl . Spreading of these inflammable substan es can cause fires.

Put away lubricants in appropriate marked containers away from not authorised people. Put away soaked rags and inflammable materials in protective containers. Do not smoke in areas used to keep inflammable materials.

Do not expose the watermaker to any kind of flames.

Wiring must be in perfect condition, all the electrical wires must be well placed and fi ed. Remove all the disconnected and not necessary cables.

Arc discharge or sparks could cause a fire, electrical connections submitted to an appropriate maintenance will help to avoid arc discharge and sparks formation.

Check that the pipes and hoses are not worn and that they have adequate support and secure clamps.

Keep any free flame or spa ks away from the watermaker.

Make sure that there is always a fire extinguisher nearby, understand the operation of the fi e extinguisher, carry out the regular maintenance and follow the instructions on the label. Do not bend or hit high pressure piping. Do not install damaged piping and verify the state of piping, do not check for leaks bare hands, use a cardboard or a brush.

If one of these condition is present, replace the component:

- Damaged fittings or with leackage;
- Damaged or cut external covers;
- Cables with no protection;
- Swelling of the external protection;
- Parts of fl xible tubes crushed;
- Fittings moved.

Be sure that all the clamps, protections and heat shields are well installed.

3.9 Cuttings Prevention

Adequately support components when working under them. Stay away from moving and rotating parts, let the protections installed until ready to perform the maintenance and reinstall them at the end.

3.10 Fluid Recommendations

3.10.1 H.P. Pump Oil

For special CAT PUMPS 35xx models, use only oil supplied by Tecnicomar or recommended oil API CIS 150. Change the oil at every interval as prescribed in the maintenance section.

3.10.2 Antiscalant Additive

Additives help to protect metallic surfaces of the hydraulic circuit. An absence or poor quantity of additives can cause the following problems:

- Corrosion;
- Formation of mineral deposits;
- Rust;
- Encrustation;
- Foam formation.

It is important to add additives at right concentration, an excess of additive concentration can cause the precipitation of solution inhibitors. Depots can cause the following problems:

- Formation of gelatinous compounds;
- Leaks in the water pump seals.

For details of safe use of the Antiscalant, refer to Safety Data Sheet provided with the administrative documents.

3.10.3 Membrane Cleaning Additives

The reverse osmosis membrane element inside the membrane housing is an expensive and delicate component of the watermaker. When properly cared for, it can be expected to last for several thousand hours of use. However, improper use, maintenance or handling can damage or destroy it very quickly.

To kill biological growth and bacteria that are present inside a membrane it can be use a biocide treatment, it also functions as a membrane wetting agent for extended storage.

Over time, bacteria can multiply and adhere to the membrane surface, thus gradually decreasing its effectiveness.

There are two main types of such deposits and a different chemical cleaner is needed for each type:

- Organic Growth - usually caused by processing brackish water or failure to properly store a membrane during extended periods of non-use. Use Alkaline Cleaner type FL412B (MC11or similar others).
- Mineral Scale - caused by mineral impurities in the intake water supply. Use Acid Cleaner type FL411A (MC3 or similar others).

The only indication that the membranes might benefit from cleaning is a substantial reduction in the quantity of product freshwater output, all other factors being normal (e.g., salinity, sea water temperature). The best way to detect such a problem is by keeping an accurate log of product freshwater output.

If you have determined that your membranes need cleaning and you know the type of deposits (mineral or organic), use the appropriate cleaner. If you do not know the nature of the deposits, try cleaning first with the Alkaline Cleaner and check for improvement in product freshwater output.

If output remains poor, repeat the cleaning process using the Acid Cleaner.

Never mix the two types of cleaners.

Always flush well with clean water between processes if performing both alkaline and acid cleaning.

For details of safe use of chemical products, refer to relevant FL411A and FL412B Safety Data Sheets provided with the administrative documents.

3.10.4 Membrane Storage Additive

When the watermaker is not to be used for an extended period of time, it should be treated with biocide, to prevent biological growth on the membrane, using FL403 Sodium Metabisulphite.

During use of Sodium Metabisulphite, adopt the following precautions:

- Spills and splashed areas should be treated immediately with copious volumes of fresh water;
- Wash skin with soap & water;
- Irrigate eyes with water and obtain medical advice;
- If inhaled, blow nose and wash nasal passages, obtain medical advice;
- If ingested, rinse out mouth and seek medical advice;
- If large amounts of this fluid are ingested then induce vomiting, seek medical advice;
- Irritation will be caused to the eyes, by inhalation and by ingestion.

For details of safe use of the FL403 Sodium Metabisulphite, refer to Safety Data Sheet provided with the administrative documents.

3.10.5 De-Chlorinated Water

Freshwater containing chlorine will damage the watermaker membranes. When flushing or preserving your system, always use fresh de-chlorinated water.
This can be obtained by:

- Using water already produced by your watermaker
- Leaving an open bucket of fresh tap water to stand for 24 hours to allow the chlorine to evaporate.

4 Installation Procedure

4.1 Components supplied by Owner

Some plumbing and electric components are to be supplied by owner.

These components are listed below:

a. Sea water inlet line (it is suggested to use for the salty water line the proper material, corrosion resistant such as naval bronze, PVC, stainless steel, etc.).

b. Discharge line(s) to the sea.

c. Fresh water line to the tank or other uses.

d. Inlet line for flushing/cleaning ope ations.

e. Fresh water line to the cleaning/flushing tank .

f. Brine line to the cleaning/flushing tank.

g. Power cable with the proper power protection based on the system power consumption.

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

4.2 Qualifications of the Installation Crew

Technicians must have technical knowledge and ability in the following fields

- Electrical, electronic, electric motors and circuits.

- Electromechanical and mechanical systems.
- Hydraulic and liquid pressure and fl w systems.
- Piping and plumbing systems.
- Water suction and pressure lines.
- Thru-hull fitting below and above water level.

4.3 Plumbing Connections

Length 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. This may cause the system to shut down due to low feed pressure.

On the installation aboard a vessel, plumb the feeding line at the bottom of the sea chest to ensures an uninterrupted supply of air free feed-water.

The inlet thru-hull fitting should be dedicated for only the watermaker. Using a single thru-hull fitting for several auxiliary systems can cause air suction leaks from other devices competing for the same feed-water.

Membranes

The membrane vessels must not work to temperature higher than 45°C or lower than 5°C (41°F).

For preservation of membrane modules in very cold areas see par. 6.3.

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.

DANGER

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 main frame, the Sand Filter and the Dosing Pump(s).
Connect the sea water line to the Booster Pump (A) or the devices that allows the inlet of sea water such as motorized valve.
Connect the outlet on the booster pump (A) to the Sand Filter (SF) (or TFD filter) inlet.

CAUTION

Be sure to tighten well gaskets and fittings o avoid air infilt ation or water leaks

- Connect the outlet of the Sand Filter (SF) (or TFD filter) to the cartridge prefilters (B).
- Connect the dosing pumps hoses on the small side-panels as labelled.

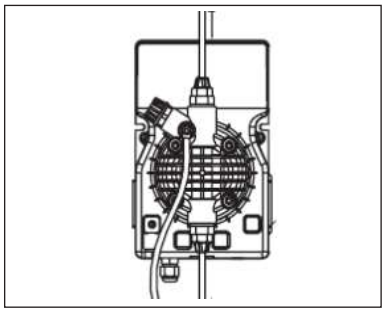


Fig. 4.1 - Dosing Pump

- Connect the FRESH WATER auxiliary outlet to the Cleaning/Flushing Tank fresh water inlet fitting.
- Connect the BRINE auxiliary outlet to the Cleaning/Flushing Tank brine inlet fitting.
- Connect the FRESH WATER outlet to the Tank connection fitting (be sure that freshwater tank has an overflow valve).

CAUTION

The product water line must be kept free and clear of any blockages.

- Connect the BRINE line (R) and the unsafe outlet (S) to the outboard piping line, if any; or if the system is equipped with one common discharge outlet (BRINE & UNSAFE), connect it outboard.
- Connect the post filtration units. These are not a standard supply but they are dependent on the quality of the system feed water and desired quality or conditions of the product water. However the product water reaches the post filt ation stage, the R.O. membrane element has removed most of the dissolved particles that are in the feed water.

4.4 Pre and Post Treatment - Dosing Pump Setting

4.4.1 Dosing Pump - Antiscalant

Fit the dosing pump on its tank and proceed as follow:

- Connect pipe shown in Fig. 4.1 - ref. 1 to the appropriate inlet situated on the watermaker frame.

- Connect cable of the electrical connection shown in Fig. 4.1 - ref. 2 to the appropriate plug on the watermaker frame.

A minimum dosing solution strength of 10% w/w is recommended. Antiscalant should be dosed continuously and proportionately to the feed water flow, to maintain the recommended dose level.
The standard dosage is 2 ppm. The dosing amount per pulse at 0 bar with the model DLXB VFT-MBB is : 280 mg/pul.

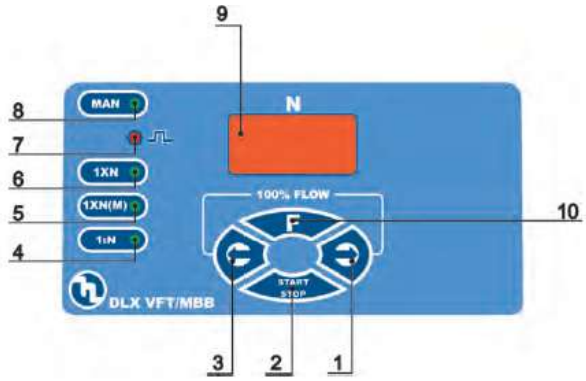
- Fill the tank with 90 liters of non-chlorinated water.
- Add and mix 9 liter of antiscalant chemical.
- Set the dosing pump to "Manual" mode, so that the counter (Fig. 4.2 ref. 5), N parameter, at the correct injections per minute.

Formula:

i.e. Feed water fl w is ~7000l/h

N [pul/min] = Dilution of antiscalant in water [%] * antiscalant required [mg/l] * feed water [l/h] / (dosing quantity at 0 bar [mg/pul] * 60 [min/h])

Example: N=10*2*7000/(280*60)=8.33 --> 9 pulses/minute --> N= 009



Pos.	Item Description
1	Incresing values button
2	ON/STAND BY button
3	Decreasing values button
4	"green" LED 1:N function
5	"green" LED 1XN (M) function
6	"green" LED 1XN function
7	"red" LED injection pulse flashing
8	"green" LED MANUAL function
9	7 segment display
10	Function selection button

Fig. 4.2 - Dosing pump - command panel

4.4.2 Dosing Pump - Chlorine

Fit the dosing pump on its tank and proceed as follow:

- Connect pipe shown in Fig. 4.1 - ref. 1 to the appropriate inlet situated on the watermaker frame.
- Connect cable of the electrical connection shown in Fig. 4.1 - ref. 2 to the appropriate plug on the watermaker frame.

A minimum dosing solution strength of 10% w/w is recommended. Chlorine should be dosed continuously and proportionately to the feed water flow, to maintain the recommended dose level. This is possible thanks to the injection counter.

The WHO drinking water standards state that 2 ppm chlorine should be added to water in order to gain a satisfactory disinfection and residual concentration. The maximum amount of chlorine that can be added is 5 mg/l. For a more effective disinfection the residual amount of free chlorine should exceed 0,5 mg/L after at least 30 minutes of contact time at a pH value of 8 or less.

The dosing amount per pulse at 0 bar with the model DLXB VFT-MBB is : 280 mg/pul

Factors which determine chlorine disinfection effectivity: chlorine concentrations, contact time, temperature, pH, number and types of microorganisms, concentrations of organic matter in the water.

As an example it is shown the disinfection time for several diffe ent types of pathogenic microorganisms with chlorinated water, containing a chlorine concentration of 1 mg/L (1 ppm) when pH = 7,5 and T = 25 °C:
E. coli 0157 H7 bacterium < 1 minute; Hepatitis A virus about 16 minutes; Giardia parasite about 45 minutes Cryptosporidium about 9600 minutes (6,7 days).

- Fill the tank with 100 liters of sodium hypochlorite (16% Cl).
- Set the dosing pump to "1/N" mode, so that the counter (Fig. 4.2 ref. 5), N parameter, at the correct injections per minute.

Formula:

Dilution of Cl [ ] * dosing quantity at 0 bar [mg/pul] * pulse counter setting [pulse/l] * N [pul/min] * 1000 m3 /l < chlorine required [ml/m3]

Example: 0.16 * 0.28 * 4 * N * 1000 < 0.2 --> 1/ N > 896 pulse/minute

4.5 Power Connection

For power connection, proceed as follow described:

- Open the cover of the Magnetic Thermal Main Switch box and connect to the main power supply according to the voltage settings. Power supply line must be 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 check the electrical consumption value.
- Connect the antiscalant dosing pump power supply to the relative junction box on the edge of the watermaker using the cable supplied with dosing system.
  The same procedure can be followed if the system is equipped also with dosing pump for chlorine injection on produced water.

DANGER

If opening the electric control box (Fig. 4.3) is needed, do not pull the cable bunch and the leads as they might break. Make sure that the main power supply is off and th t nobody can switch it on during this operation.

- Connect the watermaker steel structure to the ground using the grounding lug identified by the appropriate symbol (the point is on the steel structure or in the control panel).

- Open the pressure control valve (I) counterclockwise to avoid starting the system under pressure.
- Power on the system. The display must be lighted.

CAUTION

Be sure that the high pressure pump (F) has enough oil for correct operation. Remove the sticker from the pump oil plug if present.

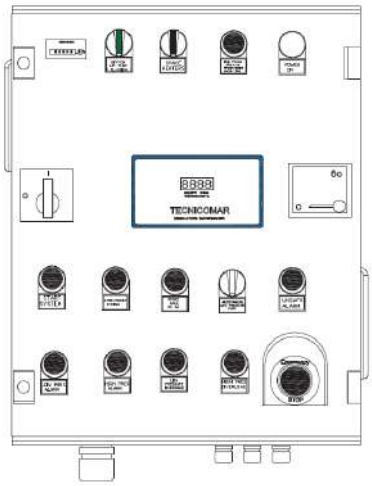


Fig. 4.3 - Control panel EMC

CAUTION

Do not press the START key before having done the first start-up procedure (see section 5).

4.6 Inverter (OPTIONAL)

4.6.1 Altivar 61

Integrated Display Terminal

Pressing ▲ or ▼ does not store the choices.

Press and hold down (>2 s) ▲ or ▼ to scroll through the data quickly.

Press ENT to save and store the selection.

The display flashes once a value is stored.

A normal display has no detected fault present and no startup:

- 43.0: Display of the parameter selected in the SUP menu (default selection: motor frequency)
- CLI: Current limit
- CtL: Controlled stop on input phase loss
- dCb: DC injection braking in progress
- FLU: Motor fluxing in progress
- FrF: Drive at fallback speed
- FSt: Fast stop
- nLP: No line power (no line supply on L1, L2, L3)
- nSt: Freewheel stop.
- Obr: Auto-adapted deceleration
- PrA: Power Removal function active (drive locked)
- rdY: Drive ready
- run: Drive running
- SOC: Controlled output cut in progress
- tUn: Auto-tuning in progress
- USA: Undervoltage alarm

The display flashes continuously to indicate the presence of a detected fault.

Detected Faults and Troubleshooting - Altivar 61

Drive does not start, no detected fault code displayed

- If the display does not light up, check the power supply to the drive.
- If the drive displays [Freewheel] (nSt) or [Fast stop] (FSt): The Fast Stop and Freewheel functions help prevent the drive from starting if the corresponding logic inputs are not powered up. This is normal these functions are active at zero so that the drive will stop if there is a wire break.

- Make sure that the run command input or inputs are activated according to the selected control mode described in the ATV61 programming manual on the CD-ROM supplied with the drive).

Conditions requiring a power reset - Altivar 61

The following table lists the conditions requiring a power reset. A power reset is accomplished by cycling power to the drive after the cause of the condition has been removed.

AI2F, EnF, SOF, SPF and tnF conditions can also be reset remotely by means of a logic input or control bit (consult the Programming Manual on the CD-ROM supplied with the drive).

EnF, InFA, InFb, SOF, SPF and tnF conditions can be inhibited and cleared remotely by means of a logic input or control bit (consult the Programming Manual on the CD-ROM supplied with the drive).

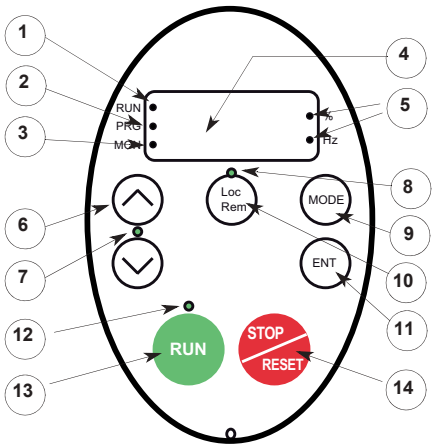
Code	Name	Probable cause	Remedy
AI2F	[AI2 input]	• AI2 signal out of range	• Check the wiring of analog input AI2 and the value of the signal.
bOF	[DBR overload]	• Incorrect DB resistor settings	• Check the size of the resistor and wait for it to cool down. • Check parameters [DB Resistor Power] (brP) and [DB Resistor value] (brU) (consult the CD-ROM supplied with the drive).
bUF	[DB unit sh. Circuit]	• Short-circuit output from braking unit	• Check the wiring of the braking unit and the resistor. • Check the braking resistor.
CrF1	[Precharge]	• Charging relay control condition or charging resistor damaged	• Turn the drive off and then back on again. • Check the internal connections. • Contact Schneider Electric Product Support.
CrF2	[Thyr. soft charge]	• Improper DC bus charging condition (thyristors)	
EEF1	[Control Eeprom]	• Control card Internal memory	• Check the environment (electromagnetic compatibility). • Turn off, reset, return to factory settings. • Contact Schneider Electric Product Support.
EEF2	[Power Eeprom]	• Power card internal memory	
FCF1	[Out. contact. stuck]	• The output contactor remains closed although the opening conditions have been met	• Check the contactor and its wiring. • Check the feedback circuit.
HdF	[IGBT desaturation]	• Short-circuit or grounding at the drive output	• Check the cables connecting the drive to the motor, and the motor insulation. • Perform the diagnostic tests via the [1.10 DIAGNOSTICS] menu.
ILF	[internal com. link]	• Communication condition between option card and drive	• Check the environment (electromagnetic compatibility). • Check the connections. • Ensure that no more than 2 option cards (max. permitted) have been installed on the drive. • Replace the option card. • Contact Schneider Electric Product Support.
InF1	[Rating error]	• The power card is different from the card stored	• Check the catalog number of the power card and ensure that it is compatible with the drive.
InF2	[Incompatible PB]	• The power card is incompatible with the control card	• Check the catalog number of the power card and ensure that it is compatible with the drive.
InF3	[Internal serial link]	• Communication condition between the internal cards	• Check the internal connections. • Contact Schneider Electric Product Support.

Code	Name	Probable cause	Remedy
InF4	[Internal MFG area]	• Internal data inconsistent	• Contact Schneider Electric Product Support to have the drive recalibrated.
InF6	[Internal-option]	• The option installed in the controller is not recognized	• Check the catalog reference and compatibility of the option.
InF7	[Internal-hard init.]	• Initialization of the drive is incomplete	• Turn off the drive and reset.
InF8	[Internal-ctrl supply]	• The control section power supply is incorrect	• Check the control section power supply.
InF9	[Internal-I measure]	• The current measurements are incorrect	• Replace the current sensors or the power card. • Contact Schneider Electric Product Support.
InFA	[Internal-mains circuit]	• The input stage is not operating correctly	• Perform the diagnostic tests via the [1.10 DIAGNOSTICS] menu. • Contact Schneider Electric Product Support.
InFb	[Internal-th. sensor]	• The drive temperature sensor is not operating correctly	• Replace the temperature sensor. • Contact Schneider Electric Product Support.
InFC	[Internal-time meas.]	• Detected fault on the electronic time measurement component	• Contact Schneider Electric Product Support.
InFE	[internal- CPU]	• Internal microprocessor event	• Turn off the drive and reset. Contact Schneider Electric Product Support.
OCF	[Overcurrent]	• Motor parameters are not set correctly • Excessive inertia or load • Mechanical locking	• Check the motor parameters. • Check the size of the motor, controller, and load. • Check the state of the mechanism.
PrF	[Power removal]	• Detected fault with the drive's Power Removal safety function[1]	• Contact Schneider Electric Product Support.
SCF1	[Motor short circuit]	• Short-circuit or grounding at the drive output • Significant earth leakage current at the controller output if several motors are connected in parallel	• Check the cables connecting the drive to the motor, and the insulation of the motor • Perform the diagnostic tests via the [1.10 DIAGNOSTICS] menu. • Reduce the switching frequency. • Connect chokes in series with the motor.
SCF2	[Impedant sh. circuit]		
SCF3	[Ground short circuit]		
SOF	[Overspeed]	• Instability • Overhauling load	• Check the motor, gain and stability parameters. • Add a braking resistor. • Check the size of the motor, controller, and load.
SPF	[Speed Feedback Loss]	• Encoder feedback signal missing.	• Check the wiring between the encoder and the drive. • Check the encoder.
tnF	[Auto-tuning]	• Special motor, or motor power not suitable for the drive • Motor not connected to the drive	• Ensure that the motor and drive are compatible. • Ensure that the motor is present during auto-tuning. • If an output contactor is being used, close it during auto-tuning.

[1] Safety function as defined by IEC61508.

4.6.2 Altivar 212

Integrated Display Terminal



	LED/Key	Characteristics
1	Display RUN LED	Illuminates when a run command is applied to the drive. Flashes when there is a speed reference present with a Run command.
2	Display PRG LED	Illuminates when Programming mode is active. Flashes in AUF, GrU modes
3	Display MON LED	Illuminates when Monitoring mode is active. Flashes in detected fault history display mode
4	Display unit	4 digits, 7 segments
5	Display unit LED	The % LED illuminates when a displayed numeric value is a percentage. The Hz LED illuminates when a displayed numeric value is in hertz.
6	UP/DOWN keys	Depending on the mode, you can use the arrows to: Navigate between the menus Change a value Change the speed reference when the UP/DOWN LED (7) is illuminated
7	UP/DOWN LED	Illuminates when the navigation arrows are controlling the speed reference
8	Loc/Rem LED	Illuminates when Local mode is selected
9	MODE	Press to select the embedded display terminal mode. Run mode (default on power-up) Programming mode Monitoring mode Can also be used to go back to the previous menu.
10	Loc/Rem	Switches between Local and Remote modes
11	ENT	Press to display a parameter's value or to save a changed value.
12	RUN LED	Illuminates when the Run key is enabled
13	RUN	Pressing this key when the RUN LED is illuminated starts the drive.
14	STOP	Stop/reset key. In Local mode, pressing the STOP key causes the drive to stop based on the setting of parameter [Loc. mot stop mode] (F 12 1). In Remote mode, pressing the STOP key causes the drive to stop based on the setting of parameter [Ext. fault stop Mode] (F 603). The display will indicate a flashing "E". If [HMI reset button] (F 135) is set to 0, pressing the stop key twice will reset the drive, if the detected fault condition has been cleared.

Alarm Conditions - Altivar 212

Alarms do not cause the drive to enter a fault condition.

Alarm Codes - Altivar 212

Code	Description	Possible causes	Remedies
AtnI	[Auto tune]	• Auto-tuning in process	• Normal if it the message disappears after a few seconds.
CLr	[Reset active]	• This message is displayed after the STOP key is pressed while an detected fault is displayed.	• Press the STOP key again to clear the detected fault.
db	[DC braking]	• DC braking in process	• The alarm code goes off in several seconds if no trouble occurs.
dbOn	[dbOn]	• Motor shaft fixing control	•
E-17	[HMI error]	• A graphic display option key has been held down for more than 20 seconds. • A graphic display option key may not be operating properly.	• Release the graphic display option key. • If this does not clear the error, replace the drive.
EI	[Excess value] The number of digits that can be displayed has been exceeded	• The number of digits entered for values such as frequencies is more than 4 (the upper digits have priority).	• Lower the frequency free-unit magnification [Customized freq val] (F102).
EOFF	[Loc. Stop en.]	• The operation panel is used to stop the operation in automatic control or remote control mode.	• Press the STOP key for an emergency stop. To cancel the emergency stop, press any other key.
Err1	[Speed ref alarm]	• The frequency setting signals at points 1 and 2 are set too close to each other.	• Set the frequency setting signals at points 1 and 2 apart from each other.
h999	[Pin&1MWh] Integral input power	• Integral input power is more than 999.99 kWh.	• Press and hold down the ENT key for 3 s or more when power is off or when the input terminal function CKWH is turned on or displayed.
H999	[Pout&1MWh] Integral output power	• Integral output power is more than 999.99 kWh.	• Press and hold down the ENT key for 3 s or more when power is off or when the input terminal function CKWH is turned on or displayed.
HEAd End	[Head] [End] Display of first/last data items	• The first and last data item in the auh data group is displayed.	• Press MODE key to exit the data group.
HI LO	[High] [Low] Parameter adjustment error	• During programming, a value was entered that exceeds the maximum or minimum value of the parameter.	• Enter a value within the bounds of the parameter
InIt	[Initialization]	• Parameters are being initialized to default values.	• Normal if the message disappears after several seconds.
LStP	[Low speed stop] Auto-stop because of continuous operation at the lower-limit frequency	• The automatic stop function selected with F256 was activated.	• To deactivate the automatic stop function, increase the frequency command above the lower-limit frequency LL+F391 or turn off the operation command.
nOFF	[Line undervolt flt]	• The phase-to-phase input voltage is too low.	• Measure the main circuit supply voltage. If the voltage is at a normal level, the drive requires repair.
OFF	[Drive stop]	• The ST-CC (run permissive) circuit is open.	• Close the ST-CC circuit.
nSt	[Lock State]	• The Li is already active when the function is validated. • The Li is already active when a configuration transfer is done with the function is validated.	• Deactivate the active Li configured.
rtry	[Auto reset]	• The drive is in the process of restart. • A momentary stop occurred.	• The drive is operating normally if it restarts after several seconds.
StOP	[Stop supply] Momentary power loss slowdown stop prohibition function activated.	• The slowdown stop prohibition function set with F302 (momentary power loss ride-through operation) is activated.	• To restart operation, reset the drive or input an operation signal again.

Pre-alarm Conditions

Pre-alarm Codes - Altivar 212

Code	Pre-alarm	Description
C	[Current alarm]	• The drive is at current limit. • For more information, refer to parameter F601 and F185
P	[DC bus alarm]	• The drive is approaching an overvoltage detected fault due to a high supply line, regenerative motor braking, or a combination of these. For more information, refer to parameters F305 and F626.
L	[Motor overload al]	• The motor overload timer has reached or exceeded 50% of its detected fault level.
H	[Drv overheat alrm]	• The drive is approaching an overheating fault detection.

The pre-alarm codes are displayed, flashing on the embedded HMI, in the following order from left to right: C, P, L, H.

If two or more troubles arise simultaneously, one of the following pre-alarm codes appears and flashes: CP, PL, CPL.

Clearing the detected fault - Altivar 212

In the event of a non resettable detected fault:

1 Disconnect all power, including external control power that may be present.
2 Lock all power disconnects in the open position.
3 Wait 15 minutes to allow the DC bus capacitors to discharge (the drive LEDs are not indicators of the absence of DC bus voltage).
4 Measure the voltage of the DC bus between the PA/+ and PC/– terminals to ensure that the voltage is less than 42 Vdc.
5 If the DC bus capacitors do not discharge completely, contact your local Schneider Electric representative. Do not repair or operate the drive.
- Find and correct the detected fault.
- Restore power to the drive to confirm the detected fault has been rectified.

When any overload function (OL1 or OL2) is active, the drive cannot be reset by inputting a reset signal from an external device or with the Stop key on the display terminal if the calculated cooling time has not expired. Calculated cooling time:

- OL1: 30 seconds after the detected fault has occurred
- OL2: 120 seconds after the detected fault has occurred

CAUTION

RISK OF DAMAGE TO THE MOTOR

- Repeated reset of the thermal state after a thermal overload can result in thermal stress to the motor.
- When trips occur, promptly inspect the motor and driven equipment for problems (such as a locked shaft or mechanical overload) before restarting. Also check the power supplied to the motor for abnormal conditions (such as a phase loss or phase imbalance).

Failure to follow these instructions can result in equipment damage.

5 First Start-up procedure

5.1 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 4), the first start-up procedure can be done:

- Open the fil ers (B) and (C) and fill them with pure non-chlorinated water. Check that filter cartridges are inside.
- Re-install the fil ers.
- Open the seawater inlet valve (A2).
- Make sure that manual three-way valve (T2) is on operation position.
- 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.
- Set Sand Filter (or TFD filter) valves in " BACKWASH" position and start only the Low Pressure Pump switching the low pressure pump switch in manual position key (see description in control panel section). Wait to rinse the Sand Filter for 10 minutes and stop the low pressure pump (see procedure 9.1.4 for setting of service/backwash of Sand Filter).
- Set back the Sand Filter (or TFD filter) valves on "SERVICE" position.
- 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).

- Turn the low pressure pump switch in automatic position.
- Check that the EMERGENCY STOP push-button is not activated (turn clockwise).
- Run the system (START).

WARNING

If after about 20 seconds the feed water pressure does not rise, the system shuts down automatically.

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 on doing it until the reading of the high pressure on the high pressure gauge matches the working pressure value, indicated on the test report (check the correct pressure of operation in the annexed test report, that refers to the specific watermaker). 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.

WARNING

Never operate the watermaker at a pressure exceeding the correct value (for example: 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.

5.2 Shut down Procedure

- Depressurize the system by turning the pressure control valve (I) counterclockwise.
- Push STOP SYSTEM on the electric box.
- Switch off the p wer supply by turning to "O" position the general switch.
- Close the seawater inlet valve (A2).

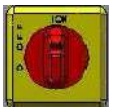
5.3 Control Panel EMC - Description and Operation

Electromechanical control panel has the following characteristics:

- Seven segment LED display with reading of the quality of produced water: salinity [µS/cm] and temperature [°C].
- Display of failures.
- High pressure and low pressure controls (by pressure switches).
- Operating hours meter.
- Mushroom-head button for emergency stop.
- Case in steel and protection class IP 55.
- Arrangment for the A.M.F. system (optional) connection.
- Electric motor space heaters starting (only when the system is stopped).
- Feed pump starting for cleaning / flushing operations.

Fig. 5.1 - Control panel EMC

- **Buttons and switches with the following functions**:

Power Switch - General switch to activate/deactivate the entire control panel	
System Start - Green lighted button, allows a differential starting of booster pump and high pressure pump	
System Stop - Red lighted button	
AMF Start for the automatic membrane flushing system (if supplied), with green lighted button	

- **Manual start of low pressure pump switch**:

1 - Automatic start of low pressure pump	
2 - Manual start of low pressure pump	

For normal operation set to position 1. and low pressure pump will start when you push the start button. Set this switch to position 2. to allow the system to backwash the Sand Filter (or TFD filter) or to circulate the membranes cleaning chemicals, by turning on the feed pump.

Low pressure pump Off/On - Switch for turn on the low pressure pump to perform cleaning / flushing operation, when the system is set in the manual position	
Space Heaters Off/On - Switch for activate the high pressure pump motor space heaters (they will activate onlywhe the system is stopped)	
Emergency Stop - Mushroom-head button for emergency stop.	

- **Alarms descriptions**:

Maintenance signals for unsafe water with yellow light indicator: when there is an high salinity value, fresh water is discharged out of board	
Green light indicator for correct operation of both low and high pressure pump (Start Button)	
Red light indicator for system stopped by any cause.	
Red light indicator for failure of low pressure pump	
Green light indicator for correct operation of the A.M.F. system (if installed)	

Red light indicator for failure of high pressure pump	
Red light indicator for failure of high pressure on fresh water line or on brine line	
Red light indicator for failure of high pressure on brine line	
Motor protection high pressure pump: yellow light indicator, with stop of the circuit	
Motor protection low pressure pump: yellow light indicator, with stop of the circuit	
Green light indicator for low pressure ump runnig for Cleaning/flushing operation	
Red light indicator for space high pressure pump motor space heaters turned on	
White light indicator for the presence of the power supply inside the control box	

- **Instruments.**

This watermaker is controlled by control box by means of:

- **High pressure switch**

  Make: THE NASON COMPANY

  Circuit: SPDT (single pole double throw)

  Rating: gold plated contacts for low current

  Operation: circuit to transfer at 1090 ± 55 PSI rising pressure

  Adjusting range: 750 to 2400 PSI

  Max operating pressure: 5000 PSI

  Set point: 70 bar

  Material: base in 316 Stainless Steel; housing in G/F Nylon.

  Termination: DIN connector 43650-A

  Mounting points on the system: membrane discharge

- **Low pressure switch**

  Make: THE NASON COMPANY

  Circuit: SPST-N.O. (single pole single throw-N.O.)

  Rating: gold plated contacts for low current

  Operation: circuit to open at 3 ± 1 PSI falling pressure

  Adjusting range: 1,5 to 5 PSI

  Max operating pressure: 250 PSI

  Set points: 1 bar / 4,5 bar

  Material: base plastic; housing in G/F Nylon.

  Termination: DIN connector 43650

  Mounting points on the system: prefilter outlet / fresh water line / discharge (brine) line

- **Mechanical low pressure gauge**

  Make: WIKA

  Material: inox, glycerin filled

  Range: 0-6 bar;

  Mounting points on the system: prefilter outlet, inlet and outlet of feed pump;

  Analog reading.

- **Mechanical high pressure gauge**

  Make: WIKA

  Material: inox, glycerin filled

  Range: 0-100 bar;

  Mounting points on the system: membrane discharge, inlet and outlet of high pressure pump;

  Analanalog reading.

- **High pressure switch**

  Make: Euroswitch

  Circuit§: SPST-N.O. (single pole single throw - N.O.)

  Rating: silver AgNi contacts

  Operation: circuit to transfer at 4/1.5 ± 0.3 bar rising pressure

  Adjusting range: 1 to 5 bar

  Max operating pressure: 40 bar

  Set points: 1bar / 4.5 bar

  Material: case in brass;

  Mounting points on the system: fresh water line / brine line;

- **Salinity and temperature probe**

  Make: TECNICOMAR

  Mounting points on the system: between fresh water outlet and motorized 3-way valve;

  Digital reading on the display of the control panel.

- **Flow meter**

  Make: Blue White

  Type: mechanical;

  Mounting points on the system: between fresh water outlet and solenoid valve.

- **Operating hours meter**

  Analogical reading of the system's operating hours on the display of the control panel.

- **Ammeter**

  Analogical reading of the electrical consumption on the display

Operative indications

1. To switch on the control box set general switch to "I".
2. Be sure that low pressure pump switch is in automatic position.
3. Two led are lighted: STOP SYSTEM and LOW PRESSURE ALARM.
4. It is possible to push START SYSTEM.

Alarms

1. When there is a low pressure failure, LOW PRESSURE ALARM led is on.
2. When there is an high pressure failure, LOW PRESSURE ALARM and HIGH PRESSURE ALARM leds are on.
3. To restart the system open the control box cover and switch on the motor switches of protection QF2 and QF3 (Fig. 5.2).
4. Then press stop to reset the alarms.
5. Now is possible to restart the system.

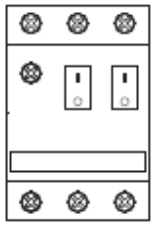


Fig. 5.2 - Motor protection switch

Emergency stop

This button stops the system but inside the control box there is still danger voltage presence.

WARNING

Only general power switch interrupt power supply input.

The control box is complying with rules in force and it is provided with CE mark.

6 Routine operation

6.1 Start-up Operation

After having carried out the first sta t-up (section 5), 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.
- Be sure that the pressure control valve (I) is open.
- Be sure that the Sand Filter (or TFD filter) valves are in SERVICE position.
- Start up the system by pressing START.
- Check that the feed water pressure is correct: the value shown on the low pressure gauge must not get below 30% of the reading as it was with new filter cartridges. If necessary, clean or replace the filter cartridges. The electric box will automatically shut down the system if the feed water pressure is below the minimum level needed for the correct operation.

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.

- Apply gradually the operating pressure (for example: 850 PSI = 60 bar) (check the correct pressure of operation in the annexed test report, that refers to the specific watermaker) by slowly turning the pressure control valve (I) clockwise.

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 (if installed).

6.2 Operation in Low or High Salinity Areas

Tecnicomar watermakers may also operate in areas with unknown feed water salinity, like lake or river waters. In low-salinity areas the applied operating pressure should be less than 66 bar. In such cases the produced water flow rate (check the flow meter on the front panel) should be kept under control when applying the operating pressure.

WARNING

The fresh water production must never exceed the system maximum production (refer to system technical characteristic, section 10).

6.3 Operation in Cold Areas

In very cold areas and in high salinity areas there will be a decrease in the fresh water production.

In any case the system must never operate below 0°C, or with feed water at temperature below 0 ° C.

WARNING

In cold areas, never operate the watermaker at a pressure exceeding 66 bar (957 PSI).

7 Special procedures

7.1 System Normal Operation

The watermaker electric box checks continuously the system operation. The watermaker does not constitute any risk for the user since the electric box automatically checks, through the appropriate sensors, the equipment correct operation.

Since the automatic controls are based on the readings of salinity probe that drives the motorized valve that deviate water to fresh water tank or to outboard, if one of this two devices are faulty it is possible to set motorized valve on manual mode. This way the control of produced water is under care of the operator. However the system can operate also in EMERGENCY conditions. In this operation mode the electric box cannot in any way shut down the system even in conditions of danger.

WARNING

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 push-button is installed on the control panel and is identified y its mushroom form, red color and the EMERGENCY text).

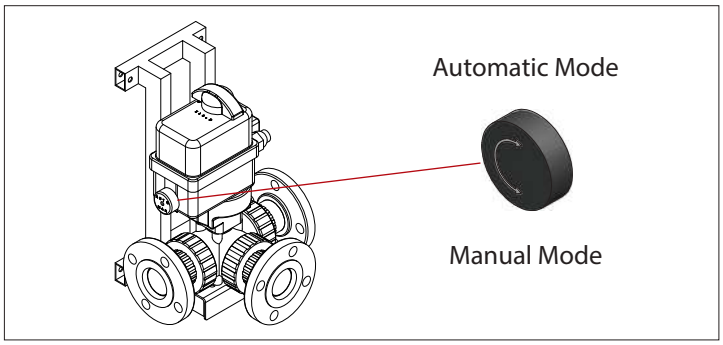


Fig. 7.1 - Motorized valve and auto-man switch

7.2 Long-Period Shut Down Procedure (Winterizing)

If the system is not used for a longer period of time and is not periodically flushed with fresh water, the 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 (also called Winterizing) should be carried out. 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.

- Close the sea water inlet valve (if installed).
- Empty the prefilters (B and C) and wash them using a dish-washing detergent.
- Reinstall the filter cartridges.
- Turn the valve (IF) on the main panel (Fig. 7.2), in the FLUSHING position.

Fig. 7.2 - Main panel

- Make sure that the Cleaning tank is full; otherwise, if the Cleaning/Flushing System is not supplied, prepare a tank and fill it up with at least 460 litres of non-chlorinated fresh water (you can use the auxiliary fresh water out, by opening the V1 ball valve while the system is running).

- Add in the tank a quantity of "FL403 Tecnicomar preservatives membrane" mixture, corresponding to the 0.2% of the non-chlorinated water volume, in the tank. For example, using a tank filled with 460 liters of water (as the TECNICOMAR cleaning/flushing tank) you have to add 920 gr of "FL403 Tecnicomar preservatives membrane" mixture (the dose may be proportionally custom, maintaining the proportion of 0.2% between the water in the tank and the "FL403 Tecnicomar preservatives membrane" mixture).

DANGER

FL/403 contains Sodium Metabisulphite: 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.

- Make sure that the cleaning tank is connected to the BRINE AUXILIARY OUTLET and to the INLET FOR FLUSHING/CLEANING OPERATION.
- Turn the manual three-way valve (T2) into the FRESH WATER INLET position for flushing; and the manual three-way valve (T3), on the brine outlet, into the CLEANING LOOP POSITION.
- Start only the booster pump: turn automatic/manual low pressure start switch in manual position (turn it clockwise), and than the Off/On low pressure pump switch in ON position (turn it clockwise).
- Circulate the solution inside the closed loop for 10 minutes.
- STOP the booster pump (turn the switch in "Off" position), set the system in low pressure pump automatic start mode (turn the switch in "automatic start low pressure pump" position) and leave the solution inside the watermaker.
- Empty the prefilters and replace the prefilter cartridges.
- Empty the Cleaning/Flushing tank and clean it well.
- Turn the valve (IF) in the "OPERATION" position.

WARNING

Do not use chlorinated water. Due to the high sensibility of the membranes, we advise also the exclusive use of flushing chemicals and filter cartridges supplied by Tecnicomar.

To resume operation after prolonged shutdown:

- Open the sea water intake valve (if installed);
- Turn the manual three-way valve (T2) into the INLET SEA WATER position;
- Open the pressure control valve (I) by turning it counterclockwise;
- Run the system for 5 minutes without applying pressure. After that, apply the right pressure as described in section 5.

7.2.1 Membrane Chemical Cleaning Procedure

Important: The membrane chemical cleaning has to be performed only when fresh water production is at least 30% lower than it was with new membranes.

1. Make sure that the Cleaning tank is full; otherwise, if the Cleaning/Flushing System is not supplied, prepare a tank and fill it up with at least 460 litres of non-chlorinated fresh water (you can use the auxiliary fresh water out, by opening the V1 ball valve while the system is running).
2. Turn the valve (IF) on the main panel, in the FLUSHING position.
3. Make sure that the cleaning tank is connected to the BRINE AUXILIARY OUTLET and to the INLET FOR FLUSHING/CLEANING OPERATION.
4. Turn the manual three-way valve (T2) into the FRESH WATER INLET position for flushing; and the manual three-way valve (T3), on the brine outlet, into the CLEANING LOOP POSITION.
5. Add in the tank a quantity of FL411A (alkaline detergent), corresponding to the 2% of the non-chlorinated water volume (temperature over 15°C), in the tank. For example, using a tank filled with 460 liters of water (as the TECNICOMAR cleaning/flushing tank) you have to add 9.2kg of FL411A alkaline detergent (the dose may be proportionally custom, maintaining the proportion of 2% between the water in the tank and the FL411A alkaline detergent). Some more chemical may be needed with raw water to reach the pH level of 2. If chemicals circulate for too long time, the temperature will increase and may cause damage to the membranes. The temperature must not get over 45°C. If required add ice to the solution.
6. Start only the booster pump: turn automatic/manual low pressure start switch in manual position (turn it clockwise), and than the Off/On low pressure pump switch in ON position (turn it clockwise).
7. Circulate the solution inside the closed loop. The pump will automatically stop when the solution inside the tank reach the minimum level. If you don't use TECNICOMAR Cleaning/Flushing system circulate the solution for 1 hour.
8. STOP the booster pump (turn the switch in "Off" position), set the system in low pressure pump automatic start mode (turn the switch in "automatic start low pressure pump" position) and leave the solution inside the watermaker for 1 hour.
9. Clean the Storage/Flushing Tank and fill it with a solution cointaing non chlorinated water (temperature over 15°C) and 2% of FL412B acid detergent. For example, using a tank filled with 460 liters of water (as the TECNICOMAR cleaning/flushing tank) you have to add 9.2kg of FL412B acid detergent (the dose may be proportionally custom, maintaining the proportion of 2% between the water in the tank and the FL412B acid detergent).

10. Repeat steps 4 to 8 with FL412B.
11. Turn the manual three-way valve (T3), on the brine outlet, into the OPERATION POSITION. Perform a membrane flushing operation following the procedure described in 7.4

DANGER

FL411A contains Trisodium Phosphate and FL412B 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 e es or skin with water and contact a doctor.

To resume operation:

- Open the sea water intake valve (if installed);
- Turn the manual three-way valve (T2) into the INLET SEA WATER position;
- Open the pressure control valve (I) by turning it counterclockwise;
- Run the system for 5 minutes without applying pressure. After that, apply the right pressure as described in section 5.

7.3 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).

CAUTION

In any case the membranes should not freeze

7.4 Short-Period Shut Down Procedure

If the system runs continuously (24 h / 24 h) for a long period of time, it is necessary to perform the short period shout down procedure every month and flush the system with fresh water.

- Close the sea water inlet valve (if installed).
- Turn the valve (IF) on the main panel (Fig. 7.2), in the FLUSHING position.
- Make sure that the Cleaning tank is full; otherwise, if the Cleaning/Flushing System is not supplied, prepare a tank and fill it up with at least 460 litres of non-chlorinated fresh water (you can use the auxiliary fresh water out, by opening the V1 ball valve while the system is running).

- Make sure that the cleaning tank is connected to the BRINE AUXILIARY OUTLET
- Turn the manual three-way valve (T2) into the FRESH WATER INLET position for flushing; and the manual three-way valve (T3), on the brine outlet, into the OPERATION POSITION.
- Start only the booster pump: turn automatic/manual low pressure start switch in manual position (turn it clockwise), and than the Off/On low pressure pump switch in ON position (turn it clockwise).
- The system will automatically stop when the cleaning tank reach the minimum level. If the system is not equipped with a TECNICOMAR Cleaning/Flushing system, let the pum run until the tank is emptyrun.
- STOP the booster pump (turn the switch in "Off" position), set the system in low pressure pump automatic start mode (turn the switch in "automatic start low pressure pump" position) .
- To resume operation follow the related procedure .

8 Common problems and Troubleshooting

First start-up

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

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

Check that:

- The sea water inlet valve is open;

  The low-pressure piping is tightened correctly;

  The filter sumps are tightened correctly;

  The prefilter O-rings are correctly placed;

  The 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).

This operation will help to eliminate the infiltrated air.

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 well set;

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 (I) is open (turn counterclockwise).

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 (low pressure gauge reading) is less than the low pressure switch setting point (check the annexed Test Report) the filtering cartridges should be replaced.

If the low pressure (low pressure gauge reading) 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.

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 the low pressure switch setting point (check the annexed Test Report) , filtering cartridges should be replaced.

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

Operation with vessel in navigation, rough sea and Low Pressure alarm on

Check the inlet pressure; if it is regular (approx. 1bar), 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.

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 is still on, contact an authorized Tecnicomar Service Dealer.

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.

Use the table below to diagnose and solve the most common problems associated with use of the Tecnicomar watermaker. Use the information contained in the table first if you encounter a problem. If the problem persists, contact an authorized Tecnicomar Service Dealer.

SYMPTOM	POSSIBLE CAUSE	POSSIBLE REMEDY
Low pressure gauge indicates very low pressure or vacuum.	Inlet Strainer blocked.	Clear strainer & purge all air from system before running HP pump.
	Clogged filter(s).	Replace fil er(s), & purge all air from system before running HP pump.
	Collapsed low pressure hose.	Check for restriction and remedy or replace hose.
	Air leaks in when running.	Reseal or re-tighten all fitting . Ensure bleed valves on fil er housings are seating correctly.
	Low pressure pump will not start.	Check mechanical end of pump, if seized strip pump and carefully free off. Replace all seals.
System not priming.	Inlet sea cock closed.	Open sea cock.
	Air leak between inlet and LP pump.	Tighten all connections and re-seat strainer cap. Check valve for leak.
	Hose from inlet too small.	Hose size must not be less than specified or size of system.
Pulsation.	HP pump valve sticking.	Clean or replace valves.
	Cavitating.	Check low pressure system for leaks or restrictions.
	Worn seals.	Replace pump seals.
Insufficient pressure	High pressure regulating valve out of adjustment or faulty.	Adjust high pressure regulating valve or replace.
	Air ingress.	Rectify leaks in LP system.
	Pressure gauge fault.	Replace.
	Leaking hoses.	Replace or repair.
Water leakage under HP pump manifold.	Worn seals.	Replace seals.
Oil leakage between manifold and crank-case.	Worn oil seals.	Replace seals.
Oil leakage around crankshaft.	Worn seal or O-ring.	Replace seal or O-ring.
	Unserviceable bearing.	Replace bearing.
Frequent packing failure or HP pump run dry.	Damaged or worn pistons.	Replace pistons. Do not run pump dry.
Main circuit breaker keeps tripping	Short circuit in system.	Remedy.
	Main circuit breaker unserviceable or of incorrect rating.	Replace.

SYMPTOM	POSSIBLE CAUSE	POSSIBLE REMEDY
LP pump will not run.	Motor overload tripped.	Investigate and reset overload.
HP pump suddenly stops or will not start	Low pressure switch open circuit.	Verify the low pressure switch and change it if defective.
	Motor overload tripped.	Reset overload, adjust pressure regulating valve for minimum pressure and restart HP pump.
HP pump does not start.	QF3 switch open (or Inverter unserviceable).	Verify QF3 switch (Verify if alarms are present on inverter display).
The output water it is discharged only overboard.	3-way solenoid valve faulty or connections loose.	Check connections. Change output from solenoid valve manually by depressing small knob on side of valve body. Change valve if it is unserviceable.
Low fresh water production.	Salinity control set too high.	Reset salinity control and calibrate the system as described in the "salinity calibration" procedure.
	Salinity sensor dirty.	Remove, clean and replace. Ensure all connections are made.
	Membranes are badly fouled.	Carry out organic and inorganic cleaning process.
	Membrane(s) damaged.	Replace membrane(s).

9 Maintenance

9.1 Preventive Maintenance

The watermaker requires some maintenance. The most sensitive component is the reverse osmosis membrane module.

Some safety components, such as three-way solenoid valve, high pressure piping and fittings must be checked periodically for the safe use of the watermaker.

When doing the activities with system completely off, follow these steps:

- Turn off the watermaker, and deactivate the remote management (if provided).
- Depressurize the system by turning the pressure control valve (I) counterclockwise.
- Push STOP SYSTEM on the electric box.
- Switch off the power supply by turning to "O" position the general switch.
- Close the seawater inlet valve (A2).

Proc.	Description
9.1.1	System General Check and Inspection
9.1.2	Preservation and Care of the Semipermeable Membrane Modules
9.1.3	High-Pressure Circuit
9.1.4	Sand Filter Maintenance
9.1.5	TFD Filter Maintenance
9.1.6	Prefilters Maintenance

9.2 Extraordinary Maintenance

When doing the activities with system completely off, follow these steps:

- Turn off the watermaker, and deactivate the remote management (if provided).
- Depressurize the system by turning the pressure control valve (I) counterclockwise.
- Push STOP SYSTEM on the electric box.
- Switch off the power supply by turning to "O" position the general switch.
- Close the seawater inlet valve (A2).

Proc.	Description
9.2.1	Replacement of Membrane Modules
9.2.2	Salinity and Temperature Sensors (M+M1)
9.2.3	Pressure Gauges Maintenance
9.2.4	Low-Pressure Switch Maintenance
9.2.5	High-Pressure Switch Maintenance
9.2.6	Low-Pressure Pump Maintenance
9.2.7	Dosing Pump Maintenance

9.3 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:

- prefilter cartridges 30 micron.
- prefilter cartridges 5 micron.
- FL/403 membrane storage solution.
- FL411A membrane cleaning solution.
- FL412B membrane cleaning solution.
- Pump oil.
- O-rings for prefilters.

9.4 Maintenance Plan

General Maintenance Plan

Proc.	Description	Maintenance Interval
Check and inspection		
9.1.1	System general check and inspection	Daily
Prefiltering circuit		
9.1.4	Sand Filter Backwash	When the outlet pressure gauge reading is 0.8 bar lower than the initial "Start up" pressure, for 15 minutes
9.1.5	TFD Filter Backwash	When the outlet pressure gauge reading is 0.8 bar lower than the initial "Start up" pressure, for 15 minutes
9.1.6	Prefilters clean or replace filter cartridges and clean the sump [(1)]	3/4 times a year or when the low pressure gauge reading (D) falls below 1 bar
Pressurizing circuit		
9.1.2	Membrane cleaning procedure	When the fresh water production is less than 30% of the production with new membranes.
Controls and produced water circuits		
9.2.2	Clean the Salinity sensor conductivity electrodes	24 months

[(1)] Use only Tecnicomar original fil ers cartridges.

High Pressure Pump Maintenance Plan

Proc.	Description	Maintenance Interval
9.1.3	Check high pressure pump oil level/quality	Daily
	Check high pressure pump oil leaks	Daily
	Check high pressure pump water leaks	Daily
	Check Plumbing	Weekly
	High pressure pump change oil	First change: after 3 months or 50 hours of operation; then every 500 hrs of operation. In case of low use, change oil every year.*
	Seal Change	Every 1500 hrs. **
	Valve Change	Every 3000 hrs. **

* Use only Tecnicomar original oil. Crankcase Capacity: 4 L (h.p. pump model 3541).

** Each system's maintenance cycle will be exclusive. If system performance decreases, check immediately. If no wear at 1500 hours, check again at 2000 hours and each 500 hours until wear is observed. Valves typically require changing every other seal change. Duty cycle, temperature, quality of pumped liquid and inlet feed conditions all effect the life of pump wear parts and service cycle.

9.1.1 System General Check and Inspection

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF

Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

Daily check:

- Check running hours of system for any routine maintenance which may be due.
- Check system sea water strainer for debris and clean as required.
- Visually inspect system for leaks and take remedial action as necessary.
- Visually inspect the high pressure flexible pipe for chafe or 'bulging'. Replace if defective. If 'bulging' is seen do NOT run the watermaker as a high pressure burst may occur and contact Tecnicomar for replacement.

Fig. 1.1.1 - Watermaker external view

Fig. 1.1.2 - Watermaker external view

- Check HP pump oil level and top up if required.
- Check condition of both system micron pre-filters. If necessary, replace them. Under normal use offshore you can expect 100 hours or more use, unless plankton or sediment is prevalent. When replacing filters, always clean the clear filter bowls. DO NOT use a detergent, as this could contaminate the RO membranes.

WARNING

DO NOT ATTEMPT TO BLEED THE SYSTEM WITH THE HP PUMP RUNNING.

- Inspect the entire system for leakage on the tubing and hoses. Repair any leaks as soon as possible.
- Check for corrosion around the stainless steel fitting . If any rust appears, remove, clean, and reassemble the fittings. Rust is a sign of crevice corrosion inside the fitting and must be dealt with promptly.
- Wash down any salt encrusted areas with a damp cloth.
- Keep the watermaker clean, dry, and salt free.

By following the instructions below and paying attention to system maintenance, you can expect years of trouble-free operation.

Pre-Run Checklist:

Before running your watermaker, always check the following:

- Any valves in the seawater intake, reject brine and product freshwater lines should be open.
- Assure that the product freshwater output is routed to a drain for testing/discarding.
- Check for bad ("rotten egg") smell from the water in the prefil er assembly. Replace the element and clean the housing, as required.
- Check power supply voltage.
- Observe the seawater around your vessel and check if it is clean enough to use for your seawater intake.

There are several things to avoid feeding to your watermaker:

- Petroleum products, such as oil, fuel, thinners, paints, paint removers, etc..
- Water containing chlorine (for example, most "dock-side" water).
- Silty water or water contaminated by fine, hard, suspended particulates.
- Putrid water, "red tides", or any seawater that smells or looks contaminated.

It is important to remember that the watermaker is designed to process clean, open-ocean seawater.
Any departure from that standard for your seawater intake runs the risk of causing excessive wear or damage to internal pump parts and/or the vulnerable reverse osmosis membrane, or producing contaminated product freshwater.

9.1.2 Preservation and Care of Membrane Modules

CAUTION

The membrane module must not be exposed to high temperatures above 45°C (the membrane container gives sufficient protection from the watermaker 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 66 bar.

Fig. 1.2.1 - Watermaker vessels

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 procedure § 7.2.

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

Watermakers are best run continuously. When not in use, biological growth in the membrane is the leading cause of membrane fouling. A warm environment will cause more growth than a cold environment. The fresh water flush will greatly reduce biological growth but may not stop it completely in certain conditions.
Membranes need to be cleaned only when feed pressures have risen 10% due to fouling or the product quality degrades. The leading cause of fouling is from biological growth that occurs when the system is left unused without flushin . Fouling from mineral scaling can happen during operation under certain sea water conditions, and from rust.
Other conditions that can cause high pressure are cold feed water, high salinity feed water and clogged filters. Low product flow is more likely to be due to low voltage, or poor feed or pump performance. Look for all other causes before cleaning the membrane. Membrane life will be shortened by excessive cleaning.

Membrane Start-Up Performance and Stabilization

The start-up performance of an RO membrane system and the time required to reach the stabilized performance depends on the prior storage conditions of the membrane. Dry membranes and wet preserved membranes, if properly stored, reach the same stabilized performance after some hours or a few days of operation. The flow performance of wet membranes is typically stable right from the start, while dry membranes tend to start at a slightly higher flow. The salt rejection of membranes in general improves

fduring the first few hours or days of operation and remains stable then. Wet membranes stabilize faster than dry membranes.

Plant Performance Normalization

The performance of an RO membrane is influenced by the feed water composition, feed pressure, temperature and recovery. For example, a feed temperature drop of 4°C will cause a permeate flow decrease of about 10%. This, however, is a normal phenomenon.
In order to distinguish between such normal phenomena and performance changes due to fouling or problems, the measured permeate flow and salt passage have to be normalized. Normalization is a comparison of the actual performance to a given reference performance while the influences of operating parameters are taken into account. The reference performance may be the designed performance or the measured initial performance. Normalization with reference to the designed (or warranted) system performance is useful to verify that the plant gives the specified (or warranted) performance.
Normalization with reference to the initial system performance is useful to show up any performance changes between day one and the actual date.
Plant performance normalization is strongly recommended, because it allows an early identification of potential problems (e.g. scaling or fouling) when the normalized data are recorded daily.
Corrective measures are much more effective when taken early.
A computer program called FTNORM is available for normalizing operating data and graphing normalized permeate flow and salt passage as well as pressure drop.
This program is available from web site www.filmtec.com and requires Excel® software.

Membrane Cleaning

There are two types of cleaners, acid and alkaline.

- The acid cleaner (Fl412B) will remove mineral scaling.
- The alkaline cleaner (FL411A) is used to remove biological by-products, oil, and dirt particles that get past the prefilters.

If membrane performance is reduced and they have not been pickled recently, cleaning with both chemicals is recommended (see Membrane Chemical Cleaning Procedure - § 7.2.1).

The alkaline cleaner should be used first: If the membrane fails to respond to both cleaning operations, this is an indication of another problem with the system, or that it is time to replace the membrane. For normal cleaning, the FL411A (MC11 or similar others) Alkaline Cleaning Compound is used first, then the FL412B (MC3 or similar others) Acid Cleaning Compound.

If known bio-fouling is present, the FL411A (MC11 or similar others) may be used first. Using hot water if possible, up to 120°F (45°C) is recommended as it greatly enhances the ability of the cleaners to do their jobs.

If the history of the system is unknown or it has been left unmanned for an extended length of time and biological growth is present, it is recommended that the system is cleaned with FL411A (MC11 or similar others), using an alternate source of unchlorinated fresh water before the system is run under pressure. A simple test can be performed to see if biological growth has occurred. Before running the system, remove the prefilters and examine their condition If the housings are full of smelly discolored water, the system was not properly stored.

Install clean prefilters if they were bad. Next check the membrane. Attach the brine discharge service hose and lead to a bucket. Open the pressure relief valve one turn, and manually run the system for 30 seconds. Examine the brine water, if it's discolored and smells bad, perform an FL411A (MC11 or similar others) cleaning with an alternate source of unchlorinated water before running the system pressurized. If the brine is fairly clean, the system can be purged, run normally, and checked for performance. Clean the membranes only if performance is reduced. Perform the cleaning procedures while the system is in acceptable sea water for purging and testing.

9.1.3 High-Pressure Circuit

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF

Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

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 fitting . Check for leaks in fittings or piping even with the system in full operation. An accurate maintenance work must be carried out periodically by the Tecnicomar servicing personnel to ensure efficient and safe system operation.

The high-pressure pump oil level should be checked periodically. Use only oil supplied by Tecnicomar or recommended oil API CIS 150.

Do not discharge the used oil in environment.

Fig. 1.3.1 - High Pressure Pump

Fig. 1.3.2 - High Pressure Pump

Use only high quality hydraulic oil which is non-foaming and non-detergent. Do not use engine oil.

Once properly installed, the watermaker high pressure pump and drive assembly require little attention. You should regularly inspect the equipment and check for any leakage of seawater or oil leaks, any leakage of oil or seawater is a sign of a problem and should be corrected.

Make certain that the watermaker remains dry. Exposure to saltwater can cause corrosion of the drive assembly and/or damage to the electric motor. Keep all electrical connections clean, dry and tight. After every 1500 hours (approximately) of use, replace the seals in the pump (See "LO-PRESSURE SEAL" procedure below).

After approximately 5000 hours of use, have the electric motor inspected for general condition.

Optimum performance of the pump is dependent upon the entire liquid system and will be obtained only with the proper selection, installation of plumbing and operation of the pump and accessories.

For extended storing or between use in cold climates, drain all pumped liquids from pump and flush with antifreeze solution to prevent freezing and damage to the pump. Do not run pump with frozen liquid.

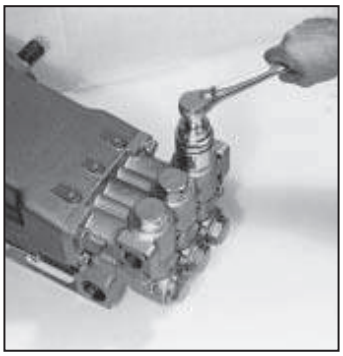
High Pressure Pump Maintenance Plan

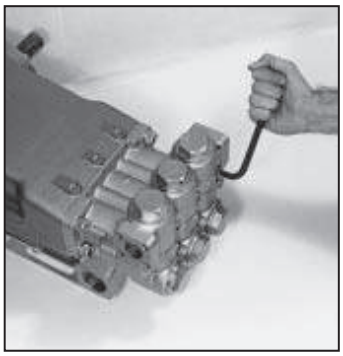
Description	Maintenance Interval
Check high pressure pump oil level/quality	Daily
Check high pressure pump oil leaks	Daily
Check high pressure pump water leaks	Daily
Check Plumbing	Weekly
High pressure pump change oil	First change: after 3 months or 50 hours of operation; then every 500 hrs of operation. In case of low use, change oil every year.*
Seal Change	Every 1500 hrs. **
Valve Change	Every 3000 hrs. **

*Use only Tecnicomar original oil. Crankcase Capacity: 4 L (h.p. pump model 3541/3531).

** Each system's maintenance cycle will be exclusive. If system performance decreases, check immediately. If no wear at 1500 hours, check again at 2000 hours and each 500 hours until wear is observed. Valves typically require changing every other seal change. Duty cycle, temperature, quality of pumped liquid and inlet feed conditions all effect the life of pump wear parts and service cycle.

For maintenance h.p. pump CAT mod. 3541/3531 see procedure instructions reported on the following pages.





SERVICING THE VALVES

DISASSEMBLY

1. Remove the six (6) M41 Hex Valve Plugs.
2. Remove the exposed Coil Spring from the top of the Spring Retainer. Thread an M10 bolt into the top of the Spring Retainer. The assembly will usually remain together. To separate, continue threading the bolt into the back side of the Valve Seat until it separates from the Spring Retainer. In all models if the assembly separates during removal, use a valve seat removal tool and lift the Seats from the chamber.

REASSEMBLY

NOTE: For certain applications apply liquid gasket to the o-ring crevices and seal surfaces. See Tech Bulletin #053 for model identification.

1. Examine the O-Rings and Back-up-Rings on the Seat and replace if cut or worn. Lubricate the O-Ring before installing.
2. Examine the surface of the Valve and Seat for pitting, grooves or wear and replace if necessary.
3. Next assemble Valve Retainer, Spring, Valve and Seat by snapping together securely. Thread the M10 bolt into spring retainer for installation.
4. Lubricate outer O-Ring and Back-up-Ring surface and walls of valve chamber and press Valve Assembly squarely into chamber. Remove M10 bolt. Place the washer over the top of the Spring Retainer and then the Coil Spring on top of the Washer.
5. Examine the O-Ring and Back-up-Ring on the Valve Plug and replace if cut or worn. Lubricate new O-Ring and Back-up-Ring before installing on Valve Plug to avoid damaging as they are worked over the plug threads. NOTE: The Back-up-Ring must go on first, then the O-Ring.
6. **Slowly** thread the Valve Plug into chamber. Exercise caution to avoid extruding or cutting the Back-up-Ring or O-Ring. Then torque to specifications.
   NOTE: Apply Loctite 242 to the threads of the Valve Plug before threading into the manifold chamber.

REMOVING THE DISCHARGE MANIFOLD

1. Remove the eight (8) hex socket head screws.
2. Tap the back side of the Discharge Manifold with a soft mallet and gradually work head from pump.
3. Remove the O-Rings from lower chambers of the face of the Inlet Manifold.

REMOVING THE INLET MANIFOLD

1. Using a hex allen wrench, remove the four (4) hex socket head screws. Rotate the Crankshaft to begin the separation of the Inlet Manifold from the Crankcase.
2. Tap the rear of the Inlet Manifold with a soft mallet and gradually work from pump. NOTE: Support from the underside and exercise caution to keep manifold aligned with Plungers to avoid damage to the Plungers as the manifold is removed. NOTE: Two screwdrivers on opposite sides of the manifold may be used to assist separation.

SERVICING THE PACKINGS

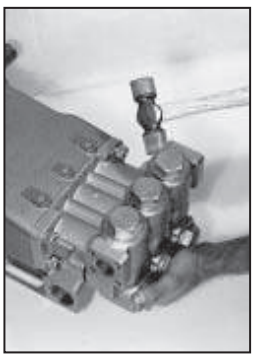
DISASSEMBLY OF THE V-PACKINGS

1. Place the **crankcase side** of the Inlet Manifold **down** on the work surface.
2. First remove the V-Packing Spacer. These may stay in either the Inlet or Discharge Manifold ports when the Discharge Manifold is removed. If they are extremely dirty or dry, remove the exposed O-Ring and Back-up-Ring and insert two screwdrivers on opposite sides to pry out of chamber.
3. Examine both front and rear O-Rings and Back-up-Rings on the V-Packing Spacer for cuts or wear and replace as needed. NOTE: The 3545, 3541 do not have Back-up-Rings.
4. To remove the V-Packing Cylinder (3520, 3521, 3527), insert two screwdrivers on opposite sides of the V-Packing Cylinder and pry out. Examine the O-Ring for wear and replace as needed.
5. Next remove Spacer with coil springs. Examine for broken or fatigued springs or scale build up or pitting and replace as needed.
6. Then with reverse pliers remove the Male Adapter, V-Packings and Female Adapter. NOTE: Using the reverse pliers may damage the V-Packings or Female Adapter.
7. Examine Female Adapter for worn I.D. and replace as needed.

REASSEMBLY OF THE V-PACKINGS

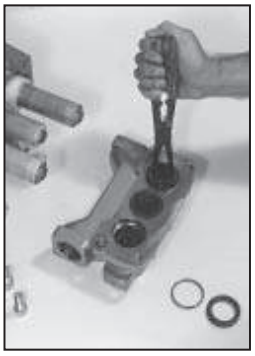
NOTE: For certain applications apply liquid gasket to the o-ring crevices and seal surfaces. See Tech Bulletin #053 for model identification.

1. Lubricate outer surface of V-Packing Cylinder and install new O-Ring in groove (3520, 3521, 3527). Press V-Packing Cylinder with **O-Ring end down** into the manifold chamber until completely seated.
2. Insert the Female Adapter into the V-Packing Cylinder (3520, 3521, 3527) or manifold chamber (3535, 3531, 3537, 3545, 3541) with the **"V" groove up**.
3. Next fit the new V-Packings together, lubricate the outer surface of the packings and insert into V-Packing Cylinder (3520, 3521, 3527) or manifold chamber (3535, 3531, 3537, 3545, 3541) with the **"V" groove up.**
4. Then install the Male Adapter into V-Packing Cylinder (3520, 3521, 3527) or manifold chamber (3535, 3531, 3537, 3545, 3541) with the **"V" groove down** (notches up).
5. Lubricate outer surface of Spacer with coil springs and insert into V-Packing Cylinder (3520, 3521, 3527) or manifold chamber (3535, 3531, 3537, 3545, 3541) with **springs facing down**. See Tech Bulletin #50 when servicing old style pumps; both the spacer with coil springs and Inlet Manifold must be updated.
6. Lubricate outer surface of V-Packing Spacer, install new O-Rings and Back-up-Rings in both front and rear groove and press into V-Packing Cylinder (3520, 3521, 3527) or manifold chamber (3535, 3531, 3537) with **small diameter down** until completely seated. NOTE: The 3545, 3541 do not have Back-up-Rings.





Model 3531, 3537



DISASSEMBLY OF THE LO-PRESSURE SEAL

1. With the Inlet Manifold on blocks and with the **crankcase side down,** insert screwdriver into seal chamber and tap opposite sides of the Washer Spacer to drive out seal assembly.
   NOTE: Models 3535, 3531, 3537, 3545, 3541 include Spacer and Lo-Pressure Seal. Models 3520, 3521, 3527 include Washer, Lo-Pressure Seal, Inlet Adapter and O-Ring.
2. Elevate Inlet Adapter with **Lo-Pressure Seal down** and tap with screwdriver on opposite sides of seal to drive seal out of Inlet Adapter (Models 3520, 3521, 3527 only). Replace the Lo-Pressure Seal and examine O-Ring for wear and replace as needed.

REASSEMBLY OF THE LO-PRESSURE SEAL

NOTE: For certain applications apply liquid gasket to the o-ring crevices and seal surfaces. See Tech Bulletin #053 for model identification.

MODELS 3535, 3531, 3537

1. With the **crankcase side of Inlet Manifold up** insert the Spacer into the seal chamber.
2. Install Lo-Pressure Seal into seal chamber with **garter spring facing down** and press squarely into position.

MODELS 3520, 3521, 3527

1. With the **crankcase side of Inlet Manifold up** insert the Washer into the seal chamber.
2. Install Lo-Pressure Seal into larger diameter of Inlet Adapter **with spring up**.
3. Next lubricate outer surface of Adapter and install O-Ring into the groove of the Adapter.
4. Press **Inlet Adapter with seal** into seal chamber with **garter spring facing down**.

MODEL 3545, 3541

1. With the **crankcase side of the Inlet Manifold up** install Lo-Pressure Seal into the manifold chamber with **garter spring facing down** and press squarely into position.
   NOTE: Spacer is installed after the Seal Retainer on model 3545, 3541. See Servicing The Plungers.

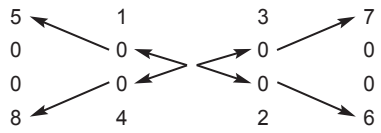
SERVICING THE PLUNGERS

DISASSEMBLY

1. Remove the Seal Retainers from the Ceramic Plungers.
2. Remove the inner collar from the front of the seal retainer.
3. Remove the used Wick and install new Wick. Lubrication: Oiler setting for Wicks is three drops per hole, twice per month for normal operation. Oiler adjustment is vertical to start feed, horizontal to stop feed, 45° to flush bearing. Additional lubrication may be required with increased hours of operation and temperature.
   NOTE: Model 3545, 3541 do not have Wicks or front Collar of Seal Retainer.
4. Replace Inner Collar on Seal Retainer.
5. Loosen Plunger Retainer 4 to 5 turns. Push Plunger towards Crankcase until Plunger Retainer pops out.
6. Unscrew and remove Plunger Retainer, Gasket, O-Ring, Back-up-Ring and Ceramic Plunger, Keyhole Washer and Barrier Slinger from the Plunger Rod.

REASSEMBLY

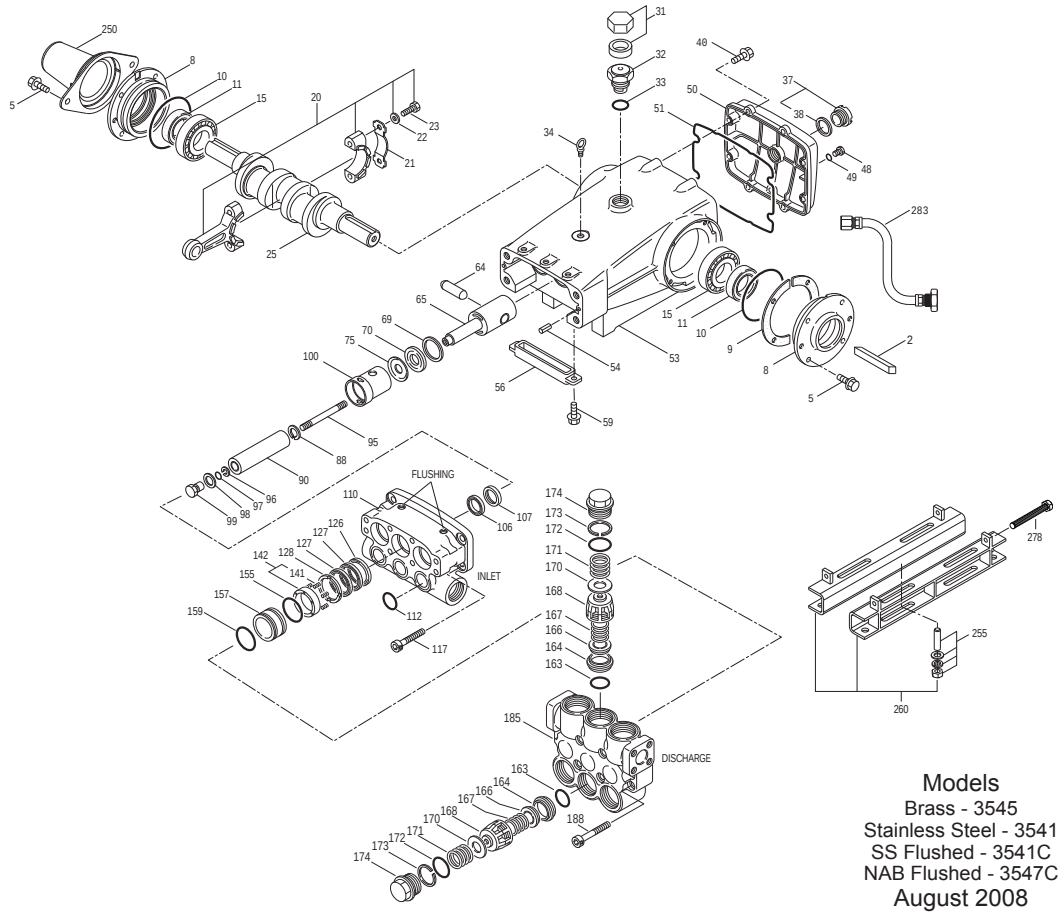
1. With these plunger items removed, examine the Crankcase Oil Seal for wear or deterioration and replace as needed.
2. Replace Keyhole Washer on Plunger Rod.
3. Carefully examine each Plunger for scoring or cracks and replace if worn.
   NOTE: Ceramic Plunger can only be installed one direction **(front to back)**. Do not force onto rod.
4. Examine Gasket, O-Ring and Back-up-Ring on Plunger Retainer and replace if cut or worn. Lubricate O-Ring for ease of installation and to avoid damaging O-Rings. NOTE: First install Gasket, then O-Ring and Back-up-Ring.
5. Apply loctite 242 to the threads of the Plunger Retainer and thread Plunger Retainer onto Plunger Rod. Torque per specifications.
6. Slip Seal Retainers over Plungers. NOTE: On Model 3545, 3541 install Spacer over end of Seal Retainer. Insert smaller diameter first. Line up Wicks with the oil holes in the Crankcase and tabs in the Oil Pan (3520, 3521, 3527, 3535, 3531, 3537).
7. Rotate shaft and line up two outside Plungers.
8. Lubricate the Plungers.
9. Carefully replace Inlet Manifold onto Plungers and press into Crankcase. Keep manifold aligned to avoid damaging Plungers.
10. Replace four (4) hex socket head screws and torque per chart.
11. Examine inlet port o-rings at bottom of manifold and replace if cut or worn.
12. Lubricate outer surface of V-Packing Spacer, O-Rings and valve chamber walls and carefully slip Discharge Manifold over V-Packing Spacer.
13. Hand tighten the two (2) hex socket head screws first. Then hand tighten the remaining six (6) hex socket head screws. Torque per chart and in this sequence.



PARTS LIST (3541)

ITEM	PART NUMBER						DESCRIPTION	QTY
	3545	**MATL**	**3541**	**MATL**	**3547C**	**MATL**		
2	*34021*	*STL*	*34021*	*STL*	*34021*	*STL*	*Key (M10x8x70)*	*1*
5	125753	S	125753	S	125753	S	Screw, HHC Sems (M8x25)	8
8	44542	AL	44542	AL	44542	AL	Cover, Bearing	2
9	815279	FBR	815279	FBR	815279	FBR	Shim, Split 2-PC	4
10	12398	NBR	12398	NBR	12398	NBR	O-Ring, Bearing Cover - 70D	2
11	13296	NBR	13296	NBR	13296	NBR	Seal, Oil, Crankshaft	2
15	29326	STL	29326	STL	29326	STL	Bearing, Roller	2
20	121467	TNM	121467	TNM	121467	TNM	Rod, Connecting Assembly (Inclds: 21, 22, 23) [10/00]	3
21	126749	STCP R	126749	STCP R	126749	STCP R	Washer, Locking (M10)	6
22	126574	STCP R	126574	STCP R	126574	STCP R	Washer, Flat (M10) — Replace as a set	6
23	122045	STZP	122045	STZP	122045	STZP	Screw, HH (M10x55) — Replace as a set	3
25	29325	FCM	29325	FCM	29325	FCM	Crankshaft, Dual End	1
31	828710	—	828710	—	828710	—	Protector, Cap w/Foam Gasket	1
32	43211	ABS	43211	ABS	43211	ABS	Cap, Oil Filler	1
33	14177	NBR	14177	NBR	14177	NBR	O-Ring, Oil Filler Cap - 70D	1
34	126743	STCP R	126743	STCP R	126743	STCP R	Bolt, Eye (M12x1.75) (For Lifting Pump Only)	1
37	92241	—	92241	—	92241	—	Gauge, Oil, Bubble w/Gasket	1
38	44428	NBR	44428	NBR	44428	NBR	Gasket, Flat, Oil Gauge - 80D	1
40	125753	S	125753	S	125753	S	Screw, HHC Sems (M8x25)	8
48	25625	STCP	25625	STCP	25625	STCP	Plug, Drain (1/4"x19 BSP)	1
49	23170	NBR	23170	NBR	23170	NBR	O-Ring, Drain Plug - 70D	1
50	45936	AL	45936	AL	45936	AL	Cover, Rear	1
51	16612	NBR	16612	NBR	16612	NBR	O-Ring, Crankcase Cover - 70D	1
53	44487	AL	44487	AL	44487	AL	Crankcase Assy (Inclds: 34, 54)	1
54	27488	S	27488	S	27488	S	Pin, Guide	2
56	27790	POP	27790	POP	27790	POP	Pan, Oil	1
59	92538	S	92538	S	92538	S	Screw, HHC Sems (M6x16)	2
64	43864	CM	43864	CM	43864	CM	Pin, Crosshead	3
65	† 45116	SSZZ	† 45116	SSZZ	† 45116	SSZZ	Rod, Plunger	3
69	126587	STCP R	126587	STCP R	126587	STCP R	Washer, Oil Seal	3
70	100488	NBRS	100488	NBRS	100488	NBRS	Seal, Oil, Crankcase	3
	44739	*FPM*	*44739*	*FPM*	*44739*	*FPM*	*Seal, Oil, Crankcase*	*3*
75	43865	S	43865	S	43865	S	Slinger, Barrier	3
88	45676	S	45676	S	45676	S	Washer, Keyhole (M16)	3
90	46806	CC	46806	CC	46806	CC	Plunger (M45x145)	3
95	† 89778	SS	† 89778	SS	† 89778	SS	Stud, Plunger Retainer (M10x135)	3
96	20189	PTFE	20189	PTFE	20189	PTFE	Back-up-Ring, Plunger Retainer	3
97	11345	NBR	11345	NBR	11345	NBR	O-Ring, Plunger Retainer - 70D	3
	11375	*FPM*	*11375*	*FPM*	*11375*	*FPM*	*O-Ring, Plunger Retainer*	*3*
	◆ *701490*	*EPDM*	◆ *701490*	*EPDM*	◆ *701490*	*EPDM*	*O-Ring, Plunger Retainer*	*3*
98	44085	SS	44085	SS	44085	SS	Gasket, Retainer	3
99	† 44084	SS	† 44084	SS	† 44084	SS	Retainer, Plunger (M10)	3
100	44119	PPG	44119	PPG	44119	PPG	Retainer, Seal	3
106	**46809**	**NBR**	—	—	—	—	Seal, LPS w/S-Spg	3
	—	—	**48384**	**NBR**	**48384**	**NBR**	Seal, LPS w/SS-Spg	3
	702013	*SFTB**	*702013*	*SFTB**	*702013*	*SFTB**	*Seal, LPS w/SS-Spg*	*3*
	◆ *46945*	*EPDM*	◆ *46945*	*EPDM*	◆ *46945*	*EPDM*	*Seal, LPS w/SS-Spg*	*3*
107	**46811**	**BB**	**48380**	**D**	**48380**	**D**	Spacer, LPS	3
110	**49482**	**BBCP R**	**48375**	**SS**	—	—	Manifold, Inlet	1
	—	—	***49304***	***SS***	***49308***	***NAB***	*Manifold, Inlet, Flushed (1/4" Flush Port)*	*1*
112	18688	NBR	18688	NBR	18688	NBR	O-Ring, Inlet Manifold - 70D	3
	11739	*FPM*	*11739*	*FPM*	*11739*	*FPM*	*O-Ring, Inlet Manifold*	*3*
	◆ *701659*	*EPDM*	◆ *701659*	*EPDM*	◆ *701659*	*EPDM*	*O-Ring, Inlet Manifold - 70D*	*3*
117	44585	S	44585	S	44585	S	Screw, HSH (M14x40)	4
126	**46812**	**BB**	**48383**	**D**	**48383**	**D**	Adapter, Female	3
127	46813	STG*	46813	STG*	46813	STG*	V-Packing	6
128	**46814**	**BB**	**48386**	**SS**	**49319**	**NAB**	Adapter, Male	3
141	45113	SS	45113	SS	45113	SS	Spring, Coil	6/18
142	**46824**	**BB**	**48382**	**SS**	**48382**	**SS**	Spacer w/Coil Springs	3
155	17784	NBR	17784	NBR	17784	NBR	O-Ring, V-Packing Spacer - 80D	3
	20138	*FPM*	*20138*	*FPM*	*20138*	*FPM*	*O-Ring, V-Packing Spacer - 80D*	*3*
	◆ *701658*	*EPDM*	◆ *701658*	*EPDM*	◆ *701658*	*EPDM*	*O-Ring, V-Packing Spacer - 80D*	*3*
157	**46816**	**BB**	**48381**	**SS**	**49334**	**NAB**	Spacer, V-Packing	3
159	17784	NBR	17784	NBR	17784	NBR	O-Ring, V-Packing Spacer - 80D	3
	20138	*FPM*	*20138*	*FPM*	*20138*	*FPM*	*O-Ring, V-Packing Spacer - 80D*	*3*
	◆ *701658*	*EDPM*	◆ *701658*	*EDPM*	◆ *701658*	*EDPM*	*O-Ring, V-Packing Spacer - 80D*	*3*
163	26143	NBR	26143	NBR	26143	NBR	O-Ring, Seat	6
	14331	*FPM*	*14331*	*FPM*	*14331*	*FPM*	*O-Ring, Seat - 70D*	*6*
	◆ *701660*	*EPDM*	◆ *701660*	*EPDM*	◆ *701660*	*EPDM*	*O-Ring, Seat*	*6*
164	**46822**	**S**	**48393**	**SS**	**48393**	**SS**	Seat	6
166	**43932**	**S**	**44108**	**SS**	**44108**	**SS**	Valve	6
167	44109	SS	44109	SS	44109	SS	Spring, Valve	6
168	44728	PVDF	44728	PVDF	44728	PVDF	Retainer, Spring	6
170	44729	SS	44729	SS	44729	SS	Washer, Spring Retainer	6
171	44644	SS	44644	SS	44644	SS	Coil Spring (70kg), Valve Plug	6
172	89827	NBR	89827	NBR	89827	NBR	O-Ring, Valve Plug - 90D	6
	11747	*FPM*	*11747*	*FPM*	*11747*	*FPM*	*O-Ring, Valve Plug - 90D*	*6*
	◆ *701494*	*EPDM*	◆ *701494*	*EPDM*	◆ *701494*	*EPDM*	*O-Ring, Valve Plug - 70D*	*6*
173	48364	D	48364	D	48364	D	Back-up-Ring, Valve Plug	6
174	**46444**	**FBB**	**49300**	**SSD**	**49300**	**SSD**	Plug, Valve	6
185	**46820**	**BBCP**	**49302**	**SSD**	**49309**	**NAB**	Manifold, Discharge	1
188	89981	S	89981	S	89981	S	Screw, HSH (M12x70)	8
250	44516	NY	44516	NY	44516	NY	Protector, Shaft w/2 Screws, Washers, Lockwashers	1
255	*34018*	*STCP R*	*34018*	*STCP R*	*34018*	*STCP R*	*Kit, Direct Mount*	*1*
	34039	*SS*	*34039*	*SS*	*34039*	*SS*	*Kit, Direct Mount*	*1*

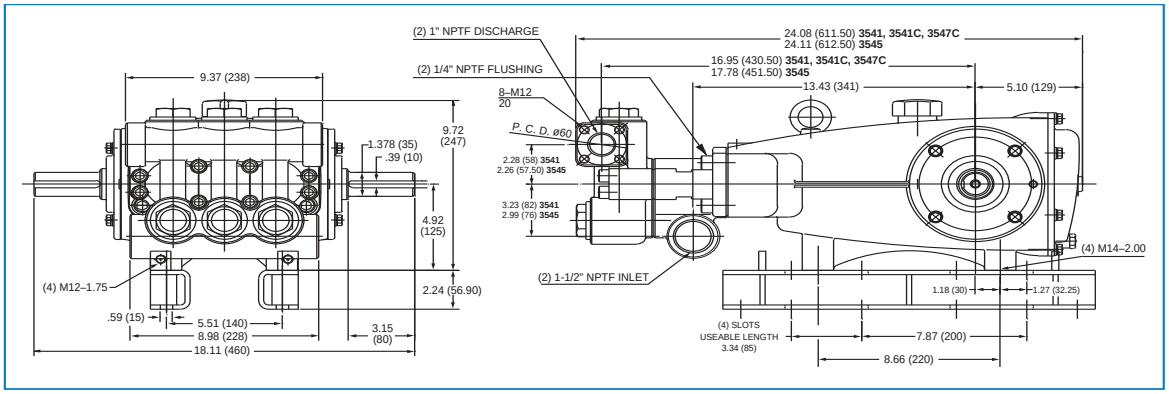
EXPLODED VIEW (3541)



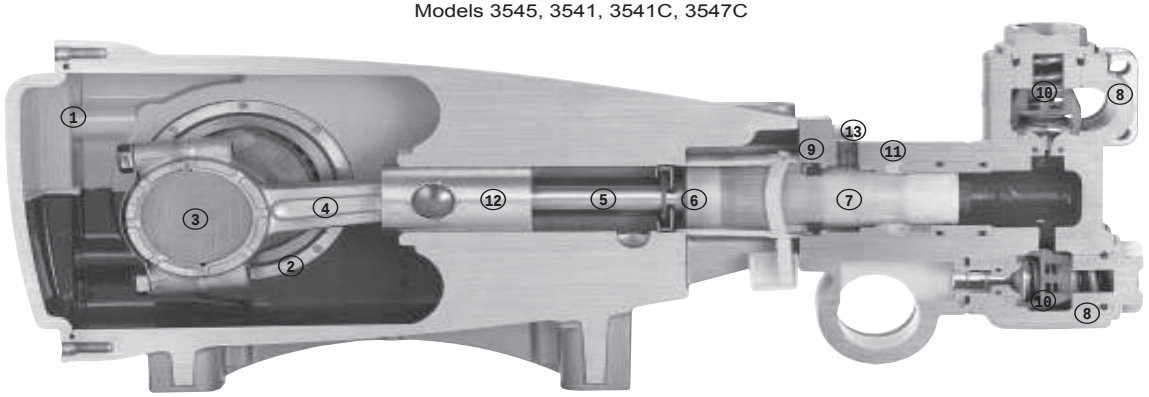
Models
Brass - 3545
Stainless Steel - 3541
SS Flushed - 3541C
NAB Flushed - 3547C
August 2008

	3545	MATL	3541	MATL	3547C	MATL		
260	*92674*	*STZP*	*92674*	*STZP*	*92674*	*STZP*	*Mounting, Box Assy (Incldes 34018)*	*1*
275	*990013*	*STL*	*990013*	*STL*	*990013*	*STL*	*Hub, 'B' 35mm w/Keyway* ***[See Drive Packages Tech Bulletin 003]***	*1*
278	*80540*	*ZP*	*80540*	*ZP*	*80540*	*ZP*	*Screw, HH (M12x100) (Rail Adjusting Screw)*	*1*
283	*34314*	—	*34314*	—	*34314*	—	*Kit, Oil Drain (3/8" x 48")*	*1*
290	*6124*	—	*6124*	—	*6124*	—	*Gasket, Liquid (3 oz.)*	*1*
299	***814834***	***BBCP***	***818371***	***SS***	—	—	*Head, Complete*	*1*
300	***33234***	***NBR****	***33834***	***NBR****	***33834***	***NBR****	*Kit, Seal (Incldes: 97, 106, 112, 127, 155, 159)*	*1*
	31261	*FPM*	*31261*	*FPM*	*31261*	*FPM*	*Kit, Seal (Incldes: 97, 106, 112, 127, 155, 159)*	*1*
	◆ *33223*	*EPDM**	◆ *33223*	*EPDM**	◆ *33223*	*EPDM**	*Kit, Seal (Incldes: 97, 106, 112, 127, 155, 159)*	*1*
310	***33235***	***NBR***	***33835***	***NBR***	***33835***	***NBR***	*Kit, Valve (Incldes: 163, 164, 166, 167, 168, 170, 172, 173)*	*2*
	31262	*FPM*	*31262*	*FPM*	*31262*	*FPM*	*Kit, Valve (Incldes: 163, 164, 166, 167, 168, 170, 172, 173)*	*2*
	◆ ***31235***	***EPDM***	◆ ***31264***	***EPDM***	◆ ***31264***	***EPDM***	*Kit, Valve (Incldes: 163, 164, 166, 167, 168, 170, 172, 173)*	*2*
—	*819000*	*F*	*819000*	*F*	*819000*	*F*	*Assy, Crankcase, Cast Iron Conversion*	*1*
390	*714500*	*SS*	*714500*	*SS*	*714500*	*SS*	*C.A.T. (Inlet pressure stabilizer or RO and boosted inlet applications)*	*1*
391	*714506*	*SS*	*714506*	*SS*	*714506*	*SS*	*Adapter, (2 per C.A.T.) (See Data Sheet for complete selection)*	*2*
392	*701828*	*SS*	*701828*	*SS*	*701828*	*SS*	*Elbow Assy used with Adapter Assy 714506*	*1*
—	*6575*	—	*6575*	—	*6575*	—	*Plunger Pump Service DVD*	*1*
—	*6100*	—	*6100*	—	*6100*	—	*Oil, Case (12 Bottles) ISO-68 Hydraulic (Fill to specified crankcase capacity prior to start-up)*	*1*
—	—	—	*6119*	—	*6119*	—	*Lubricant, Antisieze (1 oz.)*	*1*

Bold print part numbers are unique to a particular pump model. *Italics are optional items.* [ ]Date of latest production change. ◆ Silicone oil/grease required.
* Review material codes for individual items (STG and SFTB generally may be used as alternates). † Production parts are different than repair parts.
R Components comply with RoHS Directive. See Tech Bulletins 002, 003, 024, 036, 041, 043, 053, 074, 077, 083 , 099, 105 and 107 for additional information.
Pressurized Inlet and C.A.T. highly recommended for Hi-Temp, R.O. and industrial applications.
MATERIAL CODES (Not Part of Part Number): ABS=ABS Plastic AL=Aluminum BB=Brass BBCP=Brass/Chrome Plated CC=Ceramic CM-Chrome-Moly D=Acetal
EPDM=Ethylene Propylene Diene Monamer F=Cast Iron FBB=Forged Brass FBR=Fiber FCM=Forged Chrome-moly FPM=Fluorocarbon
NBR=Medium Nitrile (Buna-N) NBRS=Buna, Silicone Free NY=Nylon PPG=Glass Filled Polypropylene PTFE=Pure Polytetrafluoroethylene PVDF=Polyvinylidene Fluoride
S=304SS SS=316SS SFTB=Special Blend PTFE Black SSNP=316SS/Nickel Plated SSZZ=316SS/Zamak STG=Special Blend PTFE White STL=Steel
STCP=Steel/Chrome Plated STZP=Steel/Zinc Plated TNM=Special High Strength ZP=Zinc Plated



Models 3545, 3541, 3541C, 3547C



1 Die cast aluminum **crankcase** means high strength, lightweight, and excellent tolerance control.

2 Oversized crankshaft **bearings** provide extended bearing life and pump performance.

3 Chrome-moly **crankshaft** provides unmatched strength and surface hardness for long life.

4 Matched oversized TNM **connecting rods** noted for superior tensile strength and bearing quality.

5 Special stainless steel high strength **plunger rods** for high load bearing and longevity.

6 The stainless steel **slinge**r provides back-up protection for the crankcase seal, keeping pumped liquids out of the crankcase.

7 Special concentric, high-density, polished, solid ceramic **plungers** provide a true wear surface and extended seal life.

8 **Manifolds** are a high tensile strength forged brass, 316 stainless steel, duplex stainless steel or nickel aluminum bronze for long term, continuous duty.

9 100% wet **seal** design adds to service life by allowing pumped liquids to cool and lubricate on both sides.

10 Stainless steel **valves, seats and springs** provide corrosion-resistance, ultimate seating and extended life.

11 Specially formulated, CAT PUMP exclusive, **V-Packings** offer unmatched performance and seal life.

12 **Crossheads** are 360˚ supported for uncompromising alignment.

13 Special **Flushed Inlet Manifold** permits external flush for added cooling with high temperature liquids and lubrication with low lubricity liquids.

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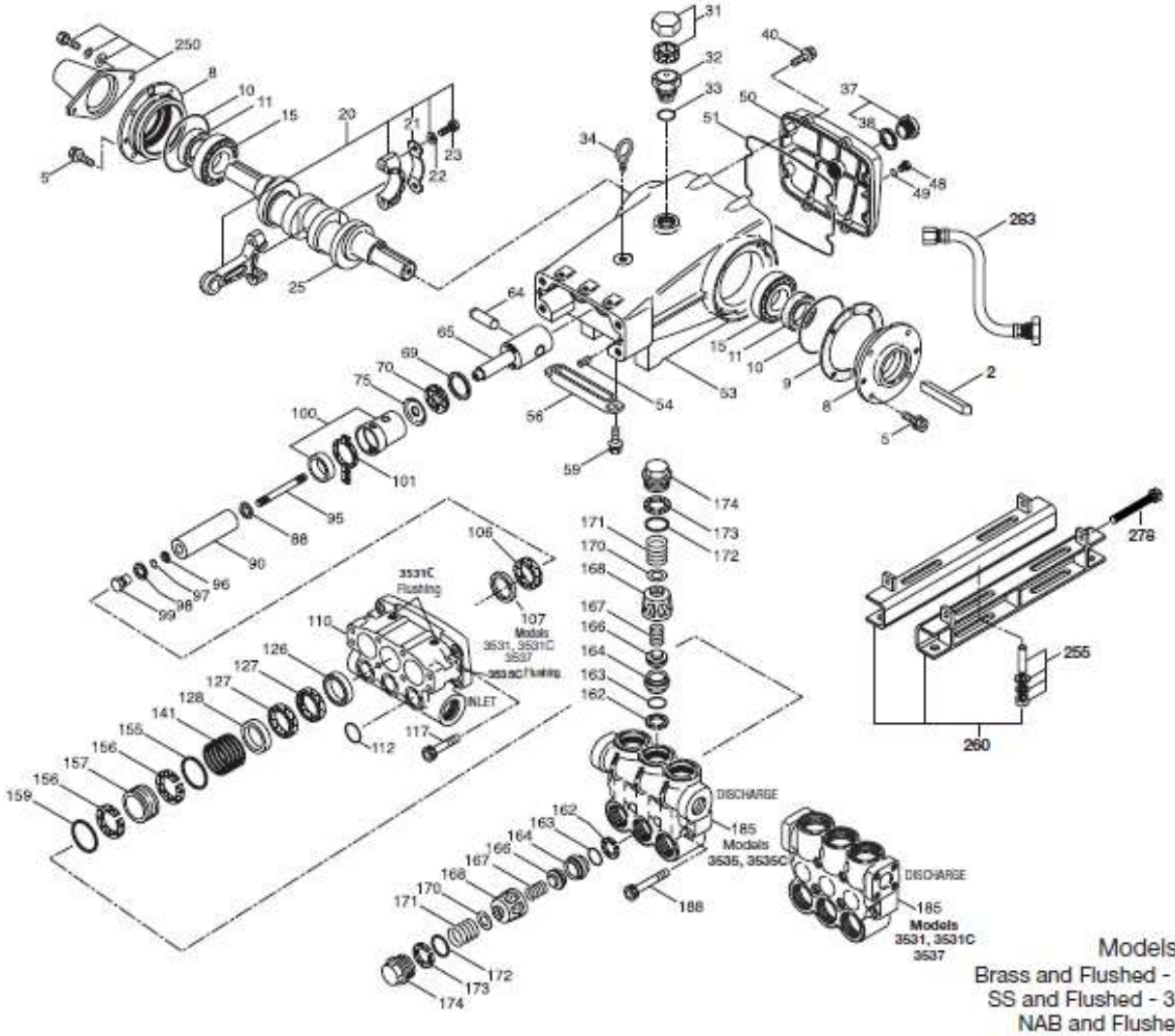
PARTS LIST (3531)

ITEM	PART NUMBER						DESCRIPTION	QTY
	3535		3531					
	3535C	MATL	3531C	MATL	3537	MATL		
2	34021	STL	34021	STL	34021	STL	Key (M10x8x70)	1
5	125753	S	125753	S	125753	S	Screw, HHC Sems (M8x25)	8
8	44542	AL	44542	AL	44542	AL	Cover, Bearing	2
9	815279	FBR	815279	FBR	815279	FBR	Shim, Split 2-Pc	4
10	12398	NBR	12398	NBR	12398	NBR	O-Ring, Bearing Cover - 70D	2
11	13296	NBR	13296	NBR	13296	NBR	Seal, Oil, Crankshaft	2
15	29326	STL	29326	STL	29326	STL	Bearing, Roller	2
20	121467	TNM	121467	TNM	121467	TNM	Rod, Connecting Assy (Inclds: 21,22,23) [10/00]	3
21	126749	STCP R	126749	STCP R	126749	STCP R	Locking Washer (M10)	3
22	126574	STZP R	126574	STZP R	126574	STZP R	Washer, Flat (M10)	6
23	122045	STZP	122045	STZP	122045	STZP	Screw, HH (M10x55)	6
25	29325	FCM	29325	FCM	29325	FCM	Crankshaft, Dual End	1
31	828710	—	828710	—	828710	—	Protector, Oil Cap w/Foam Gasket	1
32	43211	ABS	43211	ABS	43211	ABS	Cap, Oil Filler	1
33	14177	NBR	14177	NBR	14177	NBR	O-Ring, Oil Filler Cap - 70D	1
34	126743	STCP R	126743	STCP R	126743	STCP R	Bolt, Eye (M12x1.75) (For Lifting Pump Only)	1
37	92241	—	92241	—	92241	—	Gauge, Oil, Bubble w/Gasket	1
38	44428	NBR	44428	NBR	44428	NBR	Gasket, Flat, Oil Gauge - 80D	1
40	125753	S	125753	S	125753	S	Screw, HHC Sems (M8x25)	8
48	25625	STCP	25625	STCP	25625	STCP	Plug, Drain (1/4"x19BSP)	1
49	23170	NBR	23170	NBR	23170	NBR	O-Ring, Drain Plug - 70D	1
50	45936	AL	45936	AL	45936	AL	Cover, Rear	1
51	16612	NBR	16612	NBR	16612	NBR	O-Ring, Crankcase Cover - 70D	1
53	44487	AL	44487	AL	44487	AL	Crankcase Assy (Inclds: 34, 54)	1
54	27488	S	27488	S	27488	S	Pins, Guide	2
56	27790	POP	27790	POP	27790	POP	Pan, Oil	1
59	92538	S	92538	S	92538	S	Screw, HHC Sems (M6x16)	2
64	43864	CM	43864	CM	43864	CM	Pin, Crosshead	3
65	† 45116	SSZZ	45116	SSZZ	45116	SSZZ	Rod, Plunger	3
69	126587	STCP R	126587	STCP R	126587	STCP R	Washer, Oil Seal	3
70	100488	NBRS	100488	NBRS	100488	NBRS	Seal, Oil, Crankcase	3
	44739	FPM	44739	FPM	44739	FPM	Seal, Oil, Crankcase	3
75	43865	S	43865	S	43865	S	Slinger, Barrier	3
88	45676	S	45676	S	45676	S	Washer, Keyhole (M16)	3
90	43921	CC	43921	CC	43921	CC	Plunger (M40x145)	3
95	† 89778	SS	89778	SS	89778	SS	Stud, Plunger Retainer (M10x135)	3
96	20189	PTFE	20189	PTFE	20189	PTFE	Back-up-Ring, Plunger Retainer	3
97	11345	NBR	11345	NBR	11345	NBR	O-Ring, Plunger Retainer - 70D	3
	11375	FPM	11375	FPM	11375	FPM	O-Ring, Plunger Retainer	3
	◆ 701490	EPDM	◆ 701490	EPDM	◆ 701490	EPDM	O-Ring, Plunger Retainer	3
98	44085	SS	44085	SS	44085	SS	Gasket, Retainer	3
99	† 44084	SS	44084	SS	44084	SS	Retainer, Plunger (M10)	3
100	814279	PVDF	814279	PVDF	814279	PVDF	Retainer, Seal, 2 Pc. (See Tech Bulletin 105)	3
101	44112	—	44112	—	44112	—	Wick, Long Tab	3
106	† 44113	NBR	44113	NBR	44113	NBR	Seal, LPS w/SS-Spg	3
	44740	FPM	44740	FPM	44740	FPM	Seal, LPS w/SS-Spg	3
	◆ 46955	EPDM	◆ 46955	EPDM	◆ 46955	EPDM	Seal, LPS w/S-Spg	3
107	—	—	**45381**	**SS**	**44115**	**NAB**	Spacer, Lo-Pressure Seal	3
110	**49464**	**BBCP R**	**45365**	**SS**	**45124**	**NAB**	Manifold, Inlet	1
	49464C	**BBCP R**	**125397**	**SS**	—	—	Manifold, Inlet, Flushed (1/4" Flush Ports)	1
112	11379	NBR	11379	NBR	11379	NBR	O-Ring, Inlet Manifold - 70D	3
	14183	FPM	14183	FPM	14183	FPM	O-Ring, Inlet Manifold	3
	◆ 701491	EPDM	◆ 701491	EPDM	◆ 701491	EPDM	O-Ring, Inlet Manifold - 70D	3
117	44585	S	44585	S	44585	S	Screw, HSH (M14x40)	4
126	**46494**	**BB**	**48391**	**D**	**48391**	**D**	Adapter, Female (See Tech Bulletin 087)	3
	—	—	**45367**	**SS**	**45367**	**SS**	Adapter Female	3
127	44609	STG*	44609	STG*	44609	STG*	V-Packing	6
	44741	SFG	44741	SFG	44741	SFG	V-Packing	6
128	**43928**	**BB**	**45368**	**SS**	**45368**	**SS**	Adapter, Male	3
141	49519	SS	49519	SS	49519	SS	Spring, Large Coil (See Tech Bulletin 108)	3
155	48860	NBR	48860	NBR	48860	NBR	O-Ring, V-Packing Spacer - 90D	3
	20137	FPM	20137	FPM	20137	FPM	O-Ring, V-Packing Spacer - 70D	3
	◆ 701492	EPDM	◆ 701492	EPDM	◆ 701492	EPDM	O-Ring, V-Packing Spacer	3
156	48362	D	48362	D	48362	D	Back-up-Ring, V-Packing Spacer	3
157	**49478**	**BB**	**49520**	**SS**	**49521**	**NAB**	Spacer, V-Packing (See Tech Bulletin 108)	3
158	48362	D	48362	D	48362	D	Back-up-Ring, V-Packing Spacer	3
159	48860	NBR	48860	NBR	48860	NBR	O-Ring, V-Packing Spacer - 90D	3
	20137	FPM	20137	FPM	20137	FPM	O-Ring, V-Packing Spacer - 70D	3
	◆ 701492	EPDM	◆ 701492	EPDM	◆ 701492	EPDM	O-Ring, V-Packing Spacer	3
162	48363	D	48363	D	48363	D	Back-up-Ring, Valve Seat	6
163	26142	NBR	26142	NBR	26142	NBR	O-Ring, Seat - 80D	6
	14330	FPM	14330	FPM	14330	FPM	O-Ring, Seat	6
	◆ 701493	EPDM	◆ 701493	EPDM	◆ 701493	EPDM	O-Ring, Seat	6
164	**44727**	**S**	**44612**	**SS**	**44612**	**SS**	Seat, Stepped	6
166	**43932**	**S**	**44108**	**SS**	**44108**	**SS**	Valve	6
167	44109	SS	44109	SS	44109	SS	Spring	6
168	44728	PVDF	44728	PVDF	44728	PVDF	Retainer, Spring	6
170	44729	SS	44729	SS	44729	SS	Washer, Spring Retainer	6
171	44644	SS	44644	SS	44644	SS	Coil Spring (70kg), Valve Plug	6
172	89827	NBR	89827	NBR	89827	NBR	O-Ring, Valve Plug - 90D	6
	11747	FPM	11747	FPM	11747	FPM	O-Ring, Valve Plug - 90D	6
	◆ 701494	EPDM	◆ 701494	EPDM	◆ 701494	EPDM	O-Ring, Valve Plug - 70D	6
173	48364	D	48364	D	48364	D	Back-up-Ring, Valve Plug	6
174	**46444**	**FBB**	**49300**	**SSD**	**44643**	**NAB**	Plug, Valve	6
185	**49465**	**BBCP R**	**49299**	**SSD**	**76335**	**NAB**	Manifold, Discharge (See Tech Bulletin 099 and 109)	1
188	89981	S	89981	S	89981	S	Screw, HSH (M12x70)	8
250	44516	NY	44516	NY	44516	NY	Protector, Shaft w/2 Screws, Lockwashers and Washers (Included With Pump)	1



Models
Brass and Flushed - 3535, 3535C
SS and Flushed - 3531, 3531C
NAB and Flushed - 3537
March 2010

	3535 3535C	MATL	3531 3531C	MATL	3537	MATL		
255	*34018*	*STZP R*	*34018*	*STZP R*	*34018*	*STZP R*	*Kit, Direct Mount*	*1*
	34039	*S*	*34039*	*S*	*34039*	*S*	*Kit, Direct Mount*	*1*
260	*92674*	*STZP R*	*92674*	*STZP R*	*92674*	*STZP R*	*Mounting, Box Assy (Inclds: 34018)*	*1*
275	*990013*	*STL*	*990013*	*STL*	*990013*	*STL*	*Hub, 'B' 35mm w/Keyway (See Tech Bulletin 003)*	*1*
278	*80540*	*ZP*	*80540*	*ZP*	*80540*	*ZP*	*Screw, HH (M12x100) (Rail Adjusting Screw)*	*1*
279	*30278*	*STZP*	*30278*	*STZP*	*30278*	*STZP*	*Oiler (1 oz.)*	*3*
281	*30967*	*—*	*30967*	*—*	*30967*	*—*	*Glass, Oiler*	*3*
282	*10069*	*NBR*	*10069*	*NBR*	*10069*	*NBR*	*Gasket, Oiler*	*3*
283	*34314*	*—*	*34314*	*—*	*34314*	*—*	*Kit, Oil Drain (3/8" x 48")*	*1*
290	*6124*	*—*	*6124*	*—*	*6124*	*—*	*Gasket, Liquid (3 oz.)*	*1*
299	***818427***	***BBCP R***	***818372***	***SS***	***814522***	***NAB***	*Complete Head (Models 3535,3531,3537 Only)*	*1*
300	*31040*	*NBR**	*31040*	*NBR**	*31040*	*NBR**	*Kit, Seal (Inclds: 97,106,112,127,155,156,158,159)*	*1*
	33055	*FPM*	*33055*	*FPM*	*33055*	*FPM*	*Kit, Seal (Inclds: 97,106,112,127,155,156,158,159)*	*1*
	◆ *33262*	*EPDM**	◆ *33262*	*EPDM**	◆ *33262*	*EPDM**	*Kit, Seal (Inclds: 97,106,112,127,155,156,158,159)*	*1*
310	***34235***	***NBR***	***34017***	***NBR***	***34017***	***NBR***	*Kit, Valve, Preassembled (Inclds: 162,163,164,166,167,168,170,172,173)*	*2*
	31955	*FPM*	*31955*	*FPM*	*31955*	*FPM*	*Kit, Valve, Preassembled (Inclds: 162,163,164,166,167,168,170,172,173)*	*2*
	◆ *31952*	*EPDM*	◆ *31952*	*EPDM*	◆ *31952*	*EPDM*	*Kit, Valve, Preassembled (Inclds: 162,163,164,166,167,168,170,172,173)*	*2*
—	*819000*	*F*	*819000*	*F*	*819000*	*F*	*Assy, Crankcase, Cast Iron Conversion*	*1*
390	*714500*	*SS*	*714500*	*SS*	*714500*	*SS*	*C.A.T. (Inlet pressure stabilizer for RO and boosted inlet applications)*	*1*
391	*714506*	*SS*	*714506*	*SS*	*714506*	*SS*	*Adapter (2 per C.A.T.) (See Data Sheet for complete selection)*	*2*
392	*701828*	*SS*	*701828*	*SS*	*701828*	*SS*	*Elbow Assy used with Adapter Assy 714506*	*1*
—	*6575*	*—*	*6575*	*—*	*6575*	*—*	*Plunger Pump Service DVD*	*1*
—	*6100*	*—*	*6100*	*—*	*6100*	*—*	*Oil, Case (12 Bottles) ISO -68 Hydraulic (Fill to specified crankcase capacity prior to start-up)*	*1*
—	*—*	*—*	*6119*	*—*	*—*	*—*	*Lubricant, Antiseize (1oz) (See Tech Bulletin 095)*	*1*

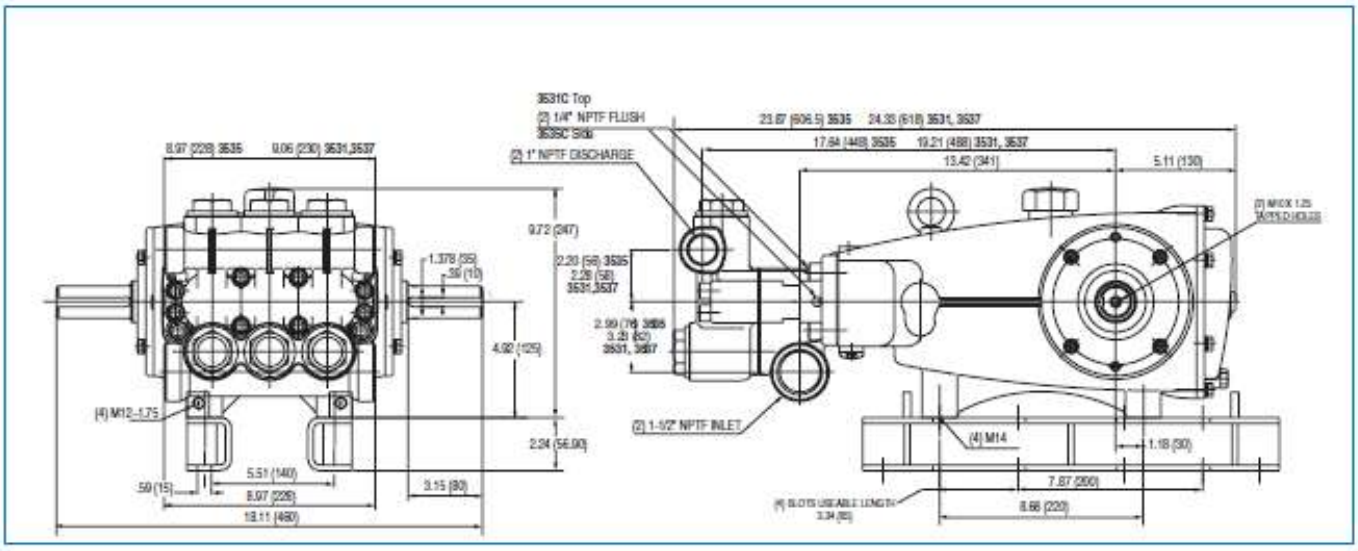
Bold print part numbers are unique to a particular pump model. *Italics are optional items.* [ ] Date of latest production change.

◆ Silicone oil/grease required. †Production parts differnt from service parts.* Review individual parts in each kit for material identification. R Components comply with RoHS Directive

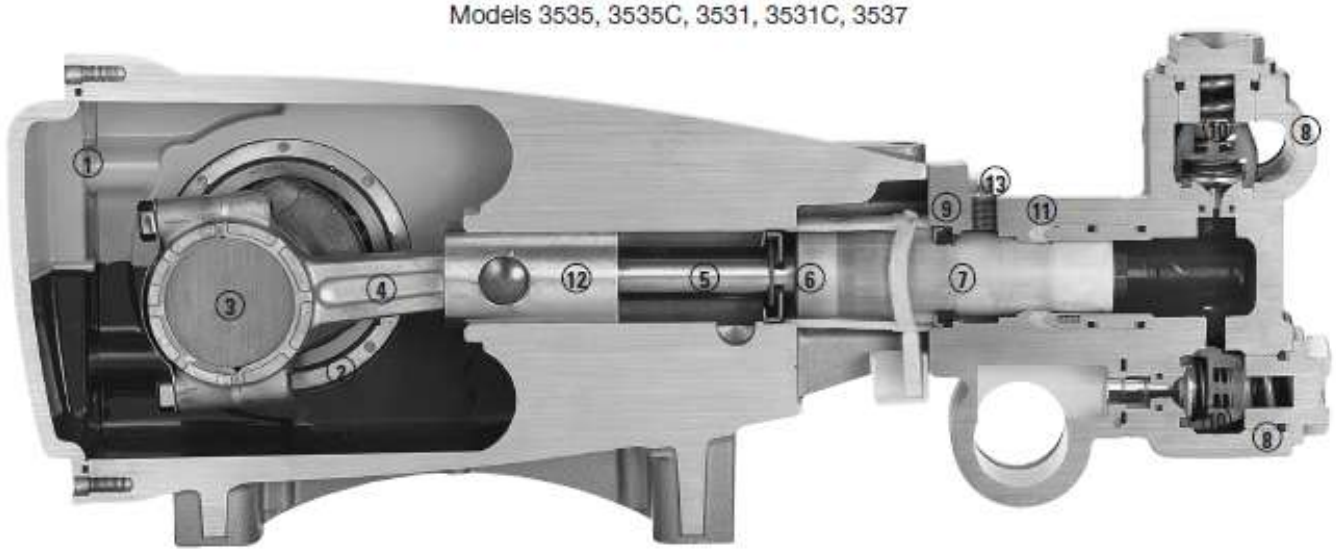
.C.A.T. highly recommended for pressurized inlet, R.O. and Industrial applications.

View Tech Bulletins 03, 024, 035, 036, 040, 041, 043, 050, 052, 053, 066, 074, 077, 083, 095, 099, 105, 106 and 109 for additional information.

MATERIAL CODES (Not Part of Part Number): ABS=ABS Plastic AL=Aluminum BB=Brass BBCP=Brass/Chrome Plated CC=Ceramic CM=Chrome-Moly D=Acetal EPDM=Ethylene Propylene Diene Monomer F=Cast Iron FBB=Forged Brass FBR=Fiber FCM=Forged Chrome-moly FPM=Fluorocarbon NAB=Nickel Aluminum Bronze NBR=Medium Nitrile (Buna-N) NBRS=Buna, Silicone Free NY=Nylon POP=Polypropylene PTFE=Pure Polytetrafluoroethylene PVDF=Polyvinylidene Fluoride S=304SS SS=316SS SSD=Duplex Stainless Steel SSL=316/Low Carbon SSZZ=316SS/Zamak STCP=Steel/Chrome Plated SFG=Special Blend (FPM) STG=Special Blend (PTFE) White STL=Steel STZP=Steel/Zinc Plated TNM=Special High Strength ZP=Zinc Plated



Models 3535, 3535C, 3531, 3531C, 3537



1 Die cast aluminum **crankcase** means high strength, lightweight, and excellent tolerance control.

2 Oversized crankshaft **bearings** provide extended bearing life and pump performance.

3 Chrome-moly **crankshaft** provides unmatched strength and surface hardness for long life.

4 Matched oversized TNM **connecting rods** noted for superior tensile strength and bearing quality.

5 Special stainless steel **plunger rods** with high strength crossheads for longevity and corrosion resistance.

6 The stainless steel **slinger** provides back-up protection for the crankcase seal, keeping pumped liquids out of the crankcase.

7 Special concentric, high-density, polished, solid ceramic **plungers** provide a true wear surface and extended seal life.

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High Pressure Pump Troubleshooting

WARNING

Turn off the p wer supply before performing any diagnosis and maintenance operations.

Do not run pump without water.

PROBLEM	PROBABLE CAUSES	POSSIBLE REMEDIES
Low Pressure	Worn nozzle	Replace nozzle of proper size.
	Air leak in inlet plumbing	Disassemble, reseal, and reassemble.
	Fouled or dirty inlet or discharge valves	Clean inlet and discharge valve assemblies.
	Worn inlet or discharge valves	Replace worn valves, valve seats and/or discharge hose.
Pump runs extremely rough, pressure low	Restricted inlet or air entering the inlet plumbing	Proper size inlet plumbing; check for air tight seal.
	Stuck or worn inlet or discharge valves	Clean out foreign material, replace worn valves.
	Leaking V-Packings	Repair with Seal Kit.
Water leakage from under the manifold	Worn or damaged Lo-Pressure seals	Repair with Seal Kit.
	Worn male and female adapter	Install new male and female adapter. Lubricate and replace O-rings in seal area.
Oil leak between crankcase and pumping section	Worn crankcase oil seals	Replace crankcase oil seals and change oil in crankcase.
Oil leaking in the area of crankshaft	Worn or improperly installed crankshaft or cut or worn o-ring on bearing case	Replace damaged O-ring and/or oil seals.
	Bad bearing	Replace bearing.
Water in crankcase	Humid air condensing into water inside the crankcase	Change oil every 3 months or 500 hour intervals using special CAT PUMPS Premium Grade Oil.
	Worn and leaking Lo-Pressure Seals and V-Packing. Operating beyond normal service cycle	Repair with Seal Kit. Initiate more frequent service cycle.
	Leaking crankcase seals or seals installed backward	Replace seals. Follow proper installation procedure. Contact service centre for crankcase servicing.

PROBLEM	PROBABLE CAUSES	POSSIBLE REMEDIES
Oil leaking from under-side of crankcase	Worn crankcase oil seals	Replace seals.
Oil leakage from drain plug	Loose drain plug or worn drain plug o-ring	Tighten drain plug or replace O-ring.
Loud knocking noise in pump	Broken or worn bearing	Replace bearing.
Frequent or prema-ture failure of the packing	Scored plungers	Replace plungers.
	Excessive inlet pressure	Reduce inlet pressure to specific tions.
	Abrasive material in the liquid being pumped	Check fil ers on pump inlet plumbing.
	Running pump dry	DO NOT RUN PUMP WITHOUT WATER.
Strong surging at the inlet and low pres-sure on the discharge side	Foreign particles in the inlet or discharge valve or worn inlet and/or discharge valves	Check for smooth lap surfaces on inlet and discharge valve seats. Discharge valve seats and inlet valve seats may be lapped on a very fine oil stone. Maintain good inlet fil er.

9.1.4 Sand Filter Maintenance

The Sand Filter requires backwashing once a week. The backwash has to be performed with clean seawater.
In general the Sand Filter requires to be backwashed when:

- Whenever the outlet pressure gauge reading is 0.8 bar lower than the initial "Start up" pressure.
- The high pressure pump makes a strange noise.
- The system starts up, but shuts down after few seconds.
- The operating pressure does not stabilize.

Follow this operation to correctly backwash the Sand Filter:

- Shut down the unit, be sure that the sea water inlet valve (if installed) is open;
- Turn the sand fil er valves to "BACKWASH" positions (refer to Figures 1.4.3-4-5);
- Start up only the booster pump by the manual start button;
- After 15 minutes switch off the booster pump (turn it in "automatic start low pressure pump" through the switch) and move the valves back to "SERVICE" position.

In addition to the normal backwashing, you must also perform some more thorough check at the end and beginning of the commissioning period.
The impurities in the water during the filt ation process through the sand, remain trapped in it.
As the dirt is trapped in the sand, the pressure the water requires to go through the fil er increases too.
The filter is equipped with two gauges indicating the pressure at input and output; as the pressure difference increases, you get closer and closer to the time when backwashing is necessary.
The multi-way valves, located on the main panel of the filter,

Fig. 1.4.1 - Sand Filter

allow to perform the operations of washing and filtering.

Opening season check

Before commissioning the sand filter, make sure that the washing operation has been carried out, otherwise proceed with it to avoid any outbreak of microorganisms.
One of the most neglected maintenance, which often causes serious problems, is the disinfection of the filter. In particular the filter is one of the places where these pathogens are able to settle and breed. Often not even the strongest disinfection with chlorine or similar is able to eradicate them because of the difficulty of reaching all of the hidden points of a filter. For this reason we can recommend a thorough disinfection with a specific product.

Replacing the sand

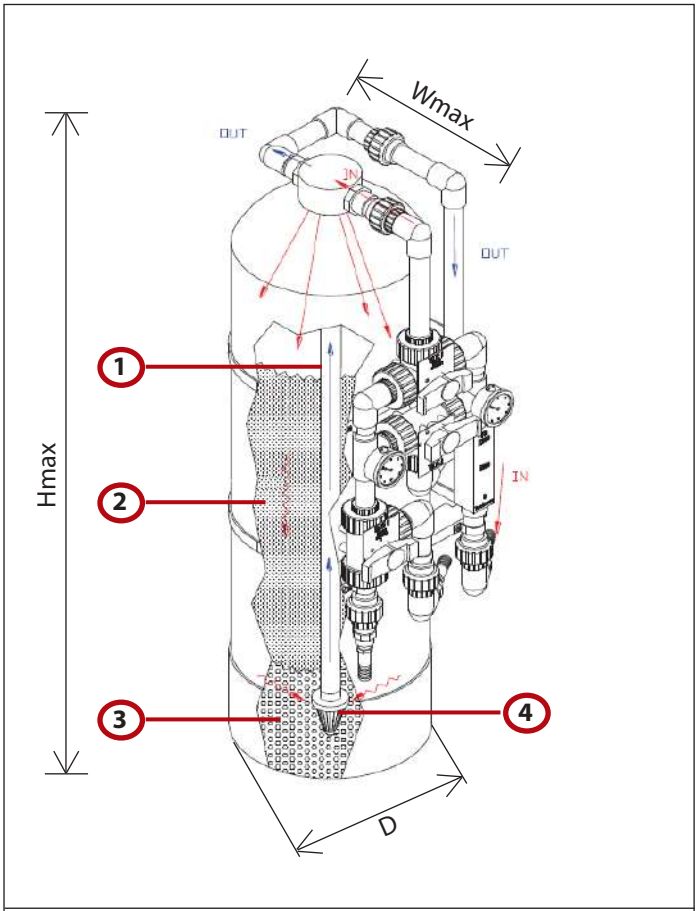
The necessity and frequency of replacing the sand depends on correct maintenance, such as backwashing and descaling. If carried out regularly and effectively the sand can last up to five years.
Poor maintenance might make necessary to replace the sand after only one year.
To empty the sand from the fil er, proceed as follows:

- Remove the input / output piping
- Place horizontally the fil er to facilitate the operation
- Access to the opening of the filter and remove the sand

Please note that the main mechanical filtration is performed by the sand filter, whereas only the remaining fine filtration has to be done by the cartridges. In this way a good sand filtration prevents a quick clogging of the filtering cartridge(s) provided in the next stage, helping to reduce replacement costs.

Backwash

This valves position is used to wash the fil er. The water fl ws reversely along the filter (from bottom to top). Doing so, the filtering bed made of sand lifts up and dirt particles are discharged together with the water. To perform the backwash it is necessary to set the valves on the sand filter main panel as shown in the Figures 1.4.3-4-5.

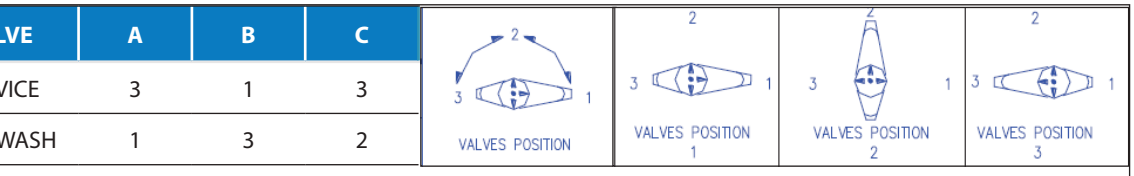


(1) Tube
(2) Quartzite 0,3-0,9 mm
(3) Quartzite 3,0-5,6 mm
(4) Bottom fil er nozzle fitting y glue slot width 0,25 mm.

Fig. 1.4.2 - Functional scheme

Sand Filter Model	Overall dimension			Quartzite 0.3-0.9 mm	Quartzite 3.0-5.6 mm
	Hmax [mm]	Wmax [mm]	D [mm]		
TFS2	1.115	450	320	62.5 kg	12.5 kg
TFS3	1.205	500	380	75 kg	25 kg
TFS4	1.630	700	560	275 kg	50 kg
TFS5	2.324	860	770	500 kg	75 kg

VALVE	A	B	C
SERVICE	3	1	3
BACKWASH	1	3	2



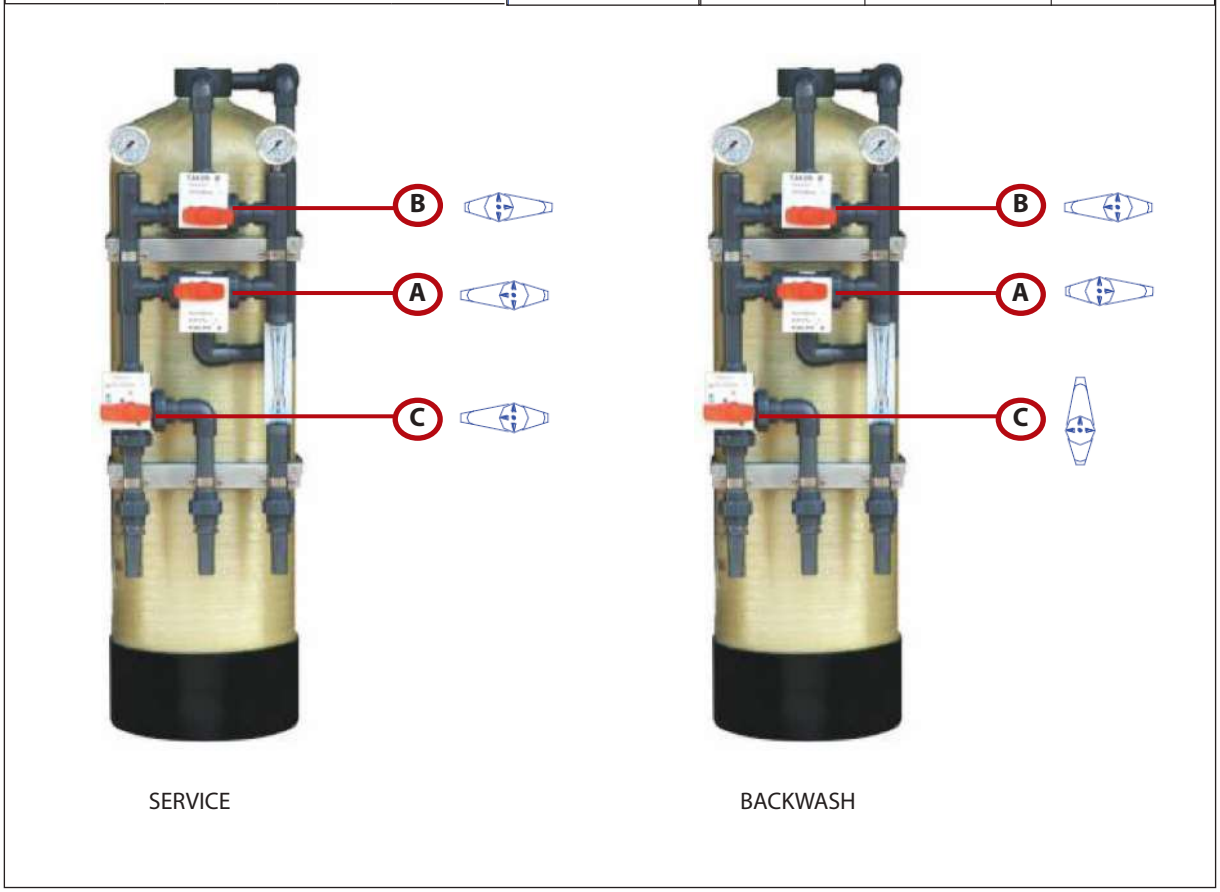


Fig. 1.4.3 - TFS2 / TFS3 Service and Backwash Valves Position

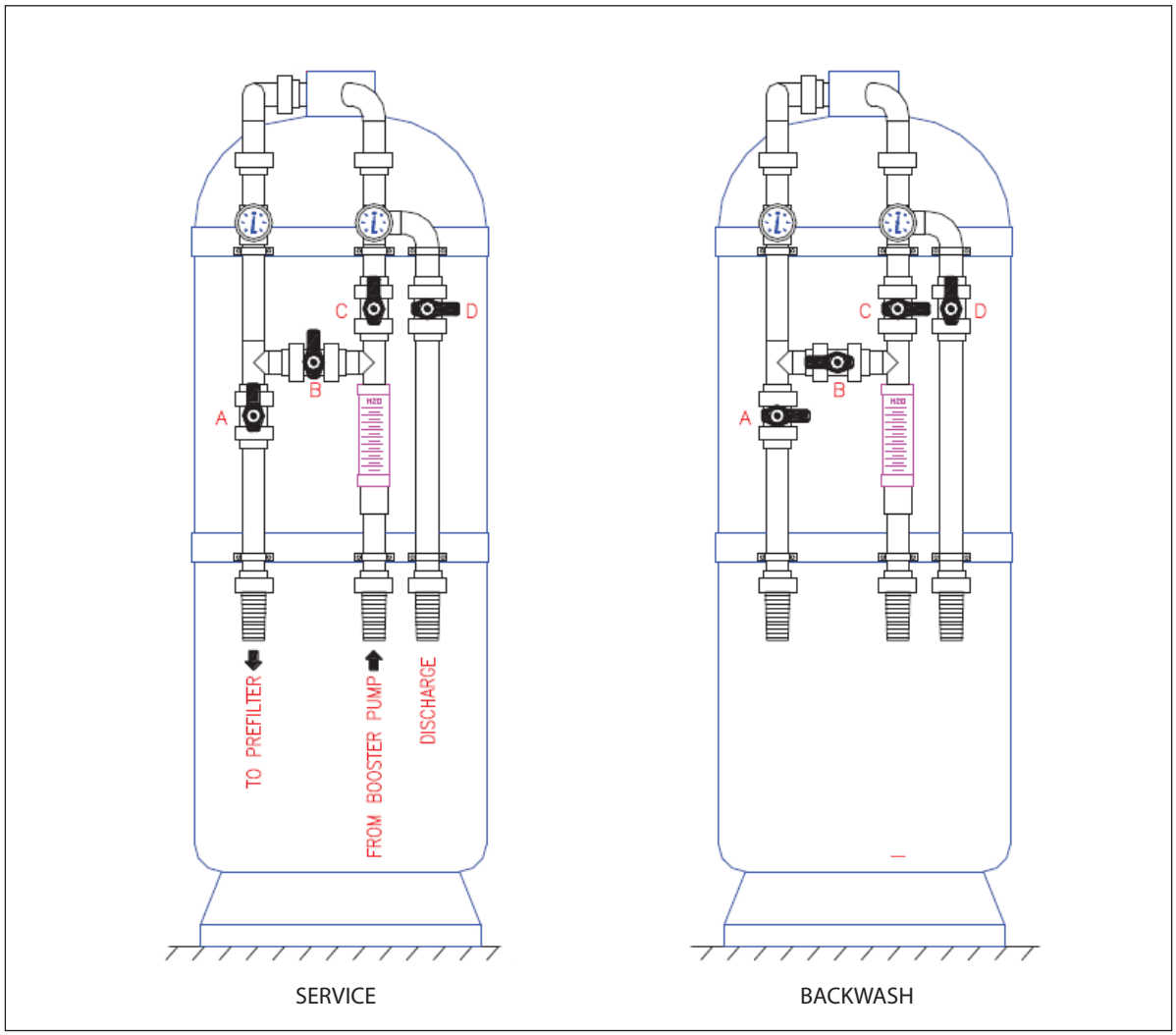


Fig. 1.4.4 - TFS4 Service and Backwash Valves Position

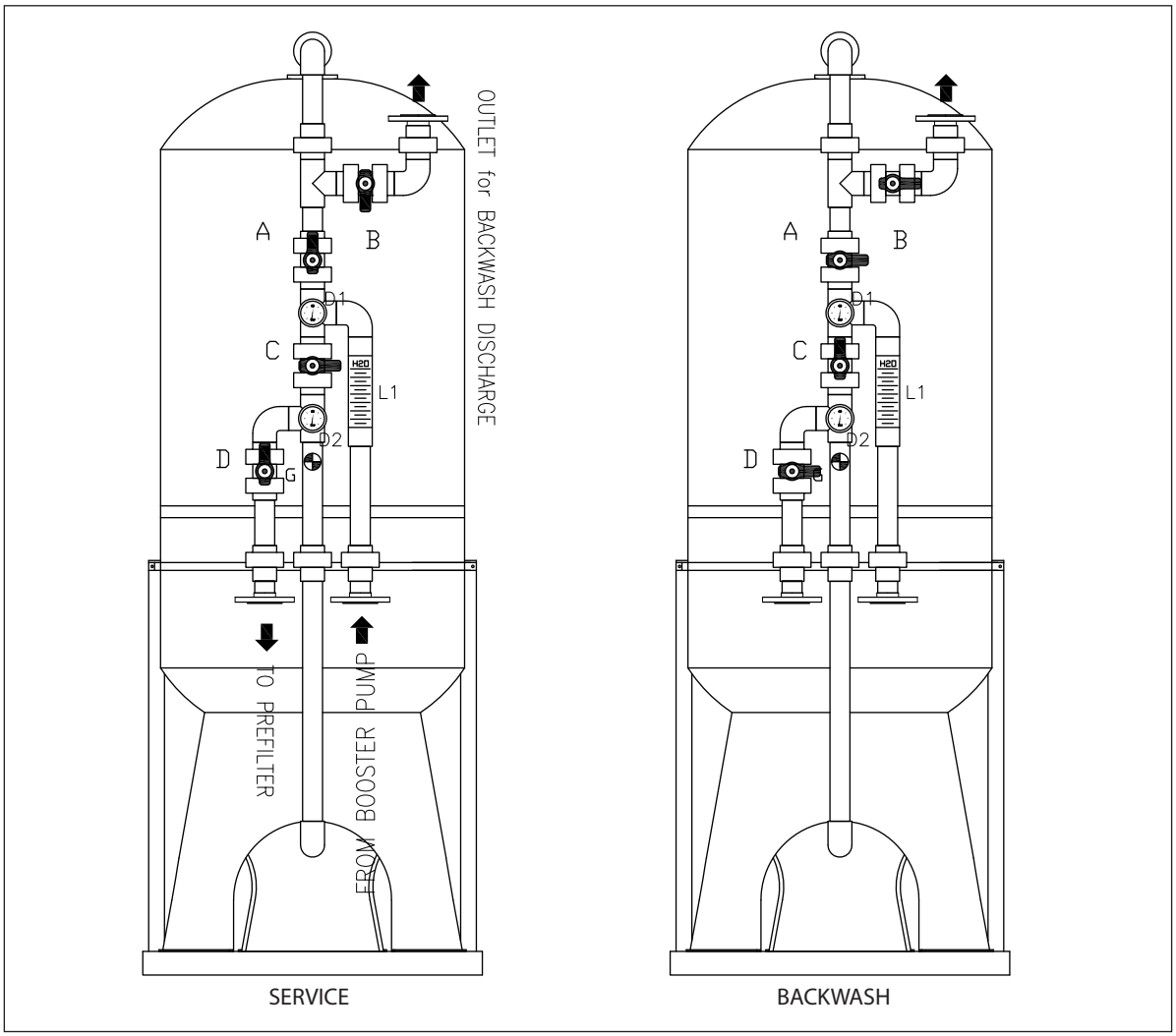


Fig. 1.4.5 - TFS5 Service and Backwash Valves Position

9.1.5 TFD Filter Maintenance

CAUTION

Always observe the following precautions.

- Do not tamper with any filt ation components whilst the system is pressurised.
- Ensure that adequate eye and skin protection is worn when conducting manual cleaning operations involving corrosive chemicals.
- Ensure that a source of fresh water is readily available and immediately neutralise and clean up any chemical spills.
- Confi m that backwash water is discharged in accordance with all environmental regulations and local authority bylaws.

System components

Filter Body

The TFD fil er body is moulded from high strength glass-fib e reinforced polyamide thermoplastic.

Helix Automatic Disc Cartridge

The disc cartridge is located within the fil er and is comprised of a stack of grooved polypropylene discs and a frame that holds these discs in place by means of a compression spring. This frame also contains the helical element and a disc cap assembly.

Fig. 1.5.1 - TDF Filter

O-Rings for Filter Cartridge

Two nitrile rubber o-rings are provided to ensure a pressure tight seal between the Helix Automatic Disc.

Cartridge and Filter Body

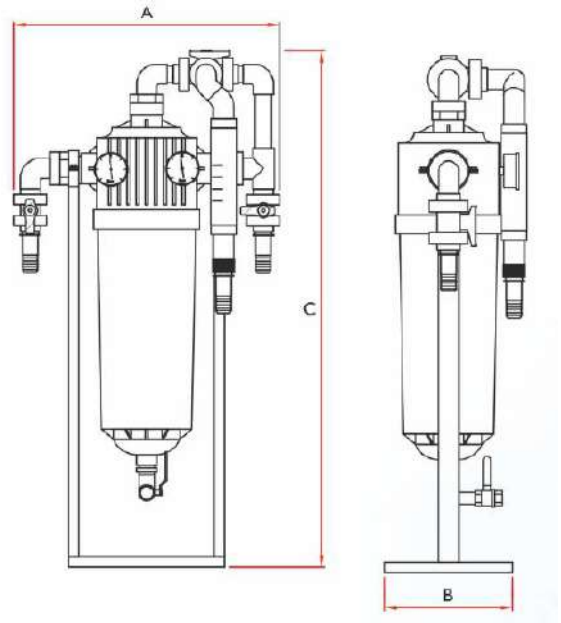
Piston O-ring Service Kit

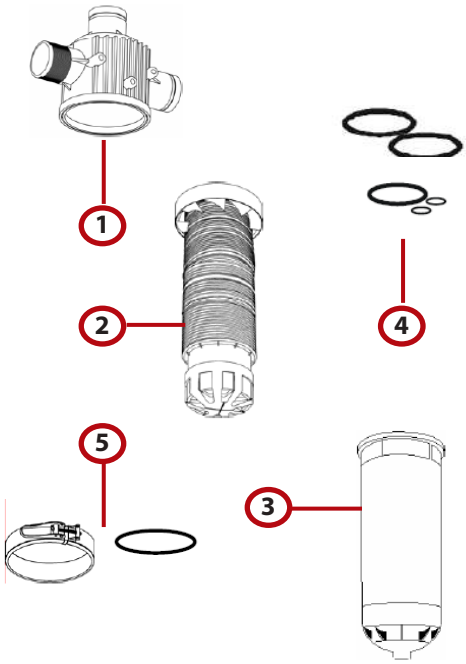
Three nitrile rubber O-rings to provide hydraulic seal within the disc cap assembly.

Filter Cover

The Filter Cover is moulded from exceptionally tough glass-fib e reinforced polyamide thermoplastic resin and is designed to withstand high internal working pressures.

Model	Overall dimension [mm]		
	A	B	C
TFD 100 Semi Automatic	52	25	89-102





Pos.	Item Description
1	Filter body
2	Helix automatic disc cartridge
3	Filter cover
4	O-Ring service kit (for Filter cartridge & Piston)
5	Clamp & O-Ring for fil er body

Fig. 1.5.2 - TDF Filter - Overall Dimensions & Spare Parts

Stainless Steel Clamp and O-ring for Cover/Body

The Filter Cover is attached to the Filter Body by means of an adjustable, Grade 316 Stainless Steel over-centre type clamp. A pressure tight seal between cover and body is achieved by means of a nitrile rubber o-ring.

Principles of operation

Filtration Mode (see Fig. 1.5.3 ref. 1)

Unfil ered water enters the filter body from the inlet manifold and is directed through a helix element that induces a high velocity hydro-cyclonic action. The resultant centrifugal force slings suspended debris particles outward away from the disc cartridge, against the inner walls of the filter cover, thus ensuring the discs remain largely clear of debris. The partially cleaned water then passes through the spring-compressed filter cartridge discs, which have been tangentially etched on both surfaces with fine grooves of a predetermined depth. The grooves in mating discs are etched at opposing pitch angles to ensure that the passages formed between them constantly change in size and shape to maximise the screening effectiveness of the filter. The depth of these grooves determines the filtration mesh size. After passing inward through the disc cartridge, clean filtered water is directed out through the filter body's spring-loaded and into the outlet manifold.

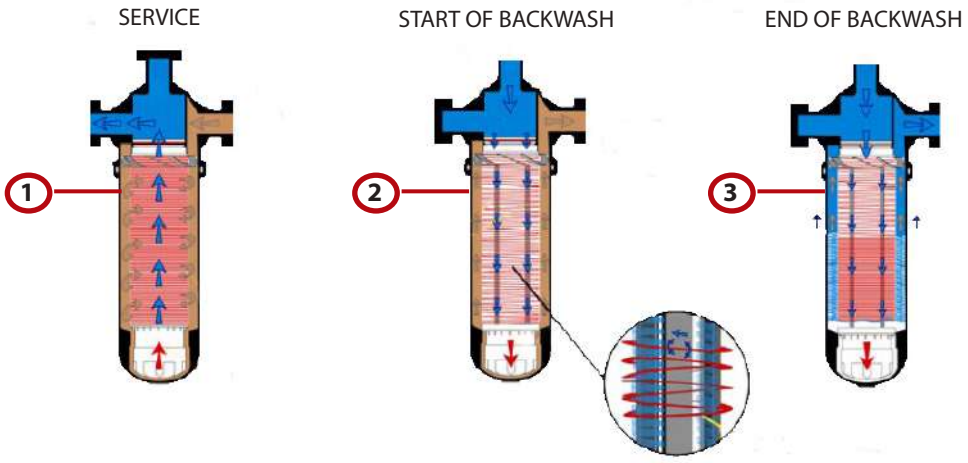


Fig. 1.5.3 - Principles of operation

VALVE	A	B	C
SERVICE	1	OPEN	CLOSED
BACKWASH	2	CLOSED	OPEN

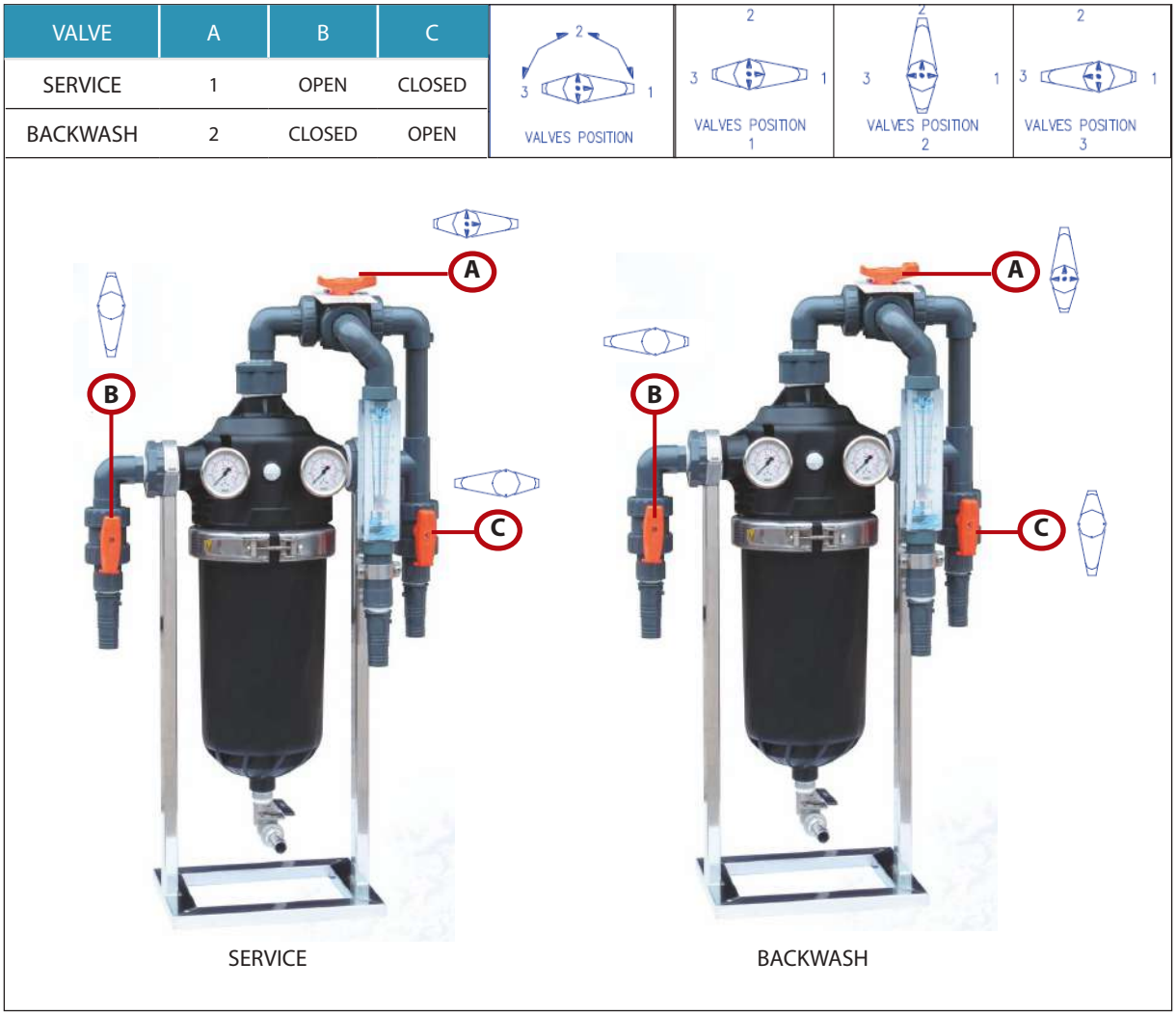


Fig. 1.5.4 - TFD Service and Backwash Valves Position

Backwash Mode (see Fig. 1.5.3 ref. 2-3)

The filter disc cartridge requires cleaning, at either a specified service time or whenever there is a pressure difference of more than 1 bar between the input and output gauge.

For backwash mode setting It is necessary to set the valve as indicated in Fig. 1.5.4.

The filtration chamber is now depressurised and vented and the flow of water through the filter body is reversed.

The clean water enters from the outlet manifold. Pressure applied by the water in these channels releases the compression spring freeing the discs, whilst simultaneously aiming clean water tangentially at their inner

surfaces . These factors combine to set the discs spinning and vibrating rapidly, thereby ensuring a highly effective cleaning action, clearing the filter cartridge of debris particles that are expelled through the flush manifold.

At the completion of the timed cleaning cycle, setting the 3 backflush valve (Fig. 1.5.4), returning it to the service operating position and with the assistance of the compression spring the flow is reversed and the normal filtration action is restored.

TFD Filter Maintenance Interval

Set desired values for.
Appropriate time interval between backflush cycles and backflush cycle duration will be determined by the source water quality, however as a guide to initial set-up, choose time interval of 60-120 minutes and duration of 30-40 seconds and monitor filter performance.
As a guide to an initial set point, use "Clean Filter" pressure differential value, plus 0,3 bar. The differential value can be read trough the two gauges which are installed in input and output of the TFD filter.

Weekly Inspection and Maintenance

- Inspect all manifolds, couplings and fil er housings for leaks.

Monthly Inspection and Maintenance

- Initiate a manual backwash cycle. On completion of manual cleaning cycle, observe and compare the "Clean Filter" Pressure Differential with the recorded set-up value.
- With the system depressurised, open all Filter Covers and visually inspect Disc Cartridges for signs of damage and to confi m the discs are being cleaned adequately during backwash cycles.

Seasonal Inspection and Shutdown

- Immediately prior to shutdown, initiate a manual backwash cycle to ensure the fil ers are in a clean state..
- Drain the filt ation system of all water and leave manifolds plugs open to air.
- Remove the Filter Cover and withdraw the Disc Cartridge by gently rocking it back and forth whilst lifting up on its Top Cap. Unscrew and remove the Top Cap to release the discs. Place loose discs in a large plastic tub and clean with a high pressure hose to remove accumulated grime. If discs remain contaminated

with algae, slime or mineral build up, they may be effectively cleaned in a two stage chemical bath process:

- Stage One. Immerse discs in a 10% Hydrochloric Acid solution for two hours, followed by a thorough rinsing in clean running water. (Ensure protective clothing, rubber gloves and eye protection is worn when handling caustic solutions. Do not use concentrated Hydrochloric Acid. If in doubt, obtain professional advice on the handling and dilution of acids).
- Stage Two. Immerse discs in undiluted household bleach for one hour, followed by a thorough rinsing in clean running water.

- Inspect the Top Cap's three o-ring seals for signs of splitting and replace as necessary. Lubricate all O-rings with a thin film of sili one grease before reassembling the Disc Cartridge.
  Note: It is necessary to remove the circlip retaining the compression spring to inspect the two smaller O-rings. Ensure the correct number of discs are installed in each cartridge.
- Inspect the Filter Cartridge, Filter Cover and Threaded Cap O-rings for signs of splitting and replace as necessary. Lubricate all O-rings with a thin film of sili one grease.
- Disassemble Air Relief Valves to check for blockage and clean as necessary.

9.1.6 Prefilters Maintenance

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF

Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

The prefil ers require maintenance when:

- The watermaker shows alarm for low pressure.
- The low-pressure (Low pressure gauge reading) is 30% less than with new filter cartridges (0.8 ... 1 bar).
- The high pressure pump makes a strange noise.

Fig. 1.6.1 - Prefilters

- 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.

Maintaining a healthy watermaker largely involves taking proper care of the prefil er assembly and seawater intake plumbing. Failure to do so is the most common cause of the two most frequent types of watermaker "failure" about:

- Producing diminished or no freshwater output.
- Producing "bad-smelling" product freshwater.

No Freshwater Output

The most common cause of diminished or no product freshwater output is air entering the seawater intake system at some point. The pump volume is small and the pressure required to press water through the membrane is high. Since air is highly compressible, a very small amount of air can keep the pump from producing enough pressure to produce product freshwater.

Periodically inspect and test the entire seawater intake system to assure that all joints and fittings are airtight, especially the connections at the prefil er assembly.

Bad-smelling Product Freshwater

The purpose of the prefil er assembly is to trap any particulates in the intake seawater that are larger than 30 microns.

A coarse strainer (if installed) performs the same chore for contaminants of larger size. In each case, trapped material remains in the prefil er housing (and/or strainer bowl) until removed.

Much of the trapped material is organic: plankton, seaweeds and flotsam of all types. After a watermaker has been turned off, this material soon begins to decompose. As it does, it breaks down into a number of chemicals composed of smaller molecules. Some of these molecules are small enough to pass through the watermaker

membrane along with the product freshwater. Perhaps the best-known example of such a chemical is hydrogen sulfide, a gas which (in small concentrations) smells like "rotten eggs."

Two main factors affect the speed with which these products of organic decomposition will contaminate a watermaker system: (1) the ambient temperature and (2) the quantity of trapped material.

Run the watermakers in near-shore situations can cause that the amount of trapped material is high, and the prefil er assembly will require more frequent attention.

Moreover, the high ambient temperatures in tropical locations greatly accelerate the rate of the decomposition process.

Prefilter Maintenance

The cartridge replacement procedure is given below:

- Shut down the unit and close the sea water inlet (if installed).
- Unscrew bolts of fastening plates that are located on the top caps of the filters (Fig- 1.6.2).
- Empty the sump and take out the filter cartridge.
- 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 is well seated and lubricated (use silicon grease).
- Reinstall the cup and tightening it.

Fig. 1.6.2 - Prefilters

9.2.1 Replacement of Membrane Modules

DANGER

HIGH PRESSURE DEVICE

Operate with high pressure equipment may cause loss of life, severe bodily harm, and/or property damage if the devices are not correctly installed and maintained.

Read and understand all guidelines given before attempting to open, operate or service the vessels or the membranes. Failure to follow these guidelines and observe every precaution may result in malfunction and could result in catastrophic failure. Misuse, incorrect assembly or use of damaged or corroded components can result in high-velocity release of the end closure of the vessels. We recommend that only a qualified mechanic experienced in servicing high-pressure hydraulic systems, open, close and service the vessels.

Fig. 2.1.1 - Vessels

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF

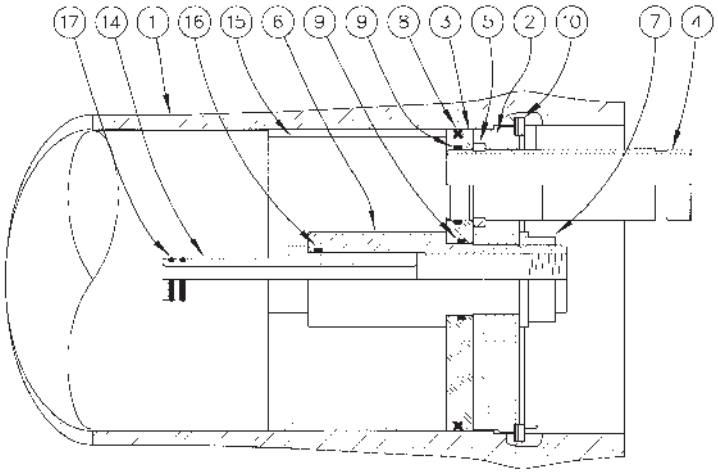
Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2). Disconnect the low and high-pressure piping from the vessels.

Proper vessel handling and installation are important to safe use and long vessel life. The guidelines outlined herein should be followed carefully; however, they are intended only as guidelines and do not relieve the purchaser from full responsibility for proper inspection, handling and installation.

Damage due to improper handling or installation is only responsibility of the purchaser.

Improper assembly, misuse or corrosion damage can result in mechanical failure, property damage and serious injury or death. Read and follow all instructions carefully.

Fig. 2.1.2 - Vessels



SECTION THROUGH END CLOSURE

Dwg. Ref	Qty. Per	Part Name	Materials/Remarks
		SHELL	
1	1	Shell Length	Filament w ound epoxy/glass composite-Head locking groves integrally w ound in-place
		HEAD	
2	2	Bearing Plate	6061-T6 aluminum alloy-hard anodized
3	2	Sealing Plate	PVC Thermoplastic
4	2	Feed/Conc Port	Type 316 Stainless Steel, Tw o piece set
5	2	Port Retainer Set	304 Stainless Steel, Tw o-piece set
6	2	Permeate Port	PVC Thermoplastic
7	2	Port Nut	PVC Thermoplastic-left hand thread
8	2	Head Seal	Ethylene Propylene, O-Ring
9	4	Port Seal	Ethylene Propylene, O-Ring
		HEAD INTERLOCK	
10	2	Retaining Ring	302 SST
		VESSEL SUPPORT	
11	*2	Saddle	Engineering Thermoplastic
12	*2	Strap Assy	304 SST - Thermoplastic cushion
13	4	Strap Screw	5/16-18 UNC, 18-8 Stainless Steel
		ELEMENT INTERFACE	
14	2	Adapter	Engineering Thermoplastic
15	1	Thrust Ring	Thermoplastic, White
16	2	Adapter Seal	Ethylene Propylene - O - Ring
17	4	PWT Seal	Ethylene Propylene - O - Ring
	*3	each furnished w ith length code 7, 7.5 & 8	

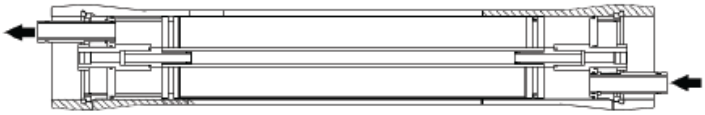
Fig. 2.1.3 - Vessel - End closure component identific tion

Fig. 2.1.4 - Head component identific tion - head disassembled

Pay particular attention to the following safety precautions:

- Inspect end closures regularly, replace deteriorated components and correct causes of corrosion.
- Do not use corroded components. Use of such components may result in catastrophic failure.
- Do not tolerate leaks or allow end closures to be routinely wetted in any way.
- Do not use excessive silicone lubricant.

This system can be equipped with single 8" membrane vessel.



Or with a double length 8" diameter vessel.

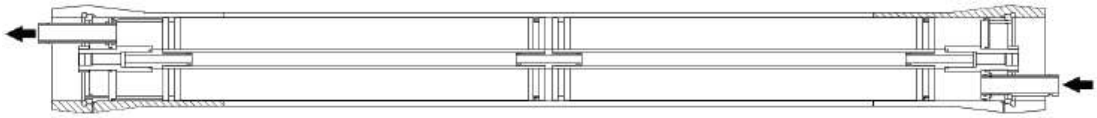


Fig. 2.1.5 - Loosening Deposits

Fig. 2.1.6 - Applying penetrating flui

OPENING VESSEL

Read all guidelines in this procedure before attempting to open the vessel.

WARNING

Do not attempt to service any component without first erifying that vessel pressure is fully relieved from the vessel. Attempting to remove the component before pressure is relieved may result in explosive release of the head.

STEP 1 RELIEVE PRESSURE

1. Be sure that are shut off all sou ces of pressure and relieve pressure from the vessel.

STEP 2 DISCONNECT PERMEATE PORT

1. Disconnect and remove permeate piping from the permeate port of the vessel.

STEP 3 EXAMINE END CLOSURE

1. Examine end closure of vessel for corrosion. If any is evident, proceed as follows:
   A. Loosen any deposits with a small wire brush (Fig. 2.1.5) or a medium grade piece of Scotchbrite®.
   B. Flush away loosened deposits with clean water.

In case of difficulty in opening vessel, read the following instructions:

CAUTION

When applying penetrating flui , be careful to avoid element contamination.
Corroded products can cause difficu y in removing head and/or other components. Do not attempt to remove components until all apparent corrosion is removed.

   A. Apply penetrating fluid (such as WD-40TM or LPS-1TM) around retaining ring at the retaining ring groove and bearing plate interfaces (Fig. 2.1.6).
   B. Use a cushioned mallet or hammer in conjunction with a wood block to tap the face of the bearing plate and retaining ring.
   C. Again attempt to remove the retaining ring.

Fig. 2.1.7 - Lifting retaining ring out of groove

Fig. 2.1.8 - Removing the retaining ring

STEP 4 REMOVE RETAINING RING

1. Lift the end of the 8" retaining ring up and out of the stainless steel groove in the shell. This can be accomplished with a pair of pliers or by using a removal tool (Fig. 2.1.7), available from Tecnicomar. The retaining ring can be lifted upward by simply rotating the tool counterclockwise after inserting it over the tab on the retaining ring. Hold the tool flat against the end margin. It is then possible to pull the end of the retaining ring straight out. If the retaining ring is difficul to remove, try soaking with a warm release agent such as LPS-1TM or WD-40TM, being careful to avoid any contamination of a membrane element. Take care to avoid hitting or levering against the vessel, as this could result in delamination.

   NOTE: Hold the removal tool flat against the end margin to keep the retaining ring tab from slipping out of the tool.
2. Remove the retaining ring from the stainless steel groove in the shell. This is accomplished by running your finger behind the etaining ring as it continues to exit the groove (Fig. 2.1.8)

STEP 5 REMOVE HEAD

CAUTION

Do not strike or apply undue force on ports to remove heads.

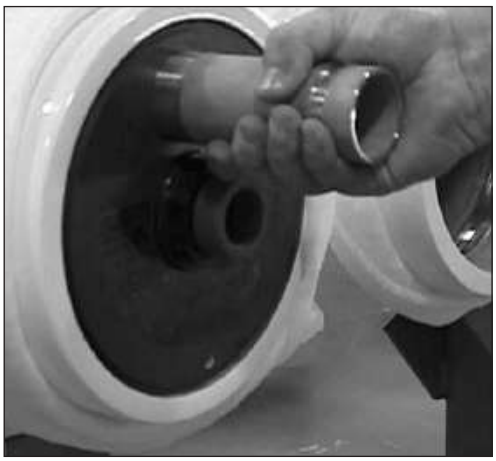


Fig. 2.1.9 - Head assembly removal by hand

NOTE: If vessel has been in service for some time, head may be difficul to remove. For assistance in head removal, an head tool is available from Tecnicomar.

STEP 5A REMOVAL BY HAND

1. Grasp feed/concentrate port and pull head straight out (Fig. 2.1.9). A sharp forceful tug may be required to start head assembly moving.
2. If the head seal remains in the vessel bore, it should be removed at this time.
   NOTE: It may be helpful to rock head slightly to break head seal bond.

STEP 5B REMOVAL USING HEAD TOOL

1. Insert the bolt through the hole in removal tool and thread into the hole in the bearing plate 1/2" deep (Fig. 2.1.10).
2. Pivot in a downward motion until seal is broken and head is freed.
3. Remove tool and set aside.
4. Grasp the feed/concentrate port and continue as explained in Step 5A.

(1) Inserting head removal tool screw into vessel head
(2) Pivot tool until seal is broken

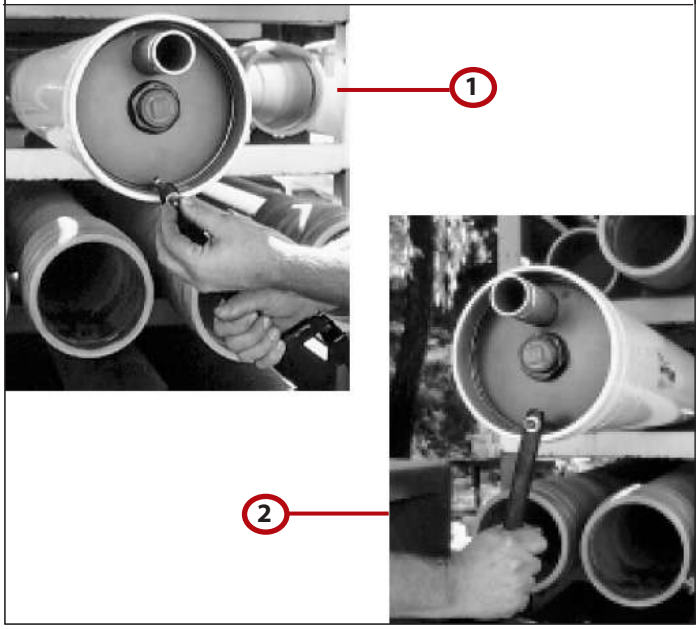


Fig. 2.1.10 - Head assembly removal by head tool

REPLACING ELEMENTS

Read all parts of this section before replacing elements.

WARNING

Do not attempt to service any component without first erifying that pressure is fully relieved from vessel. Make sure that the central (permeate) tube of membrane element stack is connected to the permeate ports inside both ends of vessel using the adapters supplied. Pressurizing vessel without elements and both adapters installed could result in catastrophic failure.

Do not proceed with step by step instructions until:

1. All pressure has been relieved from the vessel
2. Both heads have been removed from vessel following step by step instructions in "Opening Vessel".

STEP 1 REMOVE ELEMENT INTERFACE HARDWARE

1. Remove thrust ring (Fig. 2.1.11) from downstream end.
2. Remove adapters (Fig. 2.1.11) from elements at each end.

Fig. 2.1.11 - Thrust Ring and Adapter

STEP 2 ELEMENT REMOVAL (DEMOUNTING THE MEMBRANE)

Remove elements from vessel according to the following instructions.

For demounting the membranes, pull the end caps out of the pressure pipe with a slight pull at the stainless steel-fittings of the p essure hoses and slightly sidewise movements.

The membrane has to be shoved out of the pressure pipe in fl w direction, because the O-ring of the membrane prevents lateral movements against the flow direction.

According to this, during assembly, the membrane has to be shoved in the pipe in fl w direction.

Important: To avoid that the new membrane dries out, it may only be removed from the plastic packaging just before commissioning the plant.

CAUTION

Do not scratch or damage vessel bore when removing or installing elements.

WARNING

Do not pressurize vessel without elements installed or otherwise operate vessel with permeate port pressure in excess of 125 PSI*. Operation in excess of this pressure could result in catastrophic port failure.

* PVC Permeate Port

NOTE: A record of element serial numbers and locations should be made and checked during loading.

STEP 3 ELEMENT LOADING

1. Flush out vessel with clean water to remove all dust and debris.
2. Examine inside diameter of the vessel for scratches or imperfections that may affect sealing capability of head or element seals. Corrosion deposits or other foreign matter, including any excess lubricant, should be removed as described in Closing Vessel, Step 1.
3. Examine membrane element surfaces for any imperfection which could scratch the vessel bore (Fig. 2.1.12). Pay particular attention to edges of anti-telescope device (ATD/brine seal carrier). If any defects are found which cannot easily be corrected, contact Tecnicomar for corrective action.
4. Using an approximate 50% mixture of glycerine in water, lubricate the inside of the vessel. This may best be accomplished using a suitably sized swab soaked in the mixture. This procedure will ease membrane element loading and reduce chance of scratching the vessel bore.
5. Load the first element into upstream end of the vessel. Leave a few inches of the element projecting from the vessel to facilitate interconnection to next element.
6. Apply O-lube sparingly to O-ring of interconnector (amount of O-lube should be just suffici t to give a luster to the O-ring. Excess O-lube must be removed to prevent possibility of element contamination).
7. Assemble the interconnector to the loaded element.
8. Line up the next element to be loaded and assemble it to the interconnector already assembled on first element.
9. Push both elements into the vessel until a few inches are projecting from the vessel. Repeat loading process until all elements are installed.

Fig. 2.1.12 - Examine bore for scratches

CAUTION

Maintain element alignment carefully during assembly process. Do not allow element weight to be supported by interconnector. Misalignment can result in damage to interconnectors or permeate tubes or to element outer surface.

STEP 4 INSTALL ELEMENT INTERFACE HARDWARE

1. Assemble adapter to element permeate tube at each end of vessel.

WARNING

Pressurizing vessel without both adapters installed could result in catastrophic failure.

2. Install thrust ring at downstream end (Fig. 2.1.13).

Fig. 2.1.13 - Installing Thrust Ring

CAUTION

Serious damage may result if thrust ring is not installed in correct location.

NOTE: Ensure thrust ring is clean before installation. Thrust ring requires no orientation; simply push into shell.

CLOSING VESSEL

Read all guidelines in this section before attempting to close the vessel.

WARNING

Check the head assembly for corrosion. Corroded parts can result in catastrophic failure. Do not pressurize the vessel until after visually inspecting to ensure that retaining ring is fully seated.

Do not proceed until:

1. Elements and adapters have been installed in vessel following guidelines in "Replacing Elements".
2. Head has been checked for correct component assembly.
3. Vessel has been shimmed to prevent movement of the membrane elements if required.

STEP 1 INSPECT SHELL INSIDE SURFACE

1. Inspect the vessel inside surface for any corrosion deposits or other foreign matter. If any are found, clean the surface as follows:
   A. Using a medium or finer grade of Scotchbrite® and a mild soap solution, clean each end of the

vessel liner surface up to 8" in from each end of vessel.

B. Rinse away all loosened deposits from shell inside surface.

2. Inspect vessel inside surface for scratches or other damage which could cause leaks. Vessels that leak must be replaced.

CAUTION

Never attempt to repair a fibe glass shell.

STEP 2 SHELL AND HEAD SEAL LUBRICATION

1. Work O-ring lubricant into shell area behind the retaining ring groove and approximately 1/2" into the vessel I.D. (Fig. 2.1.14)
2. Ensure entire head seal is covered with a thin layer of O-ring lubricant, with no dirt or dust contamination.

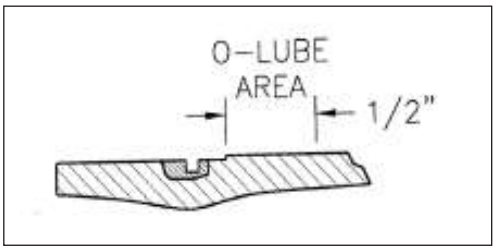


Fig. 2.1.14 - O-lube area

NOTE: Glycerin is a commercially available lubricant that will not foul membranes. However, silicone lubricant will better assist correct performance and ease head assembly, installation and removal.

NOTE: Any remaining lubricant should be cleaned from vessel bore before applying fresh lubricant.

STEP 3 INSTALL HEAD

CAUTION

Do not tighten a component into thermoplastic permeate port more than one turn past hand tight.

STEP 3A INSTALLATION BY HAND

1. Align any previously placed index marks on head assembly and vessel body. This will ensure correct alignment for port connections. Do not rotate head assembly after insertion into vessel as this may cause head seal to become detached.
2. Hold head assembly square to axis of shell and slide it straight in until a slight resistance is felt.
3. Using both hands (Fig. 2.1.15), fi mly push head in as far as it will go (a sharp, forceful thrust may be necessary to push head seal into vessel bore.) When head is in correct position, entire retaining ring groove will be exposed.

Fig. 2.1.15 - Installing head assembly by hand

Fig. 2.1.16 - Installing head using insertion tool

CAUTION

If head is allowed to rock side to side during installation, head seal may become detached.

STEP 3B INSTALLATION USING TOOL

1. Align any previously placed index marks on head assembly and vessel body. This will ensure correct alignment for port connections.
   Do not rotate head assembly after insertion into vessel as this may cause head seal to become detached.
2. Hold the head assembly square to axis of the shell and slide it straight in until a slight resistance is felt.
3. Slide tool into shell just behind the head.
4. Tap tool (Fig. 2.1.16) alternating around circumference with a dead blow hammer until retaining ring groove is fully exposed.
5. Remove tool by pulling straight out. Do not rotate.

STEP 4 INSTALL INTERLOCK

1. With the head assembly installed in shell, place the tip of the head retaining ring in the stainless steel groove (Fig. 2.1.17).
2. Begin pushing the retaining ring into the groove as you rotate your hand around the internal diameter

Fig. 2.1.17 - Installing Retaining Ring

of the shell.

3. Continue until the entire retaining ring is installed in the groove.
4. Verify that the retaining ring is fully seated in the groove before proceeding.

WARNING

Retaining ring must be correctly installed. Incorrect assembly or installation can result in explosive head failure.

STEP 5 RECONNECT PORTS

NOTE: Using teflon tape or anaerobic sealant on all threaded connections will help ensure a leak-free assembly.

1. Reconnect piping manifold to the vessel

CAUTION

Do not tighten a component into thermoplastic permeate port more than one turn past hand tight.

STEP 6 PRE-PRESSURIZATION CHECKS

It is vitally important that the following checks be carried out before any attempt is made to pressurize the vessel.

HEAD ASSEMBLY

Verify that:

1. Head assembly is in good condition, with no evidence of damage or corrosion.
2. Port nut is snug.

3. Port retainers are correctly installed.
4. Retaining rings is seated in groove

MEMBRANE ELEMENTS

Verify that:

1. Elements are installed in the vessel.
2. Element adapters are installed at each end of vessel.
3. Thrust ring is installed at downstream end of vessel.

PIPING CONNECTIONS

1. Check all piping connections to ensure that they will provide a leak-free seal.

STEP 7 PRESSURIZATION

WARNING

Do not pressurize vessel without elements installed

1. After following the above pre-pressurization checks, restart the system without pressure, starting only the low pressure pump A, and check if there are any leaks.
2. Vessels should be filled sl wly to assist trapped air to escape.
3. Vessels should be pressurized slowly to avoid damage to membrane elements and vessel components.

CAUTION

Any leakage indicates a potentially dangerous condition.
Failure to eliminate leakage may void the warranty and could result in vessel failure.

9.2.2 Salinity and Temperature Sensor (M+M1)

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF

Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

- Unscrew completely the salinity sensor (Fig. 2.2.1).
- Clean the two electrodes (Fig. 2.2.2) with a fine-grain emery paper.
- Reinstall the sensor after having applied new teflon band on the the threads.

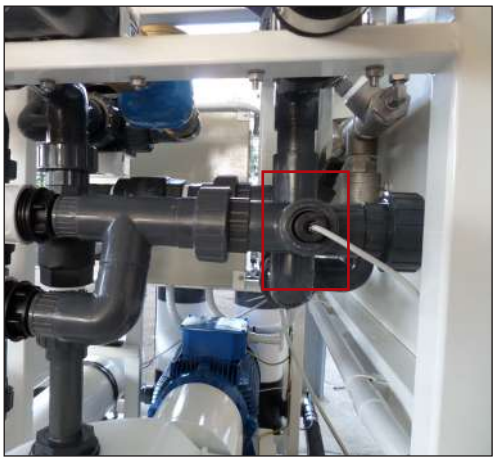


Fig. 2.2.1 - Salinity and Temp. Sensor

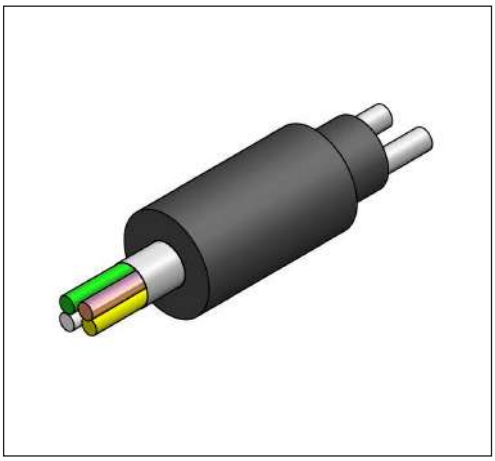


Fig. 2.2.2 - Salinity and Temp. Sensor

9.2.2.1 Salinity Calibration

DANGER

Operate inside the control cabinet may cause loss of life, severe bodily harm, and/or property damage if not correctly operate.
Read and understand all guidelines given before attempting to open the control cabinet and operate.
Failure to observe every precaution may result in malfunction and could result in catastrophic failure.

Salinity is a measurement of dissolved solids in liquid: these solids will conduct electricity to varying degrees. A special probe is used, with two electrical contacts in it, to determine the resistance to the flow of electricity in the liquid. The higher the resistance, the lower the PPM of dissolved solids.
In the Tecnicomar watermakers systems, the salinity probe is located just at the output of the RO membrane. This way we can look at the salinity level of the product water before deciding to either reject the water or

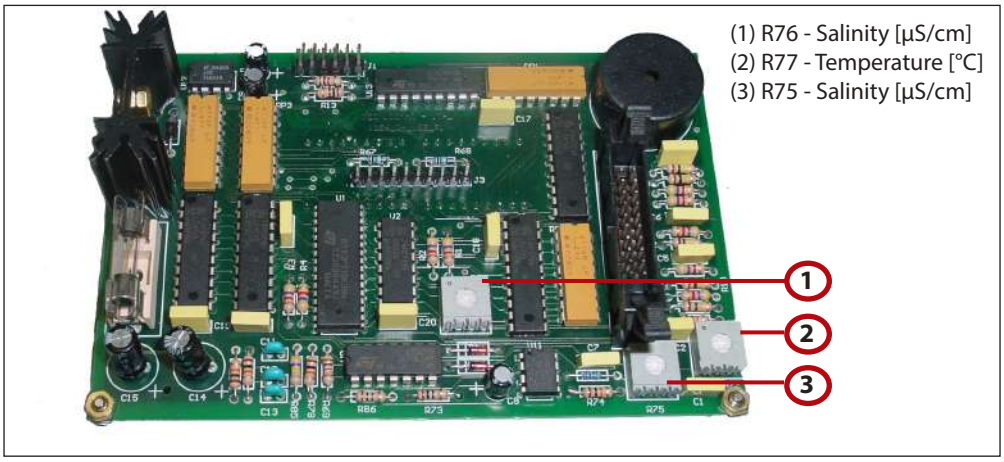


Fig. 2.2.1.1 - Electronic card - TINY

accept it and divert it into the holding tank.

The salinity level can be seen through the display of the control board.

If a hand -held salinity meter is available, it is possible simply take a reading of product water while the unit is running, then calibrate the control board to match that reading.

The salinity reading can be modified from the TINY Electronic card by adjusting the "Salinity Calibration" parameter to setting the right salinity reading.

The setting parameters of the watermaker are the following:

- Safe Water: 0 $\leq$ salinity < 1500, fresh water to tank.
- Unsafe Water: 1500 $\leq$ salinity < E03, unsafe water outboard.
- Unsafe Water: salinity $\geq$ E03, unsafe water outboard.

"E03", on display, is salinity from 2000 µS/cm onwards.

Setting points (1500, 2000) can be changed only by Tecnicomar.

Procedure for salinity calibration

- Put the watermaker in production.
- After 5 minutes, tap a fresh water sample from safe water line (make sure to wash well a little glass, several times with fresh water before reading).
- Use a conductivity meter (Fig. 2.2.1.2) and read the value.
- Access to the TINY electronic card inside the control cabinet.

Fig. 2.2.1.2 - Portable conductivity meter

- Rotate R75 trimmer (Fig. 2.2.2.1) clockwise up to its initial position.
- Rotate R77 trimmer (Fig. 2.2.2.1) counterclockwise up to its initial position.
- Read salinity value of fresh water by salinity-meter and calibrate R76 trimmer (Fig. 2.2.2.1) to the read value.

9.2.3 Pressure Gauges Maintenance

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF

Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

CAUTION

The gauge should be tightened and loosened using the wrench fl ts on the gauge socket.

Fig. 2.3.1 - (1) Low Pressure Gauge - (2) High Pressure Gauge

Never grasp the case to thread the gauge into the pressure system fittings. Doing so may cause irreparable damage to the gauge. When screwing the gauges in the force required for this must not be applied through the case or terminal box, rather only through the spanner fl ts (Fig. 2.3.2).

Fig. 2.3.2 - Fitting pressure gauge

CAUTION

A pressure gauge should never be removed when it is pressurized. Make sure the pressure system has been fully vented prior to removing a gauge.

Maintenance

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

9.2.4 Low-Pressure Switch Maintenance

DANGER

PRESSURE DEVICE

Operate with pressure equipment may cause loss of life, severe bodily harm, and/or property damage if the devices are not correctly installed and maintained.

Read and understand all guidelines given before attempting to open, operate or service this item.

Failure to observe every precaution may result in malfunction and could result in catastrophic failure.

The Low pressure switch signals the pressure fall in the sea water inlet circuit to prevent operation of the High Pressure pump when no water is present at the inlet.

This switch is factory set to "open circuit" below the inlet pressure value shown in the test report (usually 1 bar) and may need a check by the user from time to time.

If the system shuts down because of low pressure when the low pressure gauge reads a value exceeding the low pressure switch setting point value shown in the test report (usually1 bar), the pressure switch may need adjustment. The same may be true if the system does not shut down

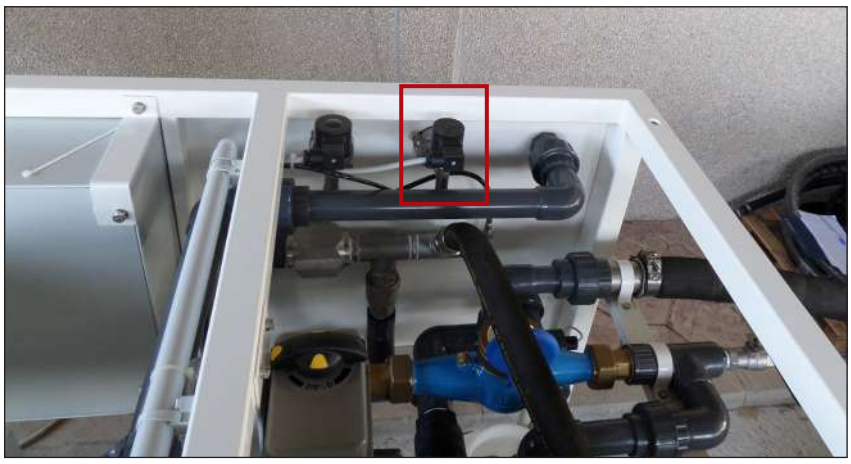


Fig. 2.4.1 - Low Pressure Switch

even with inlet pressure constantly below the low pressure switch setting point value shown in the test report (usually1 bar). In both cases the pressure switch needs checking by a technician.
An overall check can be performed by the user by following the steps listed below:

1. With the system powered off emove the low pressure switch plastic cap.
2. Using a tester, check if there is short circuit between the two wires leading to the pressure switch and that they are connected correctly. If there is a short circuit, it means that the pressure switch should be replaced. If the test is positive, proceed with the steps that follow.
3. Hold the tester probes on the pressure switch output contact and start up the watermaker following the normal procedure. Make sure that the output contact closes when the pressure gauge reading exceeds the low pressure switch setting point value shown in the test report (usually1 bar). If that is the case, the pressure switch is working normally and the origin of the trouble is elsewhere. If the contact does not close, the pressure switch should be replaced with a new one supplied by Tecnicomar.

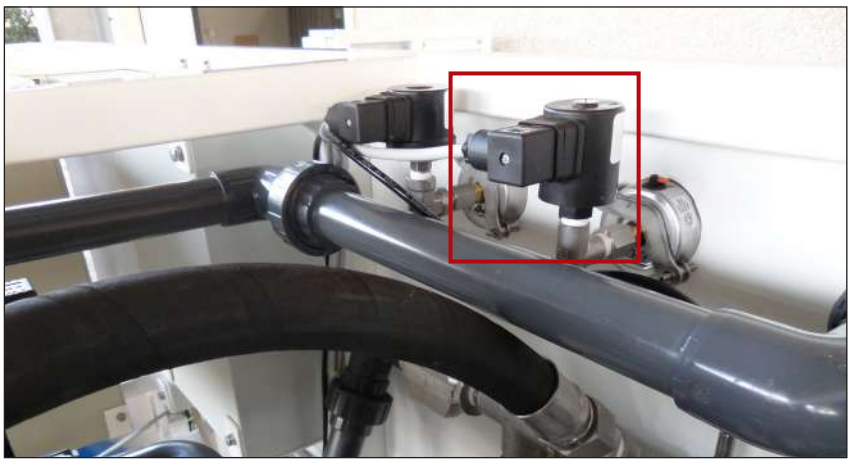


Fig. 2.4.2 - Low Pressure Switch

9.2.5 High-Pressure Switch Maintenance

DANGER

HIGH PRESSURE DEVICE

Operate with high pressure equipment may cause loss of life, severe bodily harm, and/or property damage if the devices are not correctly installed and maintained.

Read and understand all guidelines given before attempting to open, operate or service this item.

Failure to observe every precaution may result in malfunction and could result in catastrophic failure.

If the system shuts down before having reached the working pressure or if the system does not stop when the pressure is 5 bar upper than the correct pressure of operation (see test report), the high-pressure switch needs adjustment.

If the system shuts down before the pressure on the fresh water line, or on the brineline have reached the pressure switches setting point values shown in the test report; or if the system does not stop when the pressure is 5 bar upper than the correct pressure switches setting point values shown in the test report; the high-pressure switches on the brine line, or the one onthe fresh waterline needs adjustment.

The setting can be done by the user strictly following the steps given below.

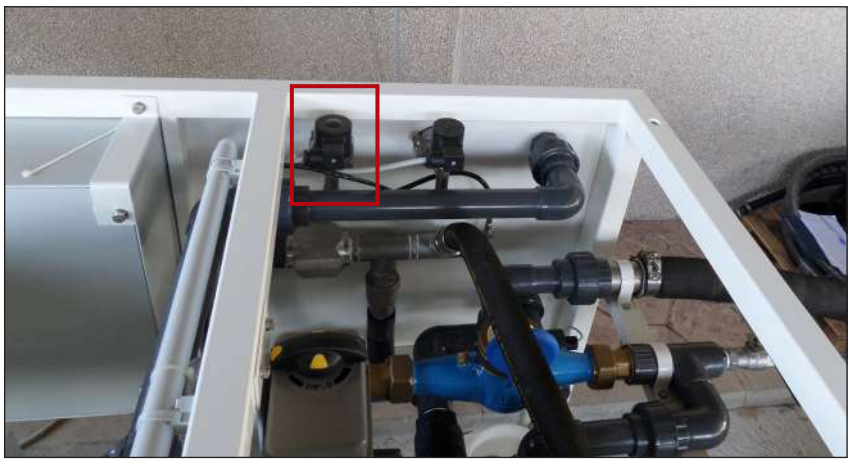


Fig. 2.5.1 - High Pressure Switch

1. Unscrew the plastic part (Fig. 2.5.2 ref. 1) on the top of the high-pressure switch (G).

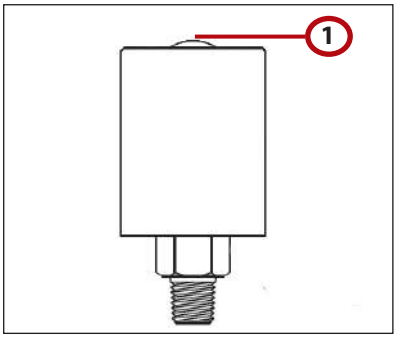


Fig. 2.5.2 - Set point adjustment screw under cap

2. Using a screwdriver tighten slightly the screw inside the switch, clockwise.
3. Depressurize the system by rotating the pressure control valve counterclockwise.
4. Start up the watermaker by pushing the START push-button.
5. Pressurize the system by turning slowly the pressure control valve.
6. If the system shuts down before reaching the correct high pressure of operation, tighten again the pressure switch screw and repeat the steps starting with step n. 3.
7. Bring the system to the correct pressure and turn the pressure switch screw counterclockwise until the system shuts down.
8. 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 operation.

Fig. 2.5.3 - High Pressure Switch

9.2.6 Low-Pressure Pump Maintenance

CAUTION

Never run the pump dry - not even for a short trial run

Check that the pump works within its field of performance, and that the absorbed current shown on the name-plate is not exceeded.
Otherwise adjust the delivery gate valve or the setting of any pressure switches.

Start the pump after filling it completely with liquid (Fig. 2.6.2).
When the pump is located above the water level (suction lift operation) fill the suction pipe and the pump through the priming hole.
Check that the direction of rotation is as shown by the arrow on the pump casing, otherwise disconnect electrical power and reverse the connections of two phases.

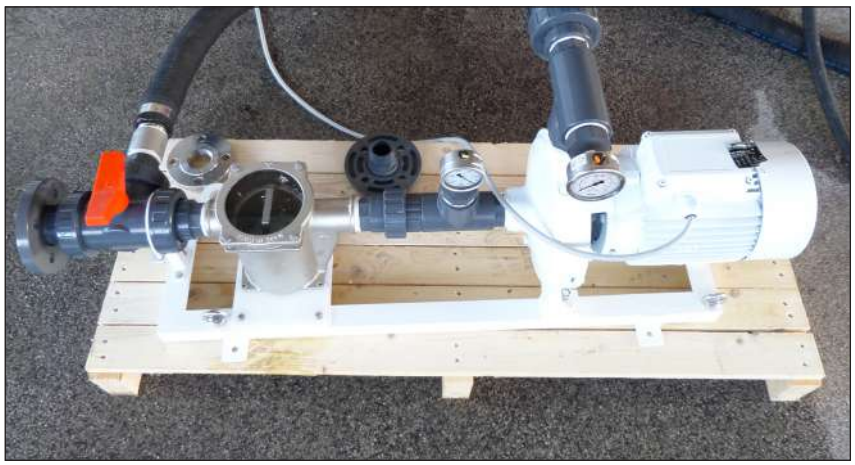


Fig. 2.6.1 - Low Pressure Pump

Maintenance

The mechanical seal does not require any preventive maintenance.

When the pump is not used, empty it completely if freezing may be expected (Fig. 2.6.3).

Check the pump for leaks before leaving it unattended and before restarting the unit, check that the shaft is not jammed and fill the pump casing completely with liquid.

WARNING

PROCEDURE TO CARRY OUT WITH SYSTEM TURNED OFF*

Depressurize the system by turning the pressure control valve (I) counterclockwise, push STOP SYSTEM on the electric box, switch off the power supply by turning to "O" position the general switch and close the seawater inlet valve (A2).

Disconnect electrical power before any servicing operation. (only lubrication may be performed, with caution, while the pump is running).

Strictly follow the user instructions and if necessary contact an authorised service centre.

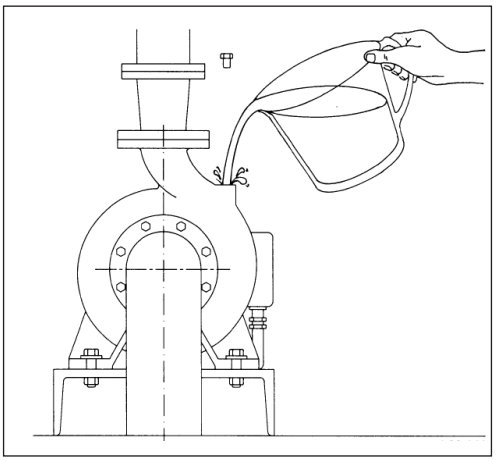


Fig. 2.6.2 - Filling the pump

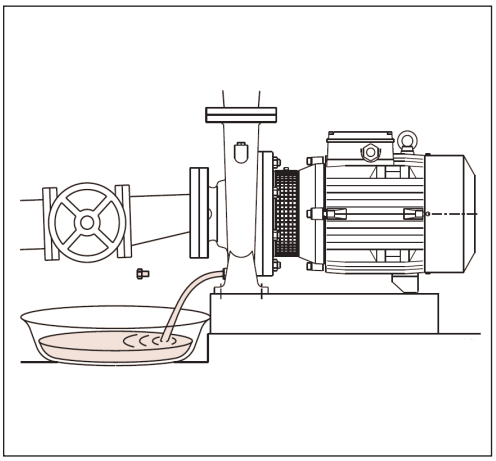
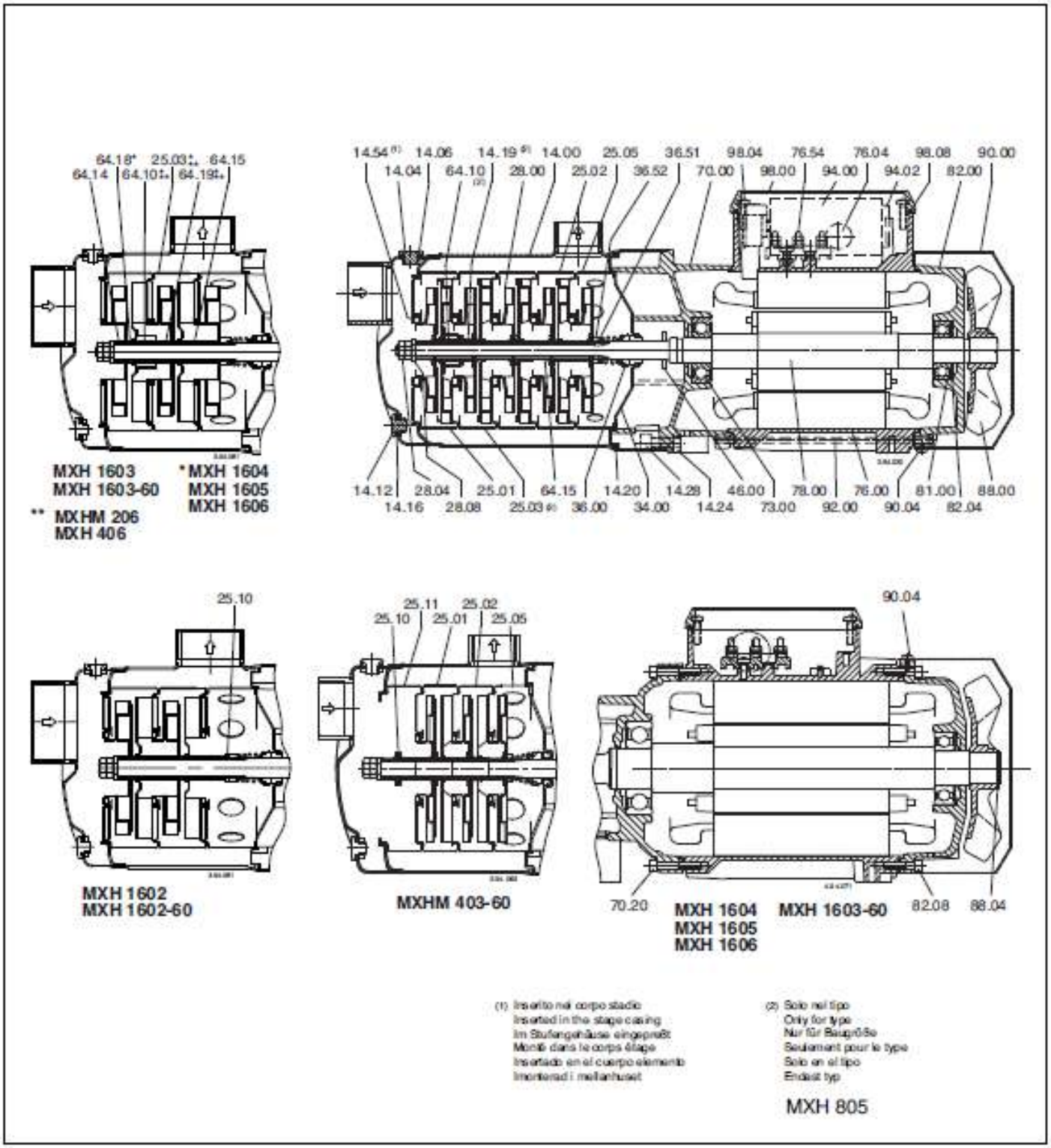


Fig. 2.6.3 - Draining the pump

* Only for the horizontal model

Feed pump Model MXHL 803-60



10,00 Ejector casing
10,04 Plug with washer
10,05 Washer
10,12 Gasket
10,16 Gasket
10,20 Screw
12,00 Casing cover
12,01 Delivery casing
12,02 Bush casing
12,03 Bearing sleeve (stationary part)
12,04 Valve guide
12,05 Circlip
12,06 Valve seat
12,07 Valve joint washer
12,10 Valve set
12,12 Valve joint
12,16 Plug
12,20 Screw
12,21 Nut
12,24 Casing cover motor side
12,30 Stage bearing sleeve
12,31 Bearing sleeve (rotating part)
13,00 Counterflange, suction side
13,01 Flange gasket, suction side
13,04 Screw
13,08 Nut
13,12 Counterflange, delivery side
13,13 Flange gasket, delivery side
13,16 Screw
13,18 Washer
13,20 Nut
13,24 Washer
13,30 Inlet adaptor
13,31 Gasket
13,34 Screw
13,38 Nut
13,50 complete union
13,54 Union nut
13,58 Gasket
13,60 Flange with adapter
14,00 Pump casing
14,02 External jacket
14,03 External jacket with suction lantern
14,04 Plug with washer
14,05 Washer
14,06 O-ring for plug
14,12 Plug with washer
14,13 Washer
14,14 Plug
14,15 O-ring for plug
14,16 O-ring for plug
14,17 Screw
14,18 O-ring
14,19 O-ring
14,20 Casing gasket
14,22 Fastening ring
14,24 Screw or stud
14,28 Nut
14,29 Washer
14,32 Fitting for pipe with washer
14,34 Washer
14,42 Plug with washer
14,43 Washer
14,46 Plug with washer
14,47 O-ring
14,50 Plug
14,54 Wear ring
14,55 Adapter ring
14,56 Grub screw
14,60 Flange, suction side
14,62 Screw
14,64 Valve, set
14,65 Gasket
14,66 Washer
14,67 Washer
14,68 Screw
14,69 Nut
14,70 Inspection cover
14,72 Screw
14,73 Nut
14,74 Washer
14,75 Gasket
14,80 Vent valve and ball
14,82 Vent valve ball
15,00 Strainer cover
15,04 O-ring for strainer cover
15,08 Stud
15,12 Hand knob
15,16 Square nut
15,50 Strainer
15,60 Spacer screw
15,70 Screw
16,00 Suction casing
16,04 Plug with washer
16,05 Washer
16,12 Air release plug with washer
16,13 Washer
16,14 Plunger valve
16,15 spring
16,16 O-ring
16,17 Valve
16,20 Casing gasket
16,30 Elbow
18,00 Interstage plate
20,00 Delivery casing
20,04 Plug with washer
20,05 Washer
20,12 Screw
20,16 Nut
20,20 Washer
22,00 Ejector
22,02 Diffuser - ejector
22,04 Nozzle
22,08 O-ring for high pressure chest
22,12 O-ring suction side
22,16 O-ring impeller side
25,01 First stage casing
25,02 Stage casing
25,03 Stage casing with bearing
25,04 Gasket
25,05 Last stage casing
25,06 Screw
25,10 Spacer Washer for missing impeller
25,11 First stage spacer
25,20 Preload ring stages
25,22 O-ring
25,23 spacer
25,24 Support ring preload
25,26 Washer
25,28 Screw
25,30 Circlip
25,32 Locking snap ring
25,34 Screw
26,00 Diffuser (pump)
26,01 Final diffuser
26,02 Diffuser plate
26,04 Screw
26,06 O-ring
26,08 Diffuser sleeve
26,10 Suction ring
27,00 Cover-diffuser
27,04 Diffuser-funnel
27,08 O-ring for diffuser-funnel
28,00 Impeller
28,02 Counter thrust bearing ring
28,04 Impeller nut (or screw)
28,05 Circlip
28,07 Washer
28,08 Washer
28,12 Circlip
28,20 Impeller key
28,24 Locking sleeve
28,50 Drive gear
28,51 Drive shaft
30,00 Delivery side impeller
30,50 Driven gear
30,51 Driven shaft
32,00 Lantern bracket
32,02 Suction lantern
32,04 Screw
32,05 Nut
32,08 elbow
32,12 Foot support
32,16 Screw
32,20 Screw
32,21 Screw
32,30 Guard
32,31 Washer
32,32 Screw
32,33 Nut
32,40 Air release plug with washer
32,41 Washer
34,00 Casing cover
34,01 Lower cover
34,02 Upper cover
34,03 Oil chamber cover
34,04 Sealing ring impeller/cover
34,05 Nut
34,06 Grub screw
34,08 Plug
34,09 O-ring
34,12 Stud
34,13 O-ring
34,16 Nut
36,00 Mechanical seal
36,50 Mechanical seal circlip
36,51 Retaining ring, split
36,52 Shoulder ring
36,54 Spacer sleeve
38,00 Packing
40,00 Radial shaft seal
40,04 Spacer ring
40,08 Shoulder ring
40,12 Circlip
42,00 Cover plate for seal
42,04 O-ring for cover plate
43,00 Packing Gland Bush
43,01 O-ring
44,00 Stuffing box gland
44,04 Lantern ring
46,00 Deflector
46,50 Sand guard
46,51 Sand guard ring
50,00 Lower bearing housing
52,00 Bearing bush
52,04 Grub screw
54,00 Support column
54,04 Grub screw
54,08 Grub screw
56,00 Adapter
60,00 Bearing housing
60,02 Foot support
60,04 Screw with washers
60,05 Washer
60,06 Washer
60,08 Nut
60,10 oiler
60,11 Oil
60,14 Plug
60,15 Washer
60,18 Plug
60,19 Washer
61,00 Base
61,02 Tie-bolt
61,03 Washer
61,04 Nut
61,07 Screw
61,30 Support foot
61,32 Screw
61,34 Washer
61,36 Nut
62,00 Bearing cover, impeller side
62,04 Gasket
62,08 Screw
62,12 Lubricating nipple
63,00 Ball bearing, impeller side
63,04 Circlip
63,22 Radial Oil Seal
64,00 Pump shaft
64,08 Shaft sleeve
64,10 Bearing sleeve
64,12 O-ring for shaft sleeve
64,13 Upper spacer sleeve
64,14 Lower spacer sleeve
64,15 Intermediate spacer sleeve
64,16 Key for shaft sleeve
64,18 Spacer sleeve
64,19 Spacer sleeve
64,20 Key for shaft end
64,21 Coupling
64,22 Coupling, set
64,23 Washer
64,24 Shear pin
64,25 Screw
64,26 Adjustment Ring
64,50 Cover plate
66,00 Ball bearing, coupling side
66,04 Shoulder ring
66,08 Circlip
66,12 Shoulder ring
66,16 Circlip
66,18 Circlip
66,19 Shoulder ring
66,22 Radial Oil Seal
68,00 Bearing cover, coupling side
68,04 Gasket
68,08 Screw
68,12 Grease cup
68,16 Compensation spring
70,00 Motor cover, pump side (l. bracket)
70,04 O-ring
70,05 O-ring
70,08 O-ring
70,09 O-ring
70,10 O-ring
70,11 Cable gland ring (float switch)
70,12 Cable gland ring
70,13 Washer
70,14 Cable fastener
70,15 Screw
70,16 Cable gland
70,17 Lock ring
70,18 Screw
70,19 Nut
70,20 Screw
70,21 Washer
70,22 Nut
70,23 O-ring
70,24 Bearing cover, pump side
70,26 Screw
70,27 Gasket
70,28 Grease cup
72,00 Mechanical seal
72,02 Circlip
73,00 Pump side bearing
73,02 ring
73,04 Circlip
73,08 V-ring, pump side
73,12 Circlip
74,04 Circlip
76,00 Motor casing with winding
76,01 Motor jacket with winding
76,02 Kit, motor jacket
76,04 Cable gland
76,05 Conduit
76,06 Nut
76,08 Plug
76,09 Nut
76,11 Thermal protector block
76,12 Thermal protector
76,13 flange
76,14 Circlip
76,15 Thermal protector cover
76,16 Support
76,20 Pin
76,30 Base support for MPC
76,31 Screw
76,32 Nut
76,50 Rewinding
76,54 Terminal board, set
76,55 Screw
76,60 Float switch
76,62 Jacket cover
76,63 Screw
76,64 Handle
76,65 Handle clamp
76,66 Washer
76,68 O-ring
78,00 Shaft with rotor packet
78,08 Motor jacket
78,10 Motor jacket
78,12 O-ring
81,00 Ball bearing
81,04 V-ring, fan side
81,08 Circlip
81,12 Compensating ring
82,00 Motor end shield, fan side
82,01 Motor end-shield, non-drive end
82,02 Screw
82,03 O-ring
82,04 Compensating spring
82,05 Screw
82,06 Washer
82,08 Screw
82,09 Nut
82,10 Eyebolt
82,11 Screw
82,12 O-ring
82,14 O-ring
82,18 Bearing cover, fan side
82,20 Screw
82,22 Grease cup
82,24 Circlip
84,00 Rotor diaphgragm cover
84,04 Rotor diaphgragm
84,08 Screw
86,00 Stator membrane cover
86,04 Membrane
86,05 Diapham protection plate
86,12 Fastening Ring
88,00 Motor fan
88,04 Circlip
88,08 Screw
90,00 Fan cover
90,04 Screw
90,05 Washer
90,08 Support screw
92,00 Tie-bolt
94,00 Capacitor
94,02 Capacitor gland
94,04 Capacitor collar
94,08 Capacitor collar
94,12 Screw
96,00 Cable
96,02 Cable with plug
96,04 Cable guard
96,05 Cable jacket
96,07 Cable fastener
96,08 Clamp
96,09 Screw
96,10 Nut
96,12 Block for power cable
96,13 Block for floating switch cable
98,00 Terminal box cover
98,04 Screw
98,05 Washer
98,08 Gasket
98,12 Terminal box
98,16 Screw
98,20 Screw
98,24 Gasket
98,28 Gasket
98,50 lamp
95,54 switch
99,00 Complete motor
99,05 eyebolt
99,06 Washer
99,07 Washer

Spare parts

When ordering spare parts, please quote data stamped on the name-plate and the position number of each spare part required in accordance with the cross section drawing.

For extraordinary maintenance of the low pressure pump, see the drawing for dismantling and assembly in the previous page.

Low Pressure Pump Troubleshooting

WARNING

Turn off the p wer supply before performing any operations.

Do not allow the pump to run when dry even for a short period.

PROBLEM	PROBABLE CAUSES	POSSIBLE REMEDIES
The engine does not start	Unsuitable power supply	Check that the mains frequency and voltage correspond to the electrical characteristics shown on the plate
	Incorrect electrical connections	Connect the power supply cable to the terminal board correctly.
	Engine overload protective device cuts in.	Check the power supply and make sure that the pump shaft is turning freely. Check that the thermal overload protection has been set correctly.
	Shaft blocked	Remove the cause of blockage.
	If the above causes have already been checked, the engine may be malfunctioning	Repair or replace the engine by applying to an authorised service centre
Pump blocked	Prolonged periods of inactivity with formation of rust inside the pump	The electric pump and small size motor-cylinder blocks can be un-blocked by using a screw driver to turn the relevant notch on the back of the shaft. For bigger units rotation may be started directly from the pump shaft or from the joint (remember to turn off the electricity supply first) or ontact an authorised service centre
	Presence of solid bodies in the pump rotor	If possible, dismantle the pump casing and remove any solid foreign bodies inside the rotor, if necessary contact an authorised service centre
	Bearings blocked	If the bearings are damaged replace them or if necessary contact an authorised service centre

PROBLEM	PROBABLE CAUSES	POSSIBLE REMEDIES
The pump functions but no water comes out	Presence of air inside the pump or suction tube	Release the air from the pump using the pump plugs and/or using the delivery control valve. Repeat the filling ope ations until all air has been expelled
	Possible infiltration of air from suction tube connections, drain plugs or filling of pump or f om the gaskets of the suction pipe	Check which part is not tight and seal the connection adequately
	Suction filter blocked	Clean the filter, if necessary, replace it .
Insufficient flow	Pipes and accessories with diameter too small causing excessive loss of head	Use pipes and accessories suitable for the specific application
	Presence of deposits or solid bodies in the internal passages of the rotor	Clean the rotor and install a suction filter to prevent other foreign bodies from entering
	Rotor deteriorated	Replace the rotor, if necessary, contact an authorised service centre
	Worn rotor and pump case	Replace the rotor and the pump casing
	Gases dissolved in the water	Perform the opening and closing manoeuvres through the feeder gate to eliminate the gas inside the pump casing .If the problem persists, contact an authorised service centre
	Incorrect direction of rotation	Invert the electrical connections on the terminal board or control panel
	Suction head excessive in rela-tion to the suction capacity of pump	Try to close the feeder gate partially and/or reduce the difference in level of the pump and the liquid being aspirated
	Suction pipe too long	Bring the pump closer to the suction tank so as to use a shorter pipe. If necessary use a pipe of a wider diameter
Noise and vi-brations from the pump	Rotating part unbalanced	Check that no solid bodies are obstructing the rotor
	Worn bearings	Replace the bearings
	Pump and pipes not fi mly attached	Anchor the delivery and suction piping as needed
	Flow too strong for the diameter of the delivery pipe	Use bigger diameters or reduce the pump flow
	Functioning in cavitation	Reduce the fl w by adjusting the feeder gate and/or using pipes with a bigger internal diameter.
	Unbalanced power supply	Check that the mains voltage is right

PROBLEM	PROBABLE CAUSES	POSSIBLE REMEDIES
Leakage from the mechanical seal	The mechanical seal has functioned when dry or has stuck	Replace the seal, if necessary contact an authorised service centre Make sure that the pump casing (and the suction pipe if the pump is not self-priming) are full of liquid and that all the air has been expelled.
	Mechanical seal scored by presence of abrasive parts in the liquid pumped	Install a suction filter and use a seal suited to the characteristics of the water being pumped.
	Mechanical seal unsuitable for the type of application	Choose a seal with characteristics suitable for the specific application
	Slight initial drip during filling or on first sta t-up	Wait for the seal to adjust to the rotation of the shaft. If the problem persists contact an authorised service centre

9.2.7 Dosing Pump Maintenance

WARNING

Before performing any maintenance or cleaning operations of the dosing pump, proceed as follows:

1. Make sure the pump is electrically deactivated (both poles) by disconnecting the conductors from the power supply using the omnipolar switch which must have a minimum distance of 3 mm between its contacts.
2. Relieve all the pressure in the pump body and the outlet piping in the most adequate way possible (be very careful during this operation).
3. Drain the liquid present in the pump body by disassembling and reassembling the pump body using the four fixing sc ews, tightening torque 180÷200 Nxcm (Fig. 2.7.2).

Please pay particular attention to this last point and we recommend the user to consult the pump drawings before starting any operations.

If any liquid losses are present in the hydraulic system (due to O-ring seals, valves or piping breakages), stop the pump by releasing pressure in the outlet piping and then proceed with maintenance operations using adequate safety measures (gloves, goggles, overalls, etc.).

Fig. 2.7.1 - Dosing Pump

DANGER

DANGEROUS OR TOXIC LIQUID DOSAGE

To avoid damage to persons and property due to contact with dangerous liquids or by the inhalation of toxic vapors, always adhere to the instructions contained in this owner's manual and keep in mind the following regulations:

- Perform operations according to the instructions of the liquid manufacturer.
- Check the hydraulic parts of the pump for damage and breakages and only use the pump if it is in perfect working order.
- Use small piping fit for the liquid being used and for the plant operating conditions, if necessary, insert the piping inside PVC protection conduit.
- Before deactivating the dosing pump, neutralize the hydraulic part using an appropriate reagent.

Maintenance

1. Periodically check the liquid level in the tank to make sure that the pump does not run dry; even though no damage will occur to the equipment itself, this is recommended to avoid any damages due to the lack of additive in the plant.
2. Check pump operation, screw seals and gaskets every 6 months and for very aggressive liquids make more frequent checks and in particular monitor the concentration of the plant additive; a reduction in additive concentration could be determined by wear on the valves (in this case substitute the valves being careful to reassemble them as in Fig. 2.7.2) or by clogging of the fil er which must be cleaned as follows.
3. The manufacturer recommends periodical cleaning of the hydraulic parts (valves and filters).

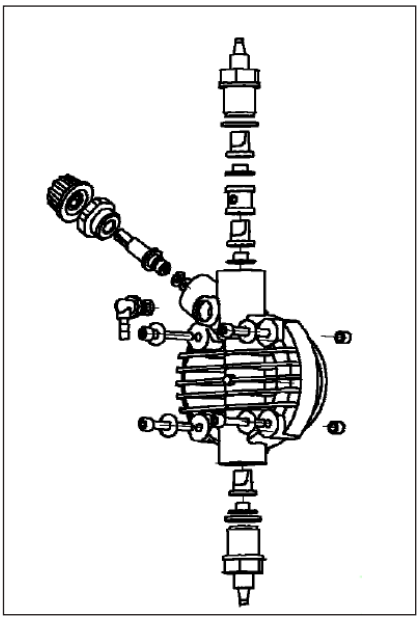


Fig. 2.7.2 - Pump fixing sc ews

It is not possible to establish a cleaning frequency as this depends on the type of application; the reagent to be used depends on the additive employed.

Good ordinary maintenance and programmed checks guarantee over time good plant conservation and operation. Check for good pump operation at least every 6 months. If the dosing pump is used continuously, make more frequent checks.

Check the headers for deposits, in this case they can be removed and washed well in water. If the deposits are difficul to remove with water, the parts can be washed with diluted hydrochloric acid (muriatic acid), obviously avoiding that the acid enters the piping and finally inse with water.

Check and substitute regularly the non-return valve with the VITON rubber valve-pusher, the membrane, header O-ring, as these are the parts which suffer the most deterioration over time.

To substitute the membrane unscrew the 4 screws, unscrew the membrane, substitute the O-ring and reassemble all the parts back making sure to tighten the screws in an equal manner (alternatively in a crosswise direction and respecting the tightening torque indicated - see Fig. 2.7.2).

Check and substitute regularly the injector rubber as it is subject to deterioration due to wear and as it also acts as a seal it may cause a return of dosing product back to the pump.

Extraordinary maintenance

All components supplied are chosen and tested according to rigid selection principles and therefore guarantee, for a long period of time, the reliability and operation of our equipment.

Due to external problems (such as overvoltages, excessive pressure and water-hammers), any bad or improper use or programming errors, may render necessary extraordinary maintenance in addition to the ordinary maintenance already mentioned.

Dosing Pump Troubleshooting

Following can be found a list of possible faults and ways to correct the faults.

FAULT	FAULT CORRECTION
The pump does not dose the product	Non-return valve deteriorated or badly assembled: assemble correctly or substitute the valve following ordinary maintenance instructions
	Membrane deteriorated, substitute the part
	Magnet fuse broken, substitute the fuse (check magnet resistance)
	Magnet burnt, substitute the magnet

FAULT	FAULT CORRECTION
The electronic part does not transmit impulses to the magnet	Broken printed circuit due to overvoltage or other causes, etc.: substitute the printed circuit
No leds are on	Check that the pump has a power supply (current plug and socket): If the pump remains inactive contact our technical assistance centre.
The pump pulses in an irregular manner	Check that the power supply values are within the limits indicated.
When the additive is finished the pump does not go into an alarm state	Check the connection between the sensor and its connector

Mechanical faults

As the system is quite robust, normally there are no mechanical problems. Occasionally there might be a loss of liquid from the nipple because the tube nut has become loose, or more simply the outlet piping has broken. It is rare to detect losses due to a broken membrane or due to wear on the membrane seal gasket.

In this remote case, the components must be substituted by removing the four screws on the pump body (Fig. 2.7.2), when the screws are reassembled tighten them equally to a maximum tightening torque of 180÷200 Nxcm. Once the liquid loss is repaired, clean the dosing pump of any additive residues which could attack the pump body.

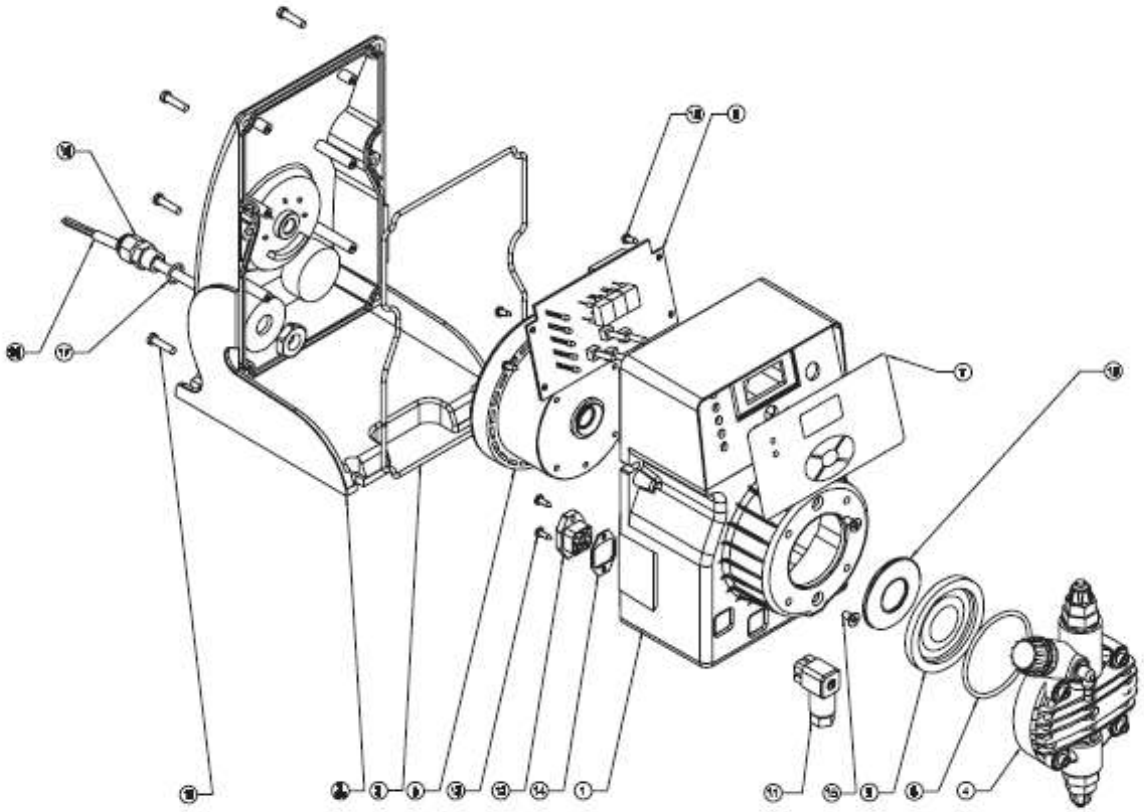
WARNING

When removing the dosing pump from the plant take care when sliding out the piping from the outlet fitting to avoid spilling any residual additive contained in the piping. Clean the pump body if any additive comes into contact with the body

The dosing pump pulses but does not send additive to the plant

1. Disassemble the suction and outlet valves, clean them and place them back to the same position (Fig. 2.7.2). If the valves present swelling, check the table for compatibility between the additive and the valves being used in the pump (the standard valve is in Viton®; or another compatible elastomer, ball valves are an optional).
2. Check for a clogged fil er.

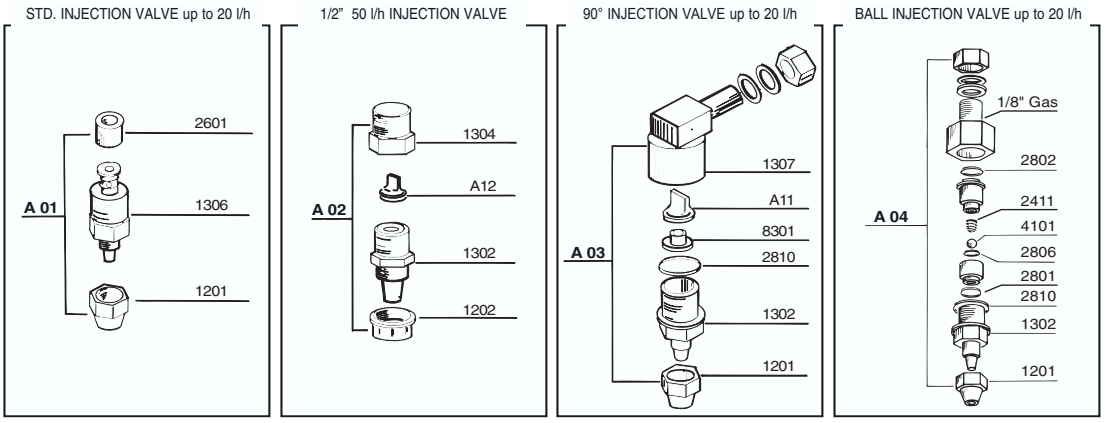
Serie DLXB *Series*



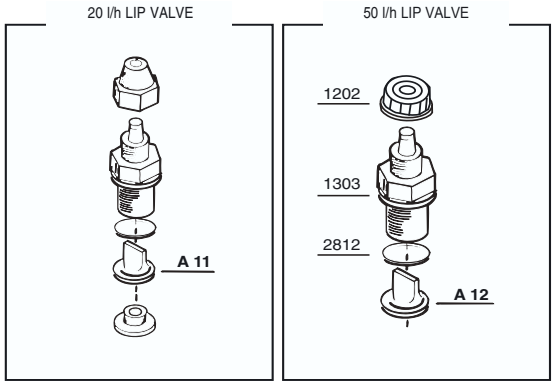
POS.	ELENCO DEI PARTICOLARI	*SPARE PARTS LIST*
1	CASSA	*CASING*
2	COPERCHIO POSTERIORE	*BACK COVER*
2 BIS	COPERCHIO POSTERIORE - BASAMENTO	*BACK COVER - BASEMENT*
3	GUARNIZIONE COPERCHIO POSTERIORE	*BACK COVER GASKET*
4	CORPO POMPA	*PUMP HEAD*
5	ELETTROMAGNETE	*ELECTROMAGNET*
6	SCHEDA ELETTRONICA	*PC BOARD*
7	PELLICOLA SERIGRAFATA PANNELLO COMANDI	*CONTROL PANEL SERIGRAPHY FILM*
8	O - RING DI TENUTA CORPO POMPA	*PUMP HEAD O - RING*
9	DIAFRAMMA IN PTFE	*PTFE DIAPHRAGM*
10	FLANGIA	*FLANGE*
11	CONNETTORE SERVIZI (FEMMINA)	*OUTPUT CONNECTOR (FEMALE)*
12	CONNETTORE SERVIZI (MASCHIO)	*OUTPUT CONNECTOR (MALE)*
13	FISSAGGIO CONNETTORE 2.9X9.5	*2.9X9.5 CONNECTOR SCREW*
14	GUARNIZIONE DI TENUTA CONNETTORE	*CONNECTOR GASKET*
15	VITE FISSAGGIO ELETTROMAGNETE M4X8	*M4X8 ELECTROMAGNET SCREW*
16	PRESSACAVO DI ALIMENTAZIONE	*CABLE CLAMP*
17	O-RING DI TENUTA PRESSACAVO	*CABLE CLAMP O-RING*
18	VITE DI FISSAGGIO SCHEDA ELETTRONICA 2.9X9.5	*2.9X9.5 PC BOARD SCREW*
19	VITE DI FISSAGGIO COPERCHIO POSTERIORE 4X16TX	*4X16TX BACK COVER SCREW*
20	CAVO DI ALIMENTAZIONE	*POWER CABLE*

VALVES

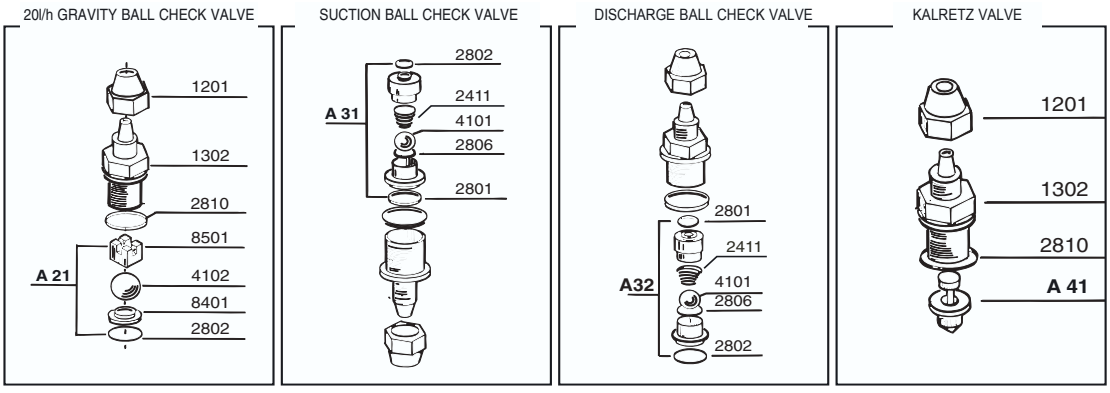
Complete injection valves



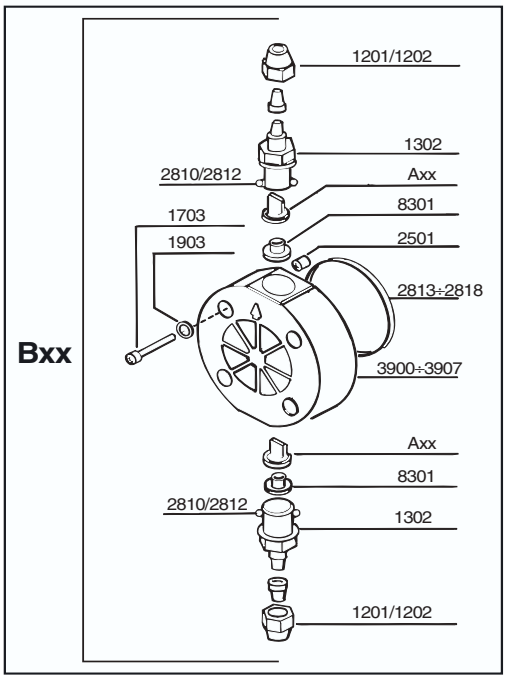
Lip valves



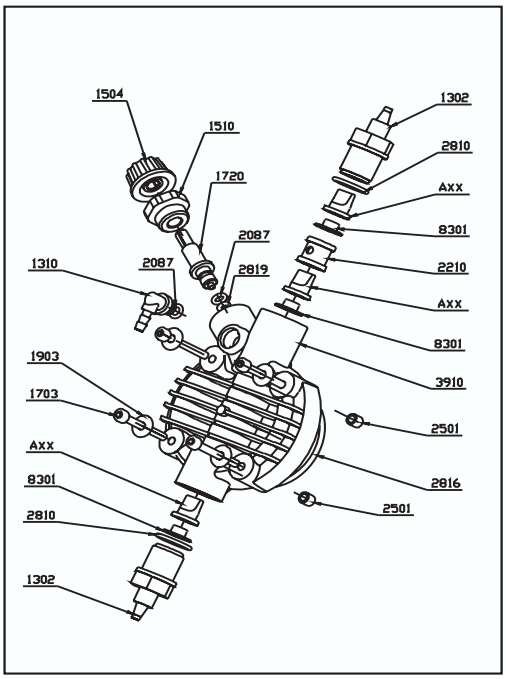
Special valves



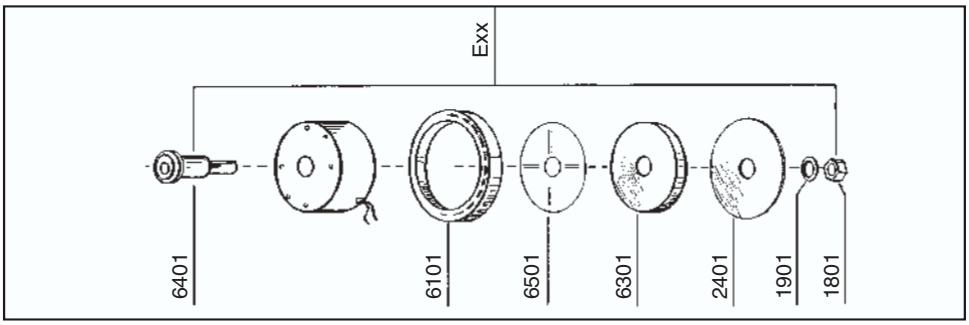
Complete Pump Head:
P.P. - PVC - Stainless Steel - PTFE



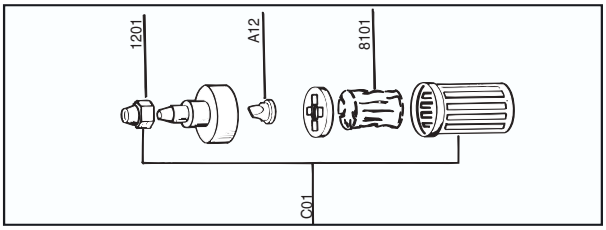
Manual air bleed
pump head



Complete Electromagnet



Std Filter up to 20 l/h



10 Technical Data and Spare Parts

10.1 Technical Data

TYPE	Max power rating (W)	Production with new membranes [1] (cubic mt per day)	Noise at 1 m distance (dBA)
STDC-SY 9000	13200	32.4 m3/d	80

[1] Test condition:

1. *Operating pressure 55 BAR (798 PSI)*.*
2. *Prefilter feed pressure 3 BAR (43 PSI)*.*
3. *Feed water temperature 25°C*.*
4. *Feed water salinity 36000 ppm*.*
5. *Feed water pH-value 3-11.*

** this value is indicative, the correct value is the one shown in the test report*

10.2 Spare Parts

High pressure pump and Low pressure pump:

P/N	Description
211PA035410000	High pressure pump CAT 3541
211PA035310000	High pressure pump CAT 3531
211PBMXHL8....	Feeding pump

Other spare parts:

P/N	Description
211VLF001F0000	Manual pressure regulation valve
204MF000000059*	Inverter 18.5 kW*
A14CE00EMC....	Control box EMC (complete)
211SW004400XLE	Membrane 12000 Gpd
211PV80E1000H2	Vessel 8" 1000 PSI
012MK…	Maintenance kit
211SMMC2AB0000	Membrane cleaning solution Kit A&B
211SM004030000	Membrane preservative solution FL 403
211VLFFF023V24	3-way valve 2" FFF for safe/unsafe

**Optional item.*

WARRANTY FOR TECNICOMAR EQUIPMENTS

TECNICOMAR warranties 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 warrantied against iron fouling (rust), chemical attack, extreme temperatures (<0°C/>+48°C), drying out, or extreme operating pressures (> 1000 PSI/70 bar).

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

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

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

WARRANTY CLAIM

A claim shall be made by delivering the part for inspection to an authorized dealer or by giving notice to Tecnicomar (fax +39.0923.960235) that shall then arrange for the necessary inspection and repair or replacement (which may be conducted at the facilities of Tecnicomar) provided such service is covered under this warranty.

RETURN PRODUCT TO TECNICOMAR ONLY AFTER RECEIVING FACTORY AUTHORIZATION INCLUDING THE ASSIGNMENT OF A RETURN MATERIAL AUTHORIZATION NUMBER. THIS NUMBER MUST BE CLEARLY MARKED ON THE OUTSIDE OF THE BOX WHEN SHIPPING.

Buyer shall pay for all related labor and materials and any shipping, transportation and other expenses associated with the service.

TECNICOMAR
DISSALATORI - WATERMAKERS

TECNICOMAR S.p.A. C/da Berbaro n.145/D
91025 Marsala - ITALY
Tel. 0923-969409 / Fax 0923-960235

Rev. 1 - Issue: 28/04/2015

TECNICOMAR
DISSALATORI - WATERMAKERS

TC 1000 *TC 2500* *TC 5000*

INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR THE UV STERILIZER

TABLE OF CONTENTS

1.0 RECOMMENDATIONS

Before using the sterilizer, read this installation, use and maintenance manual fully. Knowledge of the information and instructions contained in this manual is essential for the correct installation and correct use of the system by the user. The user must be aware of the operating mechanisms of the sterilizer as far as this falls within his competence. It is the buyer's responsibility to ensure that users are trained and aware of all the information and instructions contained in the documentation supplied. The sterilizer has been designed and built with mechanical and electrical security devices to protect the operator or the user from possible physical injury. Nevertheless, the operator or user must be aware of the potential risks that exist while working with the sterilizer. Intervention on the system by the user is only allowed within the limits of his competence and on the understanding that he has been properly trained.

The user shall be held responsible for any changes that he makes to the sterilizer. The user is responsible for all the operations necessary to keep the sterilizer running efficiently before and during use. Only the use of original spare parts offers guarantee functional

reliability and the optimization of the performance of the sterilizer. This type of system must be destined exclusively for the use for which it was designed, i.e.: the treatment of water used for drinking or process. The sterilizer must not be removed from its original position.

Do not use corrosive products, acids, scouring pads or wire brushes to clean the sterilizer. Do not wash the sterilizer with direct or high-pressure jets of water.

The manufacture declines all responsibility for injury or damages caused by failure to observe the contents of this manual. The manufacture declines all responsibility for injury or damages caused by repairs carried out by people other than qualified professionals.

The manufacturer declines all responsibility for injury or damages caused by changes, accessories or devices of any kind applied to the appliance and not expressly provided for in this manual, especially if they change the original operation of the sterilizer in any way.

2.0 WARNINGS

DANGER

The light of ultraviolet lamps may cause severe burning to unprotected skin and eyes. Avoid connecting the appliance to the electricity supply before fitting the UV lamp into the socket and fitting the protective covers.

Check that the power supply is suited to the power of the appliance to be installed and that the electric cable section is at least 1.5 mm2.

Always disconnect the power supply before working on or removing part of the sterilizer fastened in place with screws or slotted into position before switching on the electrical parts. The standard electricity supply of the appliance is monophase, 220/240V – 50Hz.

Different electricity supplies (by request) are indicated clearly in the manual and using specially labeling.

Changes in voltage in excess of 10% of the rated value can damage the electrical parts of the appliance, therefore it is advisable to check the mains voltage at all times.

The sterilizer is suitable for permanent connection only.

The packaging elements (plastic bags, polystyrene, etc.) must not be left within the reach of children as they are potentially hazardous.

3.0 SAFETY PRECAUTIONS

Always observe the safety precautions for people and items when carrying out any type of operation on sterilizers. The symbols together with the words "DANGER" and "WARNING" indicate that there is possibility of risk, as indicated below:

Indicates that failure to observe the instruction implicates a risk of electrocution

Indicates that failure to observe the instruction implicates a risk of general damage to people and/or things.

Indicates that failure to observe the instruction implicates a risk of damage to the sterilizer.

Pay particular attention to the following points:
- A Carefully read everything contained in the manual.
- B In particular, before installing the sterilizer, check the observance of the following conditions:
- B1 If there are suspended solids, install a water filter directly before the sterilizer. Failure to filter the water and limit the removal of
the suspended particles may limit the effectiveness of the same sterilizer.
- B2 The presence of sulphuric acid or iron and filterable solids in the water to be treated can cause the formation of a coating on the surface of the quartz tube which must be removed with a frequency that depends on the type of water to be treated.
- C Always switch off the appliance before performing any operation on electric cables or on electric parts of the appliance.
- D Tecnicomar S.p.A.declines all responsibility with regard to the use of the sterilizer in the event of failure to observe that stated in the
manual supplied as an integrated part of the supply.
- E The sterilizer must always be installed after the autoclave or the water timer and after every filtering or water treatment appliance.
- F The first time the sterilizer enters into service, the sterilized water must be allowed to run for 10 minutes so that any processing residue can be flushed out of the parts the water flows through.
- G If the sterilizer is out of operation, when there is a likelihood that the air temperature will fall below 0°C, it must be switched off and the water inside the sterilization chamber must be emptied to avoid damage due to frost.
- I If the sterilizer is out of operation for more than two days, it is best to disinfect it (see point 9.0)

4.0 GENERALI INFORMATION

4.1 Purpose of the manual

This manual has been created to offer the user the most thorough and clear information on the use and maintenance of the sterilizer, in order to make all the operations performed by the staff appointed to such task as safe and effective as possible. All the procedures necessary to cope with reasonably predictable emergencies that might occur during use have been listed, indicated the methods suggested by the manufacturer. Consequently it is necessary to closely observe the indications of this manual to ensure the safe and satisfactory operation of the sterilizer.

4.2 Authorised Technical Service Centre

For all technical/operational requirements, please contact the
Tecnicomar S.p.A. technical service centre at the following address:

TECNICOMAR S.p.A.
C/da Berbaro,145/D
91025 Marsala (TP) - ITALY
Tel: +39 0923.969409 Fax: +39 0923.960235 info@tecnicomar.it

IMPORTANT:
During the warranty period, no intervention may be carried out by your staff without prior authorization by our technical service office. Otherwise the warranty automatically expires.

4.3 Envisaged use

UV systems are suitable for sterilizing pre-filtered, clear water with a maximum iron content of 0.5 ppm and low organic substance content.
Under these conditions, the systems are able to guarantee the destruction of 99% of the bacterial charge at nominal capacity. For special applications, including fluids with different characteristics, you are advised to contact of technical services which, on the basis of a complete chemical-bacterial analysis, will be able to tell you the ideal calibration of the appliance.

4.4 Manufacturer's identification

TECNICOMAR S.p.A.
C/da Berbaro,145/D
91025 Marsala (TP) - ITALY
Tel: +39 0923.969409; Fax: +39 0923.960235; info@tecnicomar.it
www.tecnicomar.it

4.5 Standard packaging

The sterilizer is supplied wrapped in a sheet of bubble wrap and contained in a cardboard box.

4.6 Instructions for removing the standard packaging

There are no special precautions for unpacking the appliance, other than the normal care and caution to be used when handling fragile material. Before eliminating the cardboard packaging, check that you have not thrown away parts of the sterilizer (e.g.: unfitted tubes and bulbs), instruction booklets or other documentation.

4.7 Transport /Lifting /Handling /Acceptance

Always remember that, despite being accurately packaged and protected, the appliance contains light bulbs and quartz tubes: this means that the entire system must be considered as fragile material and handled as such. Being lightweight and of limited size, the system can be handled manually.
Upon receipt, it is necessary to open the packaging to check that the appliance is not broken, paying particular attention to the quartz tubes and light bulbs. Inform the transporter of any damage immediately.

4.8 Storage

The packed appliance must be stored in a dry environment (free from condensation) not exposed to weathering. The admissible storage temperature is 0-50°C. The boxes must not be stacked and must be kept in a horizontal position.

4.9 Supply limits

The supply includes a UV system, complete with quartz tube, UV light bulb, electrical control panel and instruction manual.
The appliance ends with two inlet and outlet trunks.

5 TECHNICAL FEATURES

5.1 General description

The UV system consists of a vertical sterilization chamber All the parts that come into contact with fluid are made of stainless steel or quartz glass. The chamber is crossed longitudinally by a quartz protection tube, which houses the germicide lamp. The aim of the quartz protection is to thermally isolate the lamps from the fluid, enabling them to operate at ideal temperature conditions. For this purpose, ultra pure quartz extruded tubes with a minimum impermeability of 95% at 2537 x 10^{-} 1om are used. The germicide lamps are of the mercury vapour, low pressure type, with main emission peak at the wavelength of 2537x10^{-} 1om, the casing of the lamp is designed to absorb the emission peak at the wavelength of 1800x10^{-} 1om, envisaging the formation of ozone in the surrounding air.
The electrical control panel is controlled and mounted onto the sterilization chamber. The systems are powered at 220 Volts by a plug to be connected to a mains socket.

5.2 Capacity

The rated capacities, with water pre-filtered to 20µ, are the following:
TC-1000: 1000 l/h
TC-2500: 2500 l/h
TC-5000: 5000 l/h

5.3 Dimensions

See drawings annexed to this manual.

5.4 Electricity supply

The sterilizer is powered at 220 VAC by a plug to be connected
to a 220V 50-60Hz mains socket.
Note: A tolerance of +/-5% is admissible (but not recommended).

5.5 Power

The absorbed powers are the following:
Power absorbed by TC-1000: 0.18A Power yielded: 38 Watts
Power absorbed by TC-2500: 0.18A Power yielded: 38 Watts
Power absorbed by TC-5000: 0.40A Power yielded: 76 Watts

5.6 Environmental conditions and operating limits

Minimum environment temperature: 5°C
Maximum environment temperature: 50°C
Minimum water temperature: 5°C
Maximum water temperature: 35°C
Maximum relative humidity: 95%
(Absence of condensation in the environment)

5.7 Tests carried out on the sterilization system

All the systems are tested in the workshop before delivery.
The system undergoes a hydraulic test, with water, reaching up to 1.5 the rated pressure.
The correct operation of the electronic card and digital display, and the correct switching on of the UV lamp are checked. 2% of production is subject to prolonged testing.

6 GENERAL SAFETY STANDARDS

6.1 Design standards applied

The electrical part of the system has been designed and built in observance of standard CEI EN 60204/1 on the safety of machinery and electrical equipment of machines.
IP control box: 54

7.0 INSTALLATION INSTRUCTIONS

7.1 Instructions for handling and transport

Always remember that, despite being accurately packaged and protected, the appliance contains a light bulbs and a quartz tube: this means that the entire system must be considered as fragile material and handled as such. Being lightweight and of limited size, the system can be handled manually.

7.2 Assembly sequence

Before installing the appliance, it is advisable to remove the quartz tube (if installed) from the sterilization chamber to prevent accidental breakage. To dismantle the quartz tube, proceed as follows:
loosen the pressure nozzle, turning it clockwise until it is completely extracted.
Extract the quartz carefully and put it in a safe place.

Caution: sometimes the o-ring tends to stick to the outer surface
of the tube.

DANGER
Quartz tubes are fragile and may cause serious injury when broken.
Consequently they must be handled with care, protecting the hands by wearing gloves that guarantee adequate protection.

7.2.1 Position the appliance

Before installing the appliance, check that there is enough space above it to allow easy extraction of the bulb and the quartz, and that there is enough space to perform maintenance.
Check that there is a power socket near the appliance to plug it in to the mains.
The sterilizer must be positioned in an area protected against accidental splashes or dripping condensation.
Do not position the sterilizer in particularly damp and dusty environments.
Ease of maintenance and reliability of the sterilizer in time depend on its correct and rational positioning.

7.2.2 Hydraulic connection

The untreated water inlet and treated water outlet connections consist of two male threaded trunks. Under the sterilization chamber there is a 1/8” plug which is used to completely empty it. Proceed as follows for correct hydraulic connection:

There must be two cut-off valves entering and leaving the system.
Installation of a by-pass enabling the stoppage of the system for maintenance while allowing the flow of water for operation is recommended.
The interposing of an anti-vibration joint between the inlet/outlet pipes and the system is recommended: any vibrations on the pipes could cause breakage of the quartz tube and/or jeopardise the seal of the pressure nozzle.
Flow rates which cause pressure surges must be avoided at all cost.
WARNING:
under no circumstances must the sterilizer be subject to mechanical stress from the pipes.

7.2.3 Assembling the quartz

After completing the hydraulic connection, insert the quartz tube into the sterilization chamber.
Pay attention when inserting the tube to avoid accidental breakage. Lubricate the o-ring with Vaseline and position it outside the. Insert the pressure nozzle and turn it clockwise without forcing it.

7.2.4 Pressurising of the system

After inserting the quartz, pressurise the system, slowing and carefully, ensuring that there are no leaks.

7.2.5 Assembling the lamp in the sterilizer

Insert the germicide lamp inside the protective quartz tube. Fit the quadripolar connector from the electrical control panel to the head of the lamp.

DANGER: RISK OF ELECTROCUTION
Germicide lamps are fragile and can cause serious injury when broken. Consequently they must be handled with care, protecting the hands by wearing gloves that guarantee adequate protection. They also contain considerable amounts of mercury and must be disposed of in observance of the laws in force.

WARNING:
Avoid touching the quartz of the lamp with your fingers so that greasy finger marks are not left on it. If this occurs, clean it using a soft cloth and alcohol.
Tighten the PVC collar onto the pressure nozzle. Tighten the cable gland onto the collar, ensuring that you do not twist the cable.

7.2.6. Electrical connection

The TC-2500 sterilizer requires a 220V power supply with a frequency of 50/60Hz to operate.
The sterilizer must be connected to the electricity main by plugging the power plug into a socket.

WARNING:
Do not extend or replace the electrical connection and map cables supplied with the system with other types of cable.

8.0 ENTRY INTO OPERATION OF THE SYSTEMS

8.1 Meaning of the buttons and nomenclature of the display

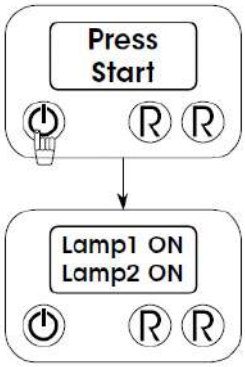
On/Off button

Ⓡ Reset buttons

H:00000 = Indicates the lamp life hours
HTOT:00000 = Indicates the total system life hours (cannot be reset)
Lamp1: ON= Indicates that lamp no. 1 is on
Lamp2: ON= Indicates that lamp no. 2 is on
Lamp1: OFF= Indicates that lamp no. 1 is switched off or burnt out
Lamp2: OFF= Indicates that lamp no. 2 is switched off or burnt out
Lumin: 100%= Indicates the lamp irradiation intensity

8.2 Starting the system

With the electric plug in the socket, the sterilizer is powered, but the lamps are switched off and the digital display indicates:



Press the system on button (symbol: ⏻)

The lamps will come on and thel display with indicate alternatively:
the lamp status (on/off), the irradiation intensity, the partial hours and total hours.

9.0 SANITIZATION

Ultraviolet systems guarantee the destruction of the bacteria inside the sterilization chamber. As no chemical disinfectant is added to the water to be treated, the system cannot act on any bacterial colonies inside the pipes after it. Consequently it is fundamental to sterilize the pipes before using the water or carry out an analytical check. A sodium hypochlorite solution can be used to sanitize the pipes, dosing quantities and concentrations that depend on the size and features of the distribution system (as a rough guide, a reside of free chlorine of at least 0.2 ppm, should spend at least 30 minutes in all the drawing points, especially those furthest from the sterilizer. The free chlorine value can easily be measured using the colorimetric kits available for sale). This operation can be repeated regularly according to need and the results of the analytical tests. After completing all the sanitization operations, flush all the utilities connected to the network with water until all the sterilizing solution has been eliminated. Water with a chlorine residue of 0.2 ppm is perfectly drinkable (chlorine could however cause problems in water for special industrial use, in water for aquariums, etc.) When the system is switched on for the first time, this flushing also eliminates any impurities left inside the system following assembly.

10.0 MAINTENANCE

The operation of the system is completely automatic and very little maintenance is required. The only vital operations are the regular replacement of the germicide lamps and the cleaning of the

protective quartz, according to requirements. Under normal operating conditions, the useful life of the lamps can be estimated at between 7,000 and 9,000 hours. The actual duration depends on various factors, such as the number of times it is switched on every day and shifts from rated voltage. The digital display mounted on the panel supplies the reading of the actual system operation time, and makes it possible to carry our scheduled maintenance. However, it is advisable to replace the lamp at least once a year (see point 10.1).
It is advisable to check the surface of the protective quartz tube at least once a quarter, cleaning it if necessary, to guarantee maximum efficiency of irradiation inside the sterilization chamber at all times (see point 10.2).

10.1 Procedure for replacing the lamp

Switch off the system (button) and pull out the power plug from the electricity main.
Loosen the cable gland, ensuring that you do not twist the cable.
Unscrew the cable gland from the collar, ensuring once again that you do not twist the cable.
Unscrew the PVC collar from the pressure nozzle.
Detach the white connector from the head of the lamp (it is only pressed in).
Gently remove the lamp from the quartz tube and put it in a safe place. Fir the new lamp, following the instructions indicated in point 7.2.5."fitting the lamps in the system".
After the new lamps have been fitted, reset the central control unit following the instructions indicated in point 10.3 "resetting the central control unit".

WARNING:
Avoid touching the quartz of the lamp with your fingers so that greasy finger marks are not left on it. If this occurs, clean it using a soft cloth and alcohol.

DANGER:
Germicide lamps are fragile and can cause serious injury when broken. Consequently they must be handled with care, protecting the hands by wearing gloves that guarantee adequate protection. They also contain considerable amounts of mercury and must be disposed of in observance of the laws in force.

10.2 Procedure for manually cleaning the quartz tube

During the normal operation of the system, substances contained in suspension in the water or incrustations due to the precipitation of salts may form on the quartz tube. These deposits prevent the passage of the UV rays and reduce the performance of the system. Therefore you must regularly clean the quartz.
It is not possible to indicate the frequency of cleaning. This depends essentially on the quality of incoming water. Should it become necessary to clean the quartz too frequently, consider the use of a pre-treatment process (filtering and/or softening).
Remove the germicide lamp following the instructions indicated in point 10.1 "Procedure for replacing the lamp".
Isolate the system from the water network, closing the cut-off valves before and after it.
Drain the sterilization chamber by opening the drainage valve under the chamber.
Remove the quartz tube following the instructions indicated at the beginning of point 7.2 "Assembly sequence".
Clean the tube using a soft cloth soaked in a cleansing solution suited to the type of deposit.

WARNINGS:
The use of soapy water is recommended and, in the case of limescale, a slightly acid solution, such as a diluted acetic or citric acid solution. Never use sharp or abrasive tools.

After cleaning, rinse thoroughly with drinking water.
Refit the quartz and lamp following the instructions indicated in points "7.2.3 Assembling the quartz", "7.2.4 Pressurising of the system", "7.2.5 Assembling the lamp in the system". To restart the system, follow the instructions indicated in points: " 8.0. ENTRY INTO OPERATION OF THE SYSTEM" and " 9.0 SANITIZATION".

DANGER:
Lamps and quartz tubes are fragile and can cause serious injury when broken. Consequently they must be handled with care, protecting the hands by wearing gloves that guarantee adequate protection.

10.3 "Resetting the central control unit"

To reset the central control unit, proceed as follows: keep the bttons pressed simultaneously for about 5 seconds. The partial hours referred to the lamp life and the illumination value must be reset, while the total hours remain the same.

11.0 INACTIVITY

11.1 Maintenance of the inactive system

There are no particular instructions to observe for the maintenance of the system during short periods of inactivity (a few days), other than the need to sanitize the pipes after the system when the system enters into service again (see point 9.0). For long periods of inactivity on the other hand, it is best to drain the water from the system and extract the germicide lamp, which should be stored in a safe place. When restarting the system, the lamp must be replaced (see point 7.2.5) and the system restarted, following the instructions
for first entry into operation (see points 8.0 and 9.0).

WARNING:
It is important that, when the system is idle and full of water, the temperature does not fall below 0°C to prevent the water from freezing inside the sterilization chamber, causing serious damage.

12.0 TAKING THE MACHINE OUT OF OPERATION

12.1 Description of demolition methods

The sterilization chamber, the plates at the end of the system and the protective caps are made of Aisi304 or Aisi316L stainless steel.
The lamp protection tubes are made of quartz glass. The o-rings are made of Viton (Fluoride-treated elastomer). The pressure nozzles (to block the protective tubes) are made of PVC.
The electrical panel must be classed as special waste. The germicide lamps are made of quartz glass and contain considerable amounts of mercury, which is exceptionally pollutant. Consequently they must be classed as toxic-poisonous waste and be disposed of in observance of the laws in force.

13.0 REPLACING SPARE PARTS

13.1 List of spare parts

See drawings annexed under chap. 15 "ANNEXES"

13.2 procedure for replacing spare parts

The replacement of important parts of the sterilizer must be carried out by the manufacturer's service centre or under its supervision.
Failure to observe this warning causes the expiry of the warranty and exonerates the manufacturer from any responsibility for direct and/or indirect damages to people or things.
Make particular reference to points: 13.2.2; 13.2.3; 13.2.4; 13.2.6

13.2.1 Replacing lamps.

See point 10.1

13.2.2 Replacing quartz tubes, pressure nozzles and o-rings

See point 10.2

13.2.3 Replacing the white quadripolar plug for the lamp

Cut off the power to the electrical control panel.
Detach the old plug and solder the new one in its place. Reconnect the power to the electrical control panel.

13.2.4 Replacing the complete electrical control panel

Switch off the electrical control panel using the special button.
Disconnect the power cable from the power socket.
Remove the lamp plugs (See point 10.1).
Detach the electrical control panel from the sterilization chamber, by moving it upwards.
Fasten the new electrical control panel in place.
Connect the lamp and the power supply, then start as indicated from points 7.2.5 onwards.

13.2.5 Replacing the electrical card

Cut off the power to the electrical control panel.
Open the screened box inside the electrical control panel using the four screws on the back.
Disconnect the wires of the faulty card.
Remove the electrical card and replace it with a new one.
Restore the connections to the electrical control panel as shown in the circuit diagram.
Close the screened box.
Reconnect the power to the electrical control panel.

14 GUIDE TO IDENTIFYING FAILURES AND ANOMALIES

"LAMP1 OFF"

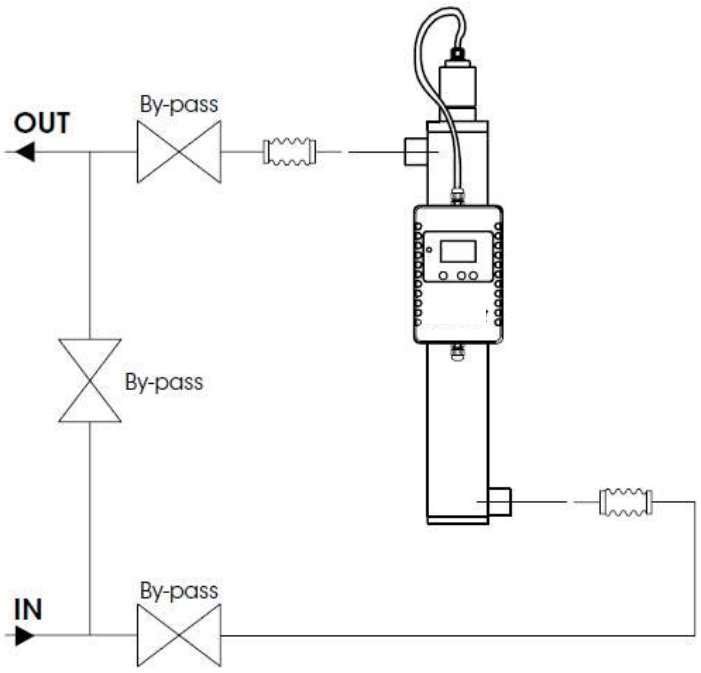
- Lamp no. 1 is burnt out, the red led beside the display is flashing: *Replace the lamp.*
- Electronic card burnt out/faulty: *Replace the electronic card.*

"LAMP2 OFF"

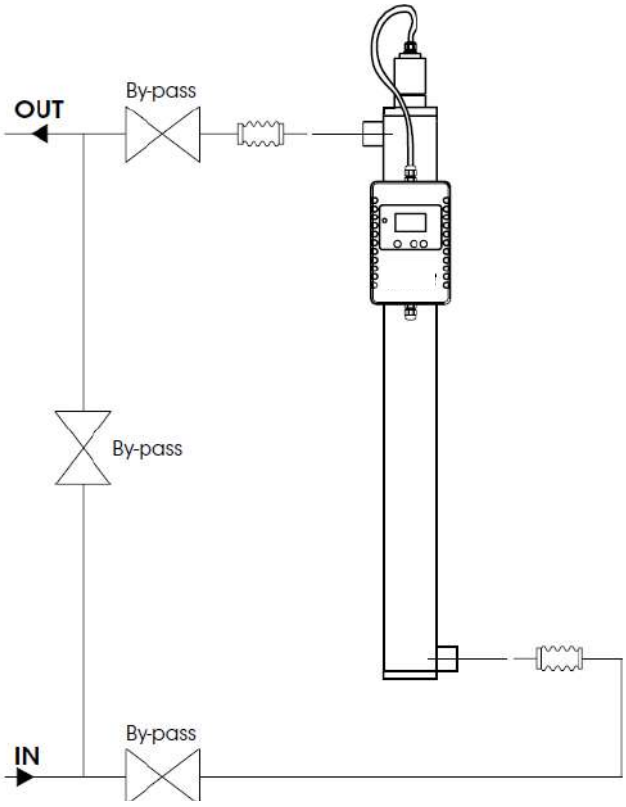
- Lamp no. 1 is burnt out, the red led beside the display is flashing: *Replace the lamp.*
- Electronic card burnt out/faulty: *Replace the electronic card.*

The system is off There is not electricity supply: *Ensure that the electricity supply is connected*:

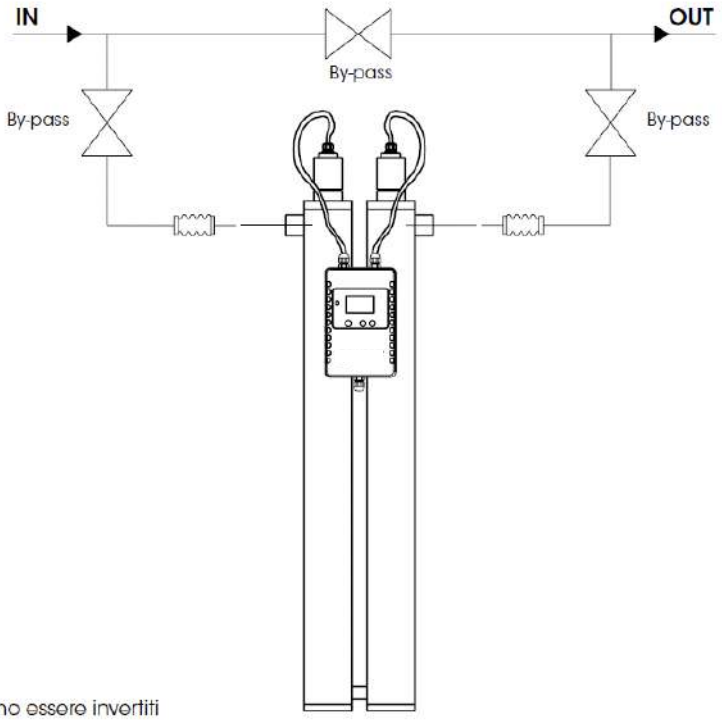
15 ANNEXES



Model TC-1000

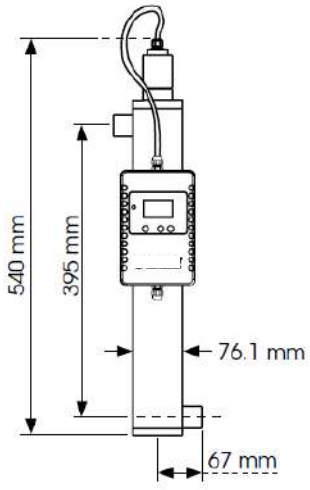


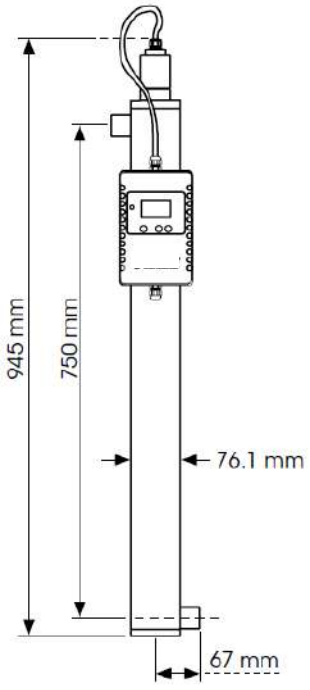
Modello TC-2500

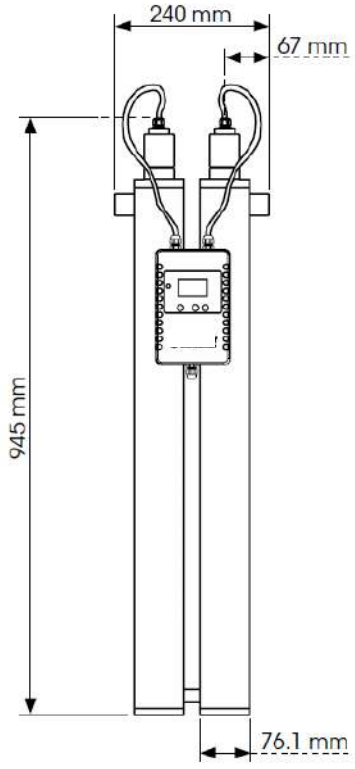


Modello TC-5000

Dimensions







TC-1000 **TC-2500** **TC-5000**

SPARE PARTS – TC 1000

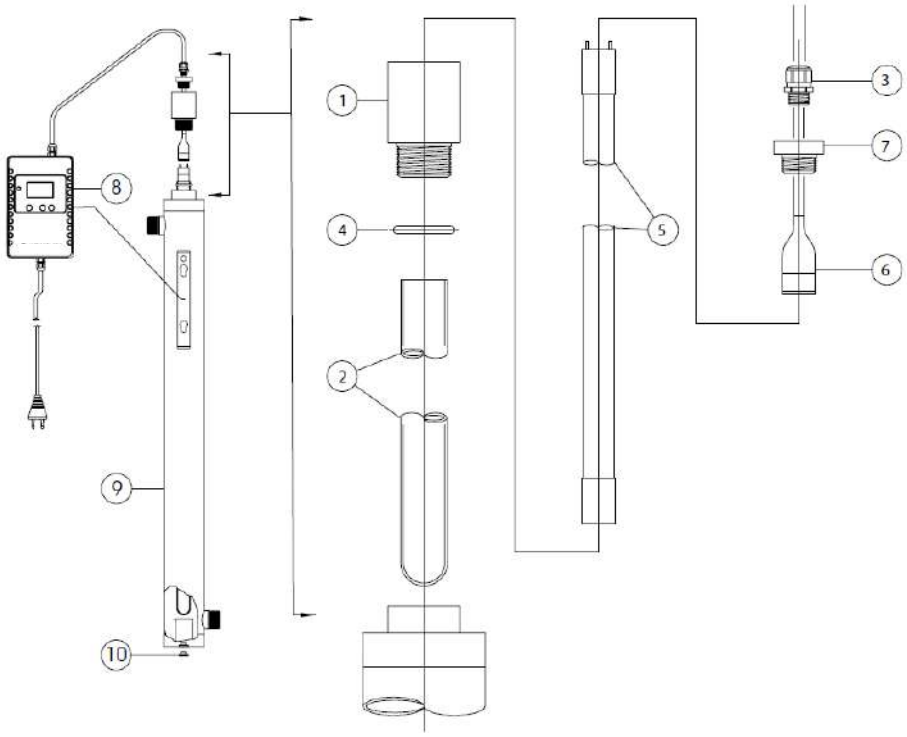
POS.	COD.	NR.PCS	DESCRIPTION
1	SH0182	1	LOCKING CONNECTOR
2	SH0125	1	QUARTZ 20TT
3	PG9	1	CABLE GLAND PG9 BLACK
4	OR4100	1	O-RING 4100
5	SH0113	1	LAMP 38W SHORT
6	ST0018	1	LAMP CONNECTION CABLE
7	ST0024	1	BLACK PVC COLLAR D.30
8	SH0150-1	1	CENTRAL BOX UNIT 1x38W – 220 Volt
9	ST0017	1	CASING
10	09190019	1	CYL. PLUG WITH ¼" GAS ALLEN SCREW

SPARE PARTS – TC 2500

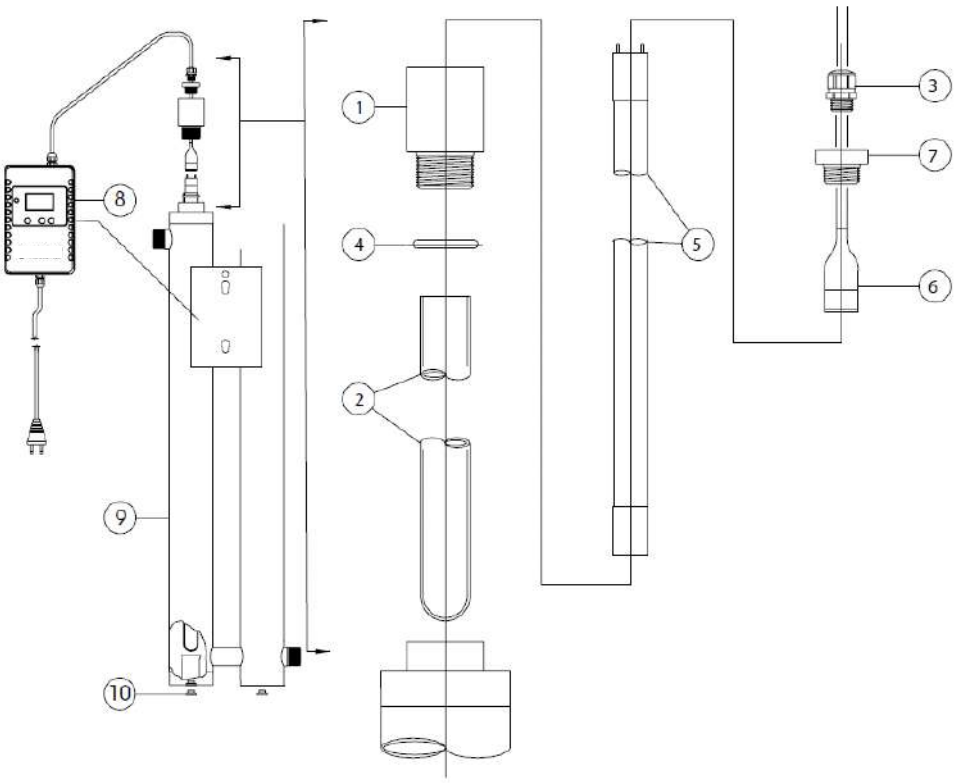
POS.	COD.	NR.PCS	DESCRIPTION
1	SH0182	1	LOCKING CONNECTOR
2	SH0130	1	QUARTZ 38TT
3	PG9	1	CABLE GLAND PG9 BLACK
4	OR4100	1	O-RING 4100
5	SH0110	1	LAMP 38W
6	ST0018	1	LAMP CONNECTION CABLE
7	ST0024	1	BLACK PVC COLLAR D.30
8	SH0150-1	1	CENTRAL BOX UNIT 1x38W – 220 Volt
9	ST0015	1	CASING
10	09190019	1	CYL. PLUG WITH ¼" GAS ALLEN SCREW

SPARE PARTS – TC 5000

POS.	COD.	NR.PCS	DESCRIPTION
1	SH0182	1	LOCKING CONNECTOR
2	SH0130	1	QUARTZ 38TT
3	PG9	1	CABLE GLAND PG9 BLACK
4	OR4100	1	O-RING 4100
5	SH0110	1	LAMP 38W
6	ST0018	1	LAMP CONNECTION CABLE
7	ST0024	1	BLACK PVC COLLAR D.30
8	SH0156-1	1	CENTRAL BOX UNIT 2x38W – 220 Volt
9	ST0016	1	CASING
10	09190019	1	CYL. PLUG WITH ¼" GAS ALLEN SCREW



ESPLOSO TC-1000 e TC-2500



EXPLODED TC-5000

WARRANTY

TECNICOMAR warranties the good design and quality of materials for 1 (ONE) YEAR from the date of purchase 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. This warranty does not cover consumption materials such as lamps and all parts subject to wearing.

The guarantee will become void if The Buyer:

- had the system installed using different procedures and materials than those described in this Manual;
- had the system repaired or modified by personnel not authorized by TECNICOMAR;
- did not respect the maintenance standards supplied 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.

CE CONFORMITY DECLARATION

The undersigned:
TECNICOMAR S.p.A.
C/da Berbaro, 145/D - 91025 Marsala (TP) - ITALY
declares, under its own responsibility, that the UV System are compliant to the essential requirements of the following directives:
Electromagnetic compatibility 89/336/EEC, 93/68/EEC
Low voltage 73/23/EEC, 93/68/EEC
Compliance with the following standards is observed:
EN 50081-1 General standard on emission (part 1): residential, commercial and light industry environments
EN 50082-1 General standard on immunity (part 1): residential, commercial and light industry environments
EN 60742 Standard related to insulation transformers and safety
Parts of the appliance destined for contact with alimentary substances are compliant to:

- •EEC Dir. 89/109 and Lgs. decree no. 108 of 25/01/92;
- •Min. decree 443 of the Ministry of Health of 21/12/90;
- •Regulation no. 174 of 6 April 2004 on the release of materials in contact with water.

This manual offers general information.
This manual does not contemplate accessorised, special or custom-built models which are only covered by the sales documents.
This manual does not allow the tracing of the product, only the sales documents can be considered valid in this sense.
The manufacturer reserves the right to alter the product
without prior notice.

TECNICOMAR®
DISSALATORI - WATERMAKERS

CALCITE FILTER

Standard manual

CALCITE CHARACTERISTIC

Calcite is a natural mineral composed of calcium carbonate and magnesium. It has the property to correct the PH of the water, making it less aggressive in terms of chemistry. The acidic water slowly dissolves the calcium carbonate and magnesium ,raising the PH to balance value so that the metals present in water, eg. copper, lead does not corrode the environment which they operates in (eg. piping).
A periodic backwashing will prevent packing, reclassifying the filter calcite bed and maintaining high flow rates.
The neutralizing properties of calcite are associated with increased water hardness.
Properties

- Color: white grey,
- Grains shape: irregular,
- Density : 1.20 kg/dm^3,
- Composition : SiO_2: 0.12%, Fe_2O_3: 0.016%, $MgCO_3$:55.6%, $CaCO_3$:44.2%

SYSTEM FEATURES

As shown in the figure the tank is filled with calcite for 2/3 of the total volume of the cylinder. The filtering system is composed of:

1. Fiberglass tank (external) - polyethylene (inside);
    a. Operating pressure: 0-10 bar;
    b. Certifications: DM 174, 97/23 CE(PED) directive, compliance with WRC IRN001 for food use, ZEFU/TUV, UDT, ASME, FDA, FRESENIUS;
2. Bottom nozzle;
3. Diffuser head;
4. Plastic pipe Ø20 mm;
5. Head cap threated with three position: filtering, backwash, draining.

CALCITE SUBSITUTION

According to chemical composition of incoming water and to the flow that passes through the filter, is necessary to replace the calcite. To replace the content unscrew the cylinder head upside down and remove the entire contents. Clean the bottom nozzle by unscrewing the bottom end of conical making sure that the slots of the stacked discs are free from scale.

Contents

Preface

Dear user, Thank you for using RUNXIN brand manual multi-port valve for water treatment systems.Please read this manual carefully before using, which will contribute to your machine offering perfect services for you normally for a long time.

RUNXIN brand manual multi-port valve is our patent product (Patent Number : ZL02257746.7, ZL02220153.X) which specially allocate in all kinds of water treatment systems.This valve has high hardness and pottery of degree of high level ceramic moving slice inside its body. As relative and moving slice have different blind holes and put through holes respectively, with change of the relative angle during slice rotate one course of circle definitely with it height laminating, it produces three different fluid pass way so as to realize these necessary functions, namely Service, Backwash and Fast Rinse. As the core control part for water treatment systems, this valve changes traditional water treatment systems tedious operation mode of a lot of valves and many pieces of pipelines, integrating various kinds of functions in one which is easier to install and operate.

- To ensure normal operation of the valve , please consult with professional installation or repairing personnel before use it.
- If there are any of pipeline engineering and electric works, there must be finished by professional at the time of installation.
- Do not use the manual valve with water that is unsafe or of unknown quality.
- Test water periodically to verify that system is performing satisfactorily.
- Do not put the valve near the hot resources or high humidity environment. And do not leave it outside.
- Forbidden to use the handle, pipelines, or other connectors as support to carry system.
- Handle or wheel is only used for turning left or right. It is forbidden to lift it up and down.
- Please use this product under the temperature between 5℃ and 45℃, water pressure between 0.1MPa and 0.6MPa. Failure to use this product under such conditions voids the warranty.
- If the water pressure exceeds 0.6MPa, a pressure reducing valve must be installed before the water inlet.

Product Characteristics

- **More reliable method for opening and closing**

It adopts the seal slice with high degree pottery, scuffresistance,corrosion proof for opening and closing, no leakage.

- **Reasonable fluid design**: Filter-Fast Rinse-Backwash-Fast Rinse-Filter.
- **Small rotation angle for opening and closing. It feels good for operation.**
- **It could be operated with pressure, leak proof.**

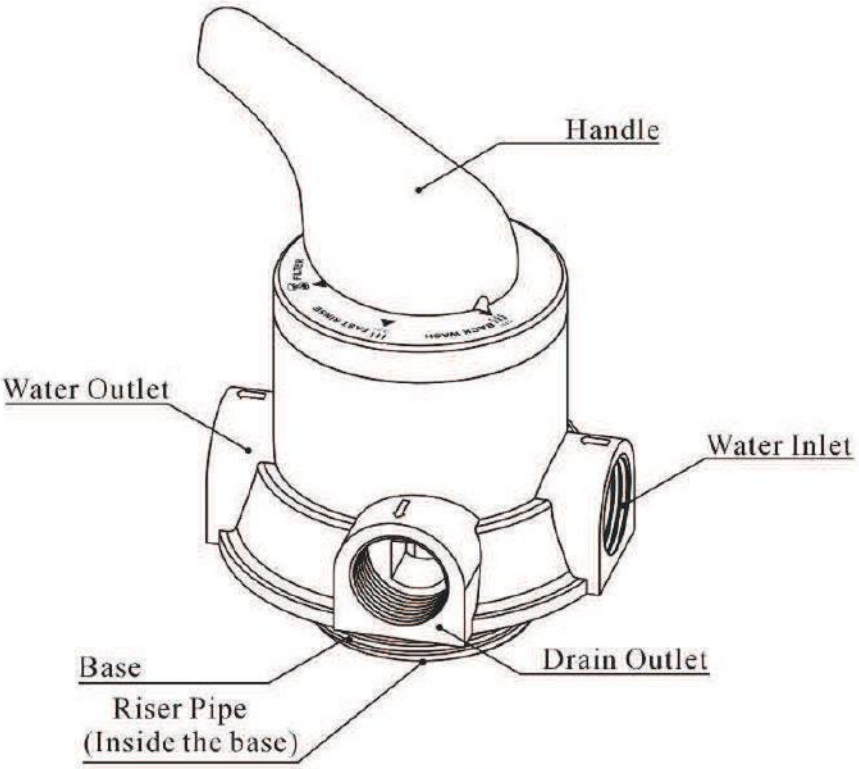
Range of Application

Water treatment system applied to Industrial,Commercial or Residential, such as:

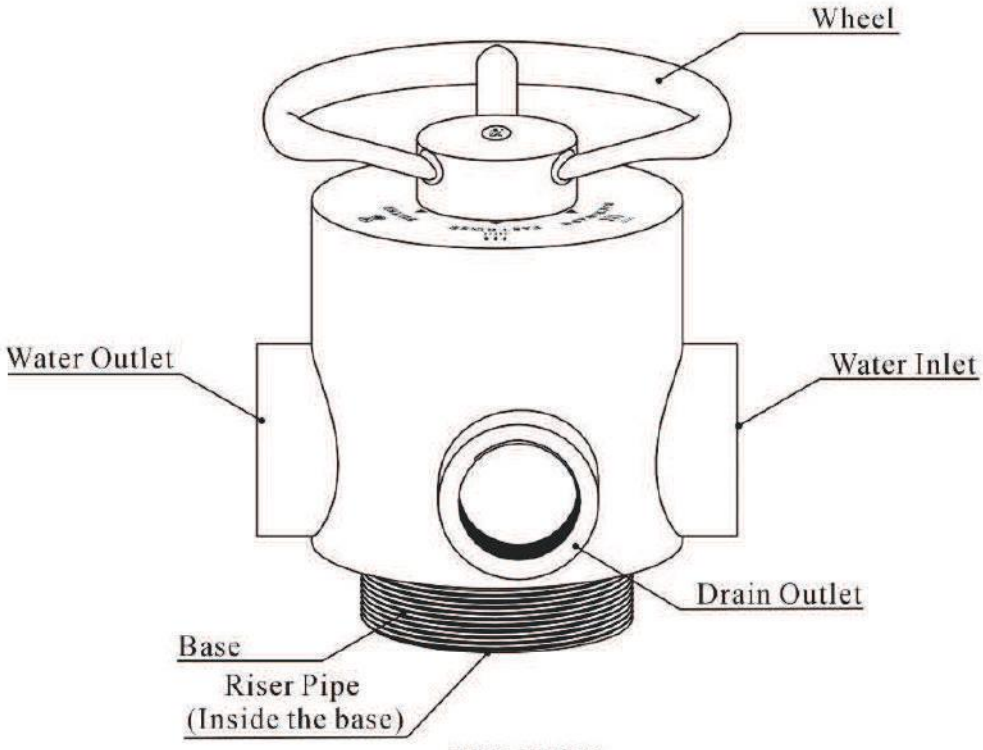
- Household Purify, Soften System.
- RO Pre-treatment System.
- Boiler Softening Water System.
- Swimming Pool Filter Equipment.
- Ion Exchange Equipment.

Product Appearance and Accessories

Product Appearance (only for reference, subject to real product)



TM.F56A



TM.F56D

Figures on Decoration Cover and its English Description

ENGLISH	FIGURE	DESCRIPTION
FILTER		In Filtration state
BACKWASH		In Backwash state
FAST RINSE		In Fast Rinse state

Product Accessories

Model	Description	Quantity	Description	Quantity
TM.F56A	2-1/2 ″ Base O-ring (φ 73×φ 5.3)	1PC	1″ Washer (φ 30×φ 24×3.3)	3PCS
TM.F56B/C	—	—	—	—
TM.F56D	4 ″ Base O-ring (φ 104.6×φ 5.7)	1PC	—	—
TM.F56E	2-1/2 ″ Base O-ring (φ 73×φ 5.3)	1PC	3/4″ Washer or 1/2″ Washer (φ 24×φ 18×3)	3PCS
TM.F56F	2-1/2 ″ Base O-ring (φ 73×φ 5.3)	1PC	1″ Washer (φ 30×φ 24×3.3)	3PCS
TM.F52	Base O-ring(φ 78.5×φ 73×3.4)	1PC	—	—

Product Specifications

Control Mode: Manual

Working Condition: Suited Pressure ——— 0.1~0.6MPa
Suited Temperature———— 5~45℃

(Table One) **Manual Multi-port Valve**

Model	Connection Size				Maximum Water Capacity
	Inlet/Outlet	Drain Outlet	Base	Riser Pipe	m³/h
TM.F56A	1″ F	1″ F	2-1/2″ -8NPSM	1.05″ OD (26.7mm)	4.5
TM.F56B	3/4″ or 1/2″ F	3/4″ or 1/2″ F	Matching with 10″ housing	1.05″ OD (26.7mm)	0.5-1
TM.F56C	3/4″ or 1/2″ F	3/4″ or1/2″ F	Matching with 20″ housing	1.05″ OD (26.7mm)	0.5-1
TM.F56D	2″ F	1-1/2″ F	4″ -8UN	1.5″ D-GB (50mm)	10
TM.F56E	3/4″ or 1/2″ F	3/4″ or 1/2″ F	2-1/2″ -8NPSM	1.05″ OD (26.7mm)	2
TM.F56F	1″ F	1″ F	2-1/2″ -8NPSM	1″ D-GB (32mm)	6
TM.F52	1/2″ F	1/2″ F	M82×3	Inserting Mode (16.5mm)	0.5-1

Note:

①M— Male Thread F— Female Thread OD— Outer Diameter

② 2-1/2″ and 4″ side-mounted connectors available when you want to operate on the side. The TOP and BOTTOM size of 2-1/2″ one is 1″, the size of 4″ one is 2″.

③TM.F56B is matching with 10″ housing. The tank whorl sizes have two kinds which are 95 rectangle whorl and 98 hackle whorl.

④TM.F56C is matching with 20″ housing.The tank whorl sizes have three kinds which are 118 rectangle whorl, 115 hackle whorl and 110 rectangle whorl.

⑤The water treatment capacity is related with flow speed, inlet water pressure, filtering materials etc. The parameters showed on the above table is only for reference.

Installation and Connection

Before installation, read all those instructions completely. Then obtain all the materials and tools needed for installation.

Perform installation according to regulated water inlet, water outlet, drain outlet and relative plumbing codes.

1、Installation requirements:

1) The shorter the distance between filter and drain point, the better;

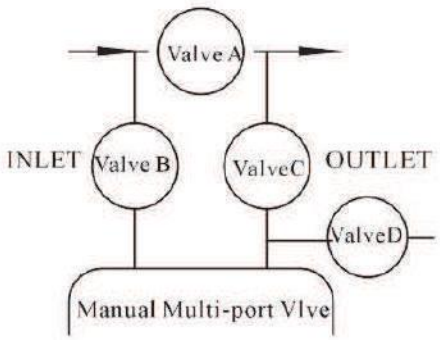
2) Leave a certain space for operating and maintaining devices conveniently.

3) Do not install the vavle near hot resources or in direct sunlight, rain and other factors that may result in damage to the product. And don't leave it outside.

4) Do not install the valve, pipeline ect under circumstances where the temperature may drop below 5℃ or above 45℃.

5)Install the valve in a place where water damage is least likely to occurif a leak develops.

2、 Installation of pipeline.



(Picture One)

In order to maintain conveniety, device is advised installation like drawing as follows:

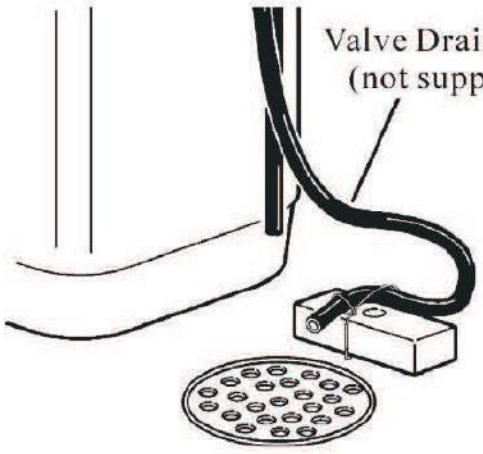
Instrucion: There are three ball valves being connected to the manual multi-port valve and the inlet and outlet pipe.Valve B isconnected to the inlet pipe. Valve C is connected to the outlet pipe.

When changing filter materials or maintaining tank, open valve A, close valve B and C. When using, open valve B and C, close valve A.ValveD is for taking water used to test.

- If making a soldered copper installation, do all sweat soldering before connecting pipes to the valve. Torch heat will damage plastic parts.
- When turing threaded pipe fittings onto plastic fittings, usd care not to cross-thread or cause damage to the valve.
- Support inlet and outlet plumbing in some manner (use pipe hangers) to keep the weight off of the valve fittings.

3、Installation of drain hose.

If use following hose as drain pipe, please fix it as the picture two shows.



(Picture Two)
Correct Method for Drain

The valve should be higher than the drain point.And the distance of the drain point shouldn't be too far.

Be sure not connect drain with sewer definitely, and leave a certain space between them avoiding wastewater be absorbing to the water treatment equipment, such as showed in picture two. If wastewater is used for other purpose, please use another container for loading. And also keep a certain space between drain and container.

- Failure to install the manul multi-port valve correctly voids the warranty.
- Installation of any pipelines and electric equipments should be performed by relative professional.
- The minimum inlet pressure is 0.1MPa,maximum inlet pressure is0.6MPa.If the inlet pressure exceeds 0.6MPa， a pressure reducing valve must be installed before the inlet pipeline.
- When installation, do not use drain hose or other connectors as support.
- Handle all components of this valve with care. Do not dorp, drag, or turn components upside down. And please use the accessories we supplied.
- Forbidden overexerted when installation and connection pipelines to avoid thread broken. And no bearance of all stresses on all ports of the valve.
- It is suggested to use PPR pipe, Wave-thread pipe or UPV Cpipe, and avoid using Aluminum Plastic pipe.
- The connection of all pipelines should be sealed enough, no leakage.Otherwise,flow capacity under some status may not reach expected effect.

Trial Running

1. Installation the multi-port valve on tank and other pipes, close the by-pass valve A (as picture one show,following same as).

2 .Opening inlet valve B to 1/4 position slowly, making water flow into the tank. When water stop flowing,open the outlet valve C.Until all the air are out of the pipe,then close the outlet valve.And check whether it is leakage. In case it is, please solve it immediately.

3 .Open the inlet valve B completely.

4 .Rotate the valve handle to the 'Backwash' position. Let drain water flow out for 3 ~4 minutes.

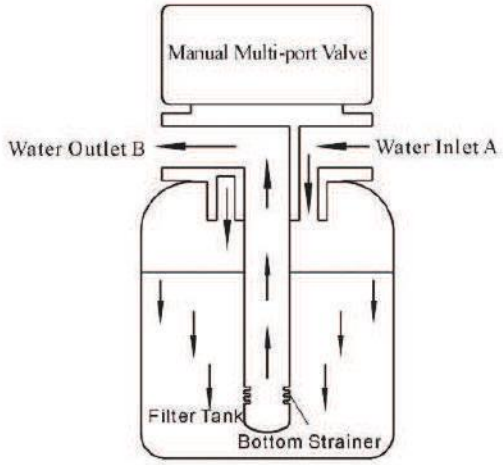
5 .Rotate the valve handle to the 'Fast Rinse' position, Fast Rinse for a certain time.

6 .Take out some water for analysis. If the water quality is eligible, then rotate the handle to the 'Service' position to be used.

- If the inlet water flow too quickly, materials in tank will be damaged. The sound from drain pipe could be heard when water flow into tank slowly.
- The operating time in backwash and fast rinse status could according to suggestions of set equipments suppliers.

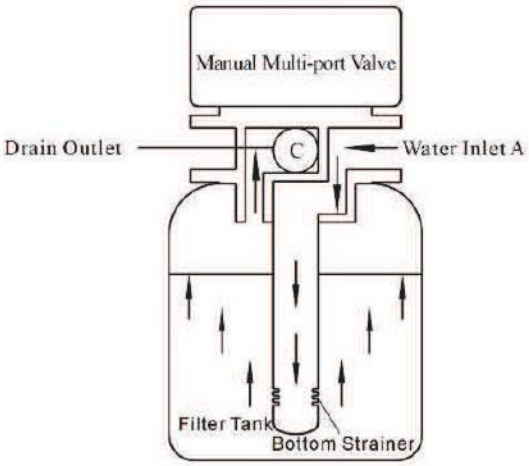
Working Principle and Flow Chart

Filtration Position



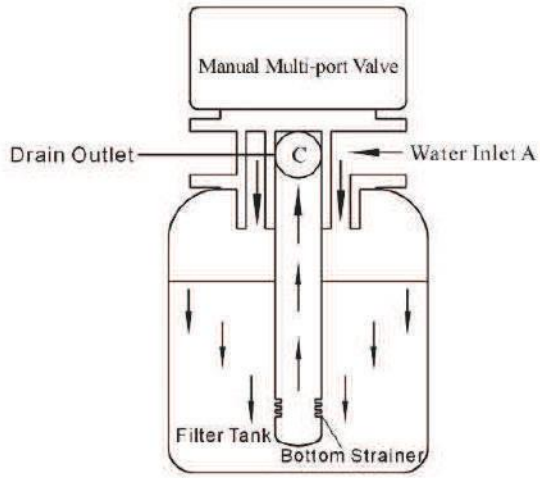
Raw water enter into manual valve form inlet A, through valve body from the top of valvecore, and going into tank from top (or riser pipe outside of tank, the same as below). Then, adownthrough filter materials to be filtered water,then through bottom strainer to return to riser pipe, upward to valve body, pass through valve core, and finallyflow out from outlet B.

Backwash Position

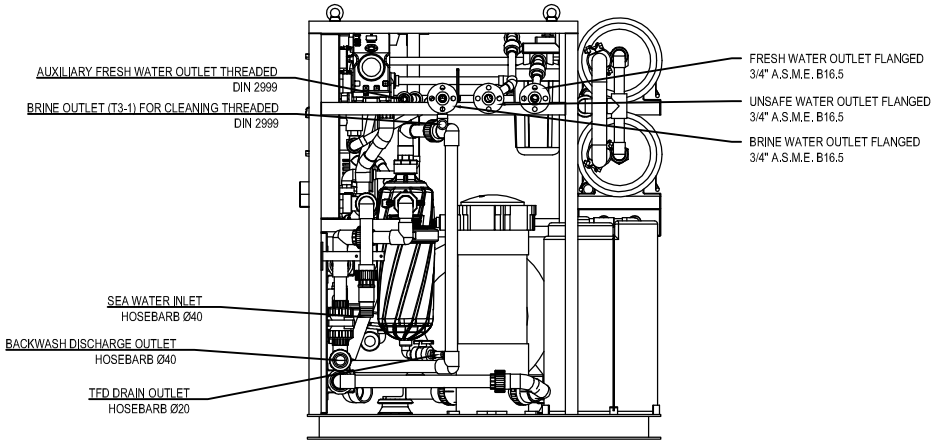


Raw water enter into manual valve from inlet A, through valve body from the top of valve core, then from the bottom of tank (or riser pipe inside, the same as below), bottom strainer into tank, upward through filter materials, and valve body, valve core, finally flow out from drain C.

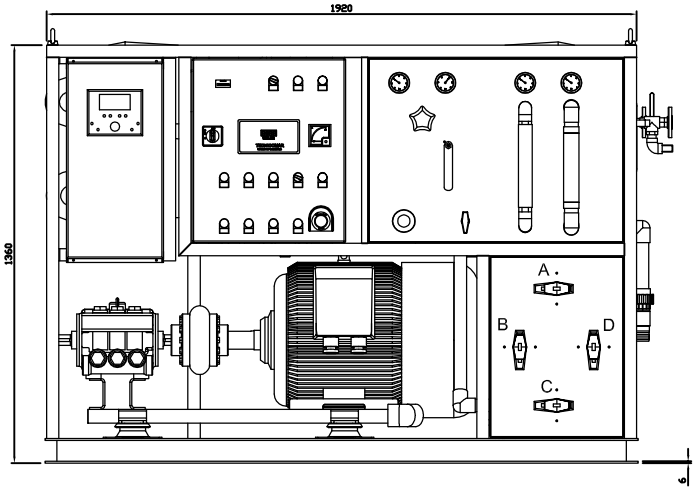
Fast Rinse Position



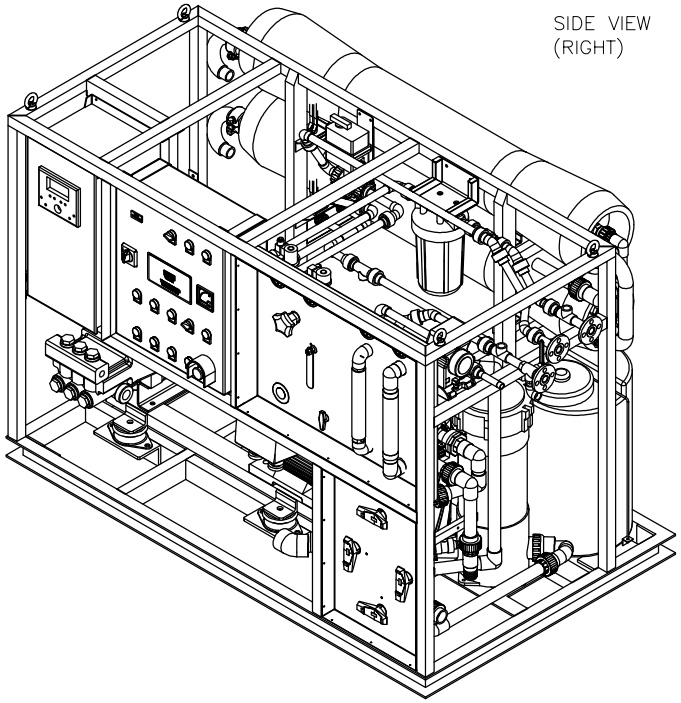
Raw water enter into manual valve fromA, through valve body from the top of valve core, and enter into tank from the top. Then, adown through the filter materials, return to riser pipe from bottom strainer, upward to valve body, through valve core, finally flow out from drain C.

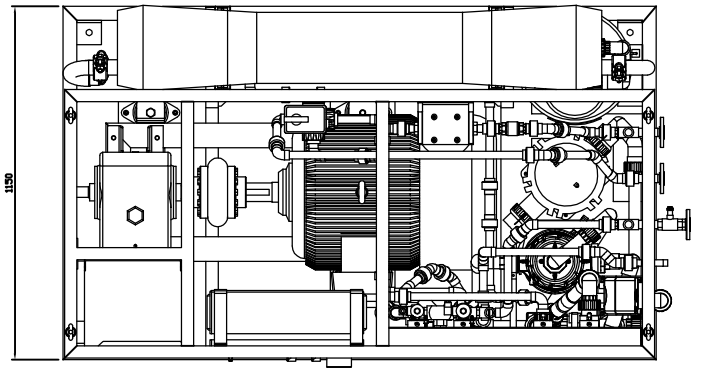


SIDE VIEW
(RIGHT)



FRONT VIEW



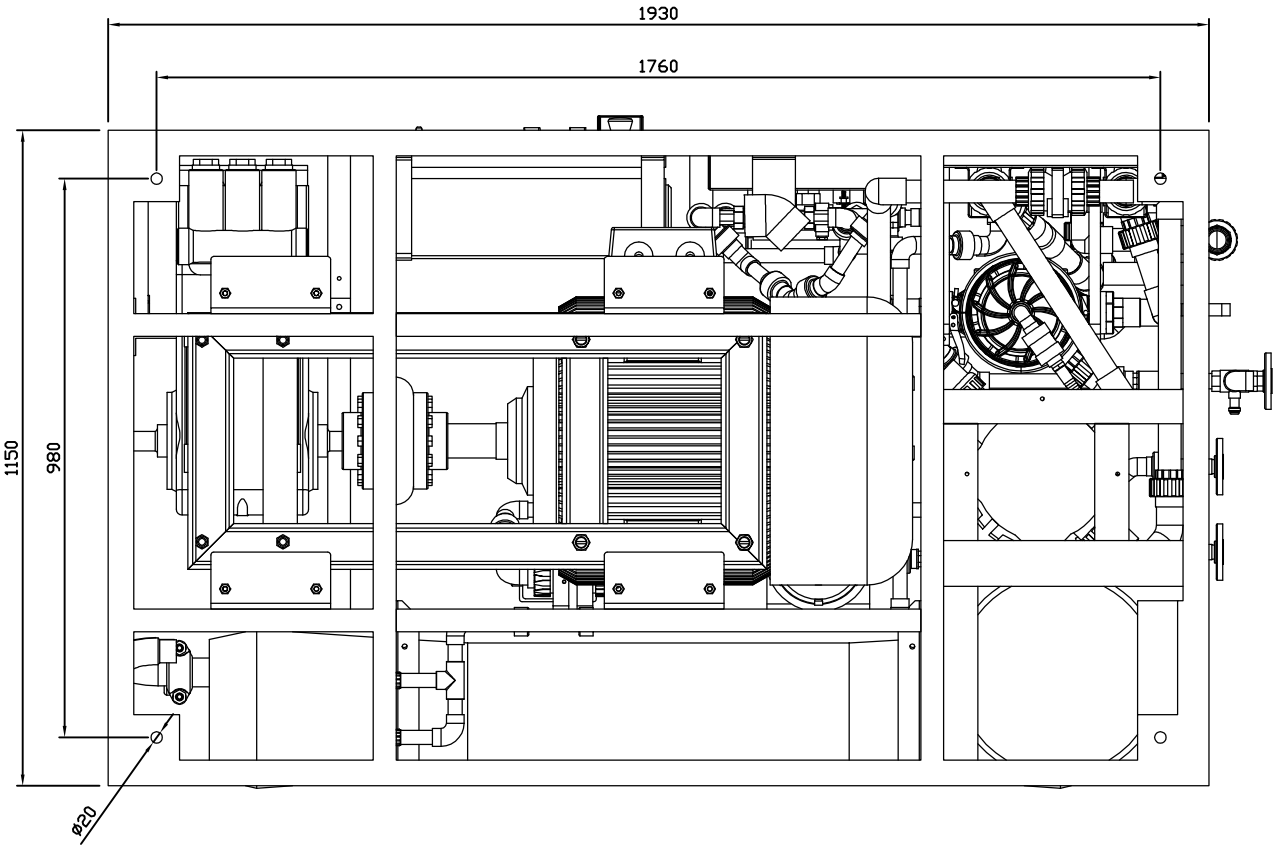


TOP VIEW

GOV. BANGLADESH LP 442 (2014) rif. 249.145.13	TOTAL WEIGHT 926 kg (DRY)	DWG ⊠ NR 260315-D01R1	260315-D01R1	L. L.	TITLE STDC SY 9000 Overall dimensions (mm)			DATE 26/03/2015
		Prog.	CONTROL NAME F. DE VITA SIGNATURE	ARCHIVE NAME B. BARRACO SIGNATURE	ISSUED BY TECHN. DEPT SCALE ---			SHEET 1 OF 2

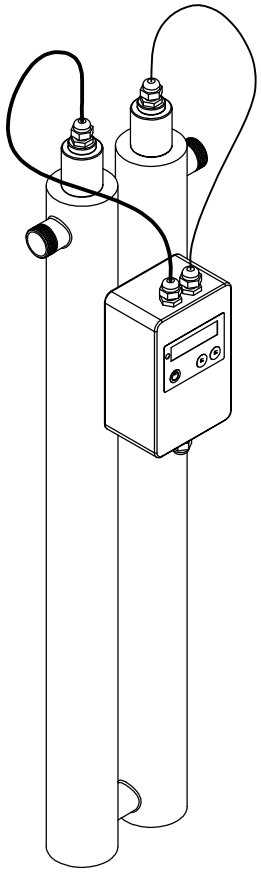
1 ---

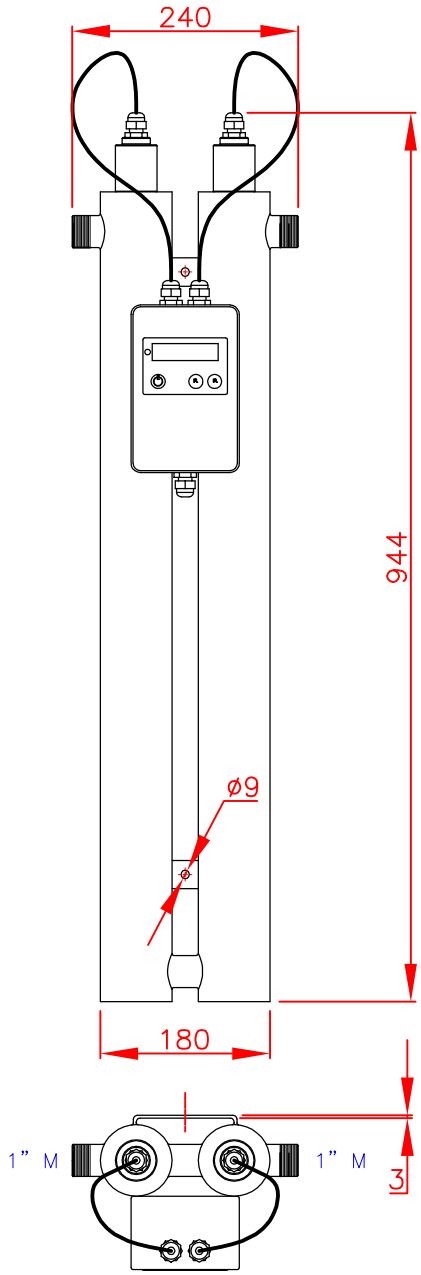
TECNICOMAR®

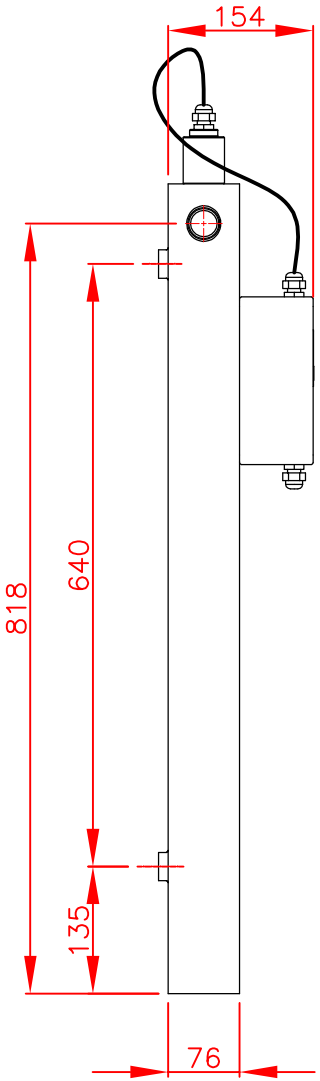


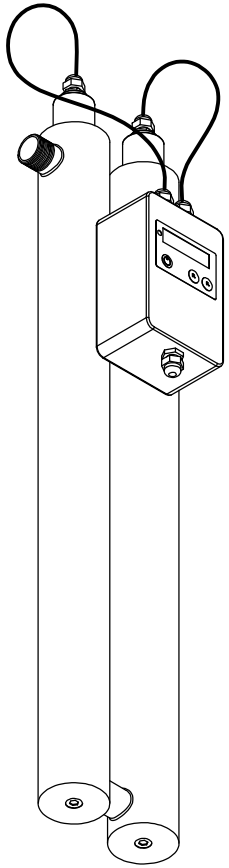
BOTTOM VIEW

GOV. BANGLADESH LP 442 (2014) rif. 249.145.13	TOTAL WEIGHT 926 kg (DRY)	DWG ☒ NR 260315-D01R1 Prog.		260315-D01R1		L. L.	TITLE STDC SY 9000 Overall dimensions (mm)			DATE 26/03/2015 SHEET 2 OF 2	TECNICOMAR®
				CONTROL NAME F. DE VITA SIGNATURE	ARCHIVE NAME B. BARRACO SIGNATURE	ISSUED BY TECHN. DEPT SCALE ---					
		ALL RIGHTS RESERVED: THIS DOCUMENT IS PROPERTY OF TECNICOMAR s.r.l. IT CANNOT BE MODIFIED, REPRODUCED, MADE KNOWN OR USED ANY WAY WITHOUT WRITTEN APPROVAL OF TECNICOMAR s.r.l.						1	---		





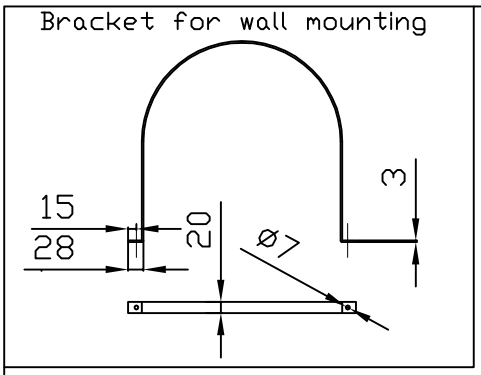


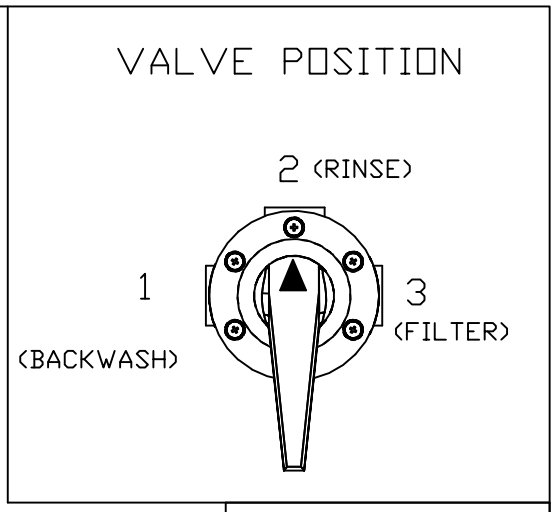


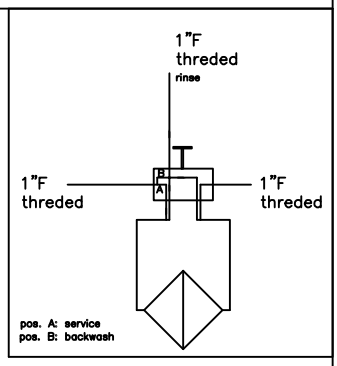
TECHNICAL DATA

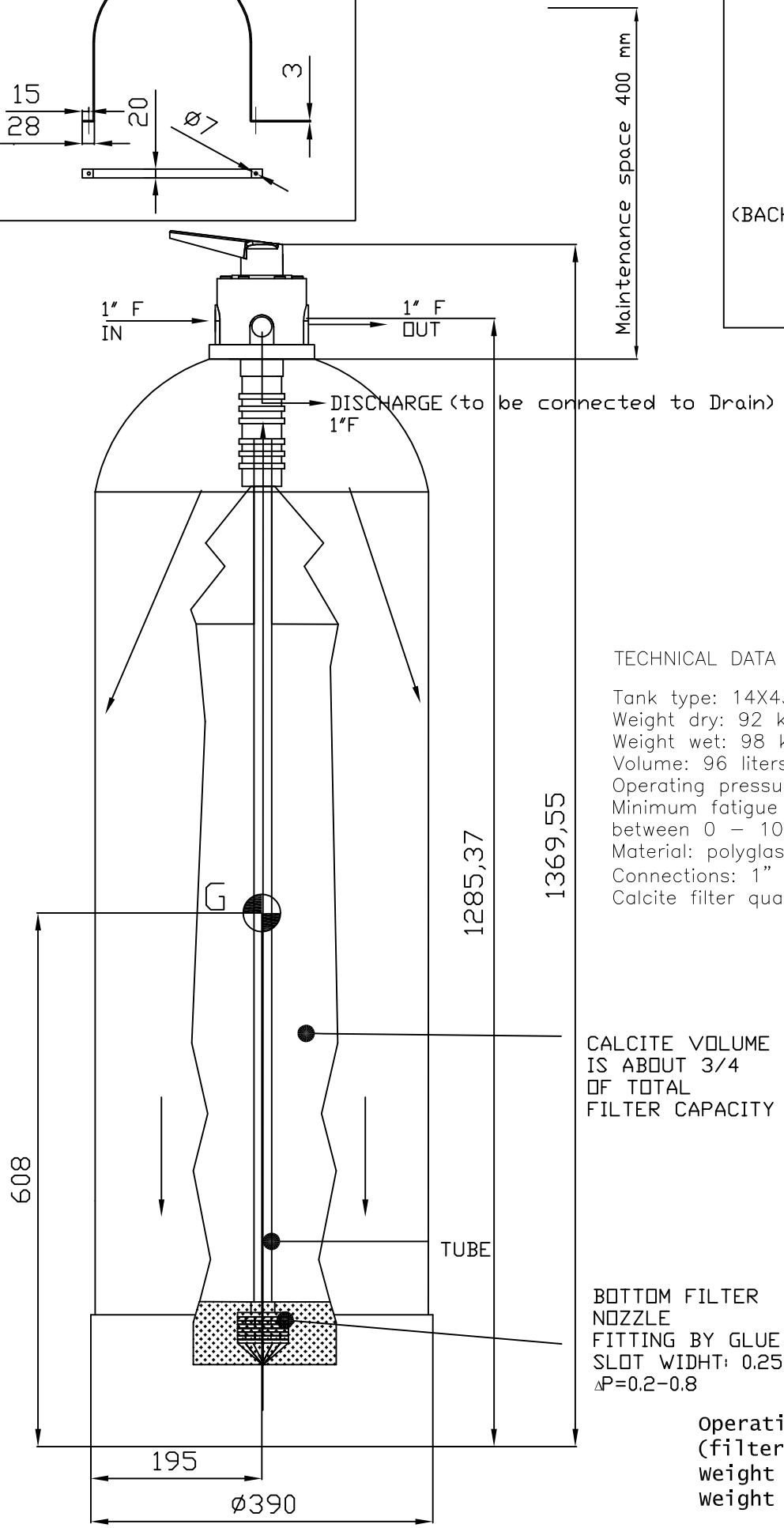
Weight dry: 10,8 kg
Weight wet: 17,8 kg
Desigh pressure: 8 bar
Material: INOX AISI 316 L
Connections: 1"M threaded
Voltage: 230V – 50/60Hz, siglephase

DOC. ☐ DWG ☒ NR 160513-D01R2	FILE NAME 160513-D01R2	DRAW BY G.B.	TITLE U.V.–SYSTEM TC–5000 Dimensions in mm	REV.	DATE	DATE 16/05/2013	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT.			SHEET 1 OF 1	
	SIGNATURE	SIGNATURE	SCALE	2	16.02.15		









TECHNICAL DATA

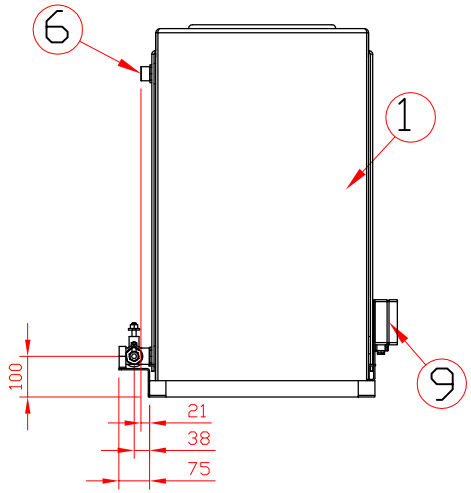
Tank type: 14X43
Weight dry: 92 kg
Weight wet: 98 kg
Volume: 96 liters
Operating pressure range: 0–10 bar
Minimum fatigue testing: 250.000 cycles between 0 – 10 Bar
Material: polyglass
Connections: 1" G, female
Calcite filter quantity: 75 kg

CALCITE VOLUME
IS ABOUT 3/4
OF TOTAL
FILTER CAPACITY

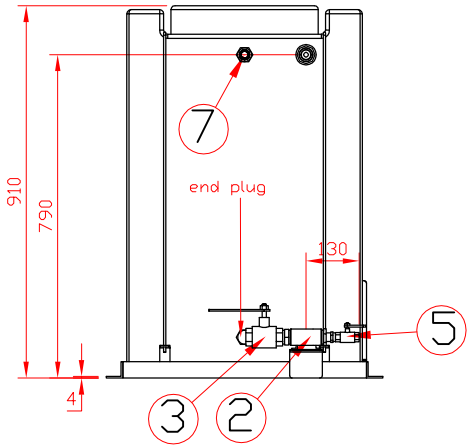
BOTTOM FILTER
NOZZLE
FITTING BY GLUE
SLOT WIDHT: 0.25mm
ΔP=0.2-0.8

Operating condition
(filter filled with 75kg calcite):
Weight dry: 92 kg
Weight wet: 98 kg

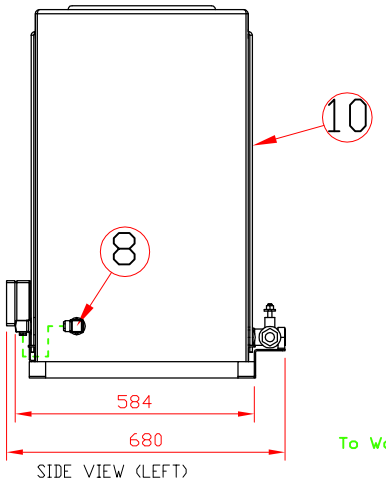
DOC. ☐ DWG ☒ NR 211212-D01R2	FILE NAME 211212-D01R2	DRAW BY G. BOSCHETTI	TITLE: Tag. NO: 585021-01 TCC/3 – CALCITE FILTER (dimensions are in mm)	REV.	DATE	DATE 21/12/2012	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT			SHEET 1 OF 1	
	SIGNATURE	SIGNATURE	SCALE ---	1	---		



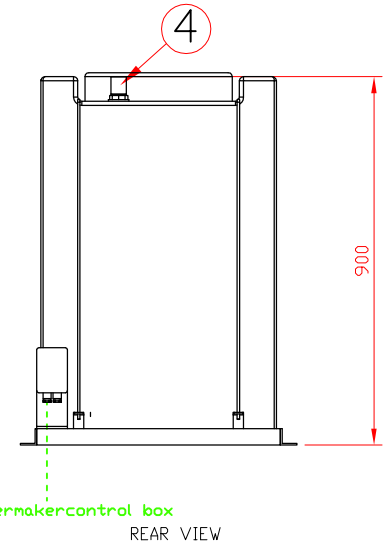
SIDE VIEW (RIGHT)



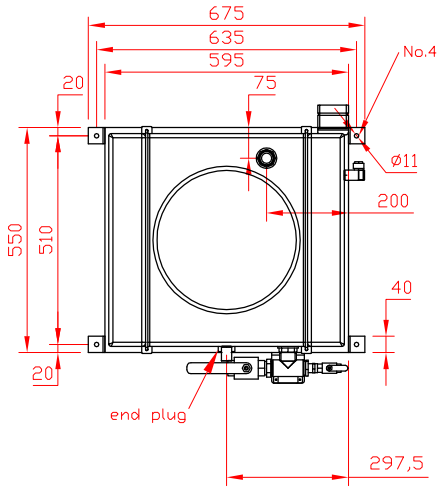
FRONT VIEW



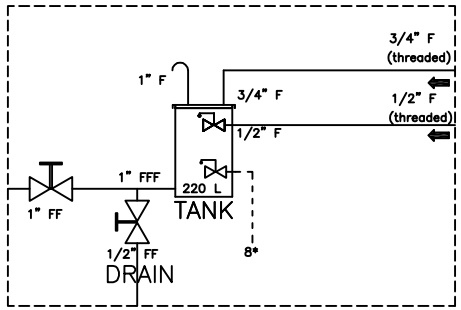
SIDE VIEW (LEFT)



REAR VIEW



TOP VIEW



cleaning/flushing system

P.no.	Q.ty	Description	Size	Note
10	2	Tank fixing hook	ø6mm	M6 threaded
9	1	Junction box for level probe	110x75x55	-----
8	1	Electromagnetic level probe	1" M	threaded
7	1	Fresh water inlet with mechanical level probe (inox socket ½")	1/2" F	threaded DIN2999
6	1	Brine inlet INOX socket ¾"	3/4" F	threaded DIN 2999
5	1	Two-way drain valve	1/2" F	threaded UNI-ISO 7/1
4	1	Air vent	1" F	threaded DIN 2999
3	1	Two-way valve on fresh water outlet	1" F	threaded UNI-ISO 7/1
2	1	Tee	1" FFF	threaded
1	1	Tank	220 L	Polyethylene

WEIGHT (DRY): 24kg

DOC. ☐ DWG ☒ NR 290415-D01R1

Prog.

FILE NAME	DRAW BY
290415-D01R1	F.D.P.
CONTROL NAME / SIGNATURE: F. DE VITA	ARCHIVE NAME / SIGNATURE: B.BARRACO
ISSUED BY: TECHN. DEPT	SCALE: ---

TITLE: Tank 220 L overall dimension in mm

REV.	DATE	REV.	DATE
		1	29.04.15

DATE: 29/04/2015

SHEET 1 OF 1

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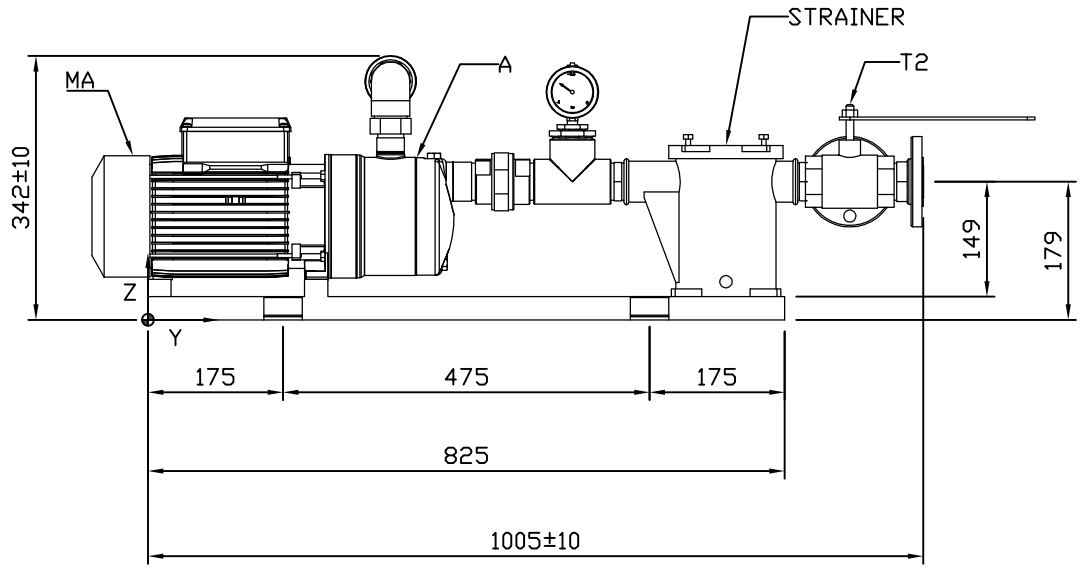
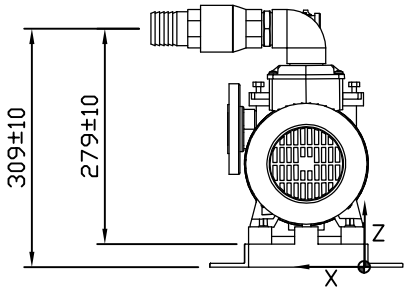
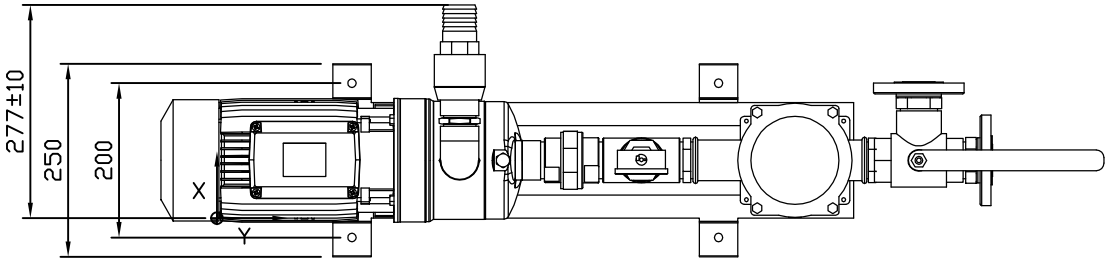
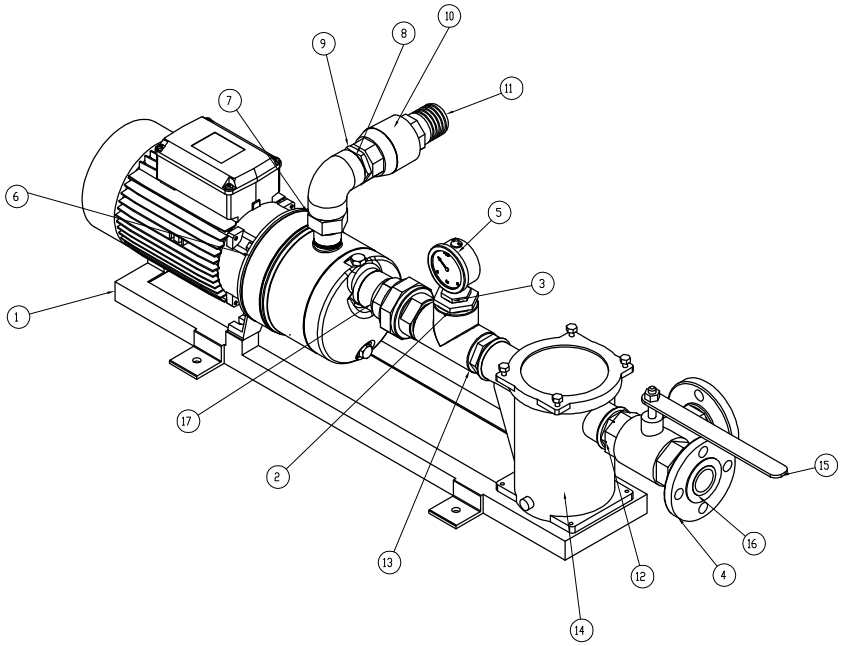




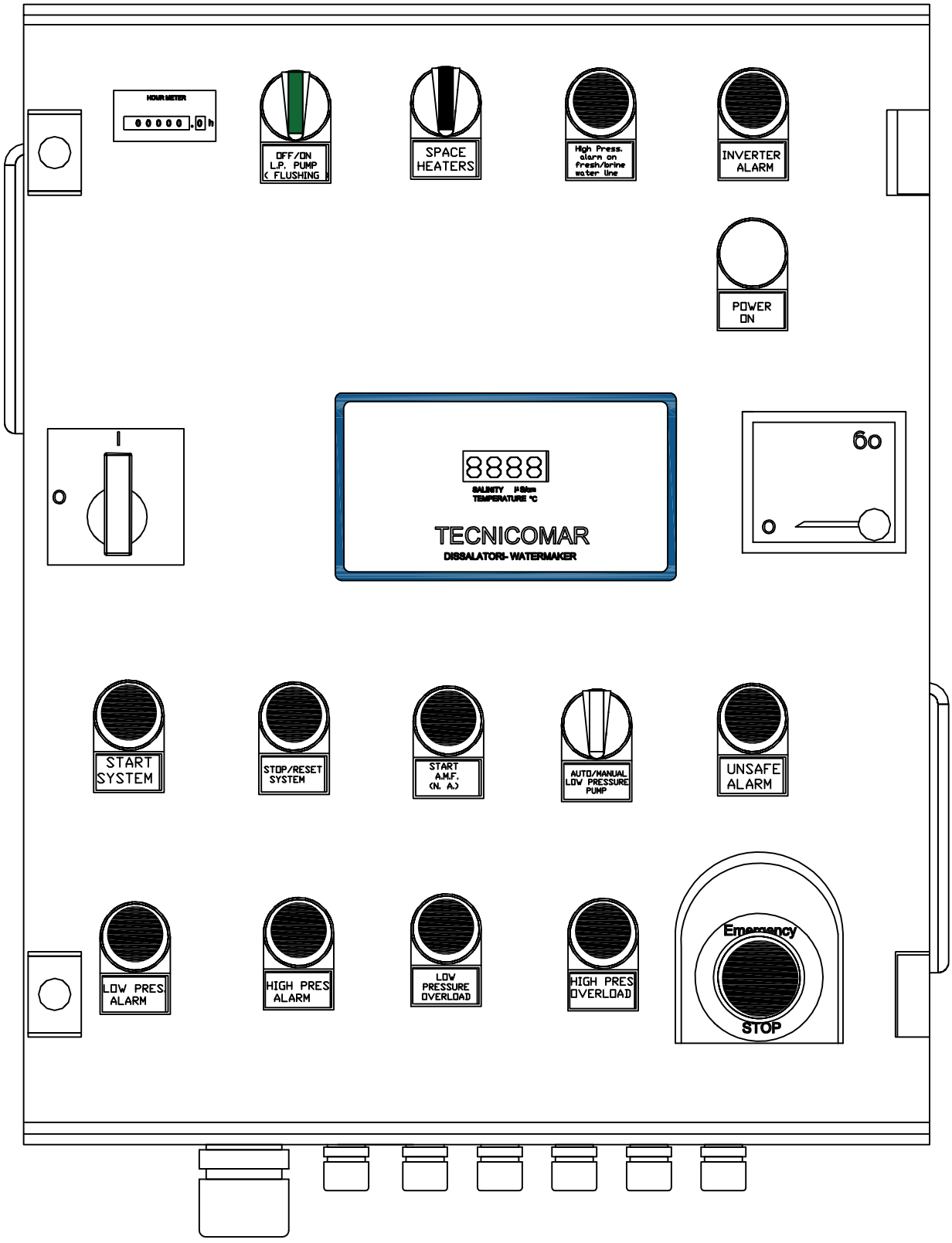




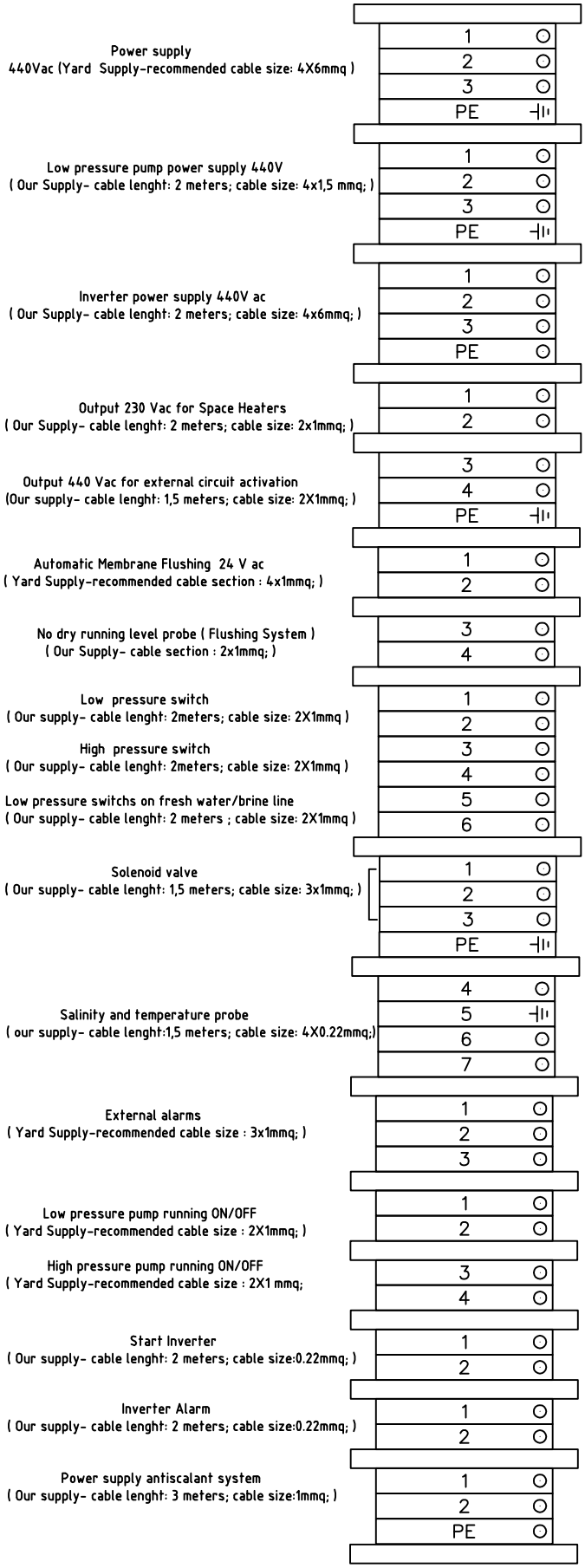
WEIGHT (DRY)
42 Kg

P.no.	Q.ty	Description	Size	Note
1	1	Frame		Inox 316L
2	1	Reduction 1" ½ - 1" M/F		Inox 316L
3	1	Reduction 1"- 1/4" M/F		Inox 316L
4	2	Flange	ASME B16.5 1" 1/4	Inox 316L
5	1	Vacum pressure gauge		Inox 316L
6	1	Feed pump 52954		Inox 316L
7	1	Double nipple	1"¼ - 1"	Inox 316L
8	1	Elbow	1"¼	Inox 316L
9	1	Double nipple	1"¼	Inox 316L
10	1	NR valve	1"¼	Inox 316L
11	1	Hose barb	1"¼	Inox 316L
12	2	Double nipple	1"½	Inox 316L
13	1	Tee	1"½	Inox 316L
14	1	Strainer	1"½	Bronze
15	1	Ball valve - 3 way	1"½	Inox 316L
16	2	Reduction nipple	1"½ - 1"¼	Inox 316L
17	1	Union	1"½	Inox 316L

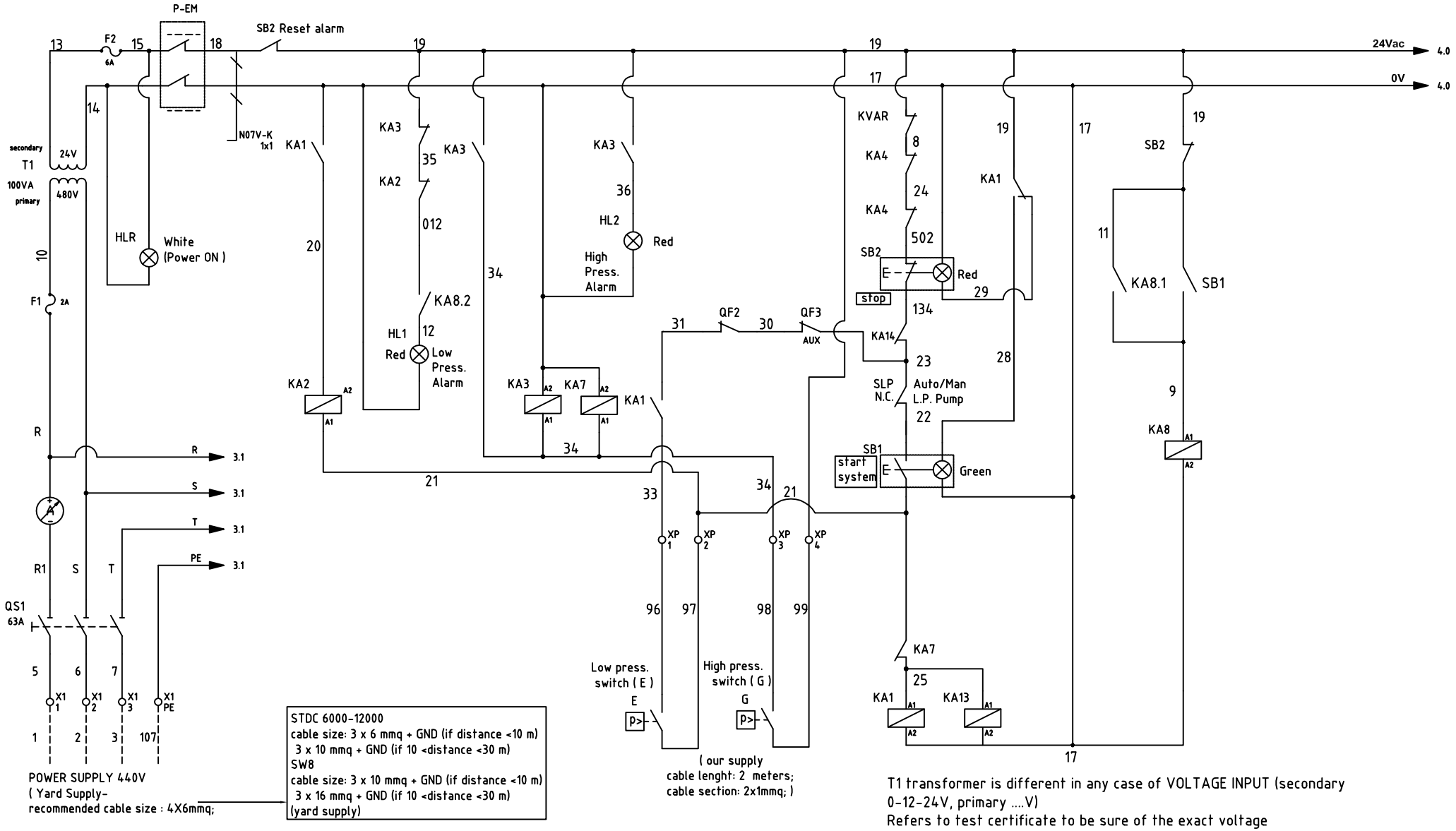
DOC. ☐ DWG ☒ NR 200315-D01R1	FILE NAME 200315-D01R1	DRAW BY L. L.	TITLE Feed pump – strainer on skid Overall dimensions (mm)	REV.	DATE	DATE 20/03/2015	TECNICOMAR®
Prog.	CONTROL NAME F. DE VITA / SIGNATURE	ARCHIVE NAME B. BARRACO / SIGNATURE	ISSUED BY TECHN. DEPT / SCALE ---			SHEET 1 OF 1	
				1	---		



DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1		DRAW BY A.G.	TITLE	REV.	DATE	DATE	
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B.BARRACO	ISSUED BY TECHN. DEPT	**Electromechanical Control Panel EMC Front View**			29/04/2015	TECNICOMAR®
	SIGNATURE	SIGNATURE	SCALE ---				SHEET 1 OF 11	



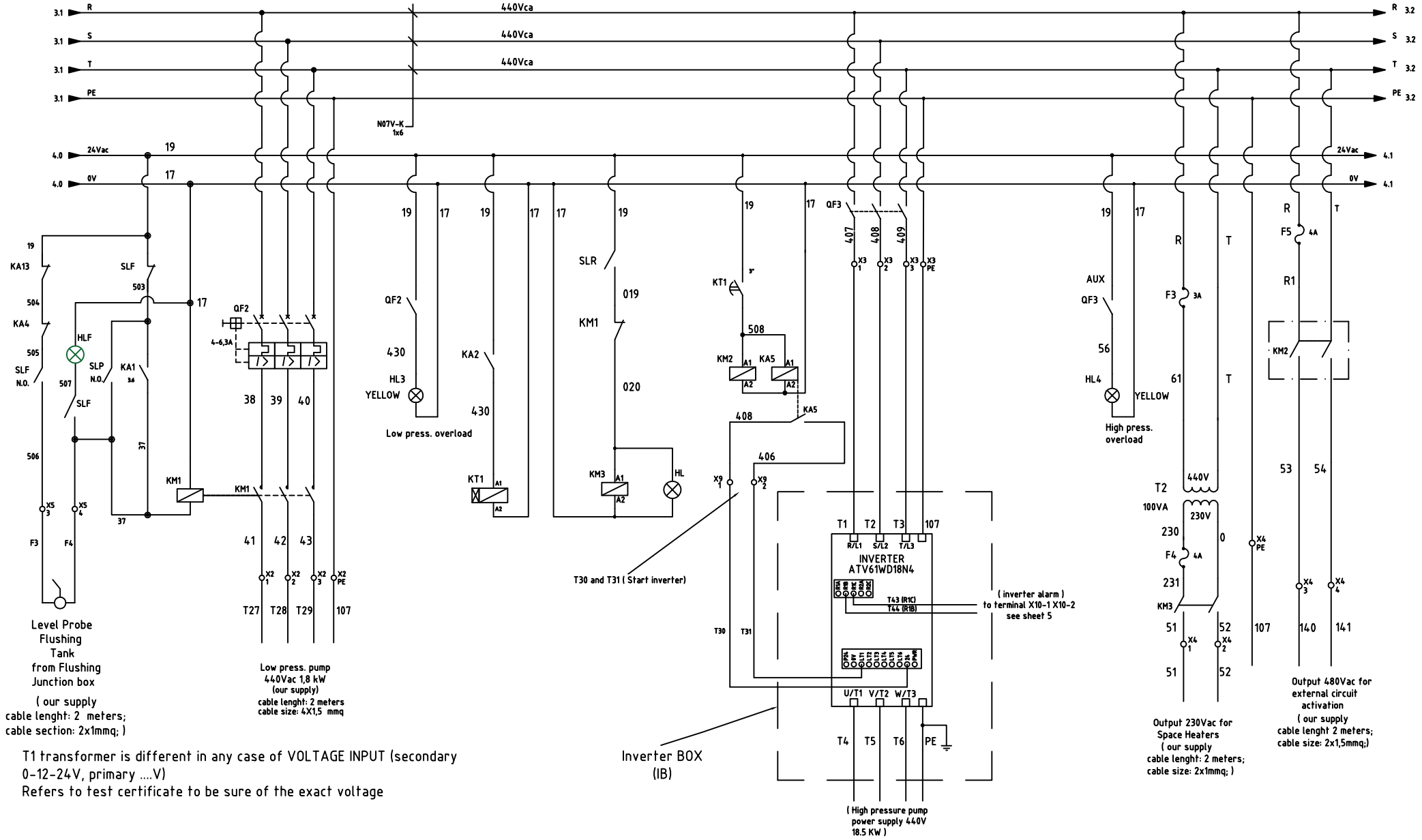
DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1		DRAW BY A.G.	TITLE	REV.	DATE	DATE	
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B.BARRACO	ISSUED BY TECHN. DEPT	Electromechanical Control Panel EMC List of Terminals			29/04/2015	TECNICOMAR®
	SIGNATURE	SIGNATURE	SCALE ---				SHEET 2 OF 11	



N.B.: With the alarm of the high-pressure light, reset the system by pressing the QS1 switch "on / off" and "off / on"

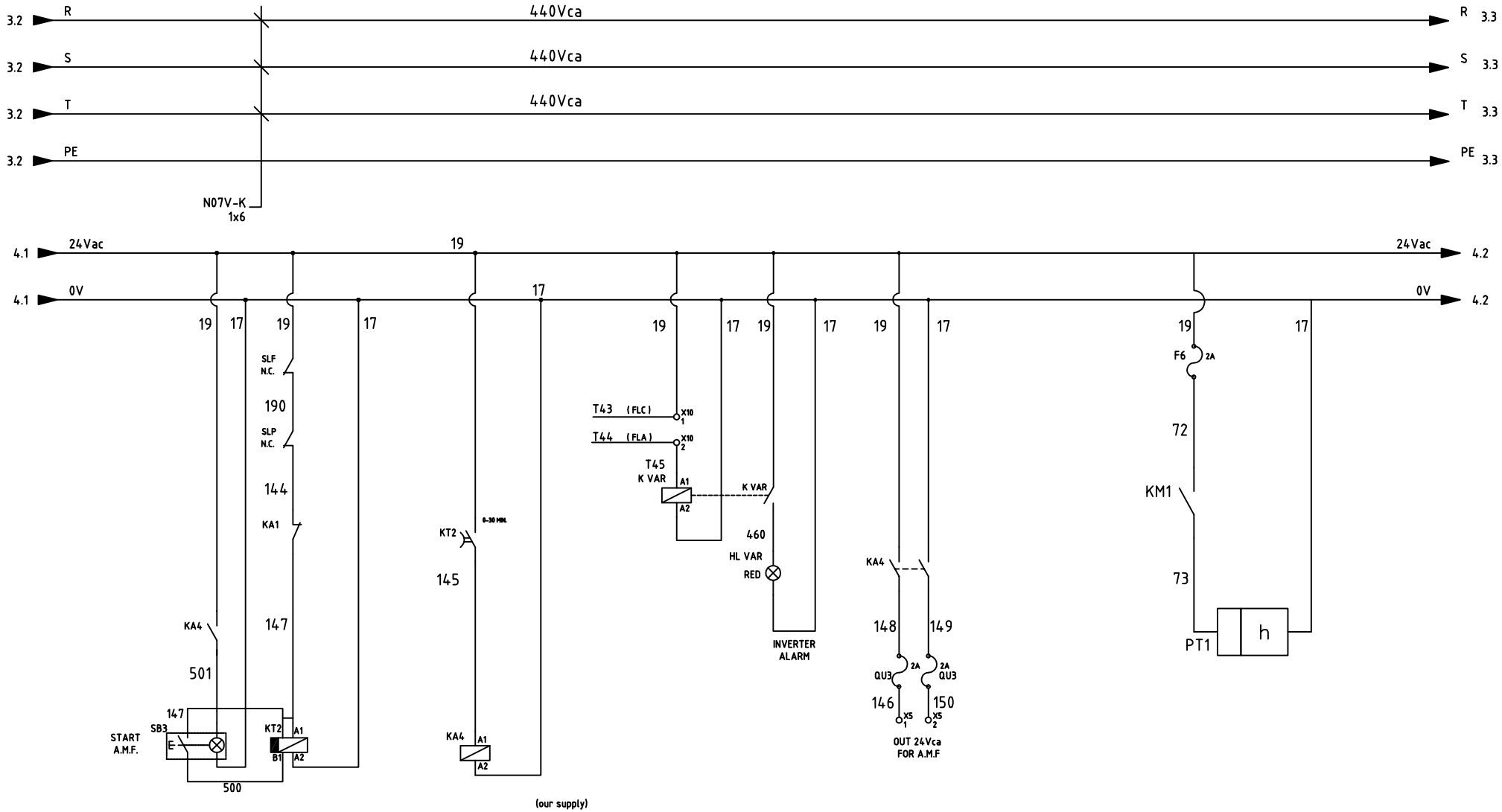
DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE Power supply Start/Stop commands	REV.	DATE	DATE 29/04/2015
Prog.	CONTROL NAME F. DE VITA / SIGNATURE	ARCHIVE NAME B. BARRACO / SIGNATURE	ISSUED BY TECHN. DEPT / SCALE			SHEET 3 OF 11

TECNICOMAR®

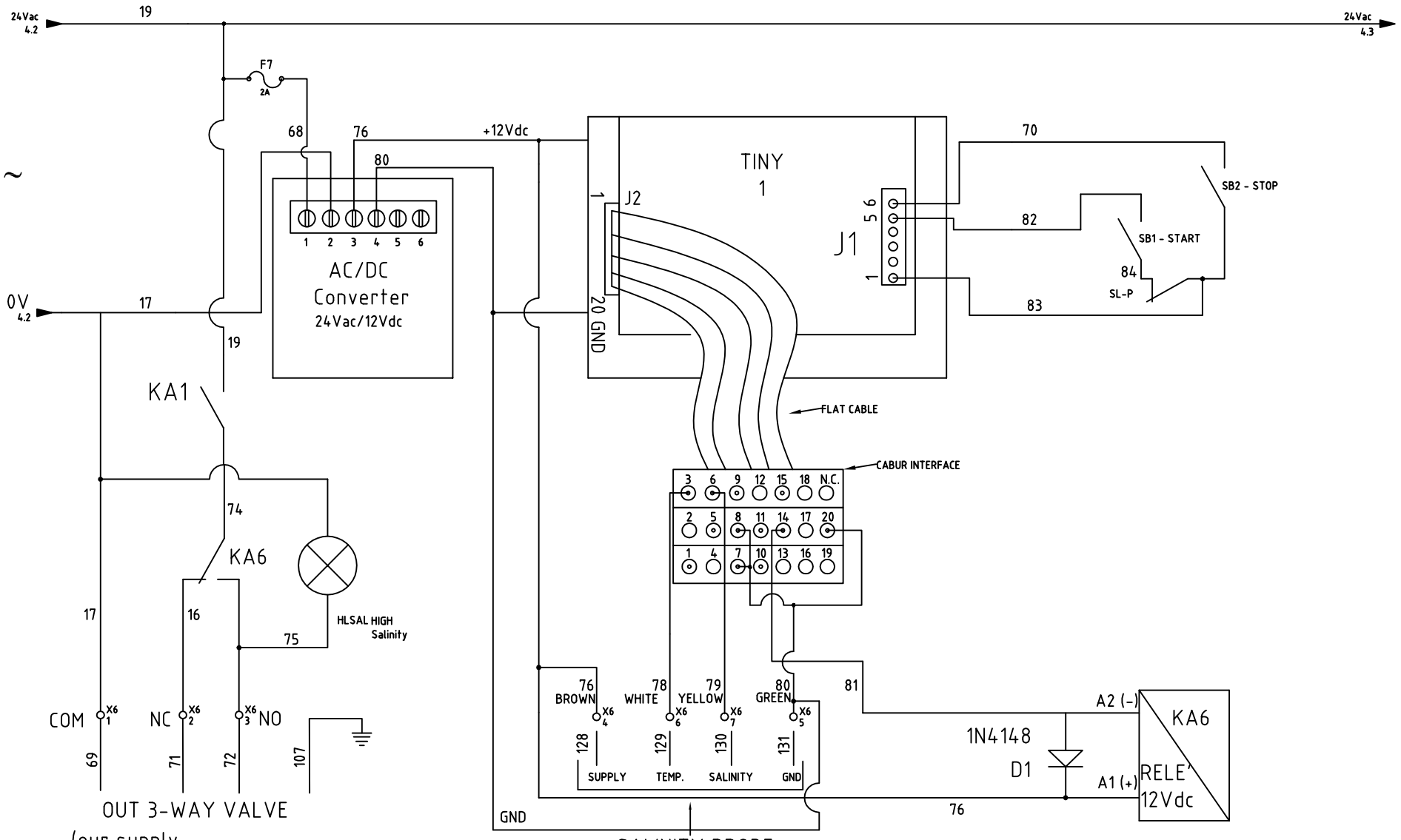


T1 transformer is different in any case of VOLTAGE INPUT (secondary 0-12-24V, primary ....V)
Refers to test certificate to be sure of the exact voltage

DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE Pump command circuit	REV.	DATE	DATE 29/04/2015	
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT			SHEET 4 OF 11	TECNICOMAR
	SIGNATURE	SIGNATURE	SCALE				

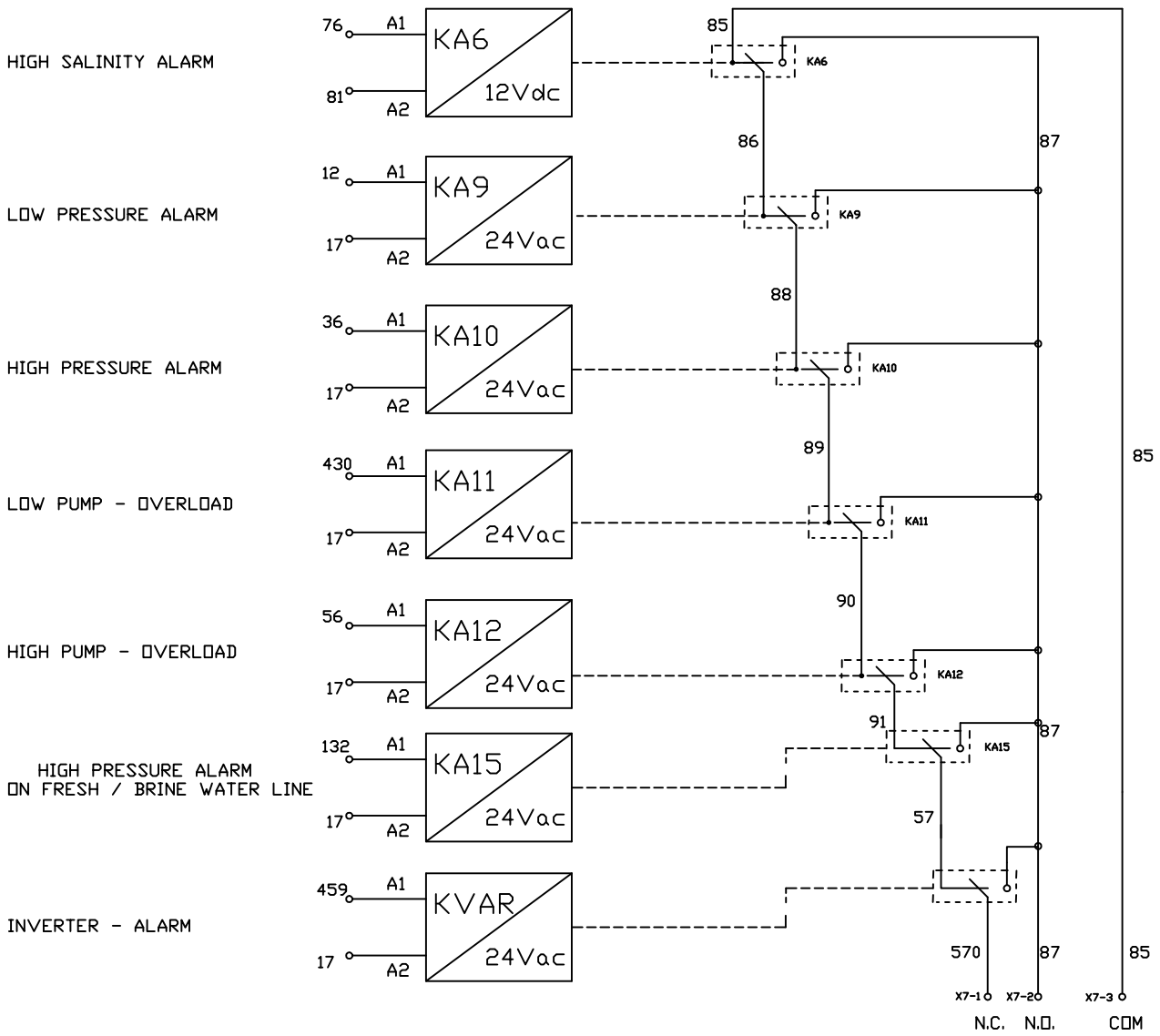


DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE Flushing circuit	REV.	DATE	DATE 29/04/2015	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA / ARCHIVE NAME B. BARRACO / ISSUED BY TECHN. DEPT					SHEET 5 OF 11	
	SIGNATURE / SIGNATURE / SCALE						



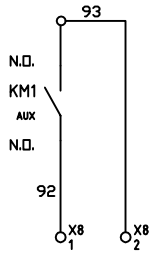
DOC. ☐ DWG ☒ NR	290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE Salinity circuit	REV.	DATE	DATE 29/04/2015
Prog.		CONTROL NAME F. DE VITA / ARCHIVE NAME B. BARRACO / ISSUED BY TECHN. DEPT					SHEET 6 OF 11
		SIGNATURE / SIGNATURE / SCALE					

TECNICOMAR

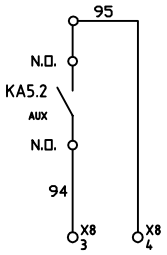


(yard supply-recommended cable size: 3 x 1 mmq; max 6 A)

DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE Alarm Signal - free contact	REV.	DATE	DATE 29/04/2015	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA / ARCHIVE NAME B. BARRACO / ISSUED BY TECHN. DEPT					SHEET 7 OF 11	
	SIGNATURE / SIGNATURE / SCALE						



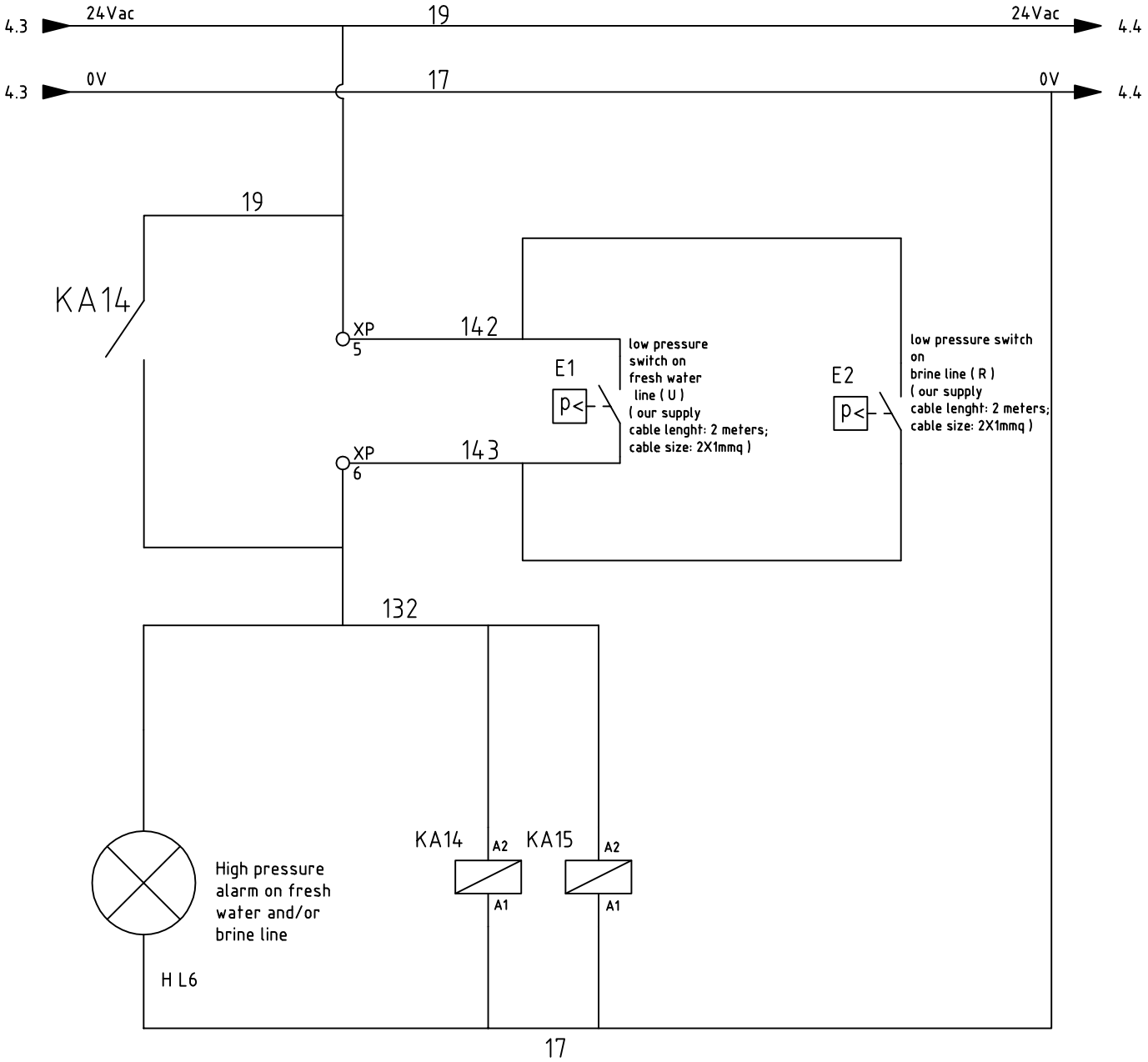
SIGNAL OF LOW PRESSURE PUMP RUNNING (free contact - Yard supply - recommended cable size: 2X1mmq;)



SIGNAL OF HIGH PRESSURE PUMP RUNNING (free contact - Yard supply - recommended cable size: 2X1mmq;)

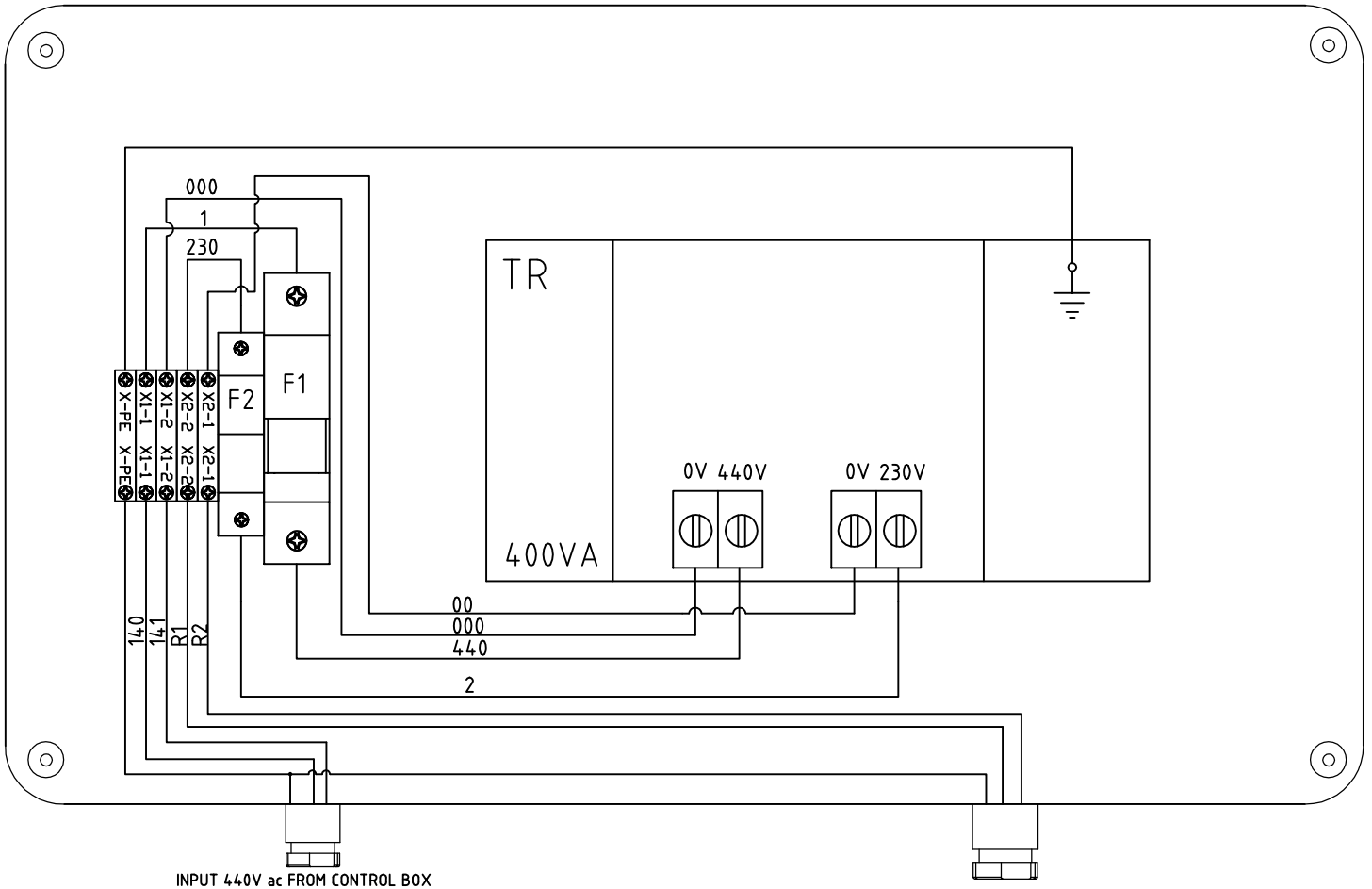
DEVICE	STATUS	OUTPUT SIGNAL
H.P. PUMP	NO RUNNING	N.O.
H.P. PUMP	RUNNING	N.C.
L.P. PUMP	NO RUNNING	N.O.
L.P. PUMP	RUNNING	N.C.

DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE Low and High pressure pumps Monitor for running ON/OFF free contacts	REV.	DATE	DATE 29/04/2015	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA / ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT				SHEET 8 OF 11	
	SIGNATURE / SIGNATURE	SCALE					



DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1		DRAW BY A.G.	TITLE	REV.	DATE	DATE	
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B.BARRACO	ISSUED BY TECHN. DEPT	Electromechanical Control Panel EMC Terminal block diagram			29/04/2015	
	SIGNATURE	SIGNATURE	SCALE ---				SHEET 9 OF 11	

Antiscalant Transformer Box
(ATB)

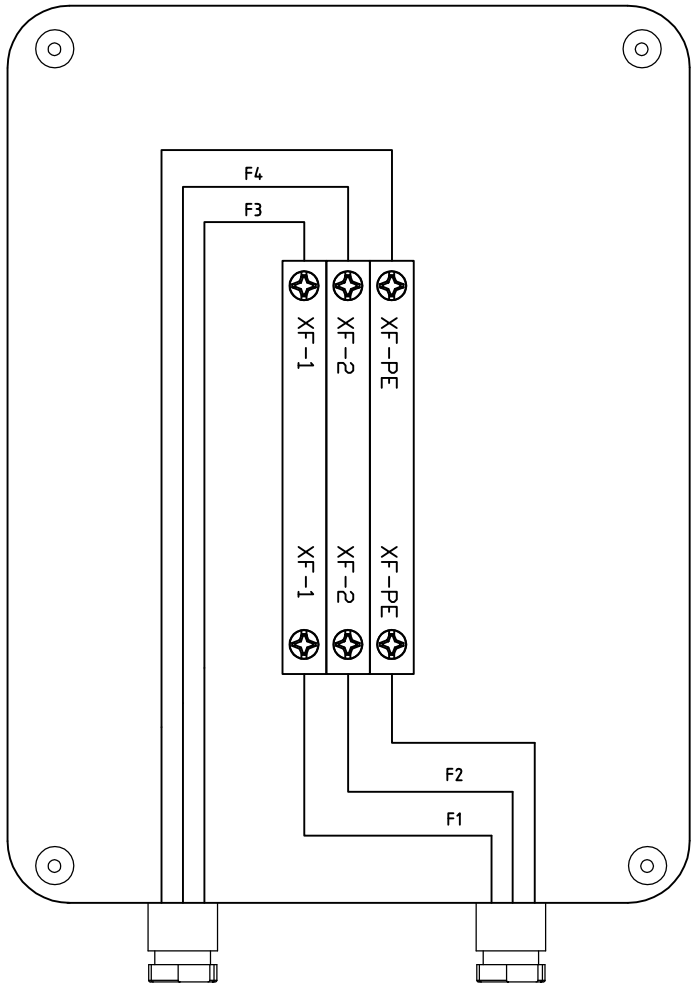


INPUT 440V ac FROM CONTROL BOX
(X4-3 ; X4-4) Our Supply
cable lenght: 2 meters
cable size: 3X1,5mmq)

OUTPUT 230V ac to Antiscalant System (
Our supply
cable lenght: 3 meters cable size: 3X1mmq)

DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE ELECTRIC CONNECTIONS Trasformer Box Antiscalant System	REV.	DATE	DATE 29/04/2015	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA / ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT				SHEET 10 OF 11	
	SIGNATURE / SIGNATURE	SCALE ---					

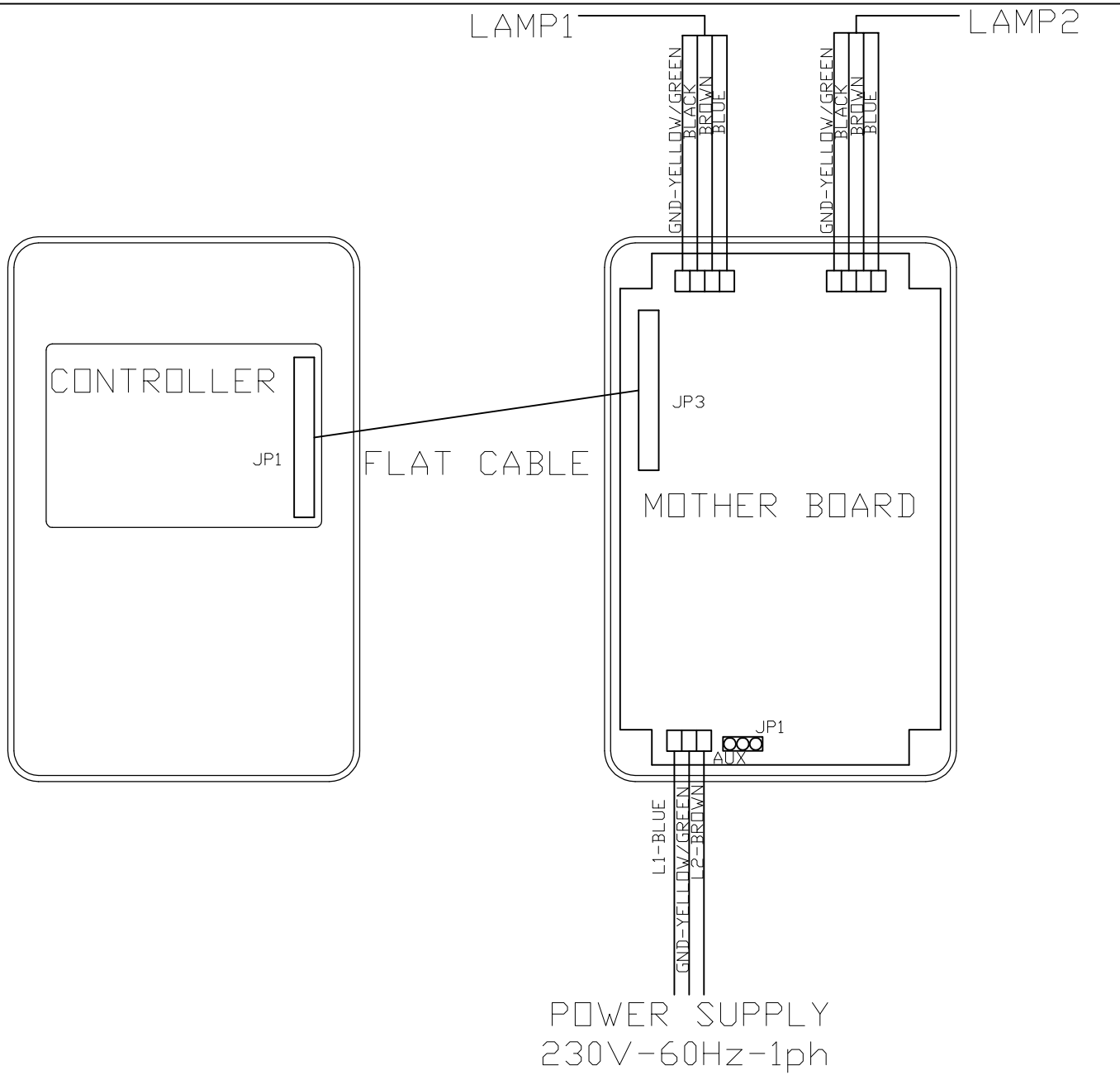
Flushing Junction Box
(FJB)



to control box of watermaker
(X5-1,X5-2 Our supply
cable lenght: 3 meters
cable size: 3X1mmq)

to level probe
(Our supply
cable lenght: 0.3 meters
cable size: 3X1mmq)

DOC. ☐ DWG ☒ NR 290415-E01R1	FILE NAME 290415-E01R1	DRAW BY A.G.	TITLE ELECTRIC CONNECTIONS Antiscalant Junction Box	REV.	DATE	DATE 29/04/2015	TECNICOMAR
Prog.	CONTROL NAME F. DE VITA / ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT				SHEET 11 OF 11	
	SIGNATURE / SIGNATURE	SCALE ---					



DOC. ☐ DWG ☒ NR 071114-E01R1	FILE NAME 071114-E01R1	DRAW BY F.D.P.	TITLE	REV.	DATE	DATE	
Prog.	CONTROL NAME F. DE VITA	ARCHIVE NAME B. BARRACO	ISSUED BY TECHN. DEPT			27/08/2013	
	SIGNATURE	SIGNATURE	SCALE			SHEET 1 OF 1	
			U.V.–SYSTEM TC5000 ELICTRICAL CONNECTIONS	1	---		

TECNICOMAR