

TEXT FOR CONTRACT SPECIFICATIONS

[WTS Large reverse osmosis system]

1. GENERAL

a. DESCRIPTION

- i. Reverse osmosis system for the production of demineralised water with suitable characteristics for feeding air humidifiers and evaporative coolers.

b. WORK REQUIRED

- i. Installation according to the manufacturer's specifications, performed by suitably qualified technical personnel [selected by the customer].
- ii. System commissioning performed by [manufacturer's technical personnel, or technical personnel authorised by the manufacturer].

c. DOCUMENTATION

- i. Technical manual for installation, instructions on safety, configuration and operation, complete with dimensions, technical specifications, performance, water circuit and wiring diagrams, standards and specifications for safe installation, guide for commissioning and operation, diagnostics, list and identification of spare parts, 2D/3D drawings, BIM/Revit files.

d. QUALITY

- i. CE
 - EMC: EN 61000-6-1, EN 61000-6-3 + A1/AC, EN 61000-6-2 + EC, EN 61000-6-4 + A1; EN 62233:2008;
 - LVD: EN 60335-1; EN 60335-2-41;
 - RoHS: EN 50581.
- ii. UKCA
 - EMC: EN 61000-6-2, EN 61000-6-3 + A1/AC, EN 55014-1 + A11, EN 61000-3-2, EN 61000-3-3 + A1;
 - LVD: EN 60335-1 + A11/A13/A1/A14/A2, EN 60335-2-41 + A1/A2;
 - RoHS: EN 50581.
- iii. EAC
- iv. WaterMark WMTS 101:2018 (reverse osmosis unit as complementary to air humidifiers and evaporative coolers certified to Watermark 101:2018)
- v. Silicone free declaration
- vi. ISO 9001:2015 - ISO 14001:2015 - ISO 45001:2018 (Manufacturer)

2. PRODUCT

a. [generic definition of the apparatus, technology]

- i. Reverse osmosis system consisting of:
 - an RO water generator on a stainless steel floor-standing skid;
 - a pressurised vessel (2-4 bars) or atmospheric pressure water storage tank with booster pump;
 - an optional UV-C disinfection system.

b. [general features and construction]

The RO water generator consists of:

- a stainless steel floor-standing skid;
- a manual shut-off valve at raw water inlet;
- a solenoid valve at the feedwater inlet;
- a rotary vane or multi-stage centrifugal pump, depending on the water flow-rate;

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- two conductivity sensors, one at the feedwater inlet and the other at the permeate outlet;
- a pre-filtration section made up of a 10 µm active carbon filter and a 5 µm sediment filter;
- two or four membranes, either osmotic or nano-filtration, depending on the unit size and version;
- a low pressure switch (0.8 bars) for safe pump operation;
- a high pressure switch (12 bars) for safe membrane operation;
- pump start/stop pressure switches (2-4 bars);
- control valves for setting the recirculation and drain water flow-rates;
- a flushing solenoid valve for optimised management of the automatic washing cycles to keep the membranes intact when the unit is not working;
- an electronic controller with backlit LCD graphic display and keypad;
- an electrical panel with protection against motor overheating;
- an descaler dosing system made up of: a peristaltic dosing pump; an injection valve; a tank containing the descaler solution and equipped with level sensor;
- pressure gauges showing the instantaneous inlet water pressure and the membrane operating pressure;
- a permeate sample collection point.

The pressurised RO water storage consists of:

- a floor-standing expansion vessel, 1.8 bar air pre-charge, max operating pressure 10 bars, PED certified, operating temperature -10 to +99 °C, inner diaphragm made from butyl suitable for food-safe applications, stainless steel flange for water connection.

Alternatively, the atmospheric pressure RO water storage consists of:

- a polyethylene tank equipped with connections for water fill, drain, overflow, booster pump intake and related shut-off valves;
- a factory-wired low/high level sensor ready for connection to the electronic controller on the RO unit;
- a booster pump with built-in electronic controller for start and stop commands (adjustable start between 1.5 and 3 bars, stop at 4 bars) and a compact expansion vessel designed to limit the number of pump activations per hour.

c. [models, capacities and variants]

- i. The RO water generator is available in six capacities:
 - 160, 320, 460, 600, 1000, 1200 l/h.
- ii. The rated volume of the expansion vessel can be:
 - 80, 100, 200, 300, 500 l.
- iii. In the event of height differences (> 10 m) between the RO water generator and the equipment, a pressurisation system made up of a 300-litre atmospheric pressure RO water storage tank and a booster pump with built-in electronic controller for start/stop commands are available.
- iv. The following types of membranes can be fitted on RO water generator:
 - reverse osmosis (salt rejection ≥ 98%), suitable for stainless steel components installed downstream of the RO system;
 - nanofiltration (salt rejection 89-95%), also suitable for brass components installed downstream of the RO system.

d. [feedwater and drain water]

- i. Potable water with the following characteristics is required at the RO water generator inlet:
 - temperature from 5°C to 30°C
 - specific conductivity at 20°C < 1000 µS/cm

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- total hardness < 500 mg/L CaCO₃ eq (< 50 °fH)
 - free residual chlorine < 0.25 mg/L
 - silica < 15 mg/L
 - iron < 0.15 mg/L
 - manganese < 0.05 mg/L
 - aluminium < 0.05 mg/L
 - turbidity < 1 NTU
 - SDI (Silt Density Index) < 3
 - COD (Chemical Oxygen Demand) < 10 mg/L
 - TOC (Total Organic Carbon) < 3 mg/L
- ii. Drain water will flow into waste water. The compatibility of salt concentration in the drain water should be evaluated to ensure it remains within the allowable limits in the place of installation.
- e. [power supply specifications]**
- i. Power supply:
- 230 VAC single phase 50 Hz
 - 230 VAC single phase 60 Hz
- ii. Environmental protection levels of main electrical components:
- motor: IP 55
 - control panel: IP 65
 - peristaltic dosing pump: IP 65
 - pressure switches and solenoid valves: IP 65
- iii. Installation shall be indoors in an equipment room with a floor drain installed.
- f. [control, characteristics]**
- i. Inputs/outputs
- Analogue input for inlet water conductivity sensor K=1
 - Analogue input for outlet permeate conductivity sensor K=0.1
 - Digital input for run command (remote enabling)
 - Digital inputs for start/stop command as a function of the outlet permeate pressure or the water level in the RO storage tank
 - Digital input for low pressure switch
 - Digital input for high pressure switch
 - Digital input for pump thermal protection
 - Digital input to detect an descaler dosing pump alarm
 - Digital input to detect when the softening system is in regeneration mode
 - 230 Vac output for pump power supply
 - 230 Vac output for descaler dosing pump power supply
 - Voltage-free output relay with selectable logic, normally closed/normally open
 - 230 Vac output for inlet solenoid valve opening command
 - 230 Vac output for flushing solenoid valve opening command
- ii. The conductivity sensors can be calibrated based on a buffer solution.
- iii. High conductivity permeate alarm is factory enabled and set to activate an alarm at a set point (editable value) with a time delay.
- iv. Periodic flushing due to inactivity and washing at start/stop of permeate production are available.
- v. An operating hour counter is displayed on the screen.
- vi. A maintenance alarm can be enabled based on the number of operating hours (editable set point).
- vii. The 230 Vac outputs can be tested in manual mode (main pump, solenoid valves and dosing pump power supply), useful when commissioning the unit or for troubleshooting purposes.

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- viii. The alarm relay can be tested in manual mode, useful when commissioning the unit or for troubleshooting purposes.
- ix. Two different profiles are available (user and manufacturer) to access the parameters menu via editable password.
- g. [performance data]**
 - i. Recovery index (permeate flow to inlet water flow ratio) equal to 50 % or 68 % depending on the model.
- h. [safety, protection and hygiene devices]**
 - i. Descaler liquid certified to EN 15040 or NSF/ANSI 60 for safe treatment of water destined for human consumption.
- i. [accessories]**
 - i. UV-C disinfection system with 254 nm wavelength and radiant energy density $> 30 \text{ mJ/cm}^2$, equipped with fixing clips and metallic support bracket for the electronic ballast. 230 VAC 50 Hz power supply. IP 42 index of protection. Housing made from polished AISI 304 stainless steel . Fault LED and alarm buzzer. Compliant with Italian DM 174/04.
- j. The type of apparatus shall be the CAREL [WTS Large]**
- k. Approved manufacturers: Carel Industries SpA**

3. EXECUTION

- a. Installation in compliance with the manufacturer's specifications**
- b. Installation in compliance with local laws and regulations**
- c. Water quality as per manufacturer's specifications is the responsibility of the user**