Sea Water Desalination

0,3 m^3/h (8 t/d) and more

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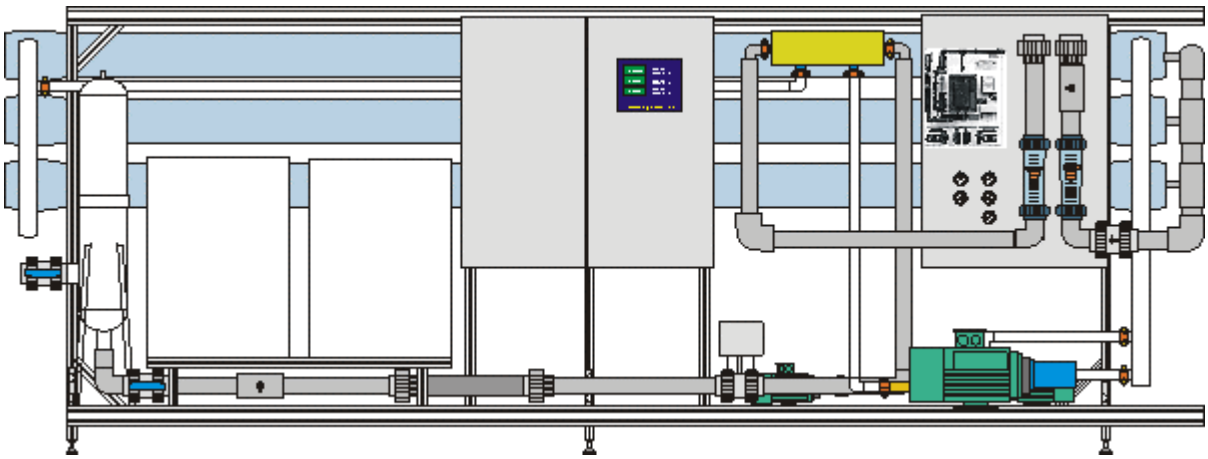

R.O. module SW-PXM 240
(modifications possible)

The advantages of AquaCare desalination units

- In water-poor countries reverse osmosis technology is an effective method to de-mineralize sea waters. With less than 4 kWh per cubic meter pure water this method is substantially more effective than e.g. the evaporation technology (75 kWh/m^3).
- WHO water quality is produced
- fully automatically controlled plant decrease maintenance costs and stops
- all plants are calculated for membrane life span by at least 3 years
- enlargement with modular systems possible
- customer's requests can be considered
- professional plants - made in Germany

Equipment characteristics of SW-PXM and SW-PXE-modules

The modular constructed system with SW-PXM **master module** and the **extension modules** SW-PXE realizes at any time a flexible planning. Stages of development can be realized fast and without changing the existing plant. The stand-still time is very low.
The PXM master module is equipped with a touch screen, that shows clearly all relevant parameters. All programs for operation and maintaining can be started with a view touches. All data are shown in two languages (e.g. English and Arabic) and are signed with color: red for failures, blue during normal operation, gray at standby. Optionally you can control the PLC with remote control over cell phone net or internet connection from any place of the earth. If additional extension modules (SW-PXE) are attached, these can be controlled over the master module. In addition, the extension modules can produce water by itself even if the master module should be out of operation. The redundant PXM-PXE system always realizes a basic supply. The PXM-PXE system of AquaCare is ideal for varying water needs, too.

The **space-saving** arrangement of the components makes possible to build-in a plant with 480 t/d in a 20'-Container (option). With larger units the dosing tanks must be specially accommodated. The container building method permits mobile operation.
Metering units for Antiscalant and acid are integrated in each module. Only with a good pretreatment and a perfect mixing by means of **static mixer** a long membrane life can be carried out. Failures with the dosing are recognized of the PLC and the plant is shut down, in order to avoid damage to the membranes.
The **pre filtration**, which protects pumps and membranes against damages, is carried out with the best available technology: **micro-filtration** (units starting with 240 t/d). This continuously driven technique cleans the water 100times better than conventional sand filters and filter cartridges. Particles will not damage the high precision pumps. A periodical disinfection is made to ensure the maximum water flow.
The plant is installed on a **profile frame**. The high pressure pipes are manufactured with duplex steel (1.4462), the low-pressure pipes are made with PVC.
AquaCare use piston pumps with very **low vibrations**. This is realized with a high number of pistons (max. 9 pieces) that drop pulsations under 1,5%. Operating pressures up to 80 bar are possible. In order to suppress the damaging effects of the so-called water hammer, the main pumps are equipped with frequency controls, which makes a gentle starting and stopping possible, too. In addition the operating pressure (depending on temperature, salinity and age of the membranes) is controlled by the frequency of the pump, too. This saves energy and during the start the connected generator will not be overloaded.
The high operating pressure realizes even at high salinities of e.g. 45,000 ppm TDS **very good rejections** and a smaller number of membranes. Especially if you must change the membranes a low number of them lowers the running costs. These advantages must be bought however with a increased current consumption. Therefore the most effective **energy recovery technology** is build-in. The direct exchange of the brine against fresh sea water is accomplished with an effectiveness by approx. 94%, which reduces cost of electricity extremely. The exchange module works nearly maintenance-free and consists of plastic and ceramic.
AquaCare uses for seawater desalination **TFC membranes** with very high rejection (min. 99.6% under standard conditions) in order to produce best water quality during a long period. The membranes are mounted in high pressure housings (83 bar/1200 psi) made of fiberglass reinforced plastic (FRP). The side ports of the housings permits a simple change of the membranes.
Regularly during operation or after stopping the system or after some failures all sea water wetted parts are flushed with disinfecting pure water (permeate). During operation the **clean in place (CIP) system** collects water in an extra tank (larger plant takes the water from the main tank). After stopping operation an auxiliary pump put disinfecting water through the system. This procedure prevents organic fouling processes at the membranes and reduces corrosion. Chlorine dioxide is added to the water, so that the plant can be switched off even for longer times. The pure water tank can be likewise used for a chemical cleaning of the membranes. An program leads the user step for step by this procedure.
The heart of the system strikes by means of a **PLC** (Siemens) and controls all relevant parameters. All functions are realizes with a touch screen. So failures with switches or control lamps will not occur. All data are displayed with colour and are stored for quality assurance. Optionally SW-PXM and SW-PXE modules can be maintained and controlled via cell phone or internet connection. Additional components (water tank, well pumps, water distributing pumps) may be integrated.

Disinfection with DOX (chlorine dioxide)

In warm countries hygienic perfect water is very important. A sea water desalination plant produced germ-free water, but however in warm areas it will be contaminated very quickly with bacteria, viruses, algae or even dangerous single-celled organisms.
The chlorine dioxide method hat following advantages:

- bactericidal, toxic against algae, spores, viruses and protozoa
- 2.5 times more oxidation power than others like chorine, hydrogen peroxide
- stronger and faster germinating than chlorine
- constant disinfection at pH 6.5 to 9.5
- long affecting
- lower costs than chlorine method
- eliminates existing bio films
- eliminates odors (phenol, smelling products of algae and bacteria)
- does not form halogenated matters (trihalomethane = THM, chlorine phenol, AOX, chlorin amine)
- does not form chlorine and does not irritate mucous membranes
- does not form explosive atmosphere, because the concentrate does not exceed 3 g/l
- starting compounds are durable, solution ready for use is best before 4 weeks (at 20°C) or 2 weeks (at 30°C)

Technical Data of AquaCare Desalination Units

Type	SW 8	SW 16	SW 36	SW 72	SW-PX240	SW-PX480	SW-PX960
Energy recovering	no				yes		
Pure water flow*	0.33 m^3/h 8 m^3/d	0.67 m^3/h 16 m^3/d	1.5 m^3/h 36 m^3/d	3 m^3/h 72 m^3/d	10 m^3/h 240 m^3/d	20 m^3/h 480 m^3/d	40 m^3/h 960 m^3/d
Operation pressure in bar	52...73	54...77	48...72	54...76	65...75		
Operation pressure in psi	755...1060	785...1120	700...1050	785..1100	945...1090		
Pure water quality at 45,000 mg/l TDS 40,000 mg/l TDS 35,000 mg/l TDS 30,000 mg/l TDS	 247 ppm 218 ppm 191 ppm 164 ppm	 257 ppm 230 ppm 201 ppm 172 ppm	 343 ppm 303 ppm 264 ppm 226 ppm	 263 ppm 233 ppm 204 ppm 174 ppm	 282 ppm 202 ppm 177 ppm 137 ppm		
Minimum pre pressure	1,5 bar / 22 psi						
Recovery	20%	30%					
Energy consumption max.	4.2 kW	5.5 kW	13.3 kW	26.7 kW	31.7 kW	63.4 kW	127 kW
Specific power consumption in kWh/m^3 permeate	< 12.7	< 8.2	< 8.9	< 8.9	< 3.2		
Dimensions (L×W×H) plus tanks of request	3.2 × 0.9 × 1.7 m				5.8 × 1.1 × 2.2 m	5.8 × 1.1 × 2.2 m	5.8 × 1.5 × 2.2 m
weight	0.2 t	0.3 t	0.4 t	0.5 t	1.5 t	2.5 t	3.2 t
Water connections feed / concentrate permeate	 DN 25 DN 15	 DN 25 DN 15	 DN 32 DN 20	 DN 40 DN 25	 DN 65 DN 50	 DN 100 DN 80	 DN 150 DN 100
Integrated micro-filtration	no				yes		
Sediment cartridges 5 µm	1 × 20“	2 × 20“	4 × 20“	5 × 20“	7 × 40“	15 × 40“	30 × 40“

* data at 25°C, 1.5 bar pre-pressure