

A high-speed photograph of water splashing, creating a dynamic and refreshing visual. The water is captured in mid-air, with numerous droplets and bubbles visible. The background is a light, clean blue, which makes the white and blue tones of the water stand out. The overall composition is clean and modern, suitable for a corporate or technical document.

**WATER &  
WASTE**  
A WÄRTSILÄ® BUSINESS

# FRESHWATER GENERATORS



## Introducing Wärtsilä's freshwater generators

Within the marine world Wärtsilä's Freshwater Generators (FWG) are known as standard for on-board freshwater production. Ship owners, builders and operators can source from the widest range of freshwater making technologies available to the market today. This range includes Reverse Osmosis Plants, Horizontal Inner Tube Evaporators, Multi Flash Evaporators, Single Stage Desalination Plants or a combination of these. Also a growing number of land-based applications is fitted with our equipment. In choosing Wärtsilä as your freshwater production partner you secure a flexible, reliable, and fully automated solution.





## Specialist solutions requiring high customer focus

Our diverse and dedicated team of engineers is developing, manufacturing and distributing freshwater solutions for and to customers worldwide. Thanks to a creative out-of-the-box mindset, this team excels in innovative and specialist solutions, bespoke set-ups that require a high customer focus.

Every successful implementation of a freshwater generator starts with an accurate analysis of the vessel's status, identifying possibilities and needs. In each case our team will strive for a solution that is most energy and space efficient. A higher energy efficiency, for instance, can often be reached by looping to energy sources already available on a vessel. Greater flexibility in construction and sizing can be accomplished by making a combination of different FWG technologies. This approach especially comes in handy when retrofitting engine rooms.

## Building on more than 125 years of history

Our freshwater division in Geesthacht, Germany, is also known as Wärtsilä Serck Como GmbH and part of the bigger Wärtsilä Water & Waste business unit.

The company's expertise in freshwater generation is unrivalled: in 1894 Serck

Como started producing its first evaporator for sea-going vessels. Having survived two world wars, we know what it means to adapt to ever changing circumstances. We believe that it is important to both invest in own innovations and to adapt to new external trends. As water maker specialist our focus is on the future. We are confident to come up with solutions for any technical challenge that will come our way.

## Total water & waste solution

Freshwater generators are part of a much wider water & waste product range, offered by Wärtsilä's eponymous "Water & Waste" business unit. Ship owners, builders and operators that are looking for a single provider for all their water, waste and wastewater challenges, will find the peace of mind they are looking for.

In addition to freshwater solutions, our total solution offer includes ballast water treatment technologies, wastewater, wet and dry waste treatment systems. Thanks to Wärtsilä Water & Waste's global agent and distributor network our after-sales and spare parts services are reliable and well organised. We are able to help our customers from the design phase of their freshwater equipment to the delivery of spare parts.

Product range

<p><b>Reverse Osmosis Plants</b></p>

<p><b>Horizontal inner Tube Evaporators</b></p>

<p><b>Multi Stage Flash Evaporators</b></p>

<p><b>Single Stage Desalination Plants</b></p>

# Reverse Osmosis

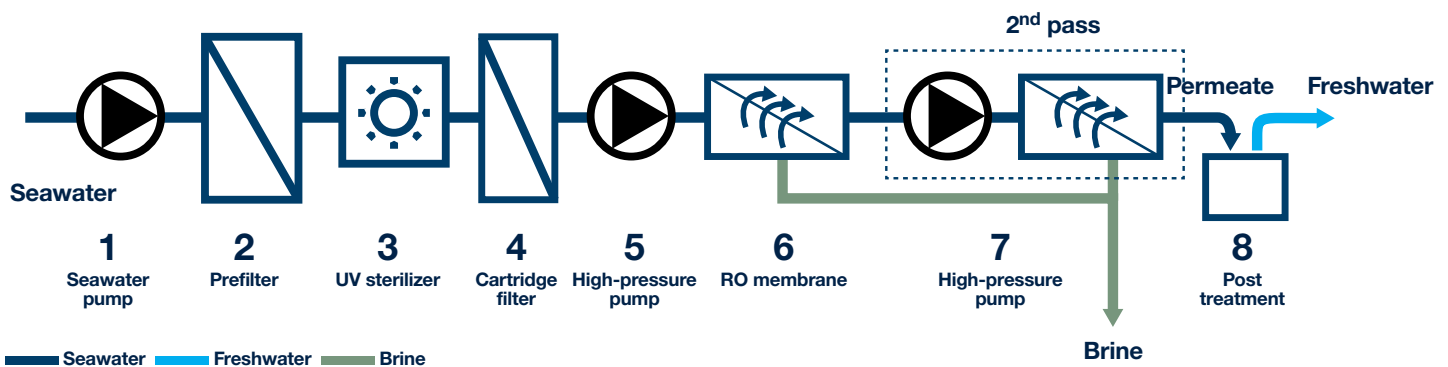
Reverse osmosis (RO) is a water purification technology that uses membranes to remove salts and impurities from the seawater in order to create permeate. Wärtsilä offers RO systems capable of producing between 10 and 1000 tons of permeate per day. The system features a modular and flexible design and is customised to meet operational and space requirements of any vessel. This allows installation and optimization of the RO system on all vessel types.

## Working principle

Seawater is pumped into the RO system by a seawater pump (1). In the first prefilter stage (2) the seawater is filtered from all suspended solids up to 40-50 micron in large RO plants, and 5 microns in small standard plants.

A second prefilter stage (4) further filters the water down to 5 microns in large RO plants, and 1 micron in small standard plants. In large RO plants a UV sterilizer (3) is installed between the two filtration stages to disinfect the filtered water and avoid bacterial growth on the RO membranes. The filtered seawater is then pumped to the RO membranes by the high-pressure pump (5). Semi-permeable RO membranes (6) remove ions, particles, bacteria from seawater to generate the permeate/freshwater. The permeate leaving the membranes, while the brine is diverted to the discharge. Optional post-treatment (8) consists of pH correction, rehardening and remineralisation. Large RO plants offer automatic flushing with low salinity water to remove the salty water from the RO housing.

RO plants typically have a single pass or a double pass configuration. In double pass plants the treated water passes through membranes twice, when the permeate from the first pass becomes the feed water for the second pass membrane via another high-pressure pump (7). Single pass RO plants supply freshwater under 500 ppm total dissolved solids (TDS). When high quality water with TDS under 20 ppm is required (for example for boilers), then a double pass RO plant is necessary.





## Technical data

- Capacity 10 – 1000 ton/day
- Single and double-pass design
- Consistent production of permeate at seawater temperature range of 0-35 °C
- Fully automatic or semi-automatic operation
- Easy connection to ship automation and control system
- UV-steriliser after prefiltration reduces chemical consumption

## Optional items for large RO plants

- UV steriliser for the filtered water
- Energy recovery device (turbocharger or pressure exchanger)
- Dosing system for pH adjustment
- Re-hardening system
- Remote monitoring system
- Flow transmitters for seawater, permeate, and brine
- Super duplex
- Containerised construction

## Key benefits

- Low energy consumption
- Easy operation and maintenance
- Flexible material selection regarding components and piping
- Modular design for minimal footprint
- Maximum flexibility: critical components can be chosen individually (pre-filtration, membranes, high pressure pumps, energy recovery devices, automation)
- All proven suppliers from Western Europe and the United States
- Engineering and installation support
- Minimal chemical consumption
- Excellent retrofit option, replacing other freshwater solutions

# HiTE

The Wärtsilä Horizontal inner Tube Evaporator (HiTE) is a multi-effect evaporator specifically designed for producing small to medium capacities of 30 to 175 tons of distillate per day. It guarantees freshwater for human consumption or clean process water for technical applications. It serves in a wide range of operational areas where alternative technologies like reverse osmosis or plate technology reach their limits. Shallow waters with poor seawater quality is an example of this.

The HiTE operates smoothly even at partial load, for example during dynamic positioning (DP) operations. The unit's control system can be fully or semi automated, and its smart processes adapt automatically to the amount of energy available. The HiTE is able to utilise waste heat, which is very convenient for vessels with varying engine profiles. The 4-effect HiTE offers up to 75% energy savings

with a specific heat consumption of 180 kWh/t compared to single effect designs (700 kWh/t). For a 3-stage HiTE this is 240 kWh/t.

The Wärtsilä HiTE is suited for a wide variety of vessel types, including special vessels, chemical tankers and small cruise ships. Also offshore and land-based applications can be equipped with HiTEs.

## Working principle

The HiTE freshwater generator consists of 3 film evaporators (connected in series) and one condenser (1). The seawater is passing through the condenser. The major portion – after being used as cooling medium – is flowing back to the sea. A certain (minor) quantity is distributed in three parallel streams (2) directly into the evaporators. The 1st effect is heated by hot engine cooling water. Before evaporation can start, the feed water

entering evaporator effect one is heated inside the tubes up to the boiling temperature.

The released vapours (3) are separated from the water/vapour mixture and are entering the 2nd and possible 3rd effects as heating medium. The procedure of condensation/evaporation is repeated in the 2nd and 3rd effect before the residual vapours produced in the 3rd effect are entering the condenser.

The surplus brines are cascaded via syphon pipes from effect to effect, as well as the collected distillates. The distillate from the 3rd effect is flashing into the condenser hot well which also serves as distillate collecting tank. The distillate is pumped into the collecting tank.

## Technical data

Model	Capacity, ton/day	L x W x H, mm	Specific thermal power, kWh/t	Electrical power, kWh *	Dry weight, kg	Wet weight kg	Foot-print, m <sup>2</sup>
HiTE 30-3	30	1800 × 1500 × 2000	240	5 .9	2100	2415	5.4
HiTE 50-3	50	2300 × 2000 × 2000	240	5 .3	3500	4025	9.2
HiTE 80-3	80	2750 × 2000 × 2000	240	4 .2	5100	5865	11.0
HiTE 120-3	120	3250 × 2000 × 2000	240	4 .1	6500	7475	14.0
HiTE 120-4	120	3750 × 2000 × 2000	195	3 .2	7200	8280	19.0
HiTE 175-3	175	4250 × 2300 × 2200	240	3 .8	7500	8550	21.5
HiTE 175-4	175	4750 × 2300 × 2200	195	2 .9	8100	9315	24.0

Seawater inlet temperature: 0 – 35°C

Heating water inlet temperature from 70 – 90°C

Water conductivity < 4 µS/cm

### Variants

Tandem ejector: without brine pump, but with higher electrical power

Heating water source: for all qualities of water between 70 °C and 95 °C, steam or a combination of both

Electrical control: PLC or manual control

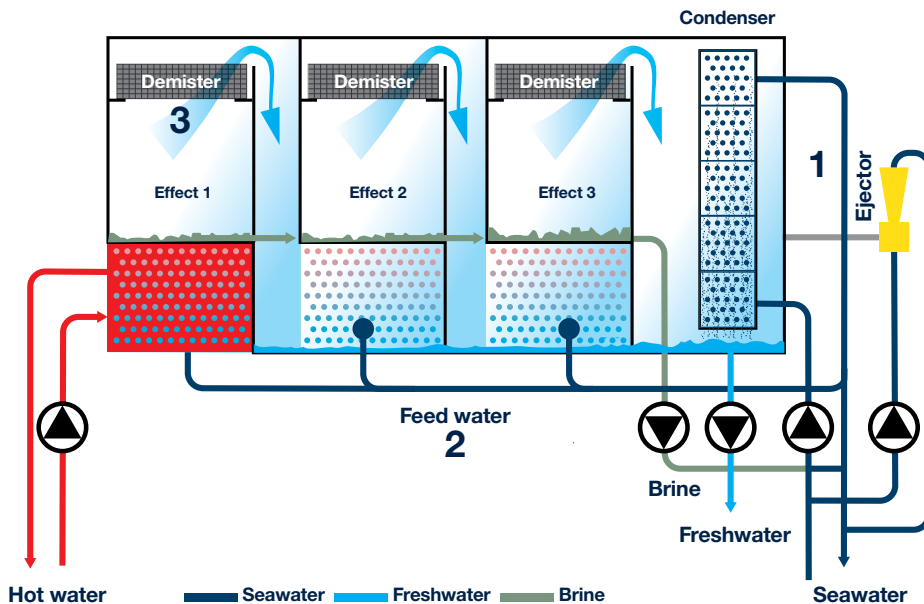
\* Electrical power consumption varies depending on conditions





## Key benefits

- Efficient & reliable multi-effect distilling process
- Low operational cost
- Lowest energy consumption in its range
- Very low water conductivity <math>< 4 \mu\text{S}/\text{cm}</math>
- Most efficient solutions when utilising engine waste heat
- Designed for easy maintenance and long service intervals
- Flexible adaptation to demand and/or supply (down to 50%) thanks to exceptional part-load capability
- Flexible use of heat sources: engine jacket water, steam or combination
- Fully automatic system
- Also suited for land-based applications



## Scope of supply

### Delivered as standard

- Tube evaporator with condenser
- Distillate pump
- Ejector pump
- Seawater pump
- Chemical dosing tank with dosing instruments
- Solenoid valve for draining lower quality distillate
- Siemens S7 control panel

### Options

- Steam booster
- Distillate cooler
- Frequency converters for pumps
- Cleaning stations

# MSF

Wärtsilä's multi-stage flash principle is one of the most reliable thermal seawater desalination processes in the world. On top of that it is the only evaporation principle where heat transfer and evaporation are strictly separated. This minimises the risk of scaling and reduces maintenance costs.

Wärtsilä's Multi-Stage Flash Evaporator (MSF) is used for producing freshwater from seawater, well water or industrial water. A special advantage of the multi-stage flash technology is that the specific heat consumption – or thermal efficiency – can be continuously adapted to the individual requirements

of each application. The produced distillate has a very low salt content which makes it suitable as technical water (e.g. boiler feed water). The distillate quality and quantity are independent from the seawater temperature which makes the MSF technology a reliable source for freshwater.

## Working principle

After leaving the first stage condenser (3), the seawater flows through the brine heater (1), where the heat input to the plant (steam or engine jacket water) causes a further temperature increase.

The seawater leaves the brine heater (1) and enters the first flash chamber (2), reaching a brine top temperature of approx. 80°C. At this point the pressure of the incoming seawater is suddenly reduced, by means of an orifice, below its equilibrium vapour pressure resulting in explosive boiling or evaporation (flashing). The pure vapour produced is then condensed, giving up its latent heat to preheat the incoming seawater (3). If this process is repeated over a large number of effects, at successively lower pressures and temperatures, large distillate production rates at reasonable performance ratios can be achieved.

## Technical data

Model	Capacity, ton/day	L x W x H, mm	Power, kW	Dry weight, kg	Wet weight, kg
115-5	115	5 700 × 2 900 × 3 000	915	18,000	21,000
300-6	300	7 300 × 2 900 × 3 300	2,388	27,000	32,000
650-6	650	9 200 × 3 500 × 3 900	5,146	37,000	45,000
775-8	775	10 500 × 3 600 × 3 900	4,812	42,000	52,000
850-8	850	11 700 × 4 200 × 3 900	4,780	43,000	53,000
950-8	950	12 000 × 3 700 × 3 900	6,395	45,000	55,000

Capacity up to 1500 t/d.  
Steady production of freshwater at seawater temperatures 0 – 32°C.

## Key benefits

- Either steam, engine jacket water or combination can be used for heating.
- Full-automatic or semi-automatic operation.
- Can be operated in part load.
- Heat transfer and evaporation are taking place in different areas, resulting in a minimised risk of scaling.
- Sturdy construction with low maintenance demands resulting in high availability.
- Solution with lowest sensitivity to malfunction & lowest lifecycle costs.
- Components in contact with seawater or distillate are manufactured with corrosion resistant materials, e.g. copper-nickel.
- Flexible dimensions allow for best utilisation of space.
- Operating frequency converter for pumps saves energy.
- Water conductivity < 4 µS/cm

## Scope of supply

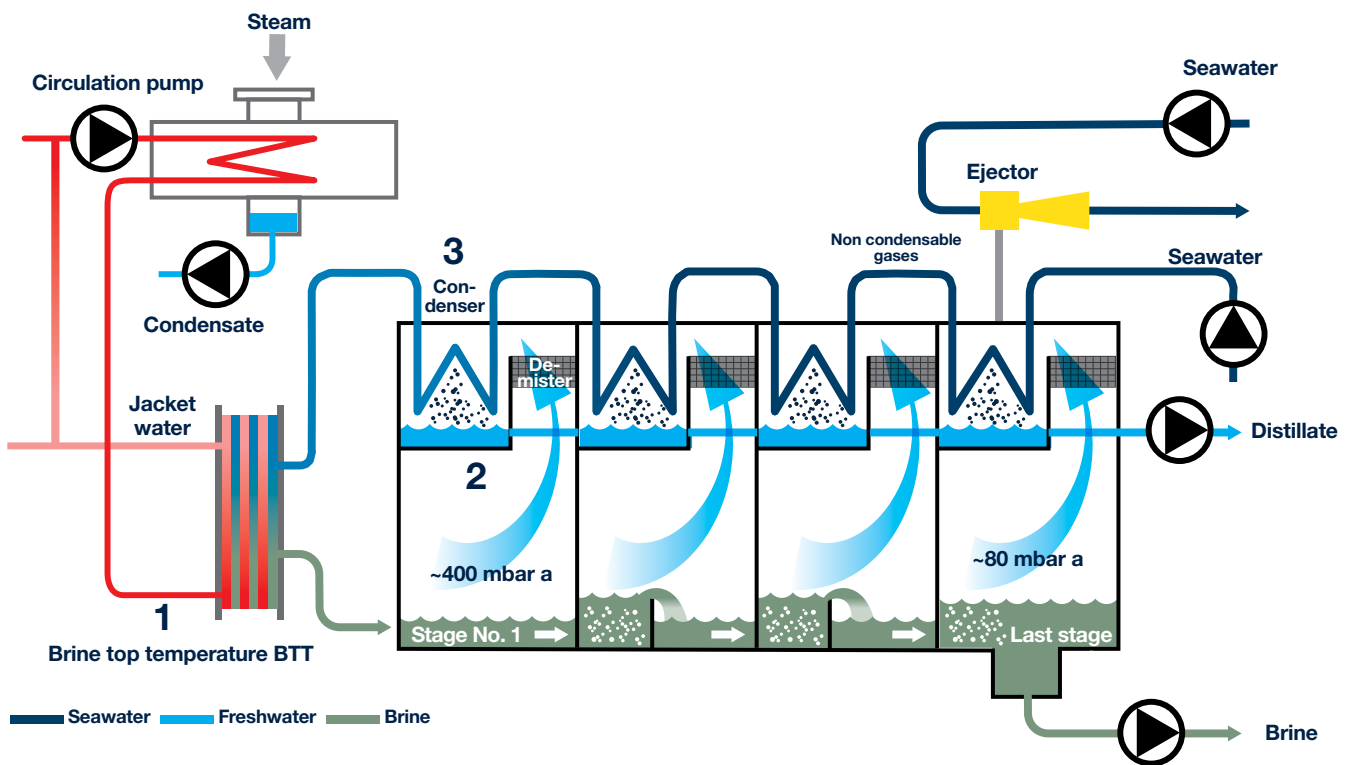
### Delivered as standard

- Flash vessel with condenser and condenser tubes
- Base frame
- Pumps, including e-motors
- Air ejectors
- Feed water heater
- Distillate cooler
- Complete internal pipework
- Control equipment and instrumentation
- Optional steam booster

### Options

- Steam booster
- Distillate cooler
- Frequency converters for pumps
- Cleaning stations





# SSD

Wärtsilä's Single-Stage Desalination (SSD) unit generates high quality freshwater in an energy efficient way. With a capacity from 8 to 35 ton/day, it is ideal for converting seawater for use as drinking or technical water onboard ships or offshore installations.

The Wärtsilä SSD is a state-of-the-art desalination unit that meets the need of long-voyage seagoing vessels where freshwater cannot be bunkered. It is also applicable in situations where clean water is required for processes. The system uses vacuum distillation to remove salt and other impurities from the seawater and convert it into high quality freshwater. The design features simple technology with a continuous and user-friendly operation. Waste heat from the diesel engine or other heat sources is used to evaporate the seawater and the system's total electricity consumption is low.

The SSD produces freshwater of the highest quality, simply and reliably. It is easy to operate, requires minimal maintenance. Spare parts are easily accessible, and no special consumables are required. Operating costs are low, and the use of time-consuming manpower is extremely

limited. Like all Wärtsilä installations, the SSD is supported by the marine industry's most extensive global service network.

## Working principle

Seawater is fed into the system, passing through the condenser (1) and air-brine ejector (2). A small part of the seawater is used as feedwater for the evaporator. The air-brine ejector,

driven by the seawater, evacuates both the excessive feed water and the chamber. A heating medium is fed into the evaporator. After approximately 5 minutes a vacuum of 90% is reached and evaporation of the feed water commences. The vapour flows through a demister (3) and is condensed in the condenser section. The distillate is pumped out of the unit.



## Technical data

Model	Capacity, ton/day	L x W x H, mm	Specific thermal power, kWh/t	Specific electrical power, kWh/t <sup>1</sup>	Weight, kg <sup>2</sup>	Space required, m <sup>3</sup>
SSD 1-1	8 - 14	970 x 960 x 1680	740	8,5	580	2
SSD 1-2	14 - 22	970 x 960 x 1680	740	8,5	620	2
SSD 2-3	22 - 30	1260 x 960 x 1680	740	8,5	710	2.5
SSD 2-4	30 - 35	1260 x 960 x 1680	740	8,5	750	2.5

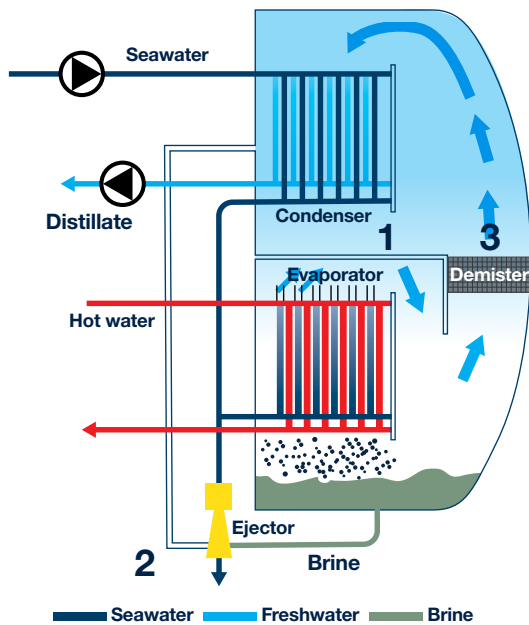
### Variants:

Heating water source: all kind of water between 70 °C and 95 °C, steam or a combination of both  
Water conductivity < 4 µS/cm

The weights given for the freshwater generators are in an empty condition. An additional 10% should be assumed for their operational weight.

<sup>1</sup> values can vary

<sup>2</sup> The weight and dimensions include the control panel.



## Key benefits

- Plug-and-play solution
- Utilising engine waste heat
- Cost-effective thanks to limited need for consumables, special tools & spare parts
- Ease of operation promotes greater safety
- Maintenance friendly
- Excellent reliability
- Control cabinet included
- Water conductivity < 4  $\mu\text{S}/\text{cm}$

## Scope of supply

### Delivered as standard

- Condenser & evaporator plates made from corrosion resistant titanium
- Distillate pump
- Combined air and brine ejector
- Chemical dosing tank including dosing instruments
- Solenoid valve for dumping bad distillate
- Control cabinet, including distillate motor starter and seawater pump motor starter
- High salinity alarm
- Complete documentation and drawing

### Options

- Seawater pump including electric motor
- Mineralization filter for adjusting the pH-value of the distillate
- UV steriliser for disinfection of the distillate
- Counter flanges
- Steam injector
- Booster heater

# Selection criteria

	RO	HiTE	MSF	SSD
Production capacity: 5 - 35 ton/day				●
Production capacity: 35 - 175 ton/day	●	●	●	
Production capacity: 175 - 1500 ton/day	●		●	
High quality distillate < 4 $\mu\text{S}/\text{cm}$		●	●	●
Bespoke design possible	●	●	●	
Able to use ship's rest heat (from engine)		●	●	●
Suitable for land-based applications	●	●	●	
Plug & Play solution, small footprint				●
Fully automatic operation (integrated PLC)	●	●	●	
Need for high filtration	●			●
Able to handle water with oil particles / emulsion		●	●	●
Maintenance less than once times per half year (in full time use)		●	●	●
Low Capex	●			●
Electrical consumption kW/ton distillate <sup>1</sup>	3.5	3.2	3.0	8.5
Modular design for extra flexibility	●			

<sup>1</sup> values can vary

# Service

Wärtsilä Water and Waste has in-house technical service teams that are able to assist customers throughout the lifecycle of their freshwater generation installations. These teams help with the optimisation of efficiency and performance. Customers can also call in our technical support during installation, start-up, operation and maintenance.

Our facility in Geesthacht Germany provides customized solutions with short delivery time and with a tight quality control. Our worldwide network of agents and distributors ensures direct local support for the majority of our customers.

Scope of equipment	Scope of performance
<b>We service following equipment:</b> <ul style="list-style-type: none"> <li>• Reverse osmosis plants</li> <li>• Desalination units</li> <li>• Evaporation systems</li> <li>• Water treatment systems</li> <li>• Cooling</li> <li>• Pre-heating</li> <li>• Condensation</li> </ul>	<ul style="list-style-type: none"> <li>• Project consultancy</li> <li>• Assembly</li> <li>• Commissioning</li> <li>• Training</li> <li>• Maintenance</li> <li>• Inspection / Preventive maintenance</li> <li>• Spare part management</li> <li>• Automation &amp; updates</li> </ul>

All our services can be certified according to following classification societies: TÜV, DEKRA, BV, LROS (Class 2.2), DNV-GL (Class II), RINA, RMROS, CCS, KR and ABS.



## Contact:

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