



# Fresh water for life

Desalination solutions for every need



While the greater part of our planet consists of water, 97% is saltwater. The Earth's supply of fresh water, stored in aquifers, surface waters and the atmosphere, is dwindling.

Alfa Laval desalination solutions, using energy from waste process heat and other sources, are economically feasible, reliable and sustainable. They generate huge volumes of high purity fresh water in land-based plants and on ships and offshore production platforms worldwide. The systems are also suitable for solar power and geothermal installations.



# We have the solutions and resources to support your need for fresh water

Population growth, higher living standards, growing competition for water, pollution and climate change are all exerting pressure on the world's shrinking water resources and forcing up the cost of fresh water. In addition, many industries require large quantities of high purity water for their processes and are realizing the benefits of becoming self-sufficient in terms of water supply.

Governments, municipalities and industries worldwide are increasingly turning to desalination as a way of addressing water shortages, so the portion of the world's water supply derived from desalination is rapidly growing.

## Energy saving solutions

In an increasingly energy conscious world, Alfa Laval's contribution has been to pioneer the development of efficient desalination systems with low energy consumption that can use a wide range of energy sources, including solar power and waste heat from industrial processes.

Alfa Laval desalination systems and equipment all have this in common – they provide highest quality water with lowest overall production costs, minimum downtime and longest economical life of the equipment.

## Serving a wide range of industries

Alfa Laval desalination systems produce potable water, process water, and boiler feed water. They are used in:

- Land-based Desalination plants
- Power industry
- Solar power and Desalination
- Geothermal installations
- Ships
- Oil & Gas offshore industry
- Food industry
- Mining
- District heating and Cooling

## More than 30,000 installations

Today, with more than 50 years' experience, over 30,000 successful installations and references throughout the world, Alfa Laval is one of the technology leaders in the desalination field.

We have installed a total freshwater capacity of more than 1,000,000 m<sup>3</sup>/day for offshore platforms, cruise ships and merchant vessels of all types, and

supplied more than 200 land-based installations for power, industry and municipal applications.

## Wherever you are, Alfa Laval is there to support you

Take advantage of our know-how and experience. We can recommend the optimal desalination solution for your needs and we have the engineering capability to integrate the technology into your process or system.

When you invest in Alfa Laval desalination systems our installation and commissioning support ensures trouble-free system start-up. Once your systems are online, you have unlimited access to a world-class customer service organization.

We have a global team of highly experienced field service engineers to support you and more than 50 service centres worldwide. With Alfa Laval you can rely on genuine spare parts and knowledgeable service personnel dedicated to serving your needs 24/7.

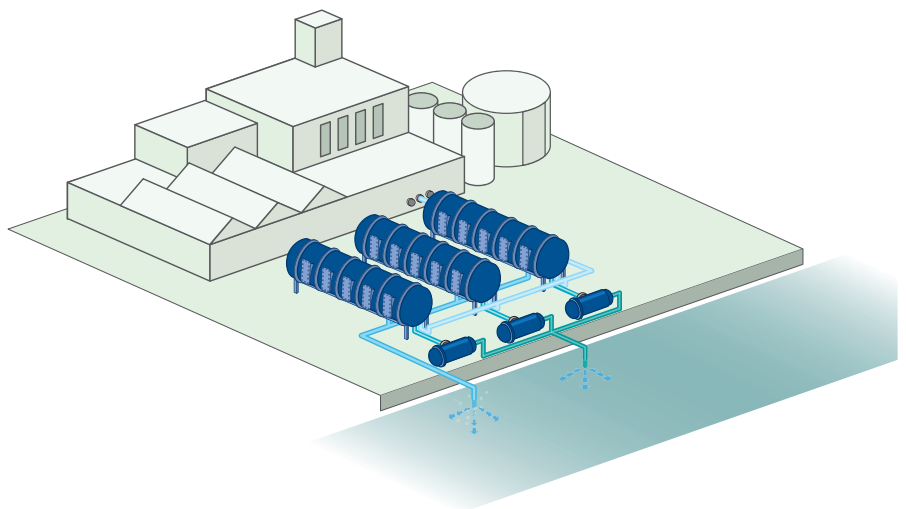




Photo: Nadeem Ahmed.

**MEP case: Karachi, Pakistan**  
 DHA Cogen Ltd (DCL) has installed two Alfa Laval MEP desalination units, total capacity 13,680 m<sup>3</sup>/day, in a new plant producing both fresh water and electrical power. “It requires the minimum amount of energy to convert seawater into drinkable water,” says DCL CEO Waqas Mohsin.

# Distillation using plate technology – purest water, lowest cost

Alfa Laval pioneered and developed the highly successful desalination concept based on plate heat exchangers. Our solutions include single and multi-effect distillation (MED) systems driven by thermal energy and electrically driven vacuum vapour compression (VVC units). All offer a high level of energy efficiency.

## Firstly, why choose distillation?

### High water purity, low sensitivity to inlet water quality

Comparing distillation with the most commonly chosen alternative, reverse osmosis (RO), distillation is the clear winner in terms of distillate purity, providing water purity in the range 2–10 ppm TDS (total dissolved solids).

Distillation systems normally offer more than 90% availability, compared to RO, which offers less than 70%.

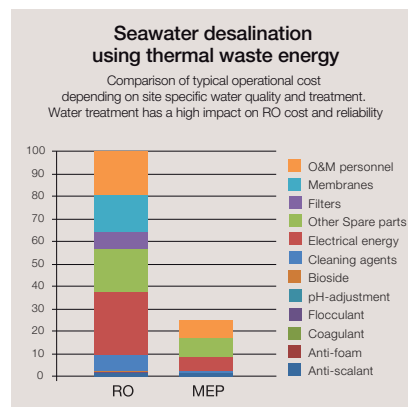
The reason is that RO is sensitive to raw water quality. Variations in salinity and content of suspended solids and harmful elements negatively affect performance. An RO system is also more prone to fouling and scaling than a distillation system. Frequent cleaning is required, which is a complex, time consuming task.

### Lowest energy consumption

The electrical power consumption of these units is down to 1 kWh per m<sup>3</sup> distillate, compared with 4 kWh/m<sup>3</sup> for a sea water RO system with an energy recovery unit. RO systems without energy recovery use up to 9 kWh/m<sup>3</sup>.

### Low chemicals consumption

At the pre-treatment stage, Alfa Laval distillers normally require simple



standard filtration and dosing with a single anti-scaling agent to avoid scaling formation on the heat transfer surfaces.

In RO systems, however, pre-treatment is the weakest part of the process. Thorough filtration and chemical treatment is required in order to avoid scaling and fouling due to particles and colloids in the membrane. Also the after treatment from RO plants must be evaluated.

Another benefit is that distillation systems can be operated by less skilled personnel while RO systems require specialist know-how. In addition, RO typically involves the frequent costly replacement of hardware and consumables.

- High efficiency and availability
- Lowest total water production cost
- High distillate purity
- Lowest energy consumption
- Small CO<sub>2</sub> footprint
- 100% performance recovery after cleaning
- No corrosion on titanium plate type evaporators
- Fully automatic operation for fast start-up and load control
- Small footprint for installation and service.



## TVC case: Kaltim, Indonesia

Three Alfa Laval TVC units, each producing 1,680 m<sup>3</sup>/day process and potable water from seawater, have been in operation at the Pupuk Kaltim Fertilizer Complex, Indonesia, since 2001. The heat transfer surfaces in the TVC units are in Grade 1 Titanium.

### It pays to think long term

Although at first glance RO seems to be the less expensive solution, it pays to look at the total picture. The somewhat higher investment for a distillation system will rapidly be recovered through savings in operating costs.

Operating costs for RO systems range from twice as high as for distillers, up to five times as high!

Also, the cost of the full pre-treatment and after-treatment process is often not included in the price of the RO system. Add the fact that RO systems often require the construction of a costly building, while Alfa Laval desalination solutions operate outdoors, and it makes sound financial sense to invest in distillation systems.

Long-term thinking pays dividends.

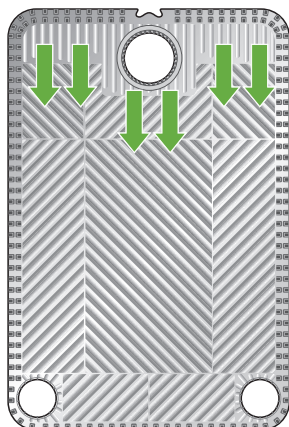
### Secondly, why choose plate technology?

#### High thermal efficiency

Why choose plate distillers and not the more traditional shell-and-tube units? Plate distillers occupy only a fraction of the space of shell-and-tube distillers. They offer much higher thermal efficiency in relation to their volume and weight.

#### Minimum scaling

In shell-and-tube distillers, scale formation adversely affects the heat transfer process, increases energy consumption and reduces capacity.



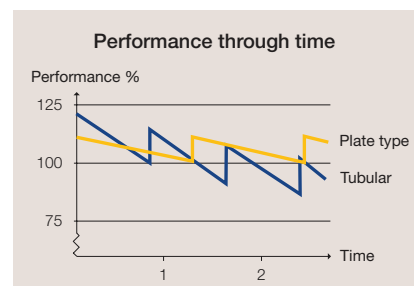
The falling film principle

With plate-type distillers these problems do not arise since they are designed to provide a controlled falling film. A controlled falling film is continuously in contact with the entire heat transfer surface. This ensures full wetting of surfaces and minimizes the risk of deposit build-ups and dry spots, which in turn, avoids scaling and maintains a high thermal efficiency.

Another factor is the short residence time of the media in the unit, which gives a faster process response to load changes and less scaling.

#### Plate type distillers can be cleaned effectively

Plate type distillers can be cleaned easily and effectively, without opening the plate stack, by in-line chemical cleaning (CIP), or, if required, they can be opened and cleaned manually.



The performance of shell-and-tube evaporators gradually decreases due to irreversible scaling and fouling. Due to their design, cleaning these units is a difficult, time-consuming task and, unlike with plate distillers, it does not return them to their original design capacity.

#### Flexible design, low material costs

Plate-type distillers can be designed for any capacity and can be expanded to provide more capacity if needed.

Compared to shell-and-tube distillers, material costs are low, even in applications where titanium is required for corrosion resistance.

Plate technology wins on all counts!



## TVC case: Iskenderun Bay, Turkey

The Sugözü coal-fired power plant needed a sustainable supply of process water. Three Alfa Laval TVC units were installed, powered by thermal energy taken as bleed steam from the power plants' turbines. Each unit has a capacity of 1,750 m<sup>3</sup> per day.

# Advanced desalination solutions from the technology leader

Alfa Laval desalination solutions range from compact single and double effect Fresh Water Generators (FWG), up to large Multi-Effect Plate systems (MEP), Multi-Effect Thermo-Compression systems (TVC) and Mechanical Vacuum Vapour Compression systems (VVC). The systems are PLC controlled, providing fully automatic operation.

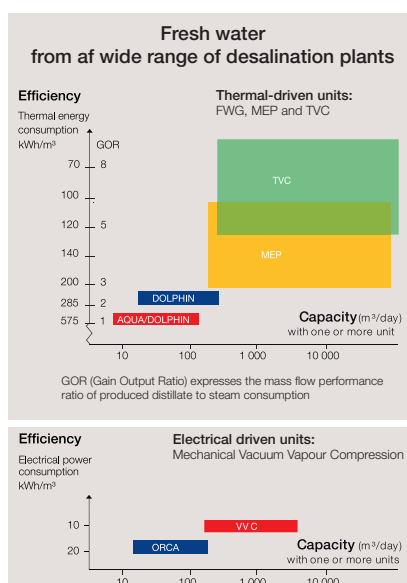


### Unique plate design – extremely high thermal efficiency

In Alfa Laval's patented plate design, the corrugated pattern promotes turbulence which ensures high heat transfer efficiency. It also causes high wall shear stress which minimizes fouling and provides support points that eliminate vibration.

### Modular designs

The modular designs of our multi-effect plate systems and vacuum vapour compression units enable them to be configured to meet specific project performance requirements. They are



equipped with efficient, compact plate pack designs in high grade titanium for maximum corrosion resistance.

### Low life-cycle cost

The low life-cycle cost of Alfa Laval desalination systems is due to their low energy requirements and their resistance to fouling and scaling, which reduces maintenance costs.

Other factors are the fact that they normally only need cleaning once or twice per year and are extremely easy to clean. Soft scaling can be removed 100% without opening the unit by acid cleaning using Cleaning-in-Place (CIP) equipment. Alfa Laval desalination systems are designed to avoid hard

scaling, but in case this should occur, direct access allows hard scale to be removed 100% manually.

### Space-saving designs

The high thermal efficiency of Alfa Laval desalination units in relation to their low weight and small footprint means that, compared to other types of desalination solutions, much higher volumes of fresh water can be generated in the same space.

### Maximum uptime

The track record of our systems in terms of reliability, availability and durability has made them popular with customers in many industries worldwide. Built to last, they will outlive the plant or the ship in which they are installed!

### Minimized environmental impact

We prioritize the environment in all our product development activities. A typical example is that Alfa Laval desalination solutions are designed to reduce CO<sub>2</sub> emissions. With an Alfa Laval solution it is possible to get financial subsidies via CO<sub>2</sub> certificates, based, for instance, on the Kyoto Protocol.

Alfa Laval desalination systems are manufactured in sustainable, high-grade materials. Thus, corrosion protection, coating and other non-environmentally friendly, life-extending treatments are unnecessary.



## MEP case: Delimara, Malta

Two Alfa Laval MEP desalination units producing 1,500 m<sup>3</sup> of fresh water per day are installed in the Enemalta Corporation's Delimara diesel power plant. The power source is waste heat from the diesel engines. The contractor was diesel power plant builder BWSC A/S.

## Solutions that will outlive your plant, ship or offshore platform

### Thermal driven units



#### AQUA, Fresh Water Generator

Available in marine, land-based and offshore versions, the Alfa Laval AQUA takes vacuum desalination to new levels of efficiency and economy with only half sea water flow in the unique 3-in-1 integrated single titanium plate pack for easy service within the footprint. The expandable AQUA can be powered by waste heat in the form of hot water and/or steam and is exceptionally easy to maintain and to operate either manually or automatically via a control panel. Capacities of 3 to 60 m<sup>3</sup>/day per unit with salinity below 2 ppm.



#### DOLPHIN, Fresh Water Generator

The two-effect DOLPHIN produces fresh water at even higher energy efficiency in automatic operation with continuous control of the fresh water quality for drinking and process use. The DOLPHIN uses the vacuum distillation process powered by waste heat from hot water like diesel engine jacket cooling water and/or steam. Equipped with corrosion resistant titanium plates the unit provides fresh water with salinity levels below 2 ppm and a long working life. Capacities of 20 to 75 m<sup>3</sup>/day per unit.



#### MEP, Multi Effect Plate Distiller

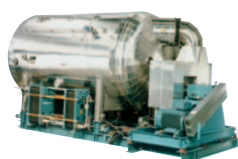
The Alfa Laval Multi Effect Desalination unit with titanium plates, ensures the most reliable and cost-effective supply of fresh water by means of sea water distillation using waste heat or low grade thermal energy from hot water or low pressure steam. Based on standard components and a modular concept, the unit can be custom-designed for the specific installation. Applicable for Power Plants, CSP, Oil & Gas Industry, Mining, Cruise Liners, Domestic water and Food.



#### TVC, Thermo Vapour Compression Distiller

The Alfa Laval TVC design doubles the efficiency of the MED units by using a mixture of live steam and re-compressed water vapour from the TVC ejector system as heating medium. The TVC unit ensures an even more cost-effective supply of fresh water with higher efficiency by sea water distillation using medium- or low pressure steam down to approx. 3 bar. The TVC units can be custom-designed for the specific application and installation.

### Electric driven units



#### VVC, Vacuum Vapour Compression Distiller

Alfa Laval land-based VVC units, with titanium plates, are a simple, efficient method of producing a constant supply of high quality fresh water driven by electric power only. Using the vacuum distillation process, they convert seawater into fresh water fully automatically with minimal power consumption and simple raw water pre-treatment. Can be designed for capacities from 300 to 1500 m<sup>3</sup>/day or higher.



#### ORCA Vacuum Vapour Compression Water Maker

The Alfa Laval ORCA unit defines the state of the art in compact electrically driven fresh water makers - easy to install and simple to maintain for production on offshore drilling rigs, production facilities and land based installations. It is built for automatic operation with only few consumables and continuous control and monitoring of fresh water quality below 5 ppm. Capacities of 20 to 70 m<sup>3</sup>/day per unit.

### Heating & Cooling



#### PHE and hot water modules

Alfa Laval Plate Heat Exchangers are used for cooling of distillate and condensate as well as heating or boosting of process water.

Hot water modules, electrical heaters and boilers can be used for heating and circulation of hot water. As FWG booster heaters they are designed to secure continuous maximum fresh water production, and to ensure constant temperature and flow, even when waste heat is limited or not available.

### Filtration & Water treatment



#### ALF filter and water treatment

The Alfa Laval ALF filter range of self-cleaning filters/strainers are designed to maintain the performance of plate heat exchangers and desalination systems by ensuring that debris or other undesirable materials cannot enter the system via the inlet water.

Fresh Water Treatment, such as pH-adjustment, remineralization and sterilising (AOT-, UV- or silver-ion) of the produced distillate, can be supplied optionally.

### **Alfa Laval in brief**

Alfa Laval is a leading global provider of specialized products and engineered solutions.

Our equipment, systems and services are dedicated to helping customers optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuffs, starch and pharmaceuticals.

Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

### **How to contact Alfa Laval**

Up-to-date contact details for all countries are available on our website at [www.alfalaval.com](http://www.alfalaval.com)