



Metal-free seawater desalination solutions

Metal substitution with thermoplastics

Tailored plastic profile solutions

Enhancing seawater desalination plants by means of plastic heat exchanger solutions



Seawater desalination plant in the Arabian Gulf. Large plants like this with a daily output of over 500,000 cubic meters of drinking water generate the potential to create huge savings by changing over to plastic components.

Metal substitution with thermoplastics

Technical plastic heat exchanger solutions



Metallic tubes and supporting parts have been used in heat exchanger applications for decades. Also in plants for seawater desalination, these metal parts have been frequently used leading up to the present day. Nevertheless, it goes without saying that metal and seawater are not compatible with each other.

This results in commonly known adverse effects to desalination plant operations such as:

fast decreasing efficiency caused by **fouling and scaling**

the usage of **huge amounts of harmful chemical additives** to prevent fouling and scaling

frequent maintenance due to **corrosion**

the need for **expensive metals associated with highly volatile prices**

Today however, the development of heat-conductive polymers shows new potential for replacing metals in desalination plants, especially within the scope of the multiple-effect distillation (MED) process and other thermal desalination processes for seawater. With the introduction of our technical plastic heat exchanger solution, it is possible to eliminate the adverse effects previously mentioned, thereby considerably enhancing plant performance.

In addition to using them for seawater desalination, polymer solutions can be implemented in a wide range of applications associated with high demands in regard to corrosion and chemical resistance.



Not metal, but ...

PP graphite the material of choice!



Conductive: Heat conductivity similar to metal

Traditionally, plastic profiles have only been known as excellent thermally insulating components. But lately, things have changed.

Now, using highly conductive graphite as a filler is offering a new set of dimensions for heat conduction applications, such as heat exchangers for example.

This polymer-graphite combination is able to achieve heat conductivity values similar to stainless steel or titanium.

Robust:

Burst strength more than 20 bar*,
heat resistance up to 90 °C

Plastics in general have a wide range of mechanical properties and can be adapted to meet various requirements.

For example, the Young's modulus can be adapted within a range of 500 to 45000 MPa. It is possible to achieve a maximum tensile strength of 330 MPa. The softening temperature may be as high as 350 °C (under a 1.8 MPa load).

* 1.5 mm wall extruded PP-GR tube

Resistant:

Chemical resistance even against highly concentrated acids, bases or saline water.

Plastics are widely used in the chemical industry to pack highly concentrated acids or bases.

Based on that knowledge, it's reasonable to rely on the use of these kinds of materials for applications subjected to corrosive environments.

Besides that, PP graphite compounds have no corrosive problems with highly salinated water, even at temperatures of 90 °C.

Smooth surface:

98% less fouling and scaling

Our high-end extrusion process enables us to process compounds with very high amounts of fillers, thereby keeping the surface of the profiles or tubes very smooth. This smooth surface results in a much better resistance to fouling/scaling because there are no voids or surface defects for particles to adhere to.

Extensive evaporation tests have shown that the typical scaling of calcium and magnesium can be reduced up to 98% using PP graphite tubes.

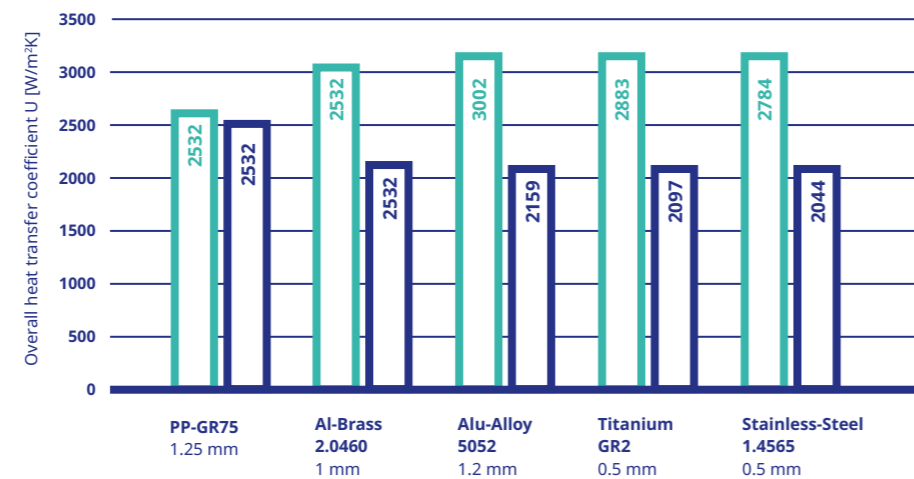


Less fouling - better performance

There is a good reason why the operators of seawater desalination plants put so much effort into keeping tube surfaces clean. If they don't use tons of chemicals, metal tubes would rapidly decrease in performance within a very short time due to the effects of fouling and scaling.

Our tests have shown that the heat transfer coefficient of metal tubes drops by about 25-30% after only 1000h. In contrast to that, the PP graphite tubes with better fouling/scaling behaviour drop only about 5%.

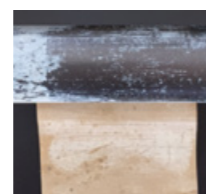
Heat transfer performance comparison



Heat transfer in fresh state (stationary values after 50 h)
Estimated heat transfer coefficient after 1000 h



Al-brass tube with seawater fouling



PP-GR tube with seawater fouling

Less chemicals and infrequent maintenance: tests with adhesive tape have shown that fouling and scaling can be easily eliminated from the PP graphite tubes.

Even more important: after a very short operation time, PP graphite tubes outperform every metal tube in its performance.

Additional benefits

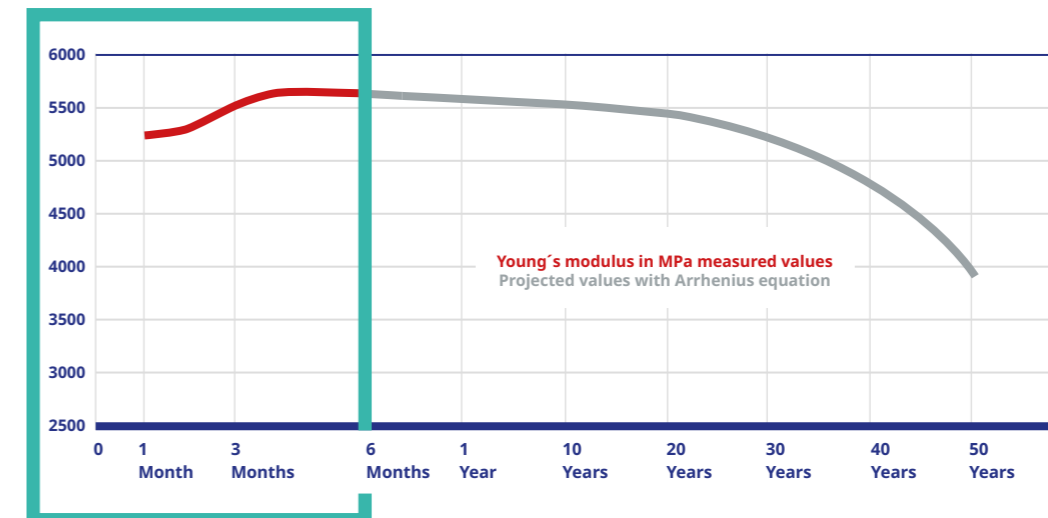
Lifetime 50+ years

Intensive tests were carried out by the Polymer Service Institute in Merseburg (Germany) to determine the long-term behaviour of the plastic tubes under operating conditions in seawater desalination plants.

Common accelerated ageing testing methods at 80 °C (which is the maximum temperature value in the MED process) were applied. Values were measured over the course of six months, supplemented by measurements performed within the scope of an additional rapid ageing test and future projections using the Arrhenius equation.

Conclusion: it takes more than 50 years before the Flexural-Modulus drops below 50% of its initial value.

Lifespan



Drinking water suitability

Our PP graphite tubes have passed the drinking water suitability test according to KTW guidelines (German drinking water standard) at a temperature of 23 °C and 85 °C (cold and hot water). The KTW standard is equivalent to the American NFS and the British WRAS standard.

More environmentally sustainable

More and more regions in the world have to rely on clean water generated by seawater desalination plants. However, seawater desalination has an impact on the environment. The Persian Gulf, for example, suffers from an input of 296 kg of copper, 23.7 metric tons of chlorine and 64.9 metric tons of antiscalants – and that on a daily basis.

Switching from heat exchanger tubes made of metal to ones made of technical plastic will change this.

- No/less antiscalants
- No/less corrosion inhibitors
- No copper emissions

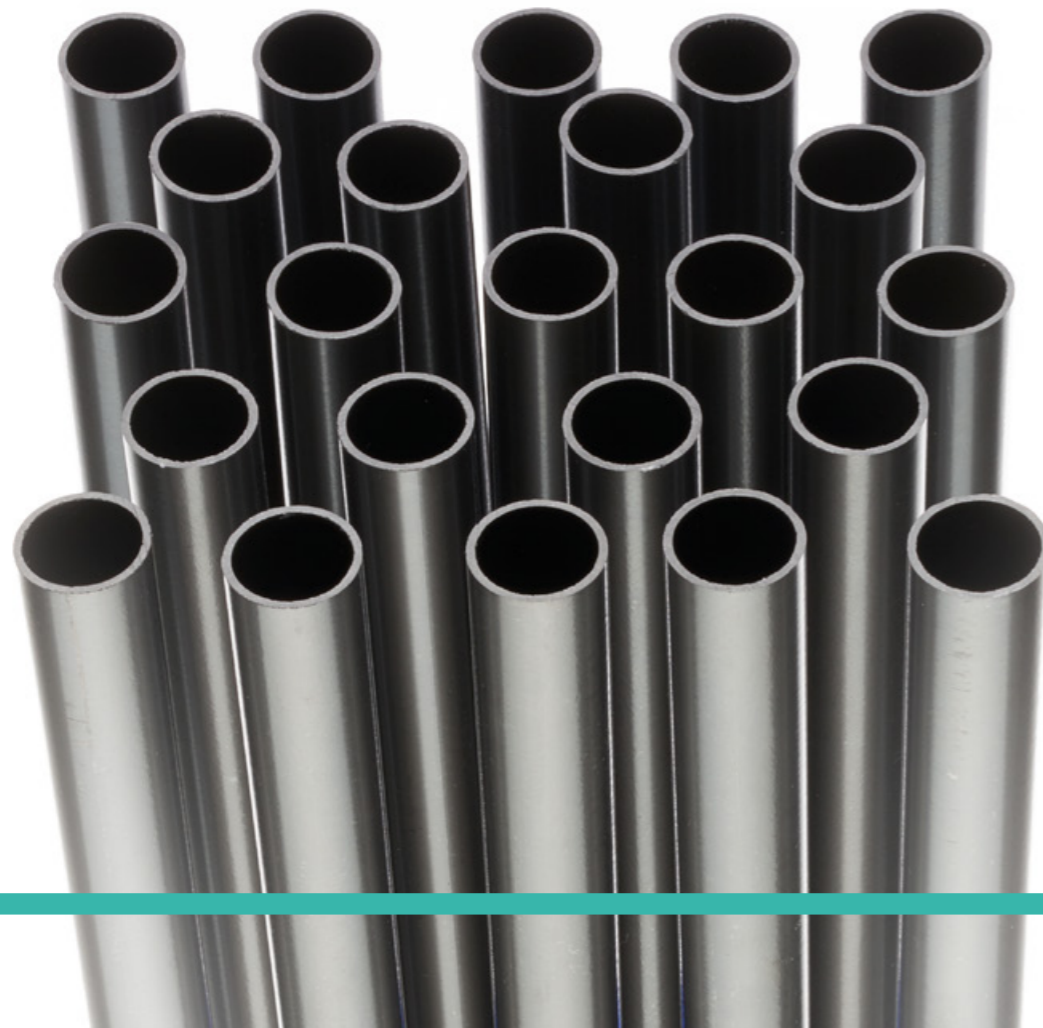
to entail a more environmentally friendly source of future drinking water.

More than just tubes

Our aim:

Full service for metal-free

seawater desalination solutions.



Plastic heat exchanger tubes for seawater desalination

First, only the tubes existed. Due to Technoform having its roots in high-tech precision profiles and tubes, that was our prospect when we started having a look into the topic of heat exchange.

However, we soon realized that the market needs a more complete package, ranging from proper connection technology to end-plates, support plates or complete housings made of plastic, thereby providing a fully plastic desalination stage in the end.

Our wide expertise in technical plastics and a strong commitment to individual solutions is the basis for fulfilling those very needs.

Connecting plastic tubes

In theory, there are numerous ways of connecting a plastic tube to mounting plates in order to enable heat exchanger system functionality.

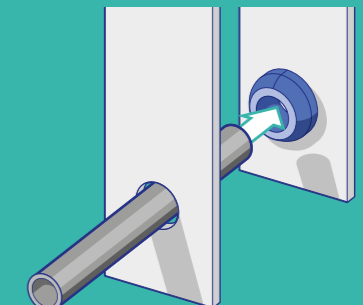
Finding the most reliable connection depends on various factors: is the mounting plate made from the same material as the tube? What is the system pressure that has to be withstood? What chemicals are involved? What's the system's operating temperature? Is there a temperature gap that has to be compensated for concerning thermal expansion? What is the distance between the tubes? The list is not exhaustive.

Based on the answers to these questions, the appropriate connection technology has to be chosen.

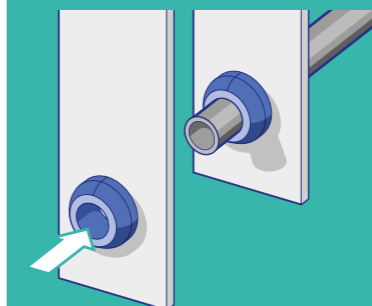
Rubber grommets – a fast and easy connection solution



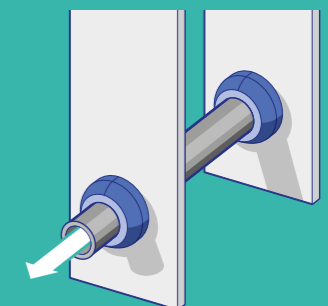
How to proceed:
1. Plug grommet into plate.



2. Push tube through rubber grommet.



3. Insert second grommet ...



4. ... and push further. Done!



Automotive



Aviation



Chemical Industry



Construction



Electrical Engineering



Insulating Glass



Lighting



Machine Construction



Oil & Gas



Power Generation



Railway



Seawater Desalination



Shipping



Ventilation/
Air Conditioning



Windows/
Doors/Facades

> Haven't found your industry? Ask us.

We love to innovate your industry.

Even when it's not about corrosion.

Originally started with tailored plastic profile solutions, Technoform has always been opening up new business fields – and still does. Providing holistic know-how and technical expertise, we are a trusted partner and problem solver for various industries today, from construction and insulating glass to automotive and aviation, from oil and gas to wastewater treatment and seawater desalination.

Our promise: consistent high quality and fastest delivery times, from the initial idea to the first sample, from pilot lot to serial production. You're looking for a plastics extrusion specialist? We make your task our own.

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