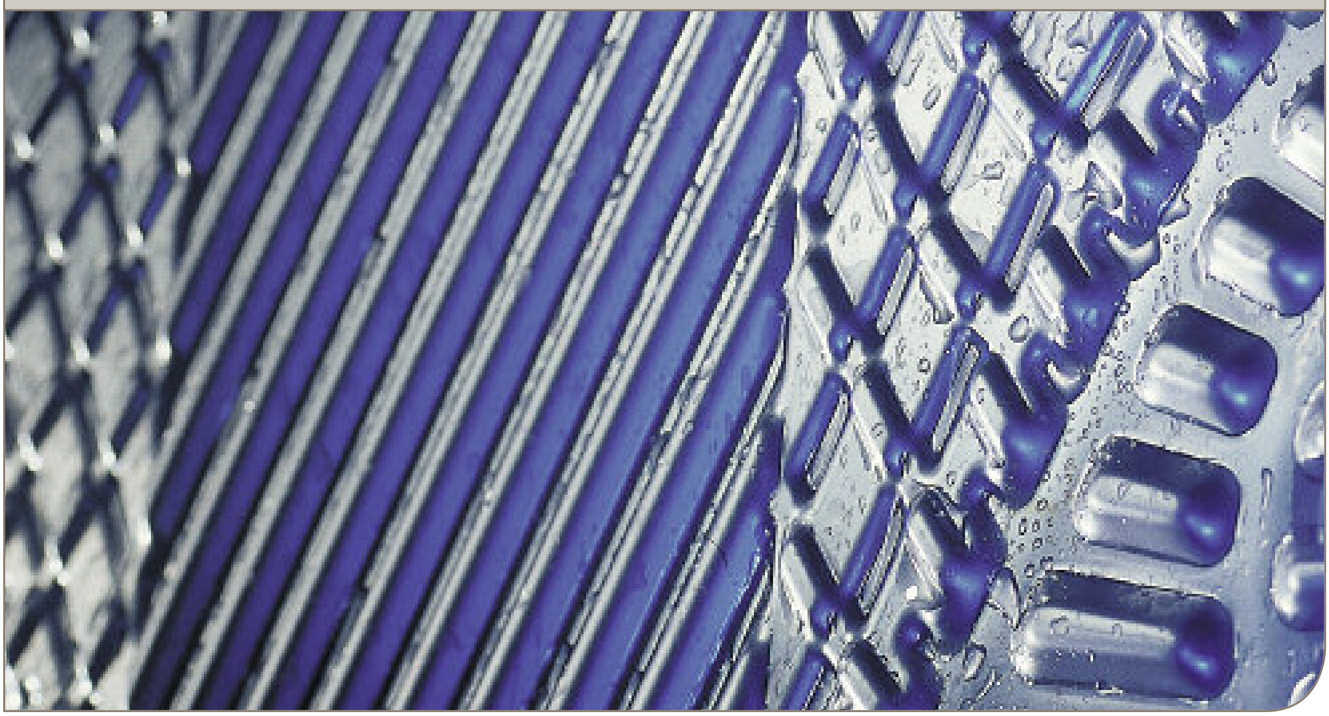
Using Alfa Laval plates make a big difference to plate heat exchanger performance

The effects and risks of using non-Alfa Laval plates

Case story



Specially designed with exact tolerances and superior manufacturing techniques, Alfa Laval plates optimize heat transfer efficiency and minimize fouling.

All plate heat exchanger (PHE) plates are not created equal. A non-Alfa Laval 0.6mm-thick plate may look the same as an Alfa Laval 0.6mm-thick plate. But it certainly does not perform like one both in terms of quality and precision. Using non-Alfa Laval plates leads to decreased PHE performance and increased costs. Here are the findings of an investigation that compares the performance of three non-original plates to an Alfa Laval plate designed for an Alfa Laval plate heat exchanger.

Background

What happens if an original 0.6mm-thick plate in an Alfa Laval plate heat exchanger is replaced by another parts supplier's plate?

To discover whether plates from three different spare parts suppliers can stand up to the task, Alfa Laval conducted an investigation to evaluate the quality of non-original plates intended as replacements parts for Alfa Laval plate heat exchangers.

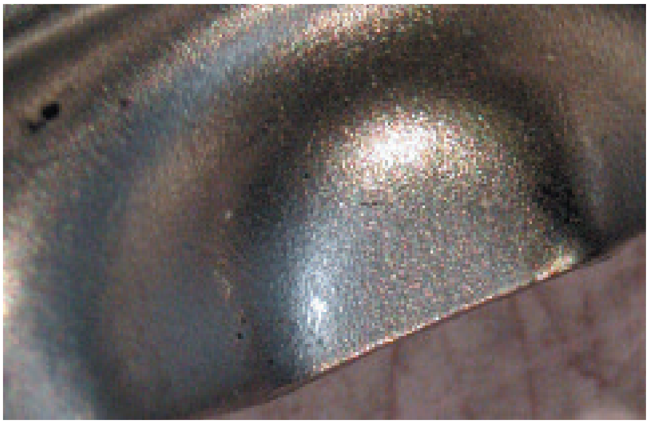
Examination

The investigation of the plates was conducted by an accredited laboratory (Swedac) and consisted of a visual examination, stereo microscope evaluation, photographic documentation and measurement of pressing depths.

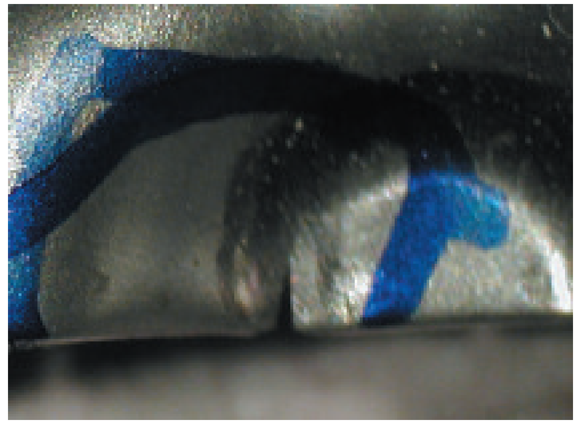
The general impression is that the plates from other manufacturers are manufactured with less precision and lower quality than Alfa Laval plates. The plates typically fail standard Alfa Laval requirements. Discrepancies were identified in these eight major areas:

- Plate pattern
- Plate distribution area
- Pressing depth
- Portholes
- Corner guides
- Gasket groove
- Gasket attachment
- Carrying bar plate interface

Plate pattern, comparison of edge



Alfa Laval.



Non-Alfa Laval with crack.

Plate pattern
The plate pattern is vital to uniform fluid distribution and heat transfer efficiency.

The Alfa Laval plate pattern is designed to optimize plate function.

Faults: A “W” plate pattern, or different plate angle, instead of the optimized Alfa Laval pattern.

Risks: Uneven fluid distribution and reduced heat transfer efficiency. Thermal performance that differs from design and therefore may affect product quality.

Plate distribution area
Located at the plate top and bottom, this area plays an important role in uniformly distributing fluids across the plate and in withstanding operating pressure.

Alfa Laval’s optimized design for the plate distribution area optimizes heat transfer efficiency, fluid distribution, design pressure capabilities and turbulence while minimizing fouling.

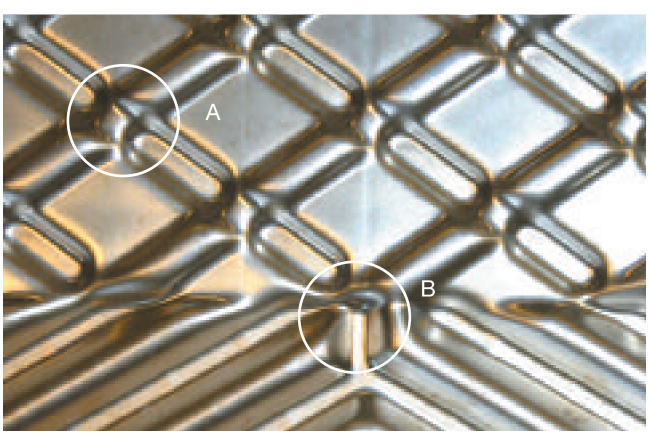
Fault: Weak, simple pattern instead of the distinct Alfa Laval pattern in the transition area between the distribution area and the heat transfer area.

Risks: Uneven distribution of fluids and reduced heat transfer efficiency. Increased fouling and decreased mechanical stability. Leakage due to pressure fluctuations causing material fatigue.

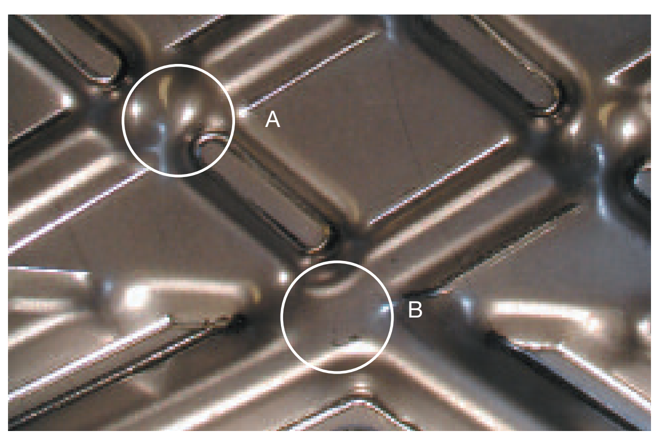
Pressing depth
The plate must be evenly pressed to optimize heat transfer efficiency, to ensure uniform distribution of both heating and cooling media, and to obtain the critical uniformity of metal-to-metal plate contact points. Alfa Laval pressing tools are manufactured to exact tolerances. This, combined with superior pressing techniques, ensures a quality surface finish. The press depths on Alfa Laval plates are designed to optimize plate function.

Faults: Uneven press depths (see table on page 3). Marks in the plates due to dirt in the pressing tool or poor material quality. Poor surface finish due to pressing tools with rough tolerances. Cracked plate edges.

Plate distribution area, comparison



Alfa Laval. Distinctly pressed pattern marked A improves stability for high pressures. The plate pattern marked B indicates press pattern design that improves fatigue resistance.



Non-Alfa Laval. Weak distribution area marked A can cause plate deformation at high pressure. The area marked B indicated reduced mechanical stability and reduce fatigue resistance.

Risks: The use of poor pressing tools and presence of dirt during the pressing process can result in plate areas that are susceptible to cracking due to metal fatigue and poor mechanical stability and gasket blowout. Surface marks are excellent initiation points for fatigue cracks, which can dramatically reduce PHE service lifetime.

Measured press depths (in mm) at different locations on the plate

	A	B	C	D	E	F	GG*
Alfa Laval	3.85	3.85	2.98	3.98	4.06	4.05	6.7
Parts supplier	3.74	3.86	2.85	3.73	3.62	3.61	5.1
% difference	–2.9	–0.3	–4.4	–6.3	–10.8	–10.9	–23.9

*GG = Width of the gasket groove.

Portholes
To provide reliable erosion prevention, Alfa Laval portholes and entrance necks are designed for low pressure drop and low velocities. Working in conjunction with the plate pattern and gaskets, the portholes help direct the flow of media through the plate and prevent the mixing of media.

Faults: Off-centre portholes in relationship to plate pattern. Incorrectly sized portholes.

Risks: Off-centre portholes can cause the plate to pivot freely and dislocate both the gasket and plate. This may weaken the sealing system, causing leakage. In addition, fatigue cracking can occur. Incorrectly sized portholes can significantly reduce heat transfer efficiency and cause equipment failure.

Corner guides
Alfa Laval plates have strong, distinctly shaped corners that enable secure fastening and keep the plates aligned. This increases mechanical strength. In addition, Alfa Laval corner guides provide additional support to the unit during major pressure and temperature fluctuations.

Fault: Lack of, or poor, corner guidance to hold plates securely in place.

Risks: Increased snaking, misalignment and sliding of plates. Gasket blowout.

Gasket groove
Alfa Laval gasket grooves are specially designed with exact dimensions and tolerances to ensure optimal sealing.

Fault: Different shape with weak groove edges.

Risks: Gasket blowout, shorter gasket lifetime and stress concentrations around the holes for plates of the snap-in type.

Gasket attachment
The juncture at which the gasket attaches to the plate is critical to proper plate function and ensures that the sealing technology functions according to design. The location of the gasket attachment must not interfere with the flow of media or compromise the mechanical properties of the plate.

Fault: Gasket system requires holes in the plates for gasket attachment.

Risks: Weakened plates due to stress concentrations around the holes.

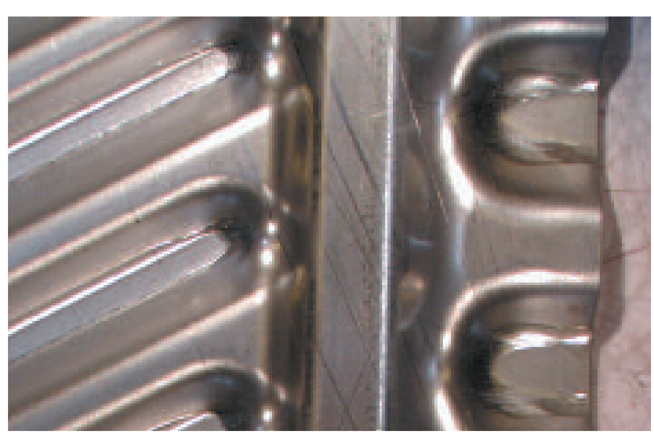
Carrying bar plate interface
As the primary support for plates during mounting, de-mounting and operation, the carrying bar plate interface is a critical element during installation, operation and service of the plate heat exchanger. The Alfa Laval carrying bar plate interface has a unique tube shape to support the weight of the plates. For larger plates, Alfa Laval uses a unique five-point alignment system.

Fault: Incorrectly shaped carrying bar plate interface.

Risks: Sliding of plates may occur during mounting and de-mounting due to poor support.

Gasket groove, comparison

Alfa Laval.



Non-Alfa Laval with scratches.

Economic effects

Using these non-Alfa Laval PHE plates for the Alfa Laval plate heat exchanger undoubtedly has economic effects on the operation of the PHE as well as the entire plant. The use of non-Alfa Laval spare parts can affect the profitability of operations in these ways:

- Reduced heat transfer efficiency.
  Incorrect plate arrangement and/or the use of non-Alfa Laval spare parts can lower the k-value or the heat transfer coefficient. This contributes to a high resistance to the transfer of heat, which can drastically increase operating costs.

  A 10% reduction in heat transfer efficiency of a normal-sized 10MW PHE in a district heating substation, for instance, translates into an additional 50 euros per MWh in cost. Reduced heat transfer may also lead to a higher pumping cost, which may require an additional investment.

- More frequent parts replacement.
  Due to the increased wear and fouling caused by inferior quality spare parts, plates and gaskets may require more frequent, and therefore more costly, replacement. Replacing a set of fluoropolymer gaskets at a typical sulphuric acid plant, for instance, can cost up to 50,000 euros, depending on PHE size and number of gaskets.

- Equipment failure.
  Using non-Alfa Laval spare parts negates the initial investment in your Alfa Laval PHE. Equipment failure is costly. For instance, replacing a marine oil cooler with titanium plates, which is vital when using seawater as the cooling medium, can cost upwards of 150,000 euro depending on the size of the unit.

- Lost production time.
  Productivity losses are probably the most expensive consequence of using non-Alfa Laval spare parts. Downtime can vary from a few hours to several weeks. An hour of lost production time on an offshore oil production platform, for example, can cost hundreds of thousands of euros while downtime at a nuclear energy plant can cost 1 million euro per week.

Conclusions

Manufactured to precisely the correct tolerances and material specifications, Alfa Laval spare parts are subject to stringent quality control procedures. It definitely pays to invest in Alfa Laval spare parts.

Using non-Alfa Laval plates that do not match the original specifications can contribute to less reliable PHE performance and put worker safety as well as the safety of your plant and the environment at risk.

In addition, the cost of using non-Alfa Laval plates can have a significant – and unexpected – impact your operating and maintenance budget.

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How to contact Alfa Laval
Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com