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高能效設計與AHRI認證

Content

Plate heat exchanger portfolio

21 July 2025

Alfa Laval

Technology platforms by Alfa Laval

Our contribution to the world of heat exchangers

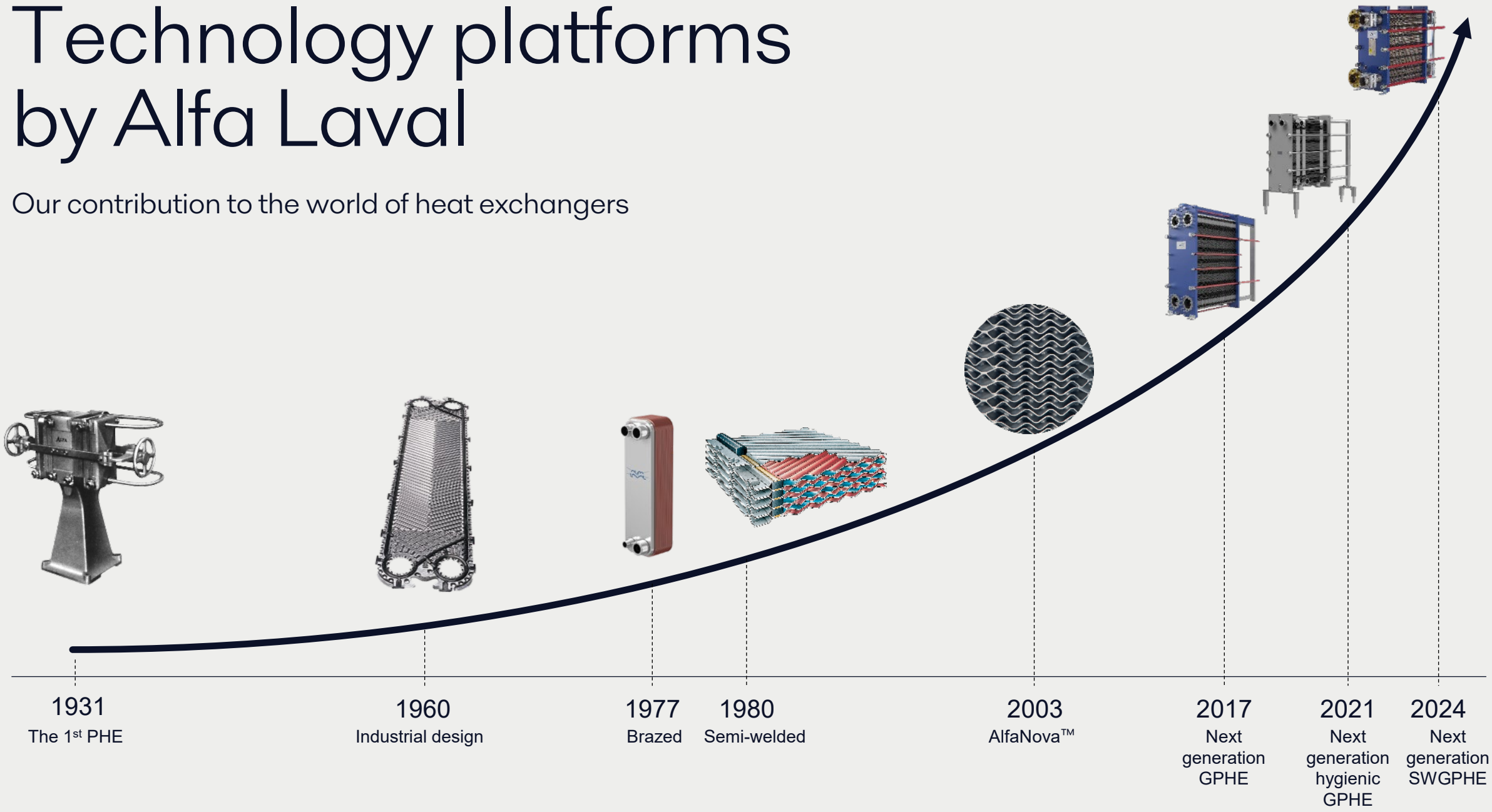
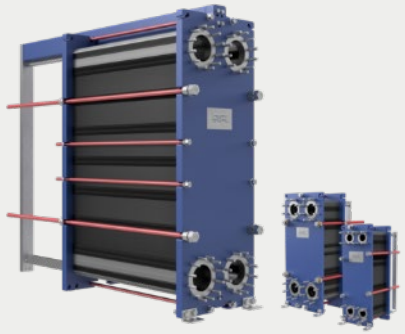


Plate heat exchanger portfolio

Semi-welded
plate heat exchangers



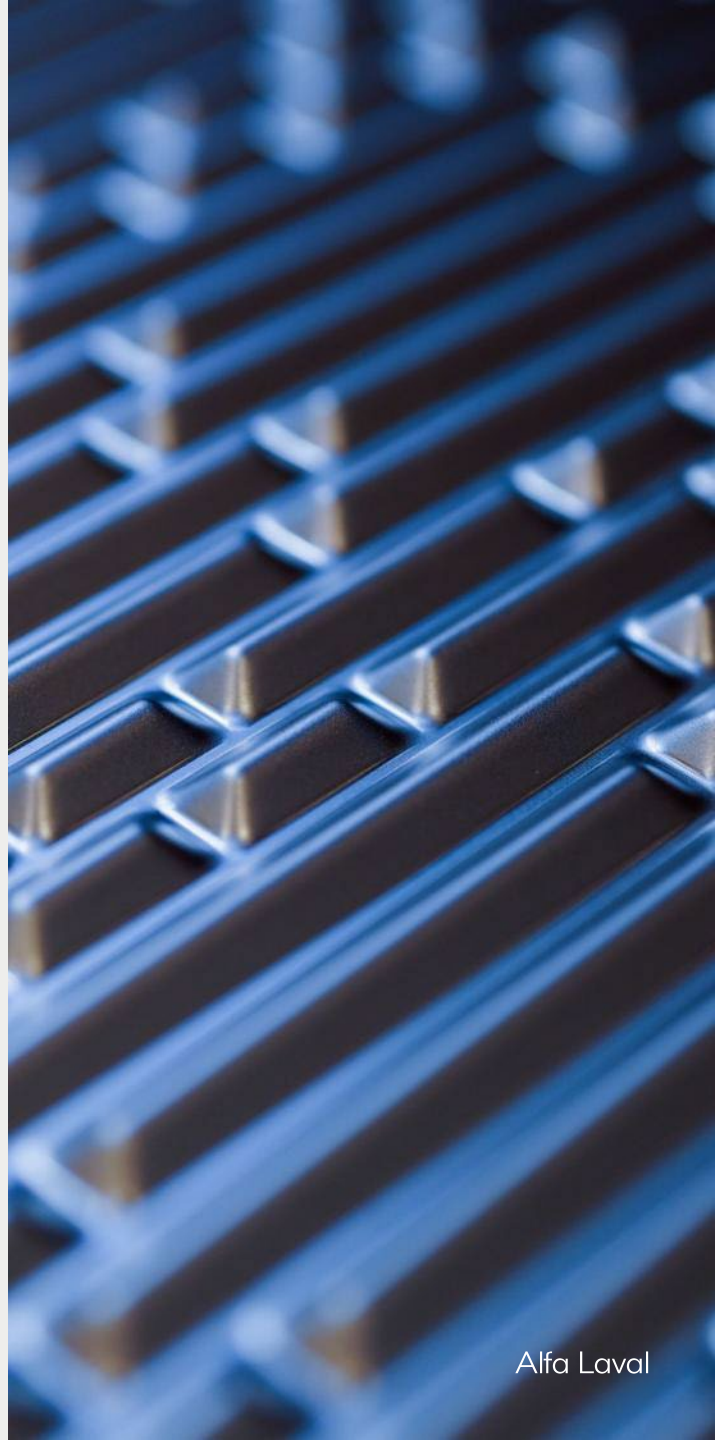
Gasketed plate-and-frame
heat exchangers

Welded plate-and-block heat
exchangers

Welded spiral heat
exchangers

Brazed
plate heat exchangers

Fusion-bonded
plate heat exchangers



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Parameters impacting sizing

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The heat transfer equation

Heat load

$$Q = k \cdot A \cdot LMTD$$

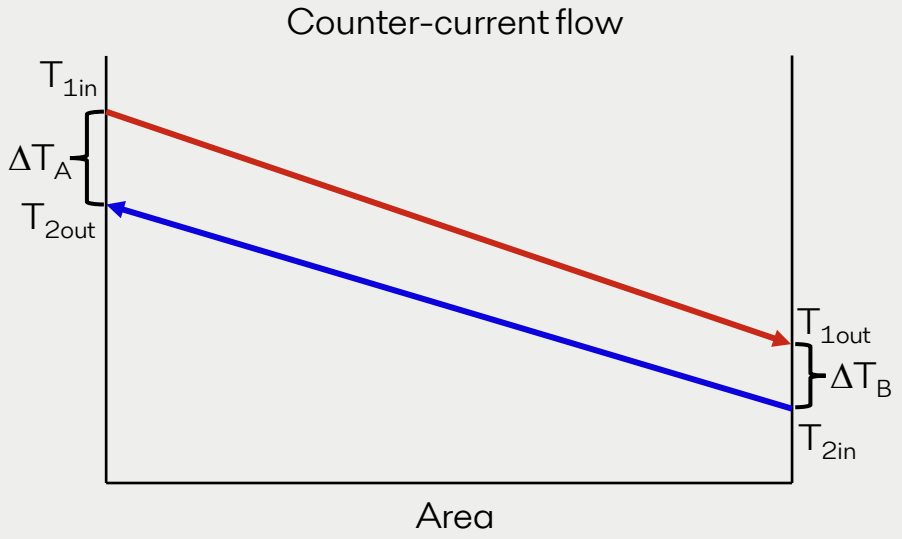
Q	heat load, W
k	k value, overall heat transfer coefficient (OHTC), W/(m^2·K)
A	heat transfer area, m^2
$LMTD$	Logarithmic Mean Temperature Difference, °C

LMTD is a measure of the average temperature difference between the hot and the cold fluid.

The heat transfer equation

LMTD

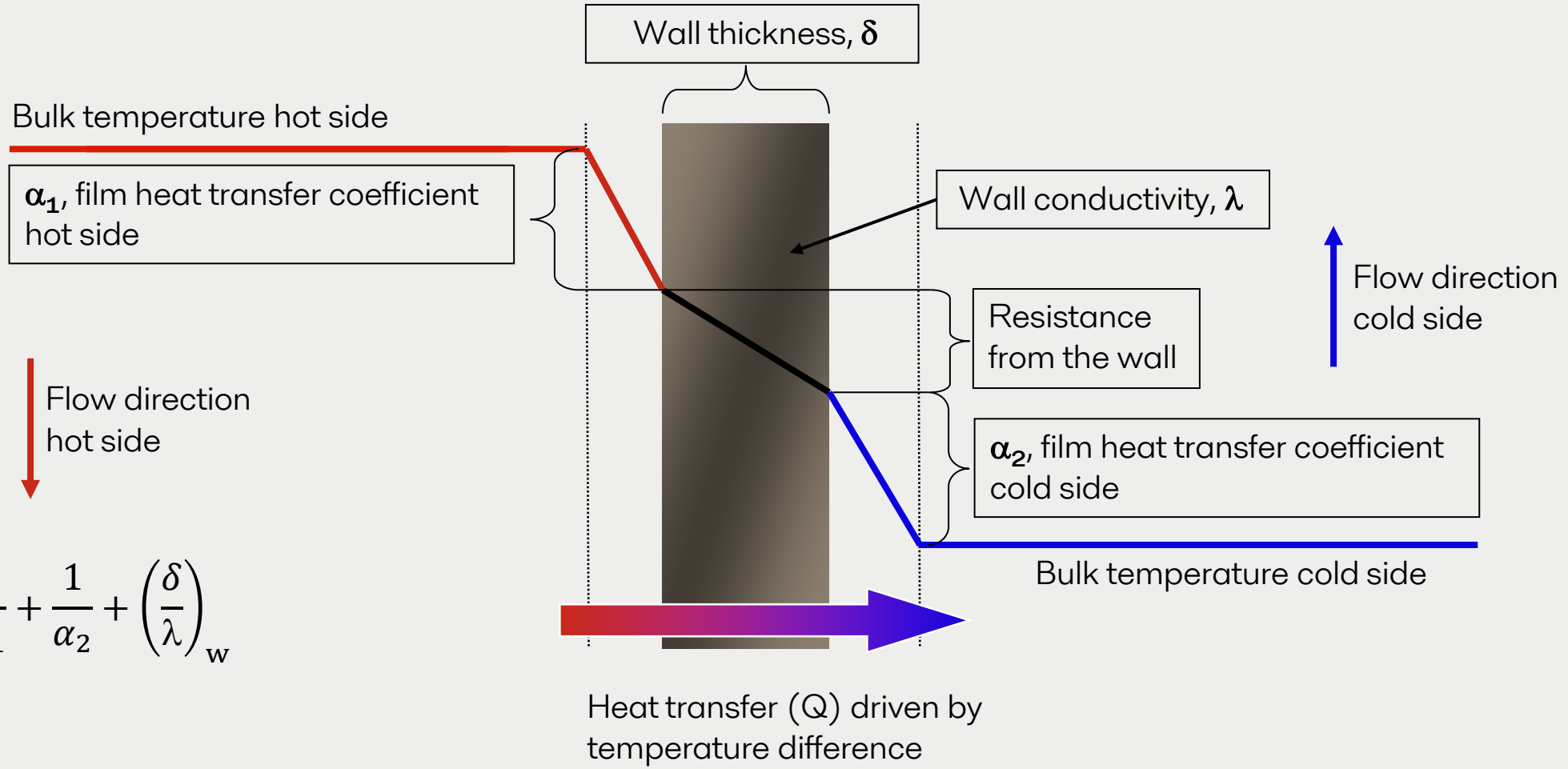
LMTD = Logarithmic Mean Temperature Difference



$$LMTD = \frac{\Delta T_A - \Delta T_B}{ln\left(\frac{\Delta T_A}{\Delta T_B}\right)}$$

The heat transfer equation

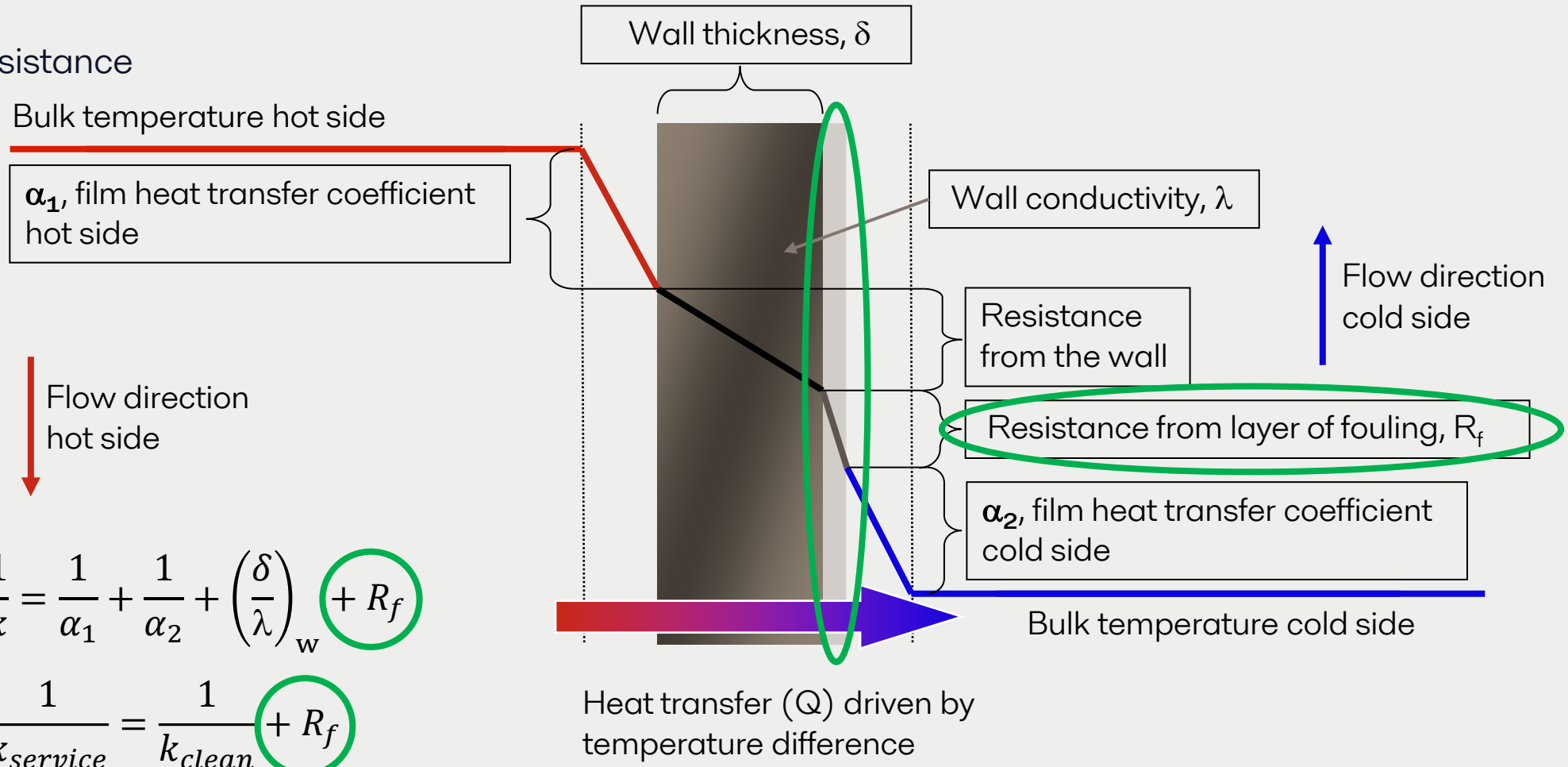
k value



$$\frac{1}{k} = \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \left(\frac{\delta}{\lambda}\right)_w$$

Design safety factors

Fouling resistance



$$\frac{1}{k} = \frac{1}{\alpha_1} + \frac{1}{\alpha_2} + \left(\frac{\delta}{\lambda}\right)_w + R_f$$

$$\frac{1}{k_{service}} = \frac{1}{k_{clean}} + R_f$$

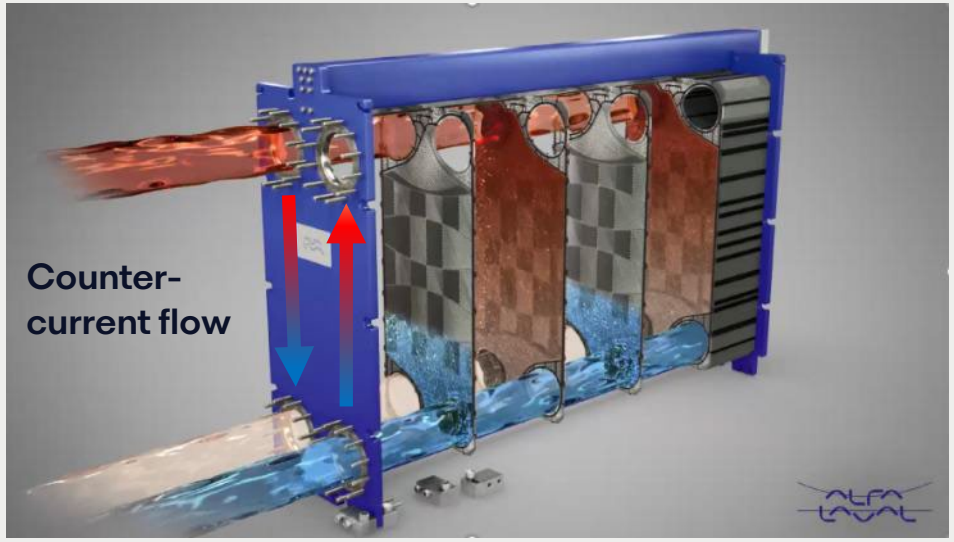
Get to know...

For HVAC applications

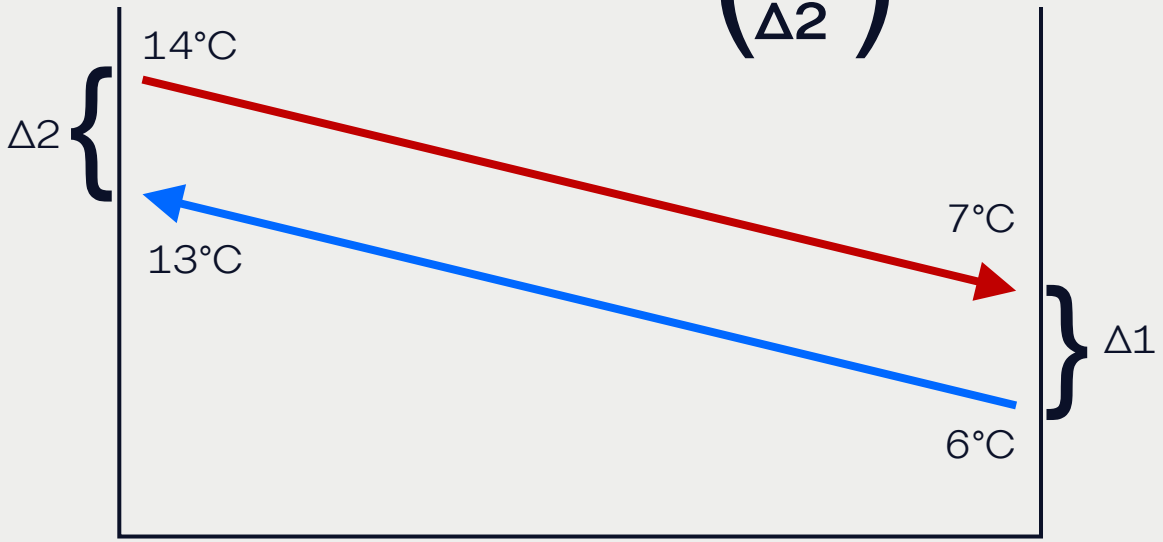
- What is the typical **LMTD (Approach Temperature)** you specify?
- What is the typical maximum **peak pressure drop** you specify across the GPHE?
- What **Margin(safety factor)** you specify across the GPHE?

LMTD
Approach temperature

$$LMTD = \frac{\Delta 1 - \Delta 2}{\ln\left(\frac{\Delta 1}{\Delta 2}\right)}$$



https://www.youtube.com/watch?v=uEInVVcc6Sc

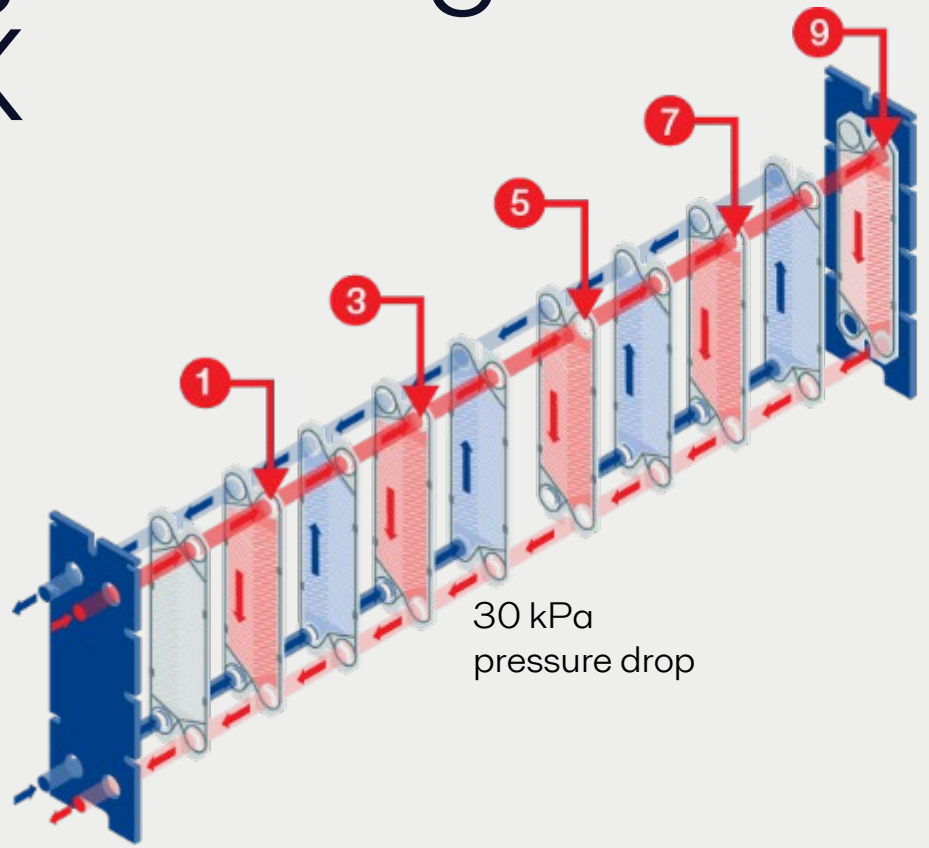


Chiller pressure breaker example

Low pressure drop – risk of fouling causing higher OPEX

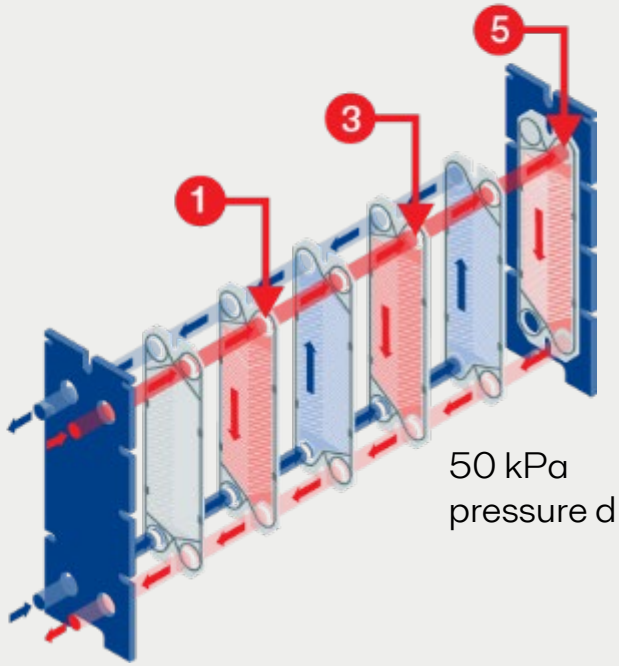
Pressure drop 30 kPa will give:

- Lower flow velocities
- Lower turbulence
- Faster fouling
- Reduced performance



30 kPa
pressure drop

Hot fluid has 5 channels for flow, number 1, 3, 5, 7, 9.
100 kW heat exchanger



50 kPa
pressure drop

Hot fluid has 3 channels for flow, number 1, 3, 5.
100 kW heat exchanger with less surface are.

Branded features

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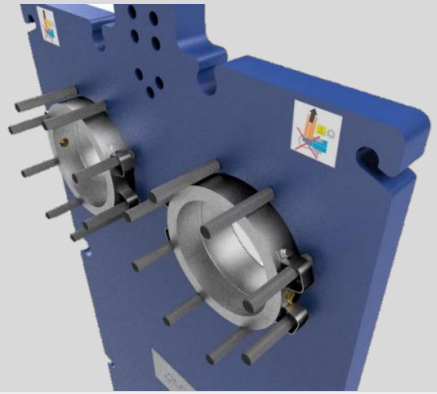
Connectivity for new or existing GPHE

Intrument flange



Connectivity sensor kit

- 4 sensors (316L) combining pressure & temperature
- Sensors can be plugged on instrument flanges or on a threaded sockets welded on the piping
- Wireless Bluetooth communication box for collecting data by the gateway
- Embeded solutions for power supply:
  - 10 - 30V DC from the site
  - Battery (estimated 3 years life time, if data collection every 10 minutes)

Connectivity sensor kit installed

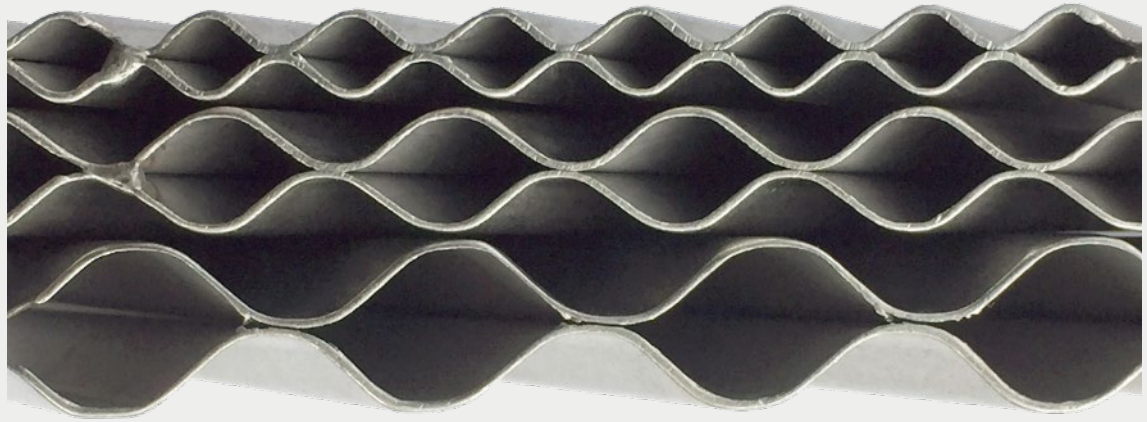
Gateway

- Power sup. 110-230V AC
- Delivered pre-configured for connecting wireless to connectivity sensor kits
- Max range 40-50 meters
- Remote activation
- Sim card included

Manufacturing techniques

Single step pressing

Narrow channels suitable for buildings & industry



Wide channels suitable for the food industry

- The right channel gap for increased thermal performance
- Higher investment costs demands high volume
- Less types of frames
- Higher themal demands
- Narrowest channel gap permits good performance & fit for HVAC ceiling height

- Alfa Laval plate denomination is B for narrow, P for medium and M for wider channel gap.
- L stands for Long plate with a higher thermal performance.
- Eg. T10 versus TL10

Connection diameter	Alfa Laval model
100 mm	T10M / T10B / TL10P / TL10B
80 mm	T8M / T8B
50 mm	T5M / T5B / T6P / T6B / TL6B
37 mm	M3 / TL3P / TL3B

Higher flowrate

Thermally more efficient

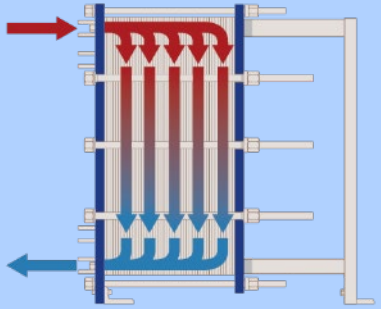
Minimise fouling and improve efficiency and performance

Effective use of available pressure – OmegaPort™
- Pressure is electricity
- Pressure drop is money
- How to utilise it best?

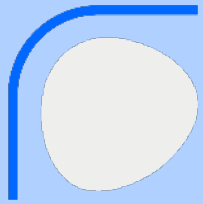
Distributing the flow – CurveFlow™
- Shortcut connection to connection
- Low efficiency as not utilising all the available surface area for heat transfer
- Fouling at lower than design flowrates

Channels proportional to flowrates – FlexFlow™
- Avoids fouling of the lower flow
- Flowrates are not always equal, why channels?
- Utilisation of available pressure drop

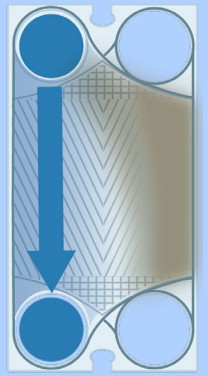
https://www.youtube.com/watch?v=pkiJl8jPcJg



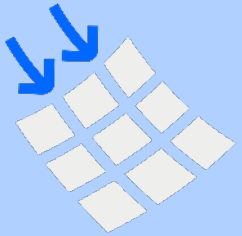
Effective use of available pressure drop



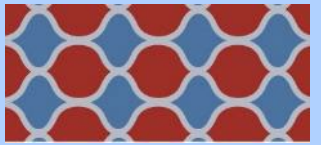
OmegaPort™
Noncircular port holes



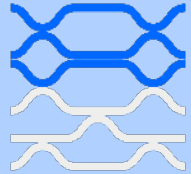
Distributing the flow



CurveFlow™
Distribution area



Perfect for applications with unequal flow, both channels stay clean longer



FlexFlow™
Plate design

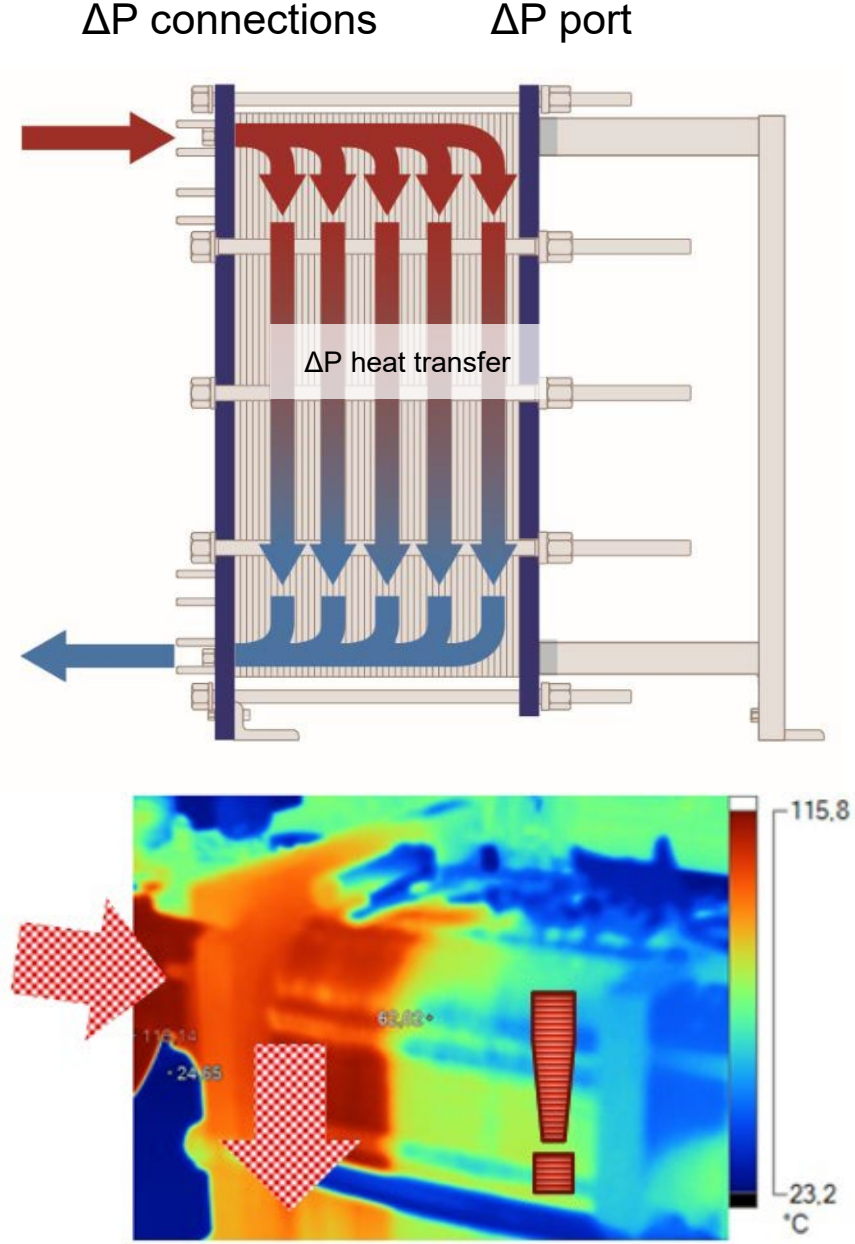
OmegaPort™

Noncircular port holes

Enhances media flow and thermal efficiency.

- Avoids shortcuts in plate pack
- Pressure drop better utilized for heat transfer

“ The price paid for heat transfer is pressure drop !”



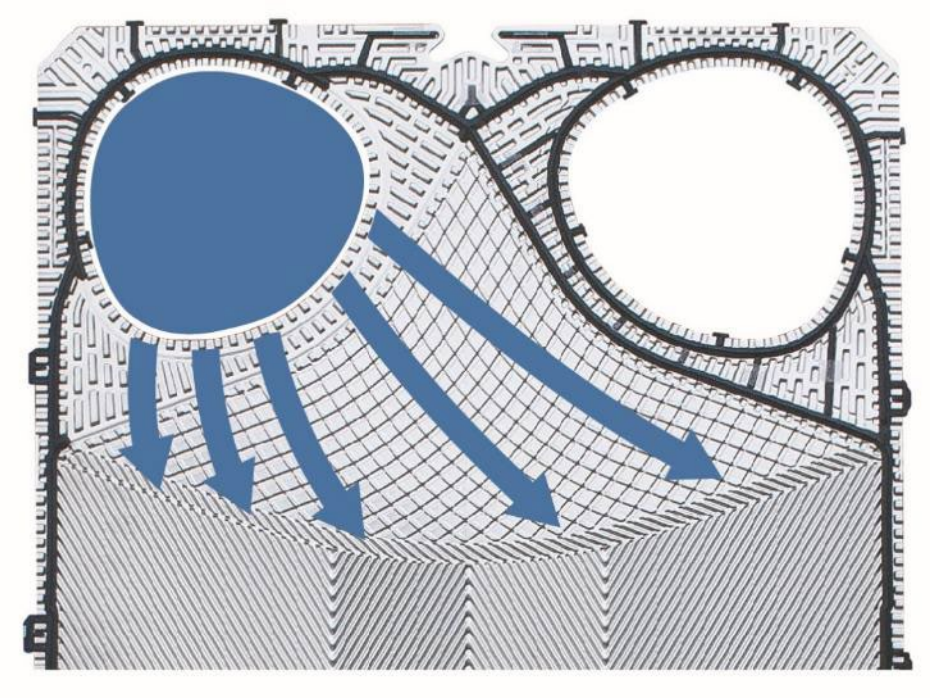
CurveFlow™

Distribution area

Improves media flow and minimizes the risk of fouling

- Fully utilizes available surface area.
- Provides perfect distribution inside channel, unit stays clean longer.

“ The art of heat transfer is distributing the flow evenly !”



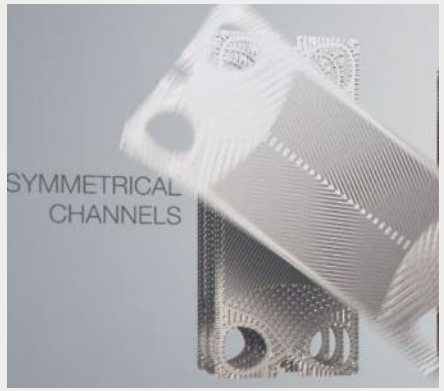
FlexFlow™

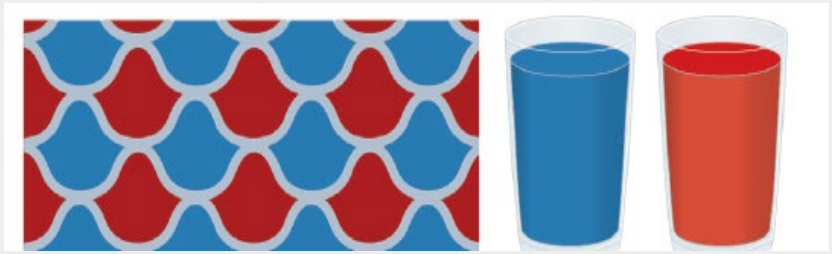
Plate design

Improves thermal efficiency and optimizes pressure drop utilization

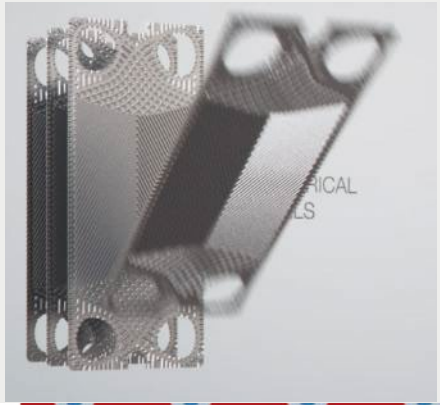
- Perfect for applications for unequal flows
- Both channels stay clean longer

Rotate 180°

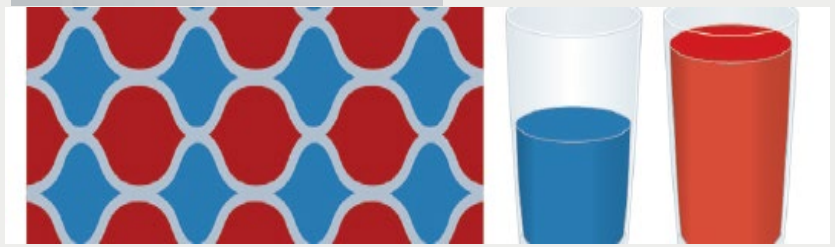




Symmetric flow - Symmetric channels



Flip



Asymmetric flow - Asymmetric channels

AHRI Performance Certification

AHRI
(Air-Conditioning, Heating, and Refrigeration Institute)

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What is AHRI LLHE 3rd party Performance Certification?

The best way to ensure that you get what you specify!

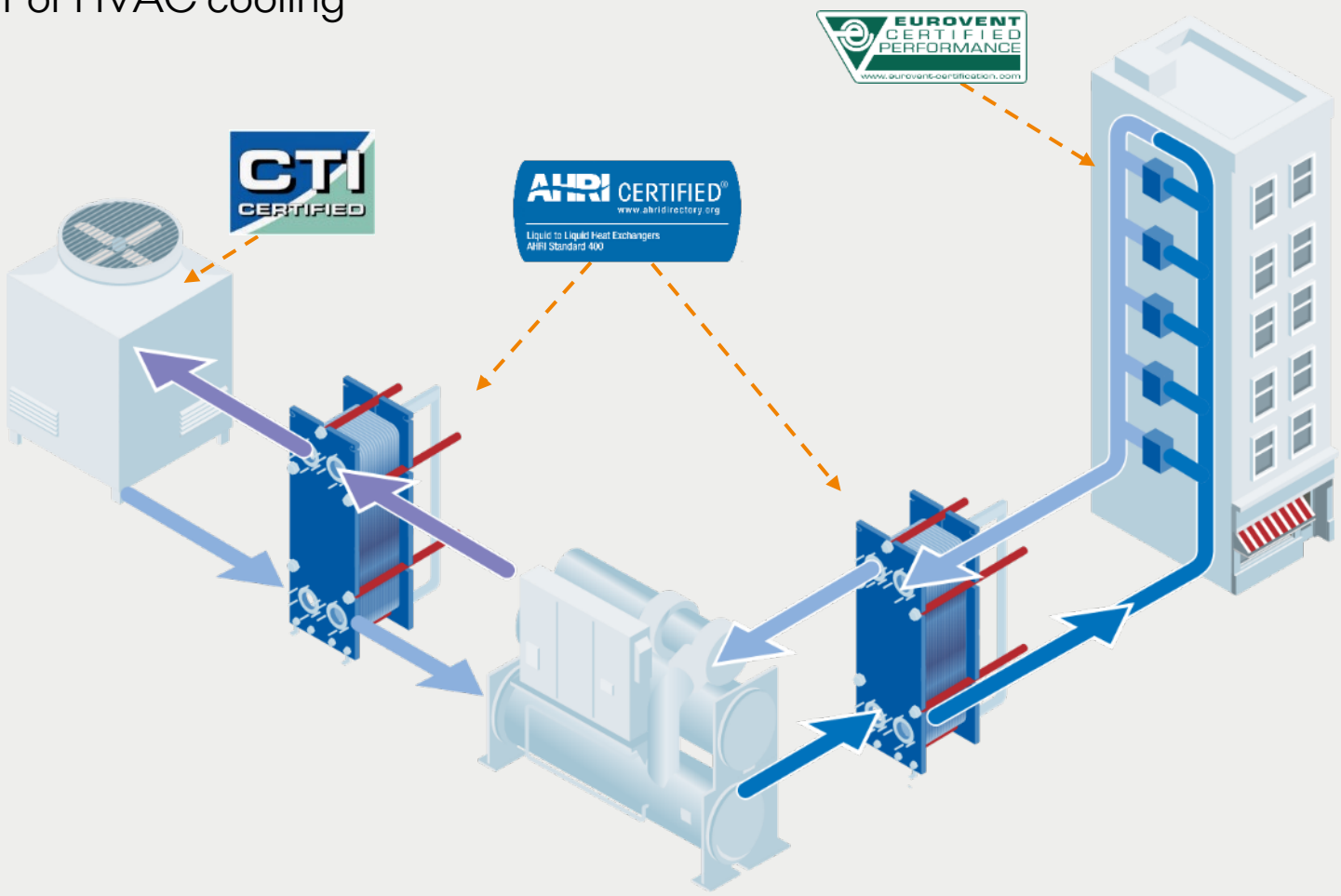
- AHRI LLHE(liquid to liquid heat exchanger) is a global certification program for gasketed plate heat exchangers
- Guarantees **thermal** and **pressure drop** performance
- Customers' tool to **evaluate quotes based on performance**

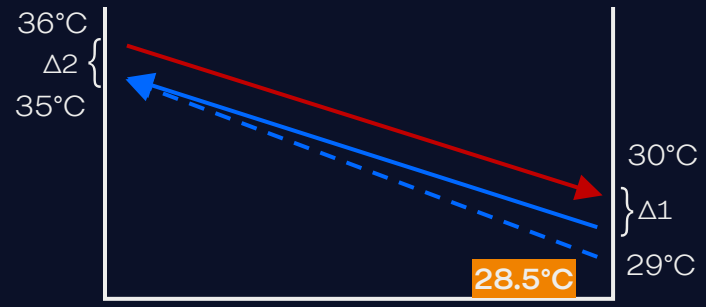
How does it work?

- Qualification process of suppliers before approval for the certification program
- **Yearly tests** to ensure that equipment comply on performance
  - Testing tolerances: capacity 5%, pressure drop 15%
- Failure to comply leads to **penalties**

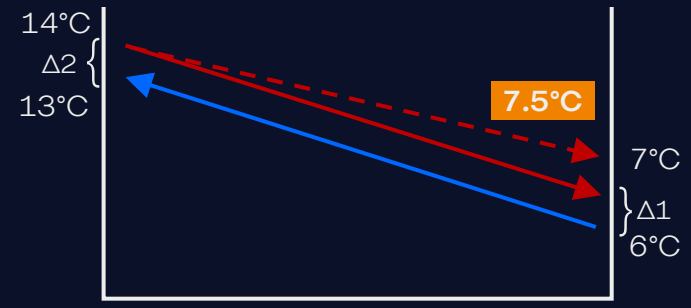
Performance certification & **market practices**

For HVAC cooling





Cooling tower interchanger



Chiller pressure breaker


Thank you