Alfa Laval

Performance certification – a **necessity** in today's plate heat exchanger market

How AHRI performance certification of plate heat exchangers protects you and your clients.

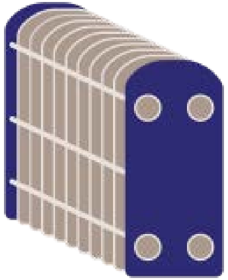
Agenda

- Parameters that effect the sizing of a plate heat exchanger
  - Approach temperature
  - Pressure drop
- Evaluation of heat transfer area (m^2)
  - Pressing depth / Channel gap
- Performance certification
  - Air Conditioning Heating and Refrigeration Institute (AHRI)
    - Energy savings
    - Protection and security
  - Why? What? How…?

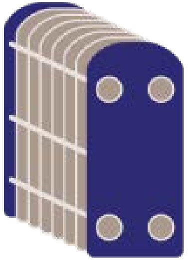
The competitive market for plate heat exchangers

Specification: 1,000 kW
35°C ⟶ 30°C 50 kPa
34°C ⟵ 29°C 50 kPa

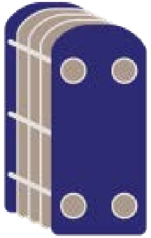
1,000 kW – 200 m^2



1,000 kW – 150 m^2



1,000 kW – 100 m^2



Which parameters have the biggest influence in sizing of a plate heat exchanger?

Heat transfer equations

$Q_{hot} = m \cdot c \cdot \Delta T_{hot}$

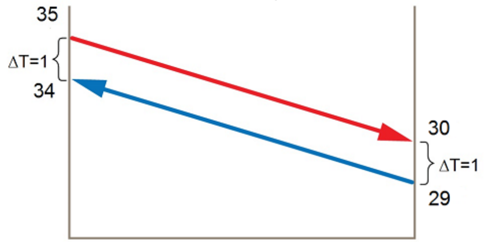
$Q_{cold} = m \cdot c \cdot \Delta T_{cold}$

$Q = k \cdot A \cdot LMTD$

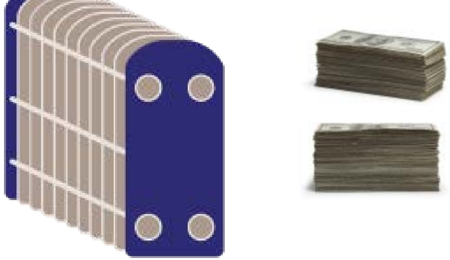
1. LMTD (approach temperature)
2. Pressure drop

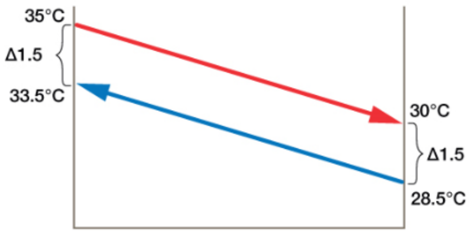
Effect of approach temperature LMTD

Specification: 1,000 kW
35°C ⟶ 30°C 50 kPa
34°C ⟵ 29°C 50 kPa

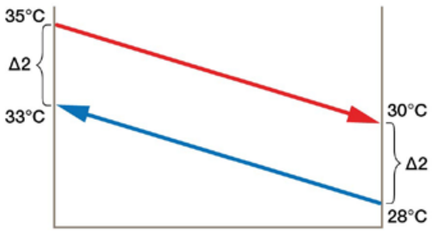


1°C LMTD
1,000 kW – 200 m²





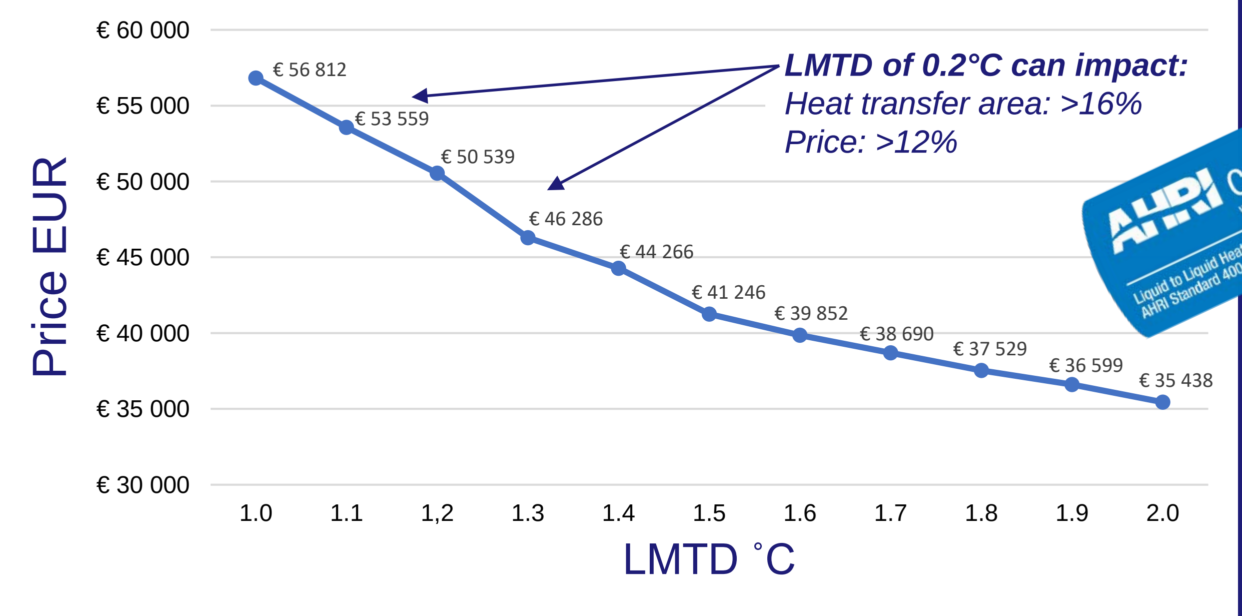
1.5°C LMTD
1,000 kW – 150 m²



2°C LMTD
1,000 kW – 100 m²

LMTD steps of 0.1°C

Specification: 1,000 kW
35°C ⟶ 30°C 50 kPa
34°C ⟵ 29°C 50 kPa



1,000	35°C → 30°C 34°C ← 29°C	Water 173 m³/hr Water 173 m³/hr	Hot side 5 Cold side 5	5	1.0	5 / 1.0 = ?	5.0	M15-B FG	387	240.0	€ 56,812
1,000	35°C → 30°C 33°C ← 28°C	Water 173 m³/hr Water 173 m³/hr	Hot side 5 Cold side 5	5	2.0	5 / 1.0 = ?	2.5	M15-B FG	203	125.9	€ 35,438

Effect of pressure drop

Specification: 1,000 kW
35°C ⟶ 30°C 50 kPa
34°C ⟵ 29°C 50 kPa

1,000 kW

35°C ⟶ 30°C 30 kPa

33°C ⟵ 28°C 30 kPa

1°C LMTD
1,000 kW – 200 m^2

1,000 kW

35°C ⟶ 30°C 50 kPa

33°C ⟵ 28°C 50 kPa

1.5°C LMTD
1,000 kW – 150 m^2

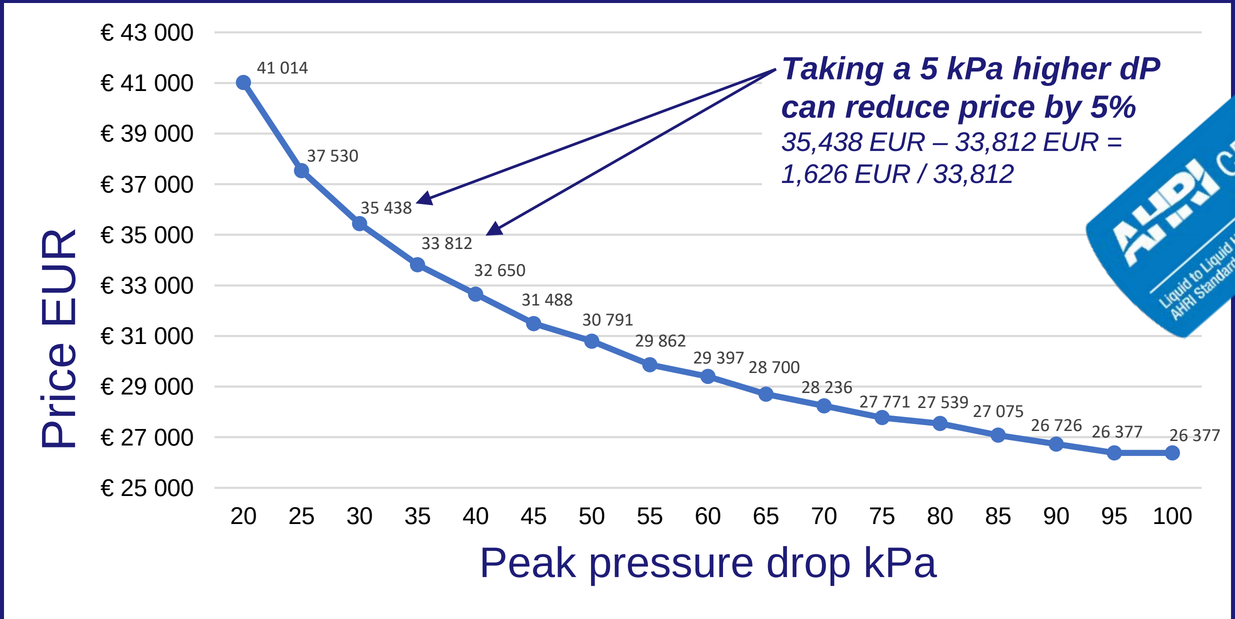
1,000 kW

35°C ⟶ 30°C 100 kPa

33°C ⟵ 28°C 100 kPa

2°C LMTD
1,000 kW – 100 m^2

Effect of peak pressure drop on plate heat exchanger sizing



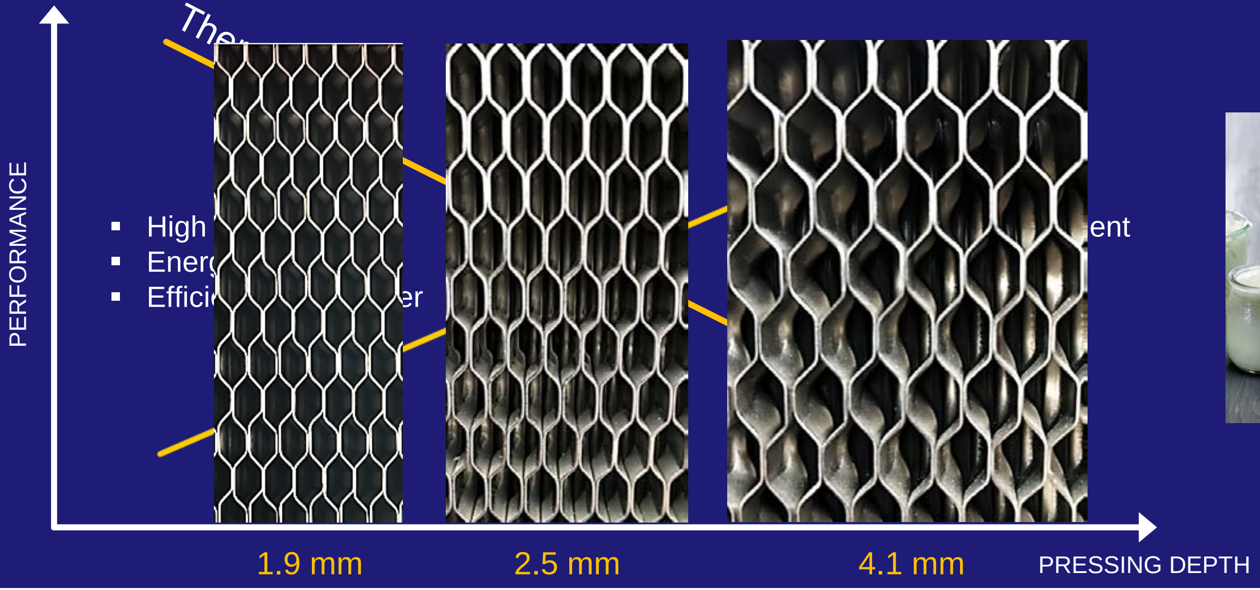
Duty kWatt	Temperature profile °C	Media & Flowrate m³/hr	LMTD °C	Maximum dP at peak flow kPa	Alfa Laval PHE model	Number of plates	Transfer area m²	Price EUR
1,000	35°C → 30°C 33°C ← 28°C	Water 173 m³/hr Water 173 m³/hr	2.0	50	M15-B FG	163	101.1	€ 30,791

Can we compare heat transfer area like for like?

Is a $m^2 = m^2$?

Plate – pressing depth

- Alfa Laval has a range of pressing depths from 1.9 mm up to 4.0 mm for optimal solution to any duty.
- There is no good or bad pressing depth – just different ones to fit various duties be it difficult or easy $m^2 = m^2$?



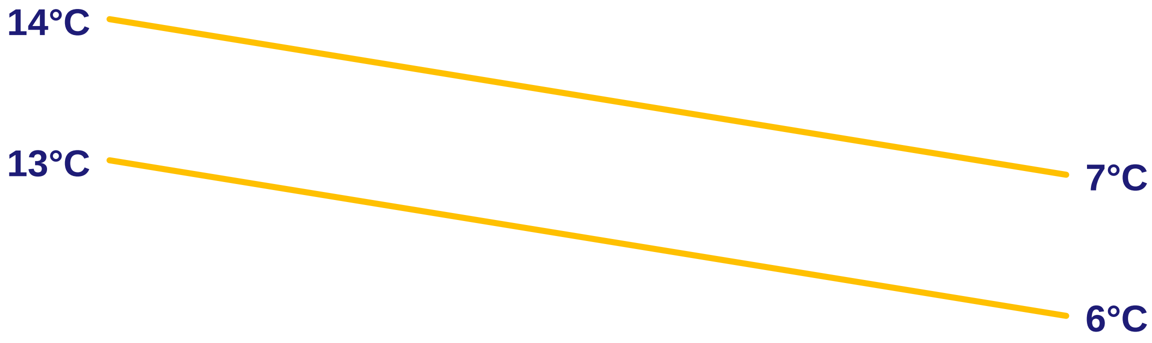
You can never be sure…

Or you can **always** be sure!

Small change, big impact 4MW ETS

Offer version 1

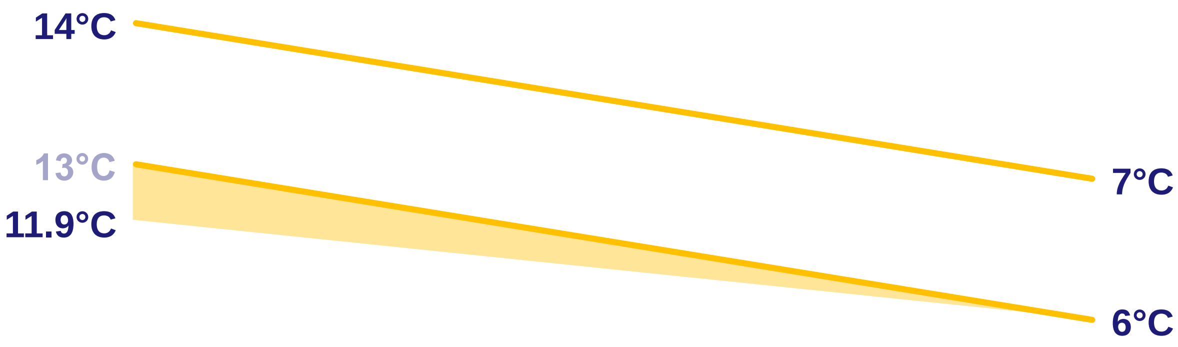
LMTD .... 1.0°C
Heat transfer area 100%
Flow rate on DC side .... 489 m³/h



Small change, big impact 4MW ETS

Offer version 2

LMTD ………………… 1.0°C ……. +0.5°C ……1.5°C
Heat transfer area ….. 100% ……. -26% …….. 74%
Flow rate on DC side.. 489 m³/h … +18.4% …..579 m³/h



District Cooling

One example where certification pays off

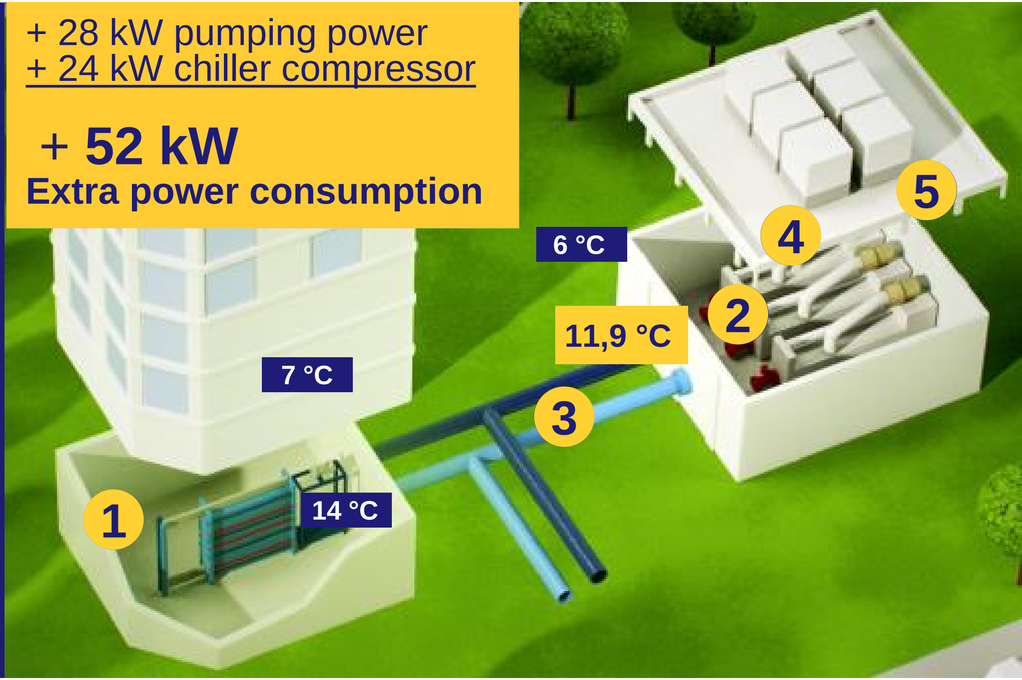
The operational cost in a district cooling system is to a large extent determined by the heat exchangers.

Small change, big impact

1. The temperature set point, 7°C is not met. Valve opens and flow increases. (from 489 to 579 m³/h)
2. Pump power consumption increases. (from 43 to 71 kW) +28 kW
3. Return temperature decreases. (from 13°C to 11.9°C)
4. Evaporation temperature decreases. (from 4°C to 3.5°C)
5. Compressor power increases. (from 1,259 kW to 1,283 kW) +24 kW

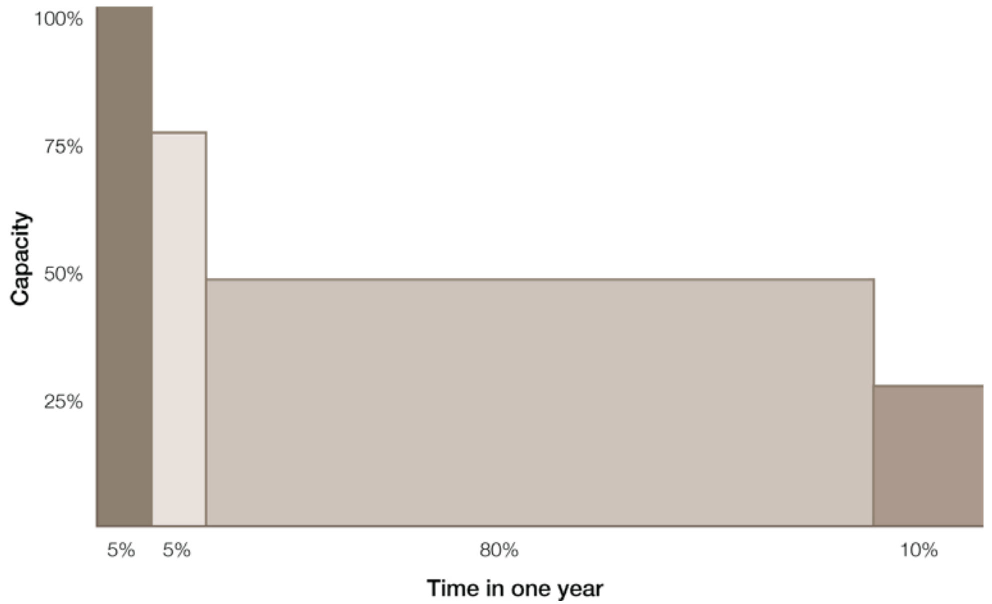
+ 28 kW pumping power
+ 24 kW chiller compressor

+ 52 kW
Extra power consumption



Under-surfaced PHE in a district cooling energy transfer station.

No buts, correctly dimensioned heat exchangers pay for themselves fast

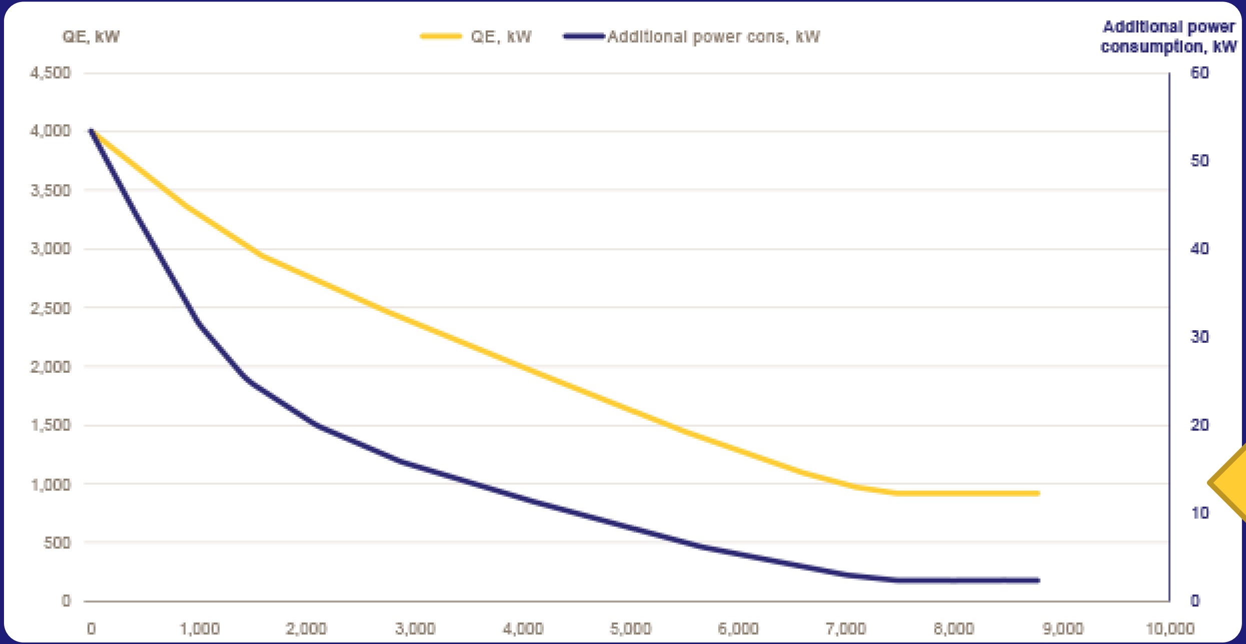


No buts, correctly dimensioned heat exchangers pay for themselves fast

Cost of 15 kW average added power in one year running time?

Assumed power cost
0.08 €/kWh

Running time / year
24 hrs x 365 days = 8,760 hrs/yr



Annual savings
8,760 hrs/yr × 15 kW × 0.08 €/kWh

= 10,512 €/y

Payback time
Approx. 1 year

15 kW average whole year

www.alfalaval.com

AHRI protects you and your clients

- Non-profit trade organization
- Develops and publishes technical standards for industry products
- Establishes procedures for measuring and certifying performance
- Saves energy, improves productivity and ensures better environment

You want the AHRI certification programs – and nothing else

- Independent third-party verification of thermal performance of plate heat exchangers in the ‘**AHRI Liquid to Liquid Heat Exchangers (LLHE) certification program**’
- Brazed/fusion-bonded plate heat exchangers in ‘**Liquid to Liquid Brazed & Fusion bonded Plate Heat Exchangers (LLBF)**’
- Lab testing principles in the AHRI 400 rating standard

Supplier verification

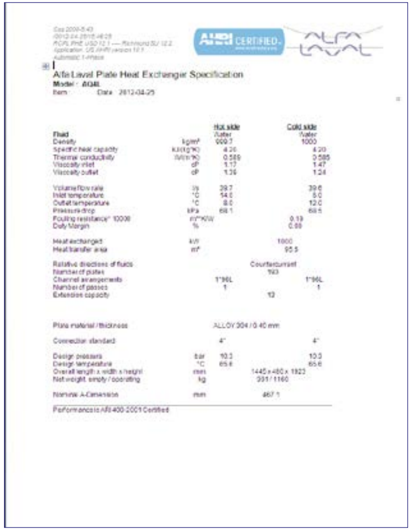
▼ LLHE Specification Sheet Verifications

Complete **this form** for each LLHE specification sheet verification request and send to **AHRI Verification.** A copy of the output sheet from the manufacturer's Selection Rating Software must be submitted in conjunction with this form. All fields must be completed prior to submission. AHRI does not verify the mechanical attributes of a specification sheet; only the thermal performance is verified. Thermal performance includes Inlet Temperatures, Outlet Temperatures, Flow Rates, Pressure Drops, Heat Load, Heat Transfer Area, Density, Specific Heat Capacity, Thermal Conductivity, Viscosity, Heat Transfer Coefficient, L.M.T.D., and Channel Arrangements.

Please allow ten (10) calendar days for AHRI to conduct verification and respond to your request.

- Select all]

1. A LINE PLATE AND FRAME HEAT EXCHANGER
2. ALFA LAVAL
3. APV
4. BELL & GOSSETT
5. DANFOSS
6. DANFOSS A/S
7. GRUNDFOS USA
8. HEAT TRANSFER
9. HISAKA
10. IES
11. KELVION ECOFLEX
12. PLATE CONCEPTS
13. POLARIS
14. SIGMA
15. SIGMARI
16. SONDEX
17. STANDARD XCHANGE
18. SUPERCHANGER
19. WESPLATE



AHRI performance certification is better for everyone

End customers

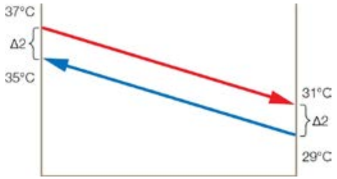
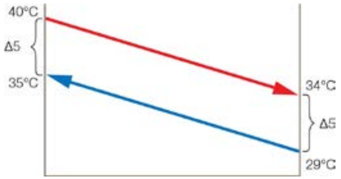
Consultants

Contractors

Suppliers

Buying a plate heat exchanger?

Heat Transfer Area comparison

Plate heat exchanger design critera			
Pressing depth (mm)	1.9	2.5	4.0
Channel gap (mm)	3.8	5.0	8.0
Height / width	>2.5	<= 2.5	<2.0
LMTD (°C)	<2.0°C	2.0 – 2.5°C	>5.0°C
NTU (ΔT/LMTD)	6/2 = 2		6/5 = 1.2
Applications	Data centre, HVAC cooling, district cooling, heat recovery, pressure breakers…	HVAC heating, district heating, sea water, cooling tower interchanger, heat recovery…	Steam, oil cooling, tap water heating, swimming pool

How to specify?

One sentence:

”The plate heat exchangers shall be AHRI certified in accordance with the AHRI Liquid to Liquid Heat Exchangers Certification Program”

AHRI CERTIFIED®
www.ahridirectory.org
Liquid to Liquid Heat Exchangers
AHRI Standard 400

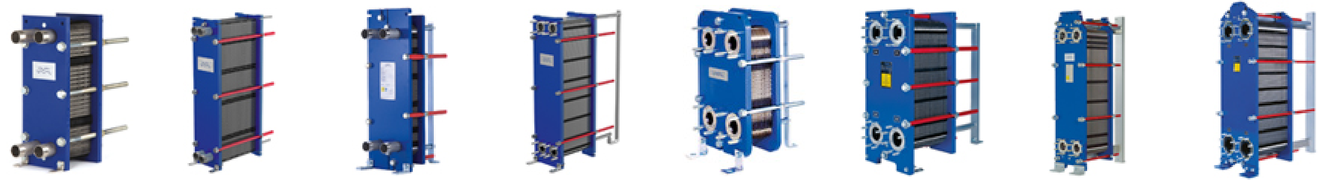
Let's create a sound plate heat exchanger market

Specifying AHRI performance certification

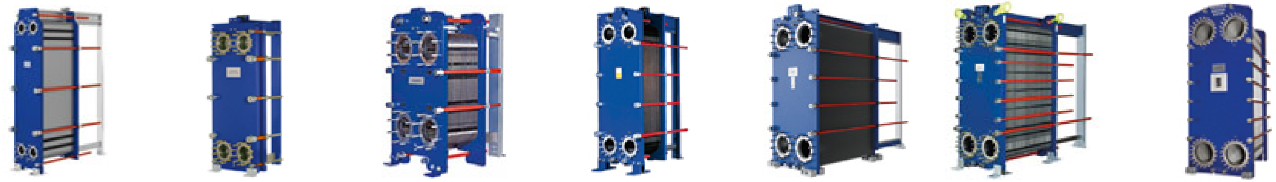
- Eliminates cheating with thermal performance
- Stimulates manufacturers to develop more efficient products
- Creates a fair basis for comparisons between suppliers
- Saves natural resources as fuel, gas and electricity
- Our social responsibility

AlfaQ™ series models

Gasketed plate heat exchangers



Model	AQ1	AQ1L	AQ2	AQ2L	AQ2S	AQ4	AQ4L	AQ6
Nominal flow rate m³/h/GPM	14/80	14/80	58/250	58/250	58/250	180/980	180/980	430/1850
Nominal design temperature °C/°F	180/300	180/300	180/300	180/300	180/300	180/300	180/300	180/300
Nominal design pressure bar/psi	16/150	16/150	25/300	25/300	25/300	25/300	25/400	30/400



Model	AQ6L	AQ8	AQ8S	AQ10	AQ14	AQ14L	AQ20
Nominal flow rate m³/h/GPM	430/1850	800/3600	700/3100	900/6000	1800/7900	2000/8000	3600/15500
Nominal design temperature °C/°F	180/300	180/300	180/300	180/300	180/300	180/300	180/300
Nominal design pressure bar/psi	30/460	30/400	30/400	30/400	25/300	30/400	25/300

Alfa Laval's corporate mission

To optimize the performance of our customers' processes. Time and time again.

Demand new Standards

New generation plate heat exchangers

The CurveFlow™ area
Improves media flow and minimizes risk of fouling.

The ClipGrip™ gasket design
Ensures perfect seal and trouble-free maintenance.

The Five-point alignment system
Secures reliable performance with easy serviceability thanks to perfect positioning.

The OmegaPort™ noncircular inlet and outlet
Enhances media flow and thermal efficiency.

Offset gasket grooves
Ensures plate utilization for maximum heat transfer efficiency.

The T-bar roller design
Provides a lower unit that is easy to service.

Website: Demand new Standards

Alfa Laval