2025 超流體先進散熱技術論壇

SuperFluid Advanced Cooling Community Conference

主辦單位 | AMPA 先進微系統與構裝技術聯盟

協辦單位 | intel. Hi-CHiP

贊助單位 | ALFA LAVAL, Castrol ON, DOW, Goreal, 高斯宝电气 Gospower, Mandala, MICROLOOPS GROUP, INVENTEC PERFORMANCE CHEMICALS, JGITEC 九谷國際, Perstorp, SOLAR 光洋應材, Y.S. TECH

Alfa Laval 全方位散熱解決方案助力資料中心節能增效

Alfa Laval's Comprehensive Cooling Solutions

Federico Lechi
Alfa Laval 全球產品應用技術經理

2025超流體先進散熱技術論壇
SuperFluid Advanced Cooling Community Conference

Alfa Laval at a glance

In MEUR

INVOICING
5,559

6,184
ORDER INTAKE

ROCE
21.0%

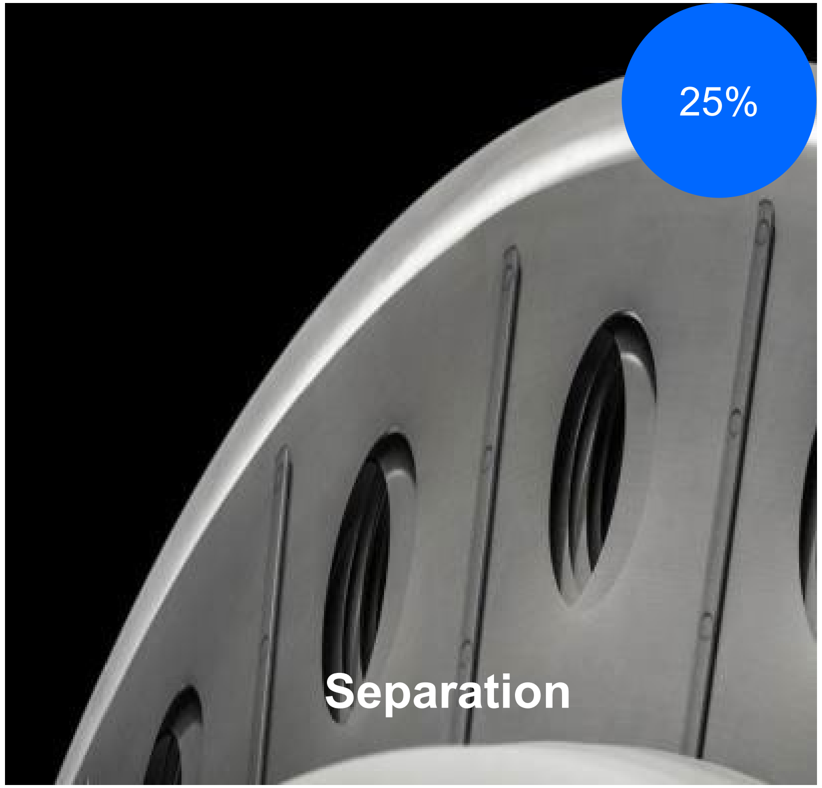
21,321
NO OF EMPLOYEES

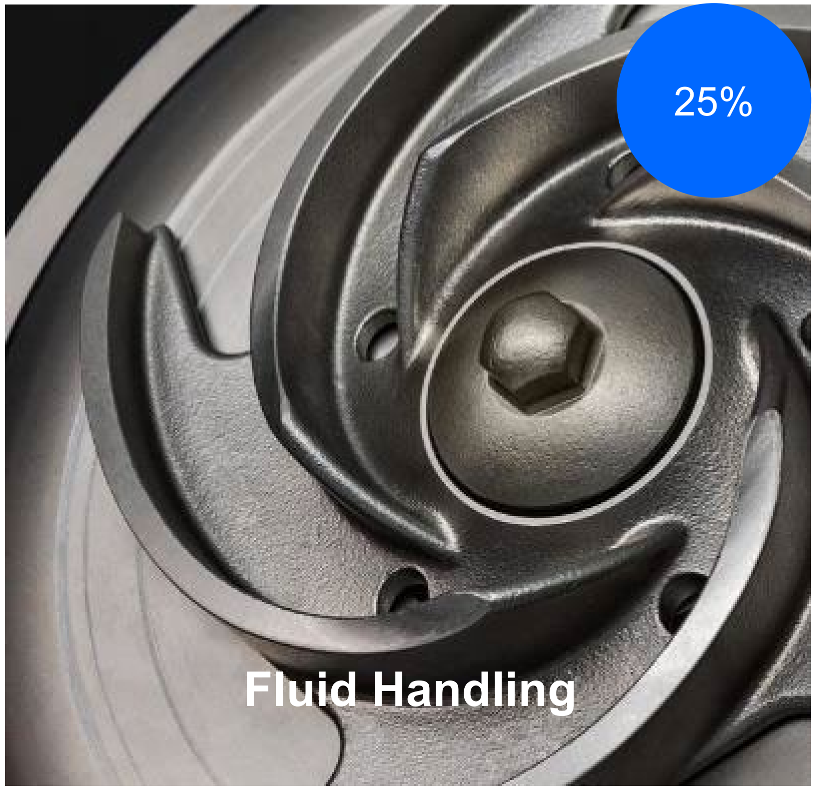
16.1%
ADJUSTED EBITA AS % OF SALES

893
ADJUSTED EBITA

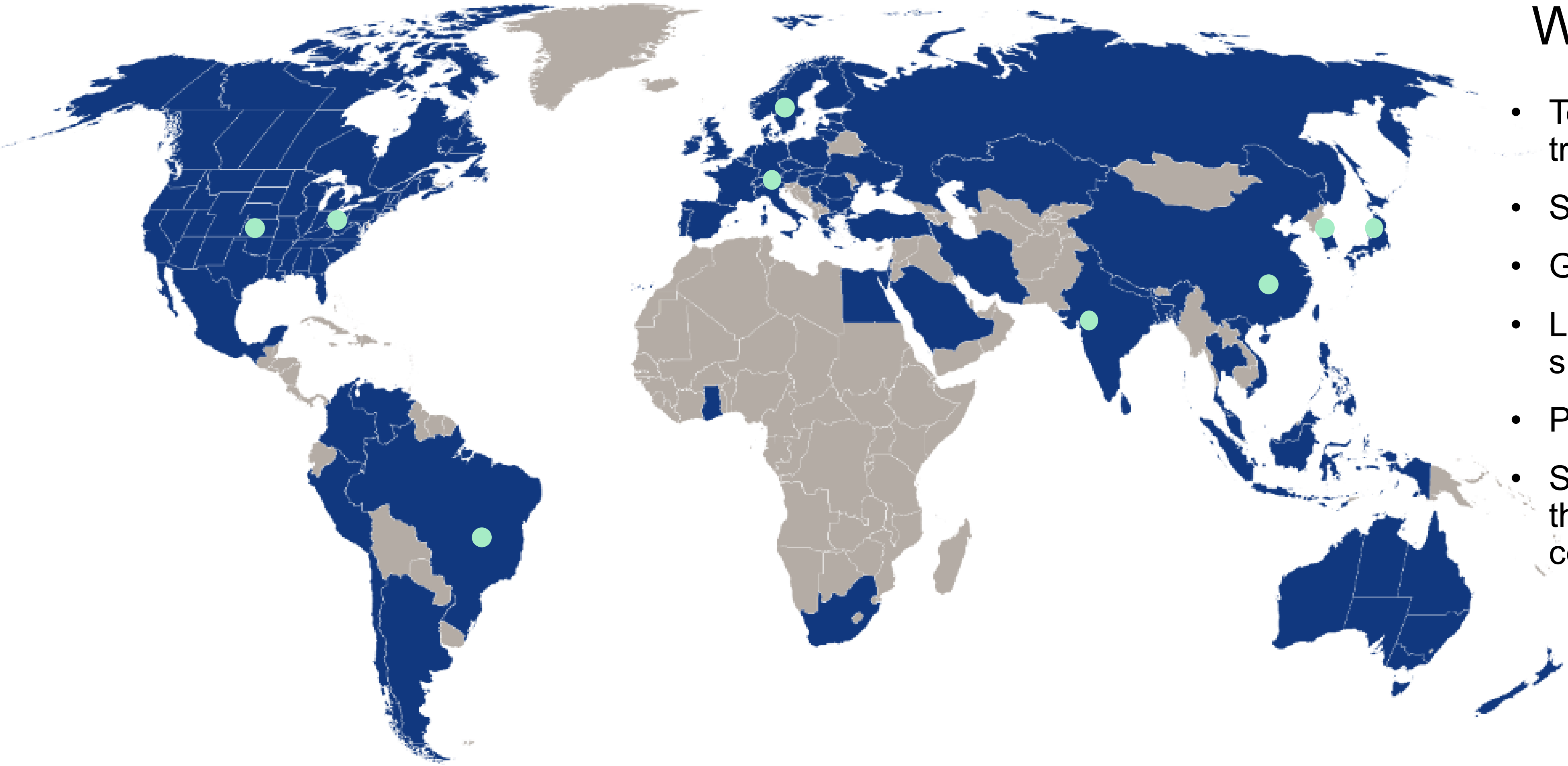
World-leading in three key technologies

Alfa Laval's operations are based on three key technologies – heat transfer, separation and fluid handling. These technologies play a key role in a number of industrial processes and Alfa Laval has a world-leading position in all three areas.





Your worldwide partner - with Strong Local Presence



What can we offer?

- Technology leadership in heat transfer
- Sustainable solutions
- Global and scalable supply
- Large installed base and proven success
- Partnerships
- Sustainable performance throughout the life-cycle with complete service offering

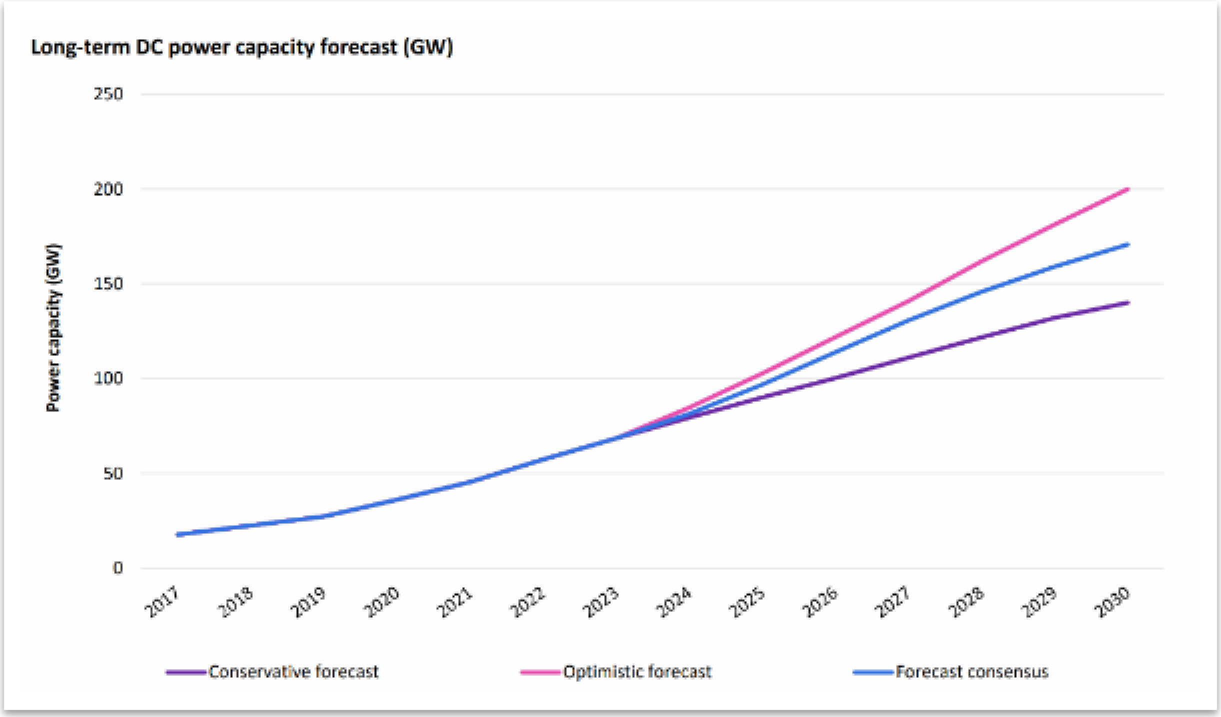
Sales Companies

Main Manufacturing Sites:

Heat Transfer products

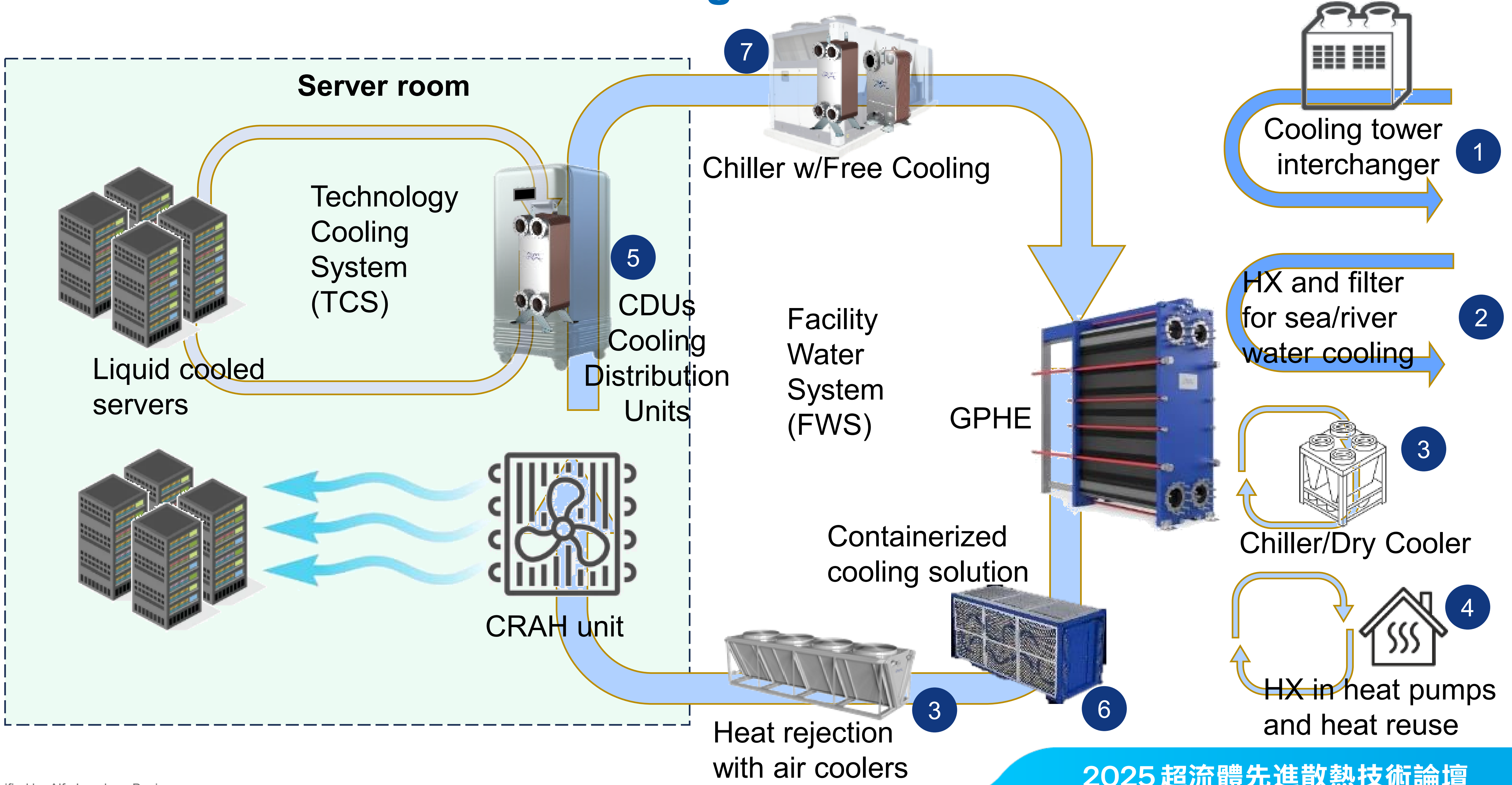
What is the DC future demand?

Data Center (DC) Market Forecast



- The optimistic forecast shows over **130 GW** over the next 5 years
- The conservative shows **70GW** extra over next 5 years
- **Alfa Laval** is a **Global Partner** and is **supporting** this **growth**

Alfa Laval in Data Center Cooling



Liquid cooling

The future of Data Center cooling

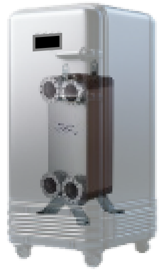
Air can not cope with these high demanding applications

Drivers:
5G
Internet of Vehicles
AI
Augmented/Virtual reality
IoT
E-sports & Online gaming
Blockchain

Liquid Cooling advantages

Opportunities:
Energy Efficiency
Footprint reduction
Easier heat reuse
Improved reliability
Lower manitenance
Lower noise

Liquid cooling technologies

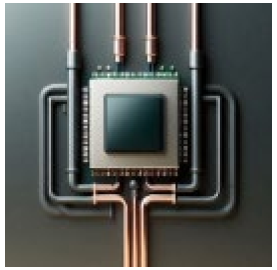


5

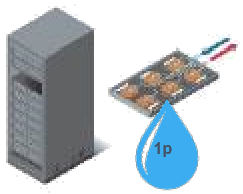
Cooling Distribution Units (CDUs)

1-phase fluid
Sensible heat transfer to a LIQUID

2-phase fluid
Latent heat transfer with evaporation/condensation

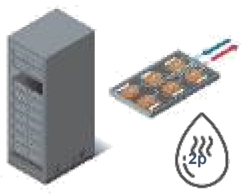


Direct-to-Chip
Liquid cooled coldplates cool the CPUs/GPUs



Direct-to-Chip 1-phase
1P liquid flows directly over the hot components of the server

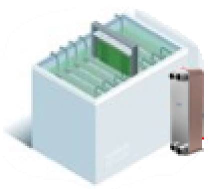
Today



Direct-to-Chip 2-phase
2P liquid flows directly over the hot components of the server

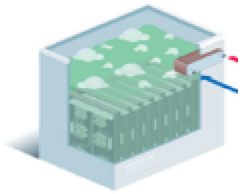
Medium Term

Immersion
The full server is immersed into a dielectric liquid



Immersion 1-phase
IT hardware is submerged in a dielectric coolant that transfers the heat directly from the components

Medium Term

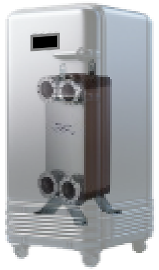


Immersion 2-phase
IT hardware is submerged in a 2P fluid that transfers the heat directly from the components

Long Term

IT power Density

DLC: types of CDUs

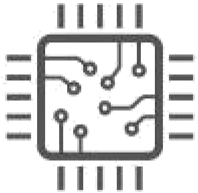


5

DLC, Direct Liquid Cooling

Small Distributed CDUs
- Capacity 50 – 250 kW
- Supply one single rack
- First solution in the market

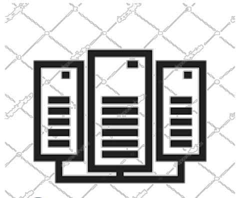
Large volumes
- Standardization
- OEM approach



Coldplate, Chip/Server Manufacturer and Cooling OEMs

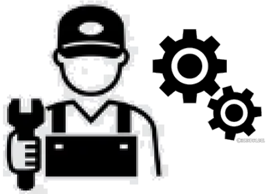
Large Centralized CDUs (in row/end of row)
- Capacity 500 – 2500 kW
- Supply multiple racks (10/30)
- 1 MW is the today standard of the market
- Larger capacities already in the pipeline

Standard, off-the-shelf
- Designed for an "average duty"
- Variable flow to reduce OPEX
- Standard control features



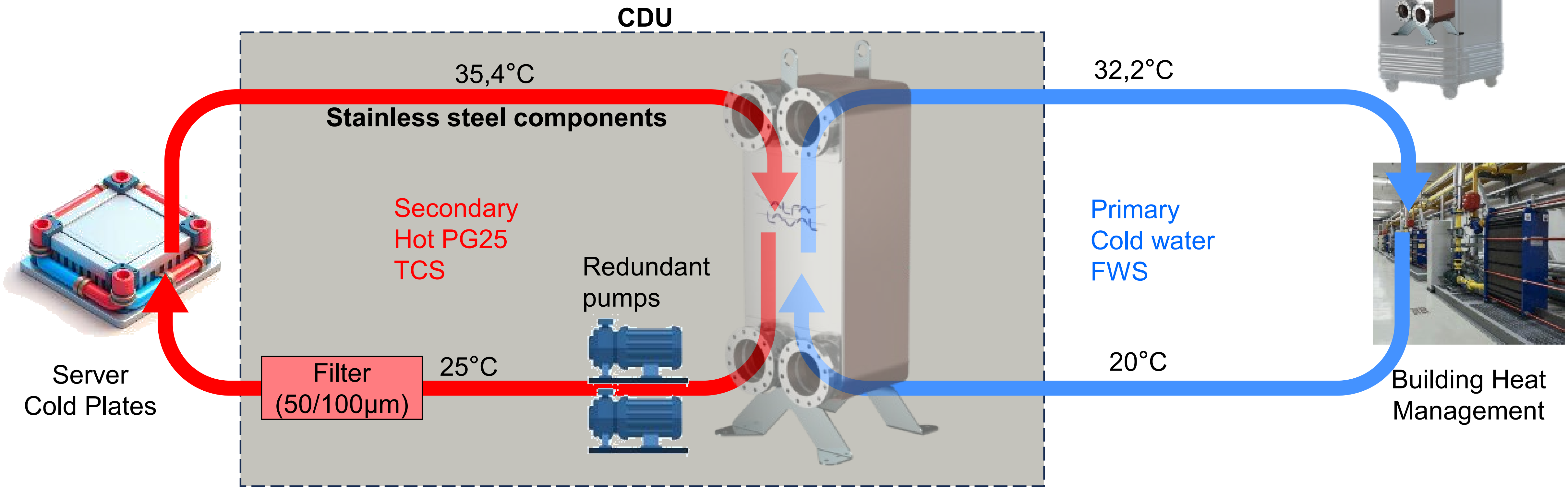
Cooling OEMs

Project design
- Tailor-Made for a specific duty
- Cost optimization
- Special control features



System Builders

The Cooling Distribution unit: CDU



CDU Hot side depends on the server/chip specs:
- Cooling capacity
- Max temperature
- Min flowrate

Need for a clean fluid: PG25, stainless steel, filter 50/100µm

Outlet for the CDU = Inlet T for coldplates

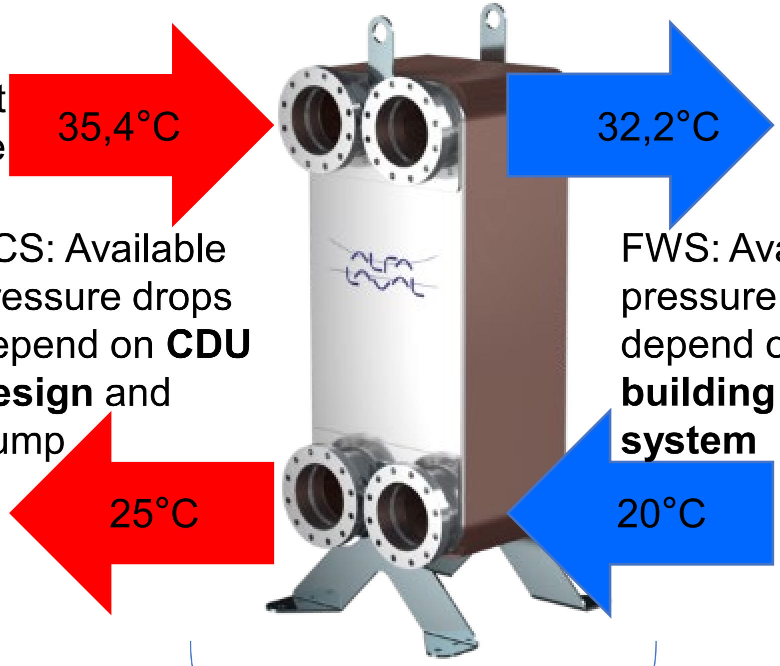
Cold side facility water system:

Depending on the building cooling system:
- Flowrate available
- Inlet temperature
- Acceptable pressure drops

How a BHE works in a CDU

Capacity [kW] is proportional to flowrates and delta T

Hot flowrate

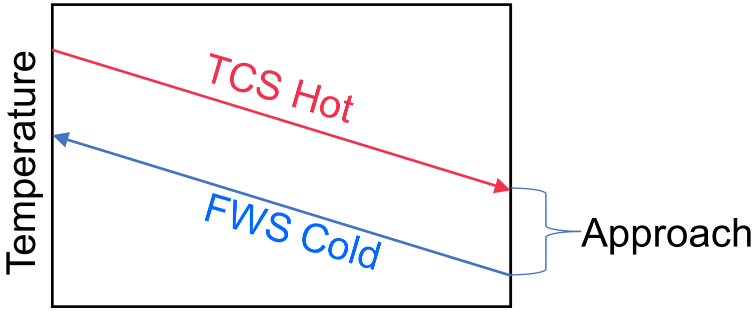


TCS: Available pressure drops depend on **CDU design** and pump

FWS: Available pressure drops depend on **building cooling system**

Cold flowrate

T. Approach = Outlet Hot T – Inlet Cold T



The HX sizing defines the **T. approach** and the **pressure drops**

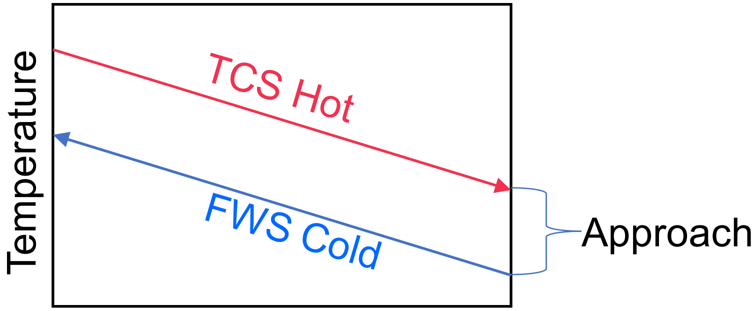
Depending on the limitations in the specs, the HX can be limited by:

- **Thermal design** (T. approach)
- **Pressure drops**
- **Flowrates** (fluid velocity)

Capacity (kW) is always depending on the duty (temperature and flows): the same BHE can deliver different capacities in different conditions

How Alfa Laval BHEs helps CDU design

Flexible platform to fine tune the BHEs design



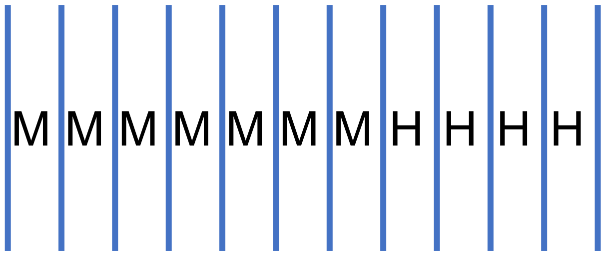
The HX sizing/selection affects the **capacity**, **T. approach** and **pressure drops**

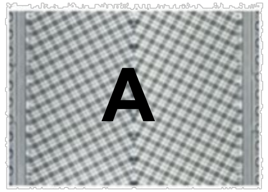
A **flexible** platform allows to fine tune the design to:

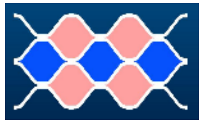
- **Minimize surface** with no compromises on **performance**
- Achieve the maximum **energy efficiency** minimizing **DC running costs**

How Alfa Laval BHEs helps CDU design

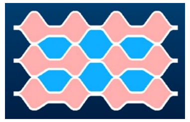
Flexible platform to fine tune the BHEs design



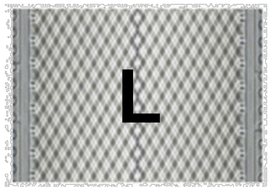




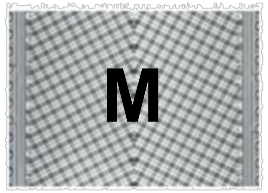
Symmetric channel: same volume for the two fluids



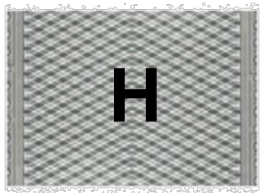
Asymmetric channel: different volumes for the two fluids



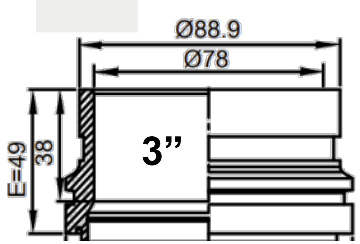
Low theta
Lower capacity
Lower DP

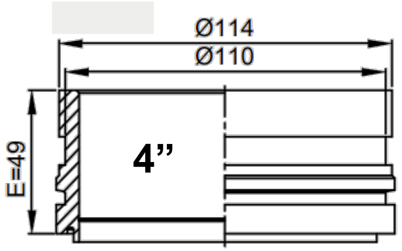


Medium theta
Medium capacity
Medium DP



High theta
Higher efficiency
Higher capacity
Higher DP





Seven levels of flexibility:

1) Wide portfolio from XS to XL units
2) Plate number
3) Three main plate types (H, M, L)
4) Asymmetric channels
5) Wide connections choice
6) Mixing channel (*selected models)
7) Multipass (*selected models)

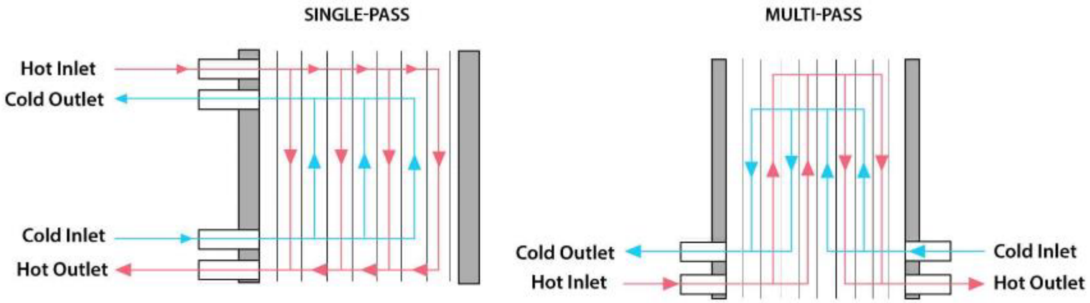
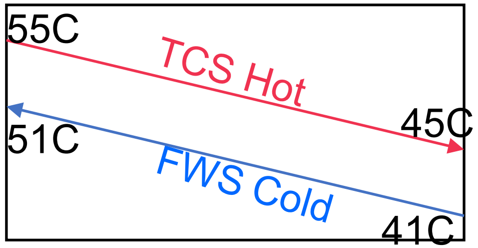
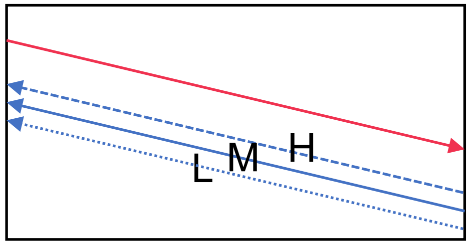


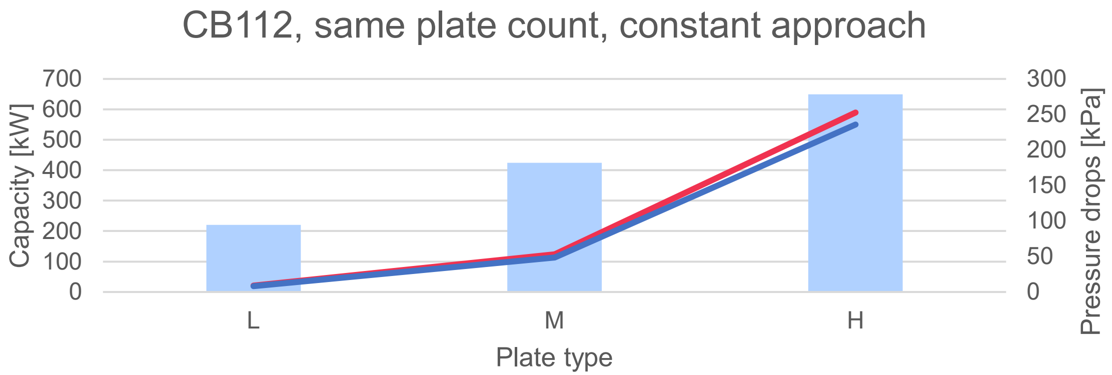
Plate (channel) types

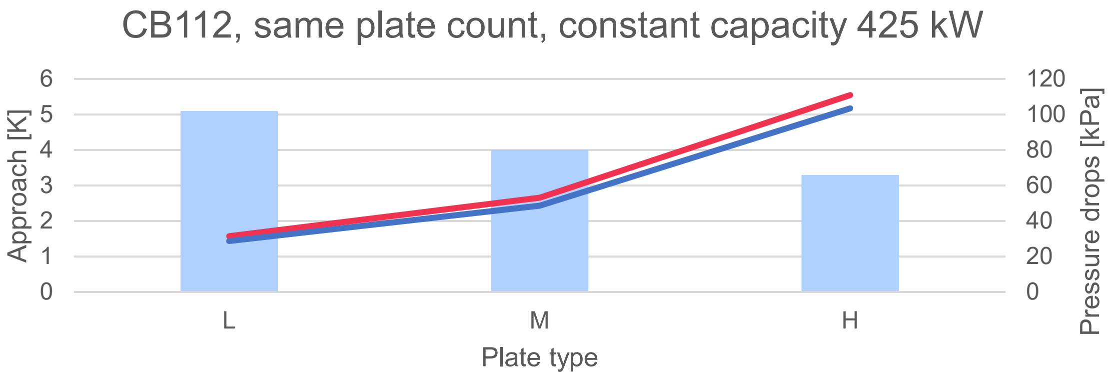
At constant temperatures (approach):
Low, Medium, High capacity and pressure drops.

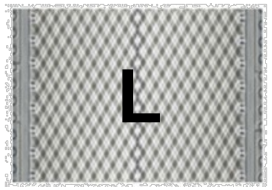
At constant flow (capacity):
Approach decreases from L to M and H plates.



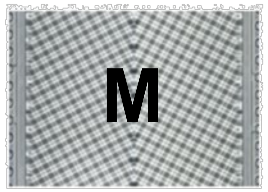




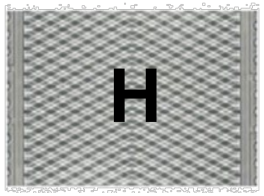




Low theta
Lower efficiency
Lower capacity
Higher approach
Lower DP



Medium theta
Medium efficiency
Medium capacity
Medium approach
Medium DP



High theta
Higher efficiency
Higher capacity
Lower approach
Higher DP

How Alfa Laval BHEs helps CDU design

The HX sizing affects the **capacity**, the **approach** and the **pressure drops**
A **flexible** platform allows to fine tune the design to:

- **Minimize surface** with no compromise on **performance**
- Achieve the maximum **energy efficiency** minimizing **DC running costs**

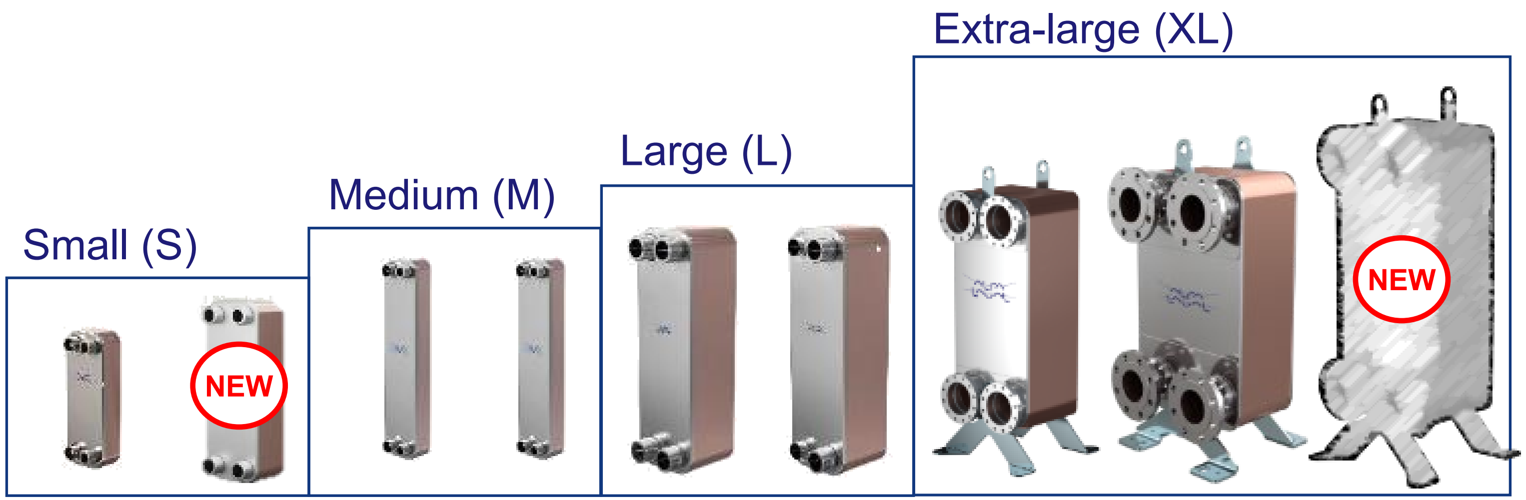
Parameter	Effects				
	w/ constant temperature approach			w/ constant capacity/flowrate	
	Flow	Capacity	Pressure drops	Approach	Pressure drops
⬆ Front area (model)	⬆	⬆	*depends	⬇	⬇
⬆ Plate number	⬆	⬆	⬆	⬇	⬇
Plate from L to H	⬆	⬆	⬆	⬇	⬆
Asymmetric vs symmetric plate	⬇	⬇	⬇	⬆	⬇
⬆ connection diameter	pressure drops ⬇				
2 pass vs1 pass	⬆⬆	⬆⬆	⬆⬆	⬇⬇	⬆⬆
Mixing plates	intermediate effect between different plate types				

How to match application needs

CDU in rack sizes:
- 1U=1,75’’ (44,45mm)
- 2U=3,5’’ (88,9mm)
- 3U=5,25’’ (133,35mm)
- 4U=7’’ (177,8mm)

”Pizza Box” Chassis
Server installed in the standardized chassis:
Width 19” (480mm)
Height 1U, 2U, 3U...
Depth variable

Server Rack
- Structrure designed to house multiple server, switches, routers
- Racks are modular and standardized
- Typical rack can house 42 1U servers



CB30	CB40	CB60	CB62	CB110	CB112	CB210	CB410	CB450
113x 313 mm	121x 333 mm	113x 527 mm	113x 529 mm	191x 616 mm	191x 616 mm	324x 742 mm	490x 793 mm	
In rack 3U fitting	In rack 3U fitting	In rack 3U fitting	In rack 3U fitting	End of row	End of row	End of row	End of row	
Up to 80kW	Up to 250kW			Up to 700kW		Up to 1600kW		
Indicative Max Capacity (kW) acc.to PD limitations, T. Approach, application, media, etc…								

CB40 model – DC key features

S&M formats for Distributed CDUs

- Suitable for 1-phase applications (CDU’s, HVAC, Oil cooling)
- Extended 1-phase S&M product portfolio
- Compact design tailored for demanding thermal duties
- 3U fitting

Thank You