Room, row, rack or server -
choosing the right cooling systems

Markus Gerber

Business Development Manager
Data Solutions Europe

Our Mission

Data Solutions

Building a more sustainable and electrified world

Environmental, social and governance

Weblink

DIRECTIVES

DIRECTIVE (EU) 2023/1791 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 13 September 2023
on energy efficiency and amending Regulation (EU) 2023/955 (recast)

- **Focus areas:**
  - Transport >30% energy consumption
  - Building stock with poor energy performance
  - ICT sector 2,7% of energy consumption in 2018 expected to rise to 98,5 TWh by 2030
- **Reporting obligation**
  ….The collected data should be used to measure at least some basic dimensions of a sustainable data centre, namely how efficiently it uses energy, how much of that energy comes from renewable energy sources, the reuse of any waste heat that it produces, the effectiveness of cooling, the effectiveness of carbon usage and the usage of freshwater….

Energy efficiency law has been agreed 21.Sep 2023

Valid for data center:

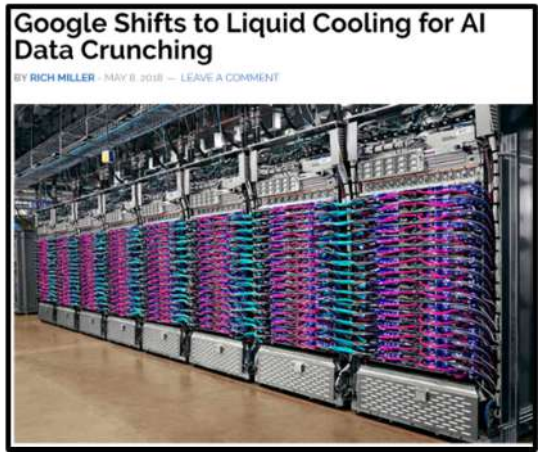
Governmental >= 300kW and private >1MW

- Power Usage Effectiveness (PUE) and Energy Reuse Factor (ERF)
  - July 2026 → PUE 1,2 and ERF 10% for new build DCs
  - July 2027 → PUE 1,5 and ERF 15% for DC build before June 2026
  - …
- It could be possible that global data center organizations with a presence in both the EU and UK may adopt the EU reporting requirements for use in the UK.

Heat network zoning policy and energy performance certificate (EPC)

High Density Liquid Cooling

NEW POWER DEMANDING APPLICATIONS ON THE RISE



Data Center Cooling

	Aisle Containment	InRow cooler	Rear Door Cooler	Direct to Chip	Immersion
					
Design	Room based	Aisle/row based	Rack based	Server based	Server based
Approach	Air cooled		Indirect water-cooled		Direct water-cooled
Density	~10 kW	<15kW	<50kW	~100kW	50kW
Inlet °C	-	<18 to 20°C	<24°C	20 to 40°C	20 to 45°C
Energy Reuse	O	+	++	+++	+++
Risk	Components are known			Compute and infrastructure merge	

nVent

General Comparison IRC vs. RDC

- Invest cost higher with RDCs as long as 1 IRC cools 2 racks or more
- IRC requires more space inside row, RDC can keep row length constant

IRC

- low to mid thermal requirements

- Load per rack < 15 kW
- Water supply temp < 18 °C
- Lower water return temperatures

vs.

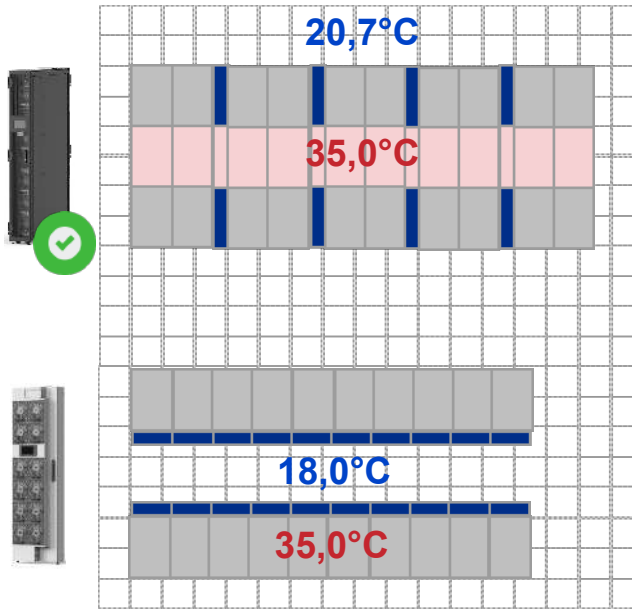
RDC

- high performance or high efficiency
  (= increased water supply temperature)
- Load per rack 10 – 70 kW
- Water supply 16 - 28 °C
- High water return temperature

General Comparison IRC vs. RDC

CASE 1 - 200kW @10kW each rack

Air flow: 6.800 m³/h - Fluid flow: 75 lpm
Fluid inlet temperature 14°C
Air exhaust temperature 35°C



20 racks - Containment
8 IRCs - capacity 248kW
Delta T Air 14,4K
Delta T fluid 6,0K (20°C return)

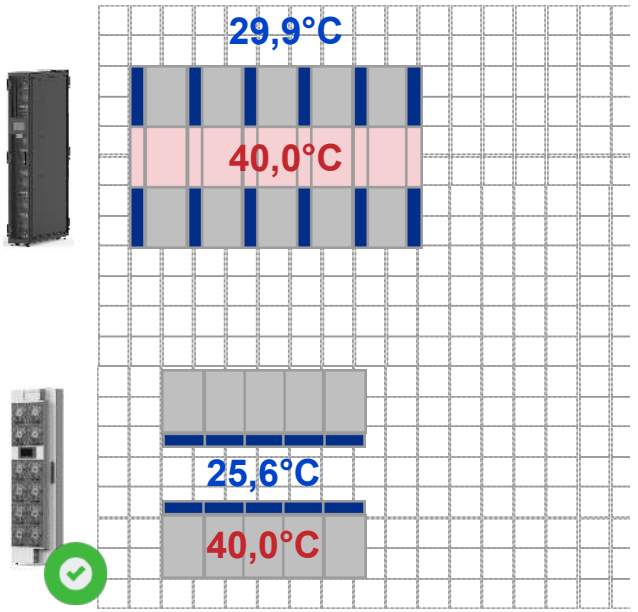
Footprint: 37,44m²
10,4m by 3,6m

20 racks
20 IRCs - capacity 740kW
Delta T Air 17,0K
Delta T fluid 7,1K (21,1°C return)

Footprint: 33,6m²
8,0m by 4,2m

CASE 2 - 200kW @20kW each rack

Air flow: 6.800 m³/h - Fluid flow: 75 lpm
Fluid inlet temperature **24°C**
Air exhaust temperature **40°C**



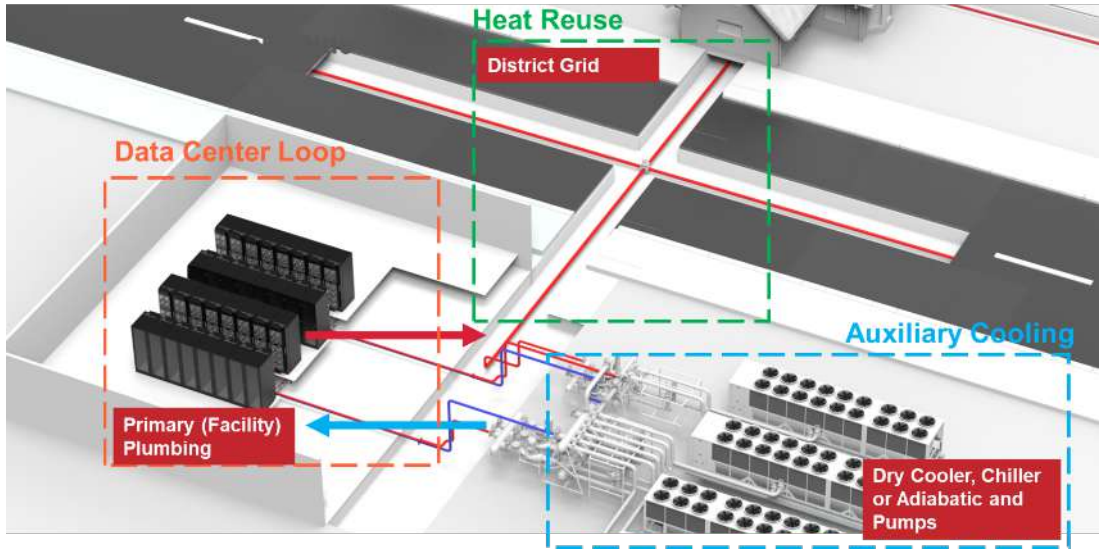
10 racks - Containment
12 IRCs - capacity 260kW
Delta T Air 10,1K
Delta T fluid 4,2K (28,2°C return)

Footprint: 20,88m²
5,8m by 3,6m

10 racks
10 RDCs - capacity 308kW
Delta T Air 14,4K
Delta T fluid 5,9K (29,9°C return)

Footprint: 16,8m²
4,0m by 4,2m

Let us boost the RDHx…



Air flow: 10.000 m³/h - Fluid flow: 100 lpm

	Inlet		Outlet	Delta T
Air	50°C		21,7°C	23,8K
Fluid	14°C		28,3°C	12,4K

86kW

	Inlet		Outlet	Delta T
Air	45°C		21,2°C	23,8K
Fluid	14°C		24,6°C	10,6K

74kW

	Inlet		Outlet	Delta T
Air	45°C		24,6°C	20,4K
Fluid	20°C		29,1°C	9,1K

63kW

	Inlet		Outlet	Delta T
Air	45°C		27,3°C	17,7K
Fluid	24°C		31,9°C	7,9K

55kW

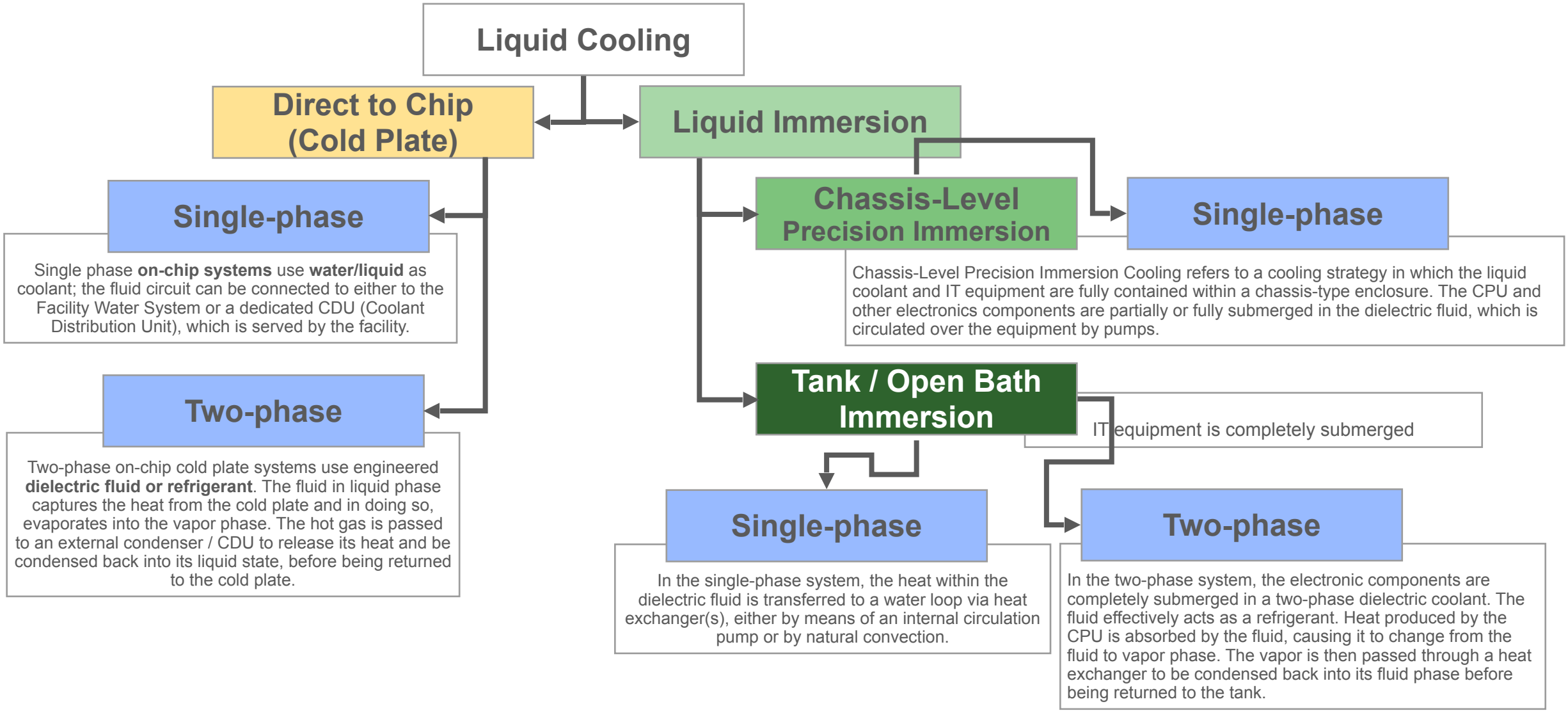
Air flow: 8.000 m³/h - Fluid flow: 60 lpm

	Inlet		Outlet	Delta T
Air	45°C		28,0°C	17,0K
Fluid	24°C		34,2°C	10,2K

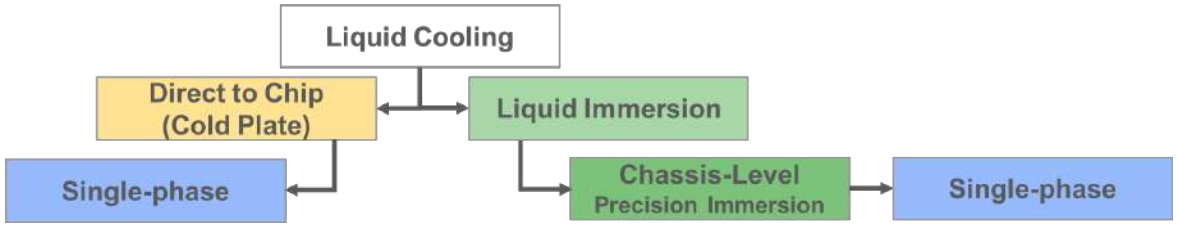
42kW

nVent

Direct water-cooled - five main architectures



Direct water-cooled



COOLING DISTRIBUTION UNIT - CDU
Rack mount or stand-alone
Main components: Liquid to liquid heat exchanger, Pumps, Controller

RACK MANIFOLD
Distribution to the cold plates / chassis with drop free quick disconnects

IT Equipment

COLD PLATES

CHASSIS IMMERSSION

INFRASTRUCTURE COMPONENTS

- Racks
- PDUs

- COLD PLATES Supplementary Cooling Rear Door and Row Air

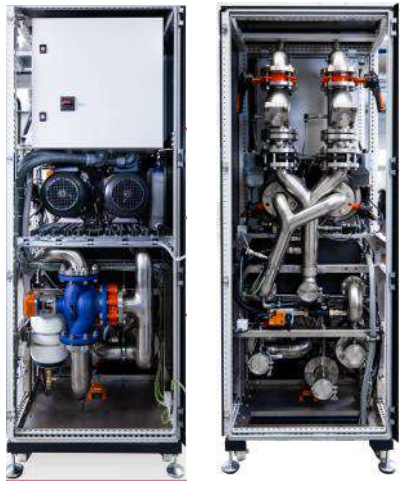
- CHASSIS IMMERSION 21” rack

Design Options CDU

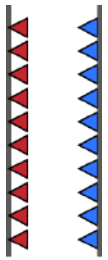
LTA = Liquid to Air
POC and existing infrastructure

CDU = Liquid to Liquid

Rack Mount CDU (LTA) to Support 1 – 3 racks with Direct to Chip cooled equipment.

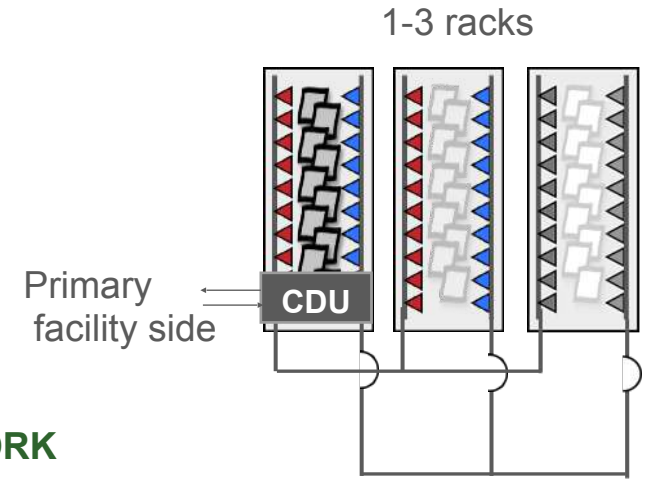


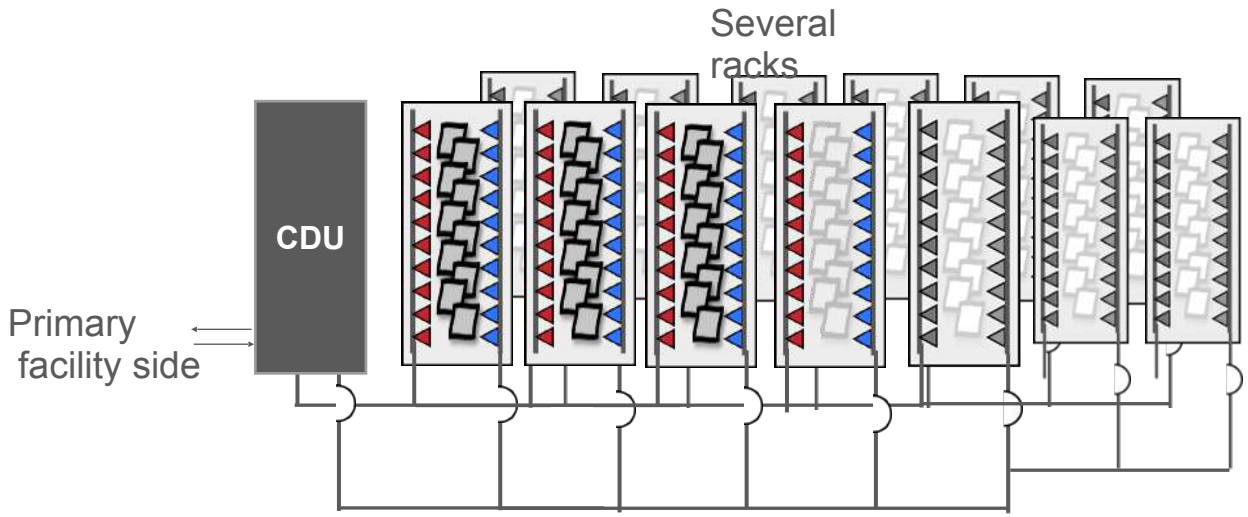
Stand alone CDU (LTA) to support several racks with Direct to Chip cooled equipment.



Manifolds

Cold Plates
(Or Chassis)





SECONDARY FLUID NETWORK

Short Break Out

3phase 32 Amp
22.1kVA

4x PDUs for 80kW
(without redundance)

Electrical Input	
Acceptable input voltage	400-415V 3ph Wye
Input current (phase)	30A (24A derated) / 32A
Input frequency	50/60 HZ
Max Input power	17.3/ 22.1kVA
Input Plug	IEC 60309 530P6/532P6

Electrical Output	
Output voltage	240/230
Maximum output current (phase)	
Overload protection (internal)	6, 20
Outlet configuration	(24)C13, (24)C13/(24)C19

3phase 63 Amp
43.5kVA

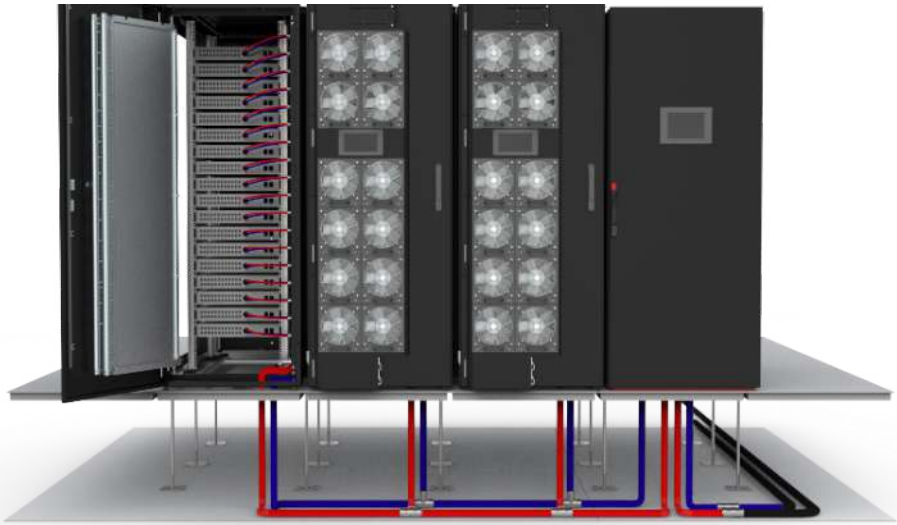
2x PDUs for 80kW
(without redundance)

Electrical Input	
Acceptable input voltage	400-415V 3ph Wye
Input current (phase)	60A (48A derated) / 63A
Input frequency	50/60 HZ
Max Input power	34.6/43.5 kVA
Input Plug	IEC 60309 560P6/563P6

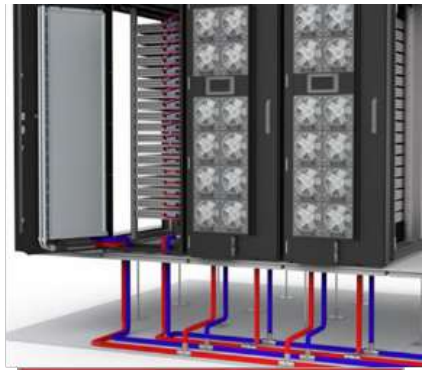
Electrical Output	
Output voltage	240/230
Maximum output current (phase)	
Overload protection (internal)	12, 20
Outlet configuration	(21)C13, (21)C13/(21)C19

Hybrid Liquid Cooling – 80kW

Combining RDHx and CDU



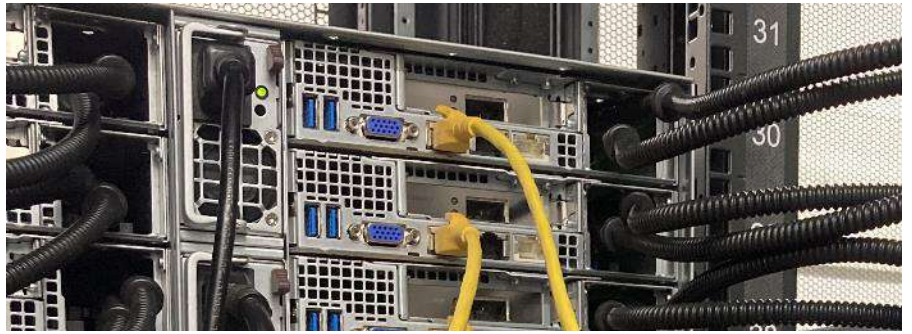
Series loop with rack CDU



Parallel Loop with Row CDU

Project Example:

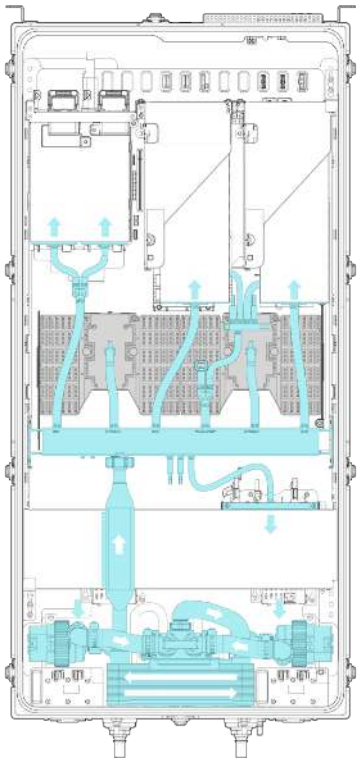
- 9 Racks 47RU x 800W x 1400D with RDCs
- 4x 63Amp 3P PDUs each rack
- 2x Manifolds (42 connections)
- 2x standalone CDUs in Technical Room



Precission Chassis Immersion – 60kW

Combining Chassis immersion and CDU

- 19“ server is placed in a 21“ chassis
- The liquid is floating around the components
- Heat exchanger in the rear transfers the heat to secondary liquid circuit



Trusted Data Center & Networking Solutions for a Connected World

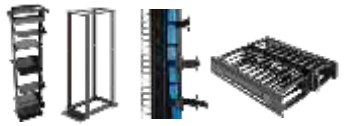
Networking & Server Cabinets

Power Management

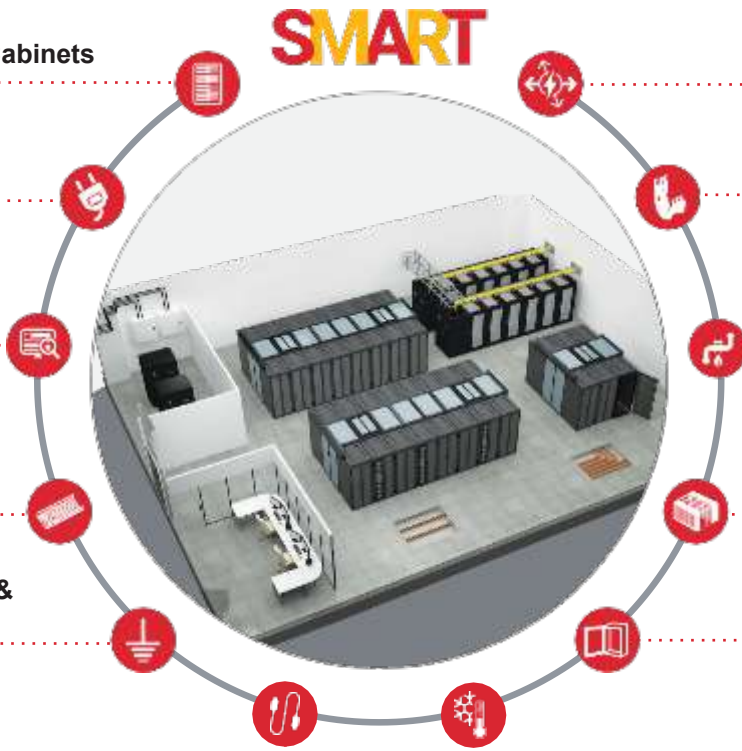
Monitoring & Access Control

Cable Support & Pathways

Grounding, Bonding & Protection



Cable Management



Power Distribution

Fixing & Fastening

Leak Detection

Aisle Containment

Wall-mount Racks & Enclosures

Precision & Direct-to-chip Liquid Cooling

Our flexible modular portfolio, combined with design and project support, enables you to specify and deploy your project on time to ensure data and network infrastructure availability and protection.

nVent

nVent Data Solutions

Work with experts to get the best fitting solution

Want to learn more?

https://www.nvent.com/en-gb/data-solutions