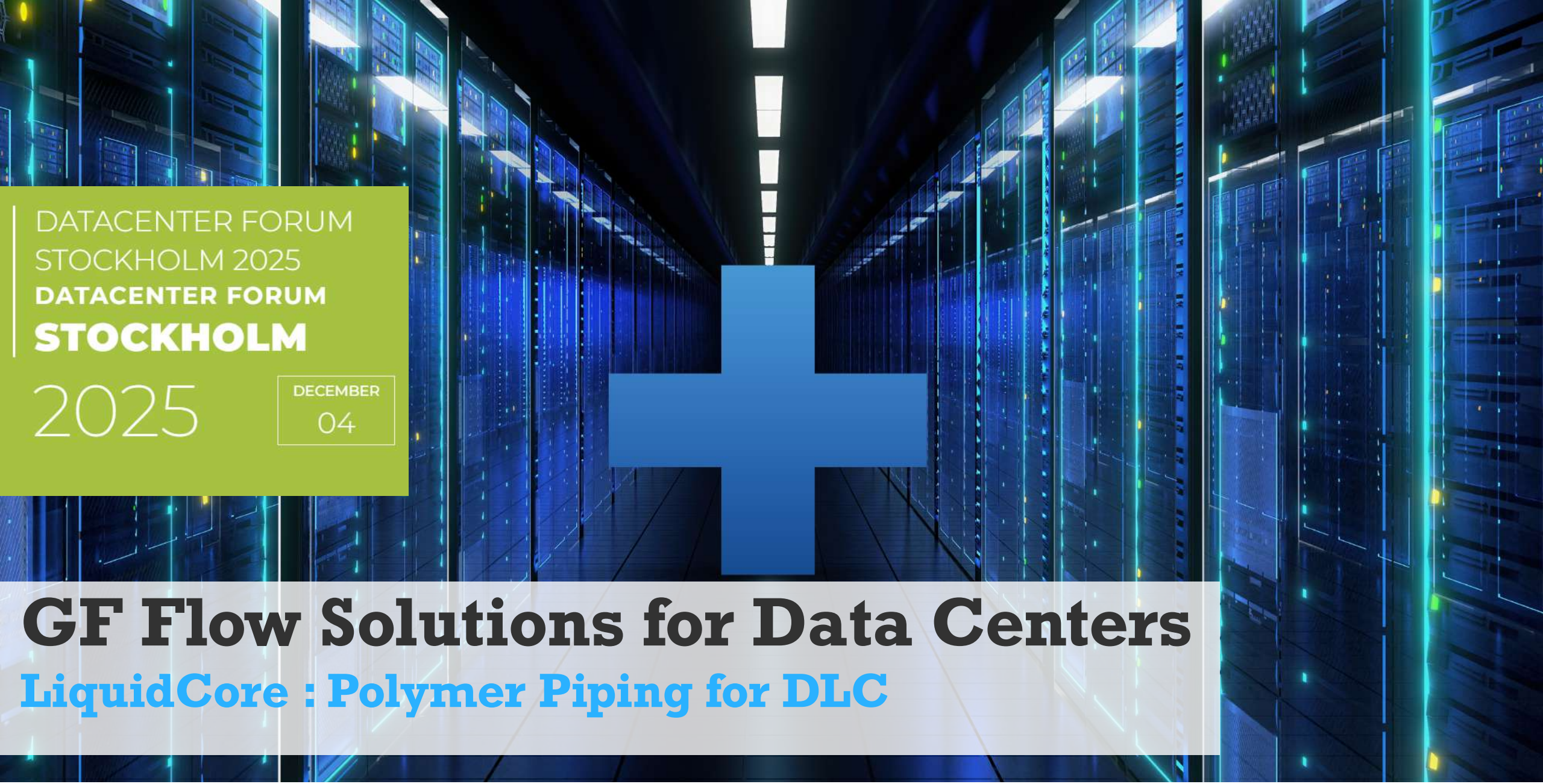


GF Flow Solutions for Data Centers

LiquidCore : Polymer Piping for DLC

Innovating flow solutions since 1802

1802 – Foundation

Our first major innovation was a fitting.

19th Century

Scaling foundry operations and expansion into steel and high-precision components.

Early 20th Century

Automated production and standardized piping systems.

Late 20th Century

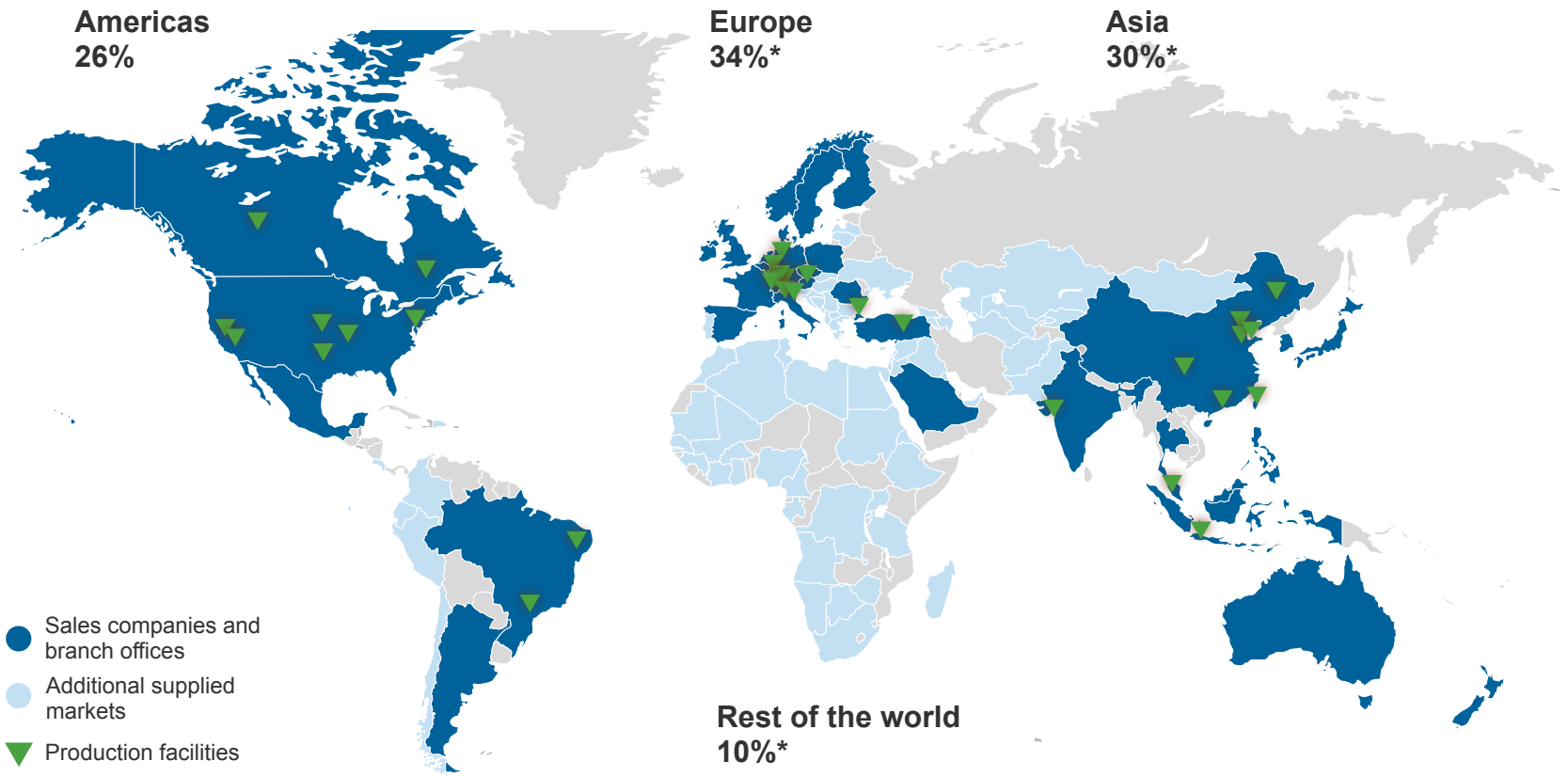
Thermoplastics and welding technology, new type joints.

2000s

High purity solutions, Digitalization and sustainability initiatives.

GF is present across the globe

GF Industry and Infrastructure Flow Solutions



GF Corporation

+ CHF 4.8 bn

Sales 2024

+ 19’023

Employees worldwide

+ 184

Total locations

+ 46

Countries

*Key figures based on the financial year 2024

#1 in engineered industrial flow solutions

Sales (2024 pro-forma new structure)

CHF ~1’100 million

Competitive advantage

- Customized and prefabricated solutions
- Unique know-how in material, engineering and automation of flow processes
- Global presence and service levels

Customers

Micron, intel, PALL, BECHTEL, tsmc, xylem, VEOLIA, OPUB

Key segments


Semiconductors


Chemical Process


Water Industry


Marine


Data Center


Food and Beverage


Energy


Life Sciences


PVDF / ECTFE


Pre-insulated pipes


PP


PVC


Valves


Actuators


Measurement

GF offers widest variety of non-corrosive plastic piping solutions

ecoFIT

PVC-U

PVC-C

PROGEF Standard & Plus

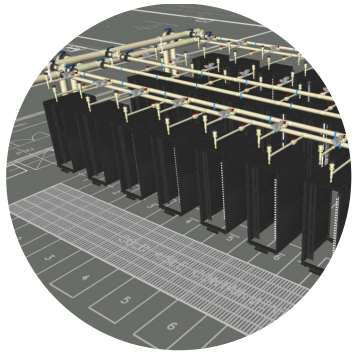
PROGEF Natural

SYGEF Standard & Plus

SYGEF ECTFE

ELGEF Plus

From design to operation, we support the entire construction process and beyond



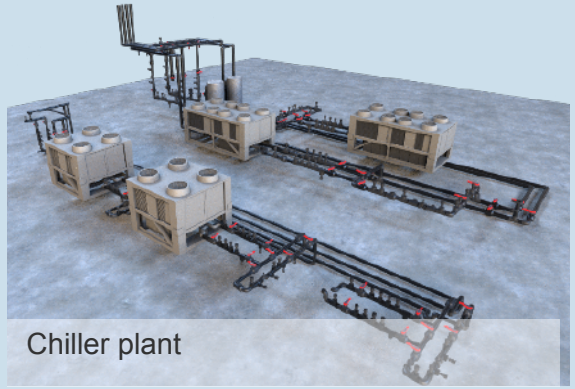
Design and engineering services
We support engineering and design at the front end of a project

Pre-fabrication production facilities, channel sales, and installation training
We pre-fabricate systems and modules in our 16 prefabrication hubs and deliver them directly to construction sites

Lifecycle support
We partner with OEMs and EPCs throughout the lifetime of their construction projects

Specification — **Planning** — **Design** — **Training** — **Preparation** — **Implementation** — **Commissioning** — **Operation**

Facility and Process Waters
… a long history of Mission Critical Projects >25yrs


Chiller plant


Roof tops


Machine Rooms

Thermal Walls **AHUs** **Evaporative Cooler** **Chillers** **Water Cooled Condensers** **Dry Cooler** **Cooling Towers** **Heat Pumps**

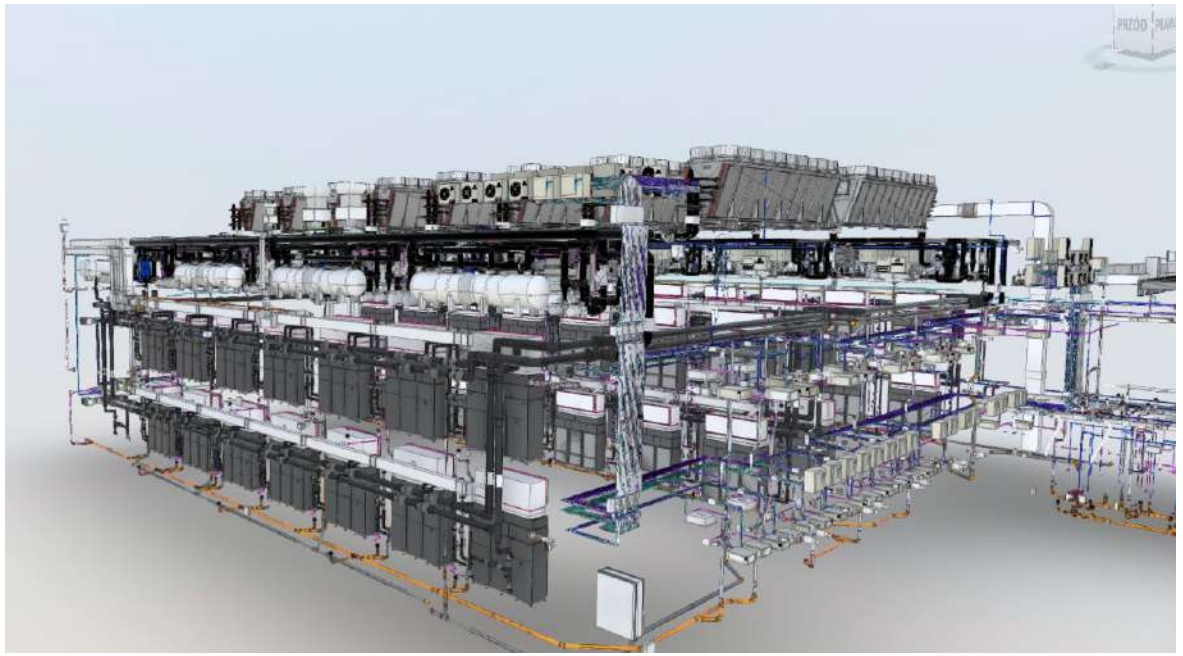
- Chilled Water
- Condenser Water
- Industrial Water
- Chemical Water Treatment

- Process water
- Make Up and Domestic Water
- Drainage and Condensate
- Waste Heat Recovery
- Facility Water (from CDU or Immersion)

GF covers
Operating conditions:

- **-40°C to +80°C (+140°C)**
- **DN10-1000mm**
- **PN 16**
- **Indoors and outdoors**

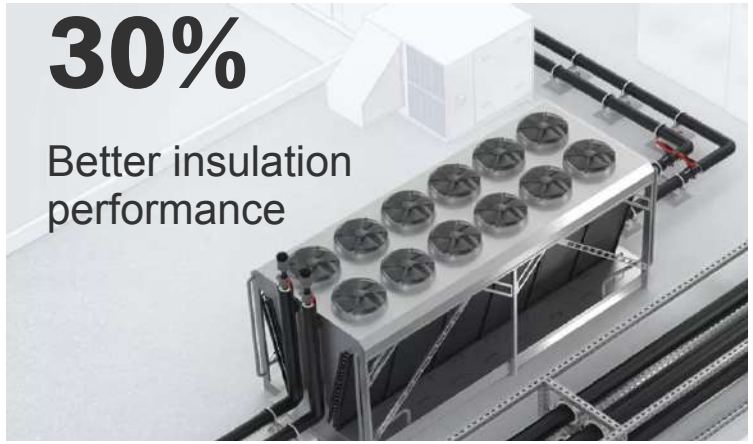
We have a long history and successful track record realising Mission Critical Facilities

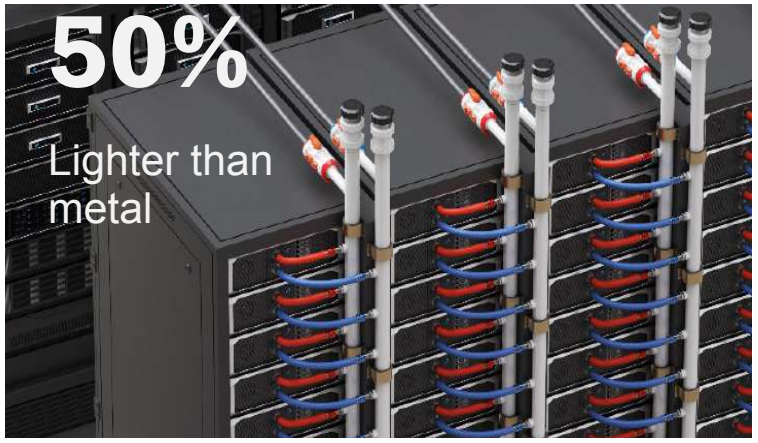


Google USA
Microsoft USA,
Equinix Irland
GSI Germany
ARK DC UK
Data 4 Poland
Colt UK
AWS Spain
Facebook Irland
Equinix Australia
Converge Philippines
Telefonica UK
Airtrunk Japan,
Telefonica UK
Amazon Spain
Next DC Australia,
Google Finland
Digital edge Korea
Delta Japan / Taiwan,
Digital Realty UK
LG Taiwan
Giga Taiwan
AWS UK
Samsung Taiwan
Equinix Germany
Samsung Taiwan,
Airtrunk Malaysia
Apple Denmark

Engineered for Data Centers

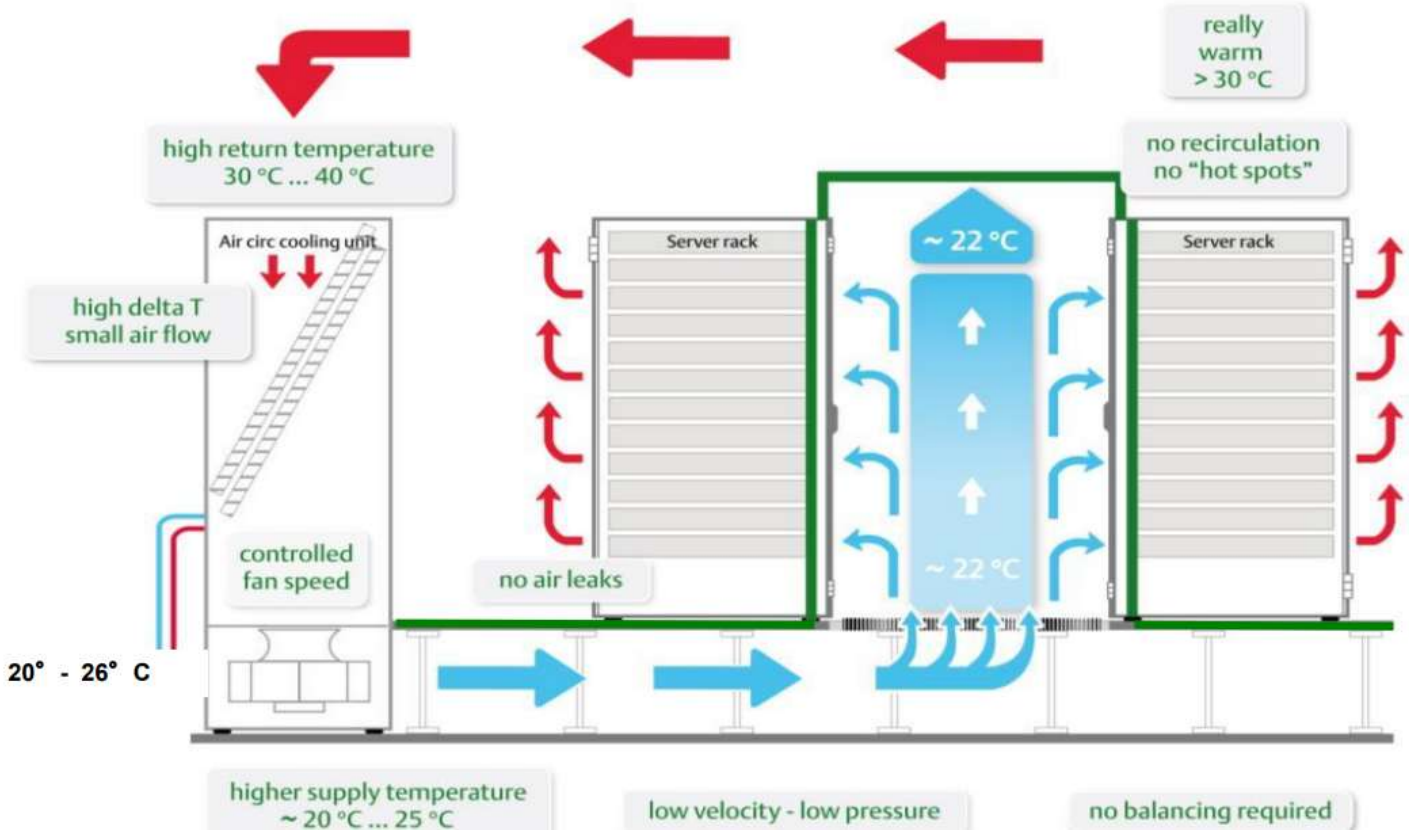
Polymer Piping Delivers Value

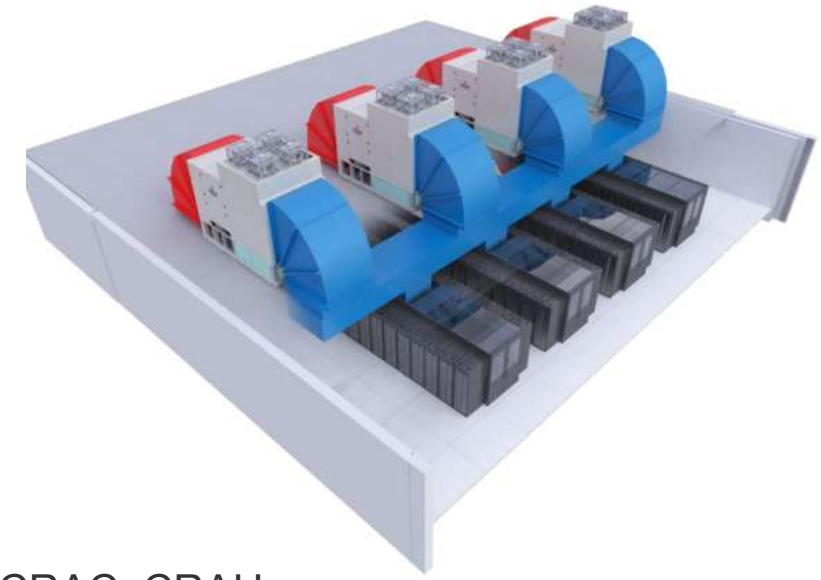




Data Center Cooling

was and still will be with air, but transition to liquid is happening



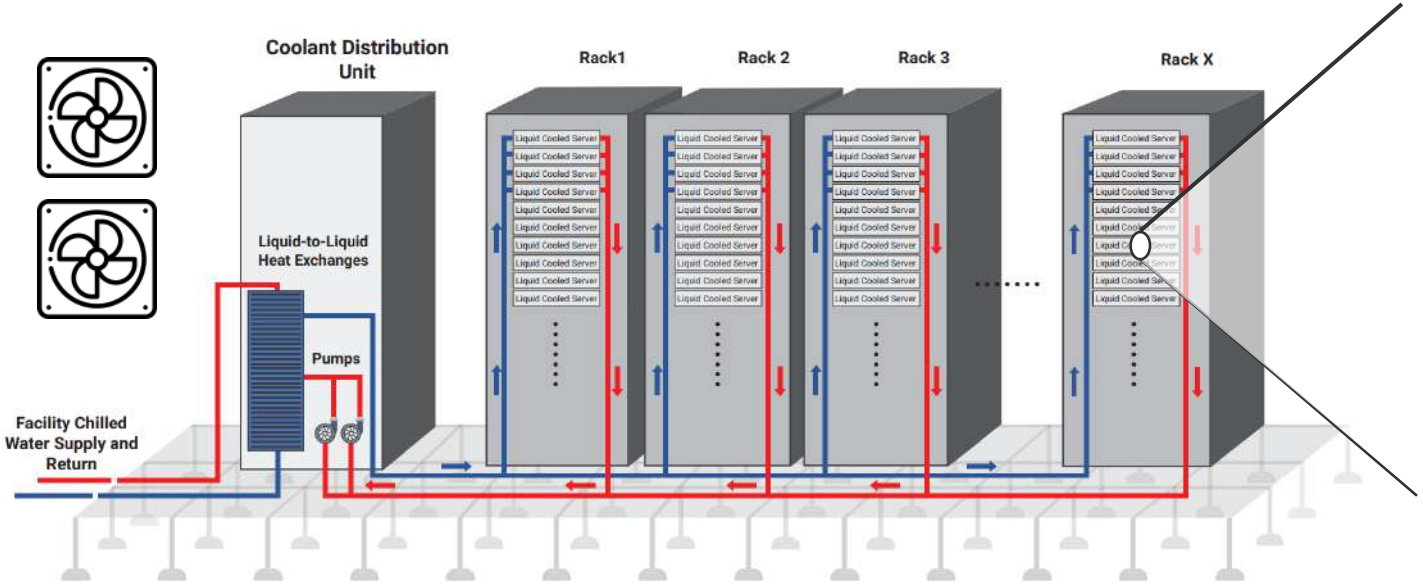


CRAC, CRAH
Roof-Top , External
Air cooling the servers in the racks

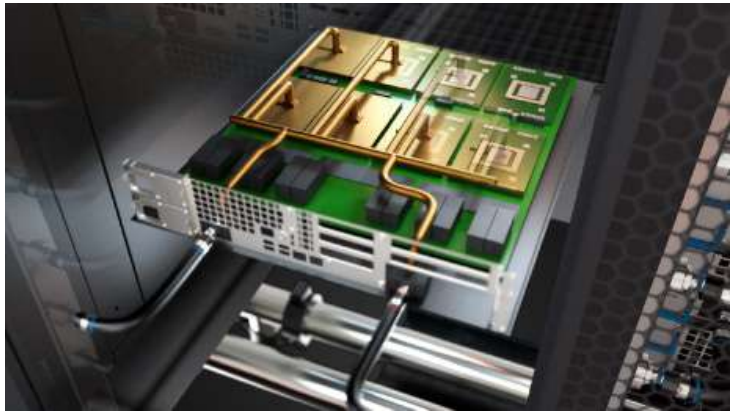
New Data Centers designs will be hybrid
80% Liquid Cooled: 20% Air Cooled

Design Criteria :

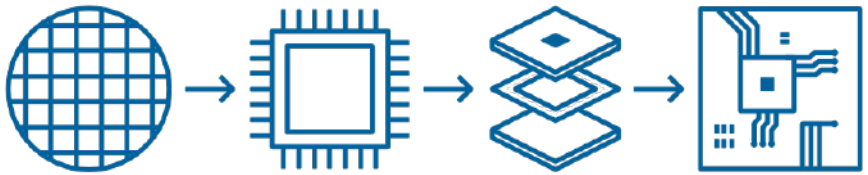
- **Hybrid of air-cooled** and hybrid air/**liquid cooled racks**
- **Liquid cooling** infrastructure to be sized for **95%** of the IT equipment
- **Air cooling** infrastructure to be sized for **44%** of the IT equipment
- **AHU's designed for 44% of IT Capacity**



Liquid cooling for GPUs / CPUs 80% of heat generated



Over 30 years in Microelectronics: Trusted in the frontline of the world's most valuable chips



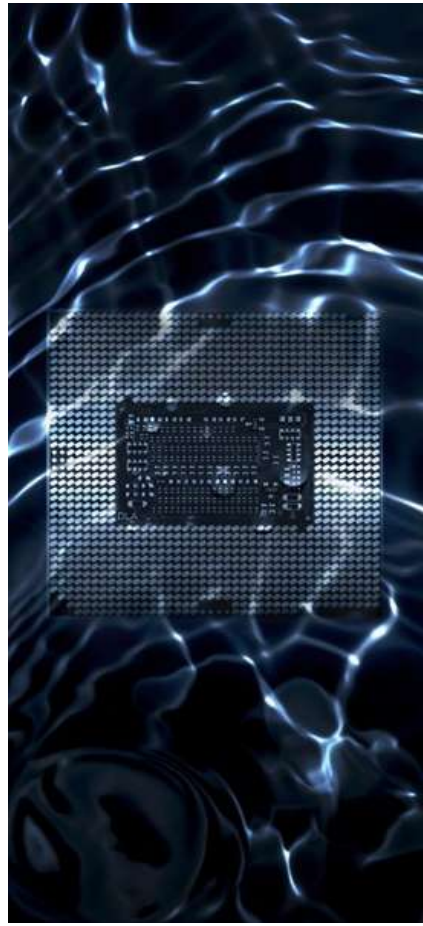
Multiple Supply Excellence Awards, latest 2025.

200+
Wet processes

Majority of **semiconductor manufacturing processes** rely on **ultrapure water** (UPW).

1 per trillion (10^{12})
impurity particles

constant innovation, ensuring to stay **ahead of industry**.



GF is solution provider for applications requiring absolute reliability and purity

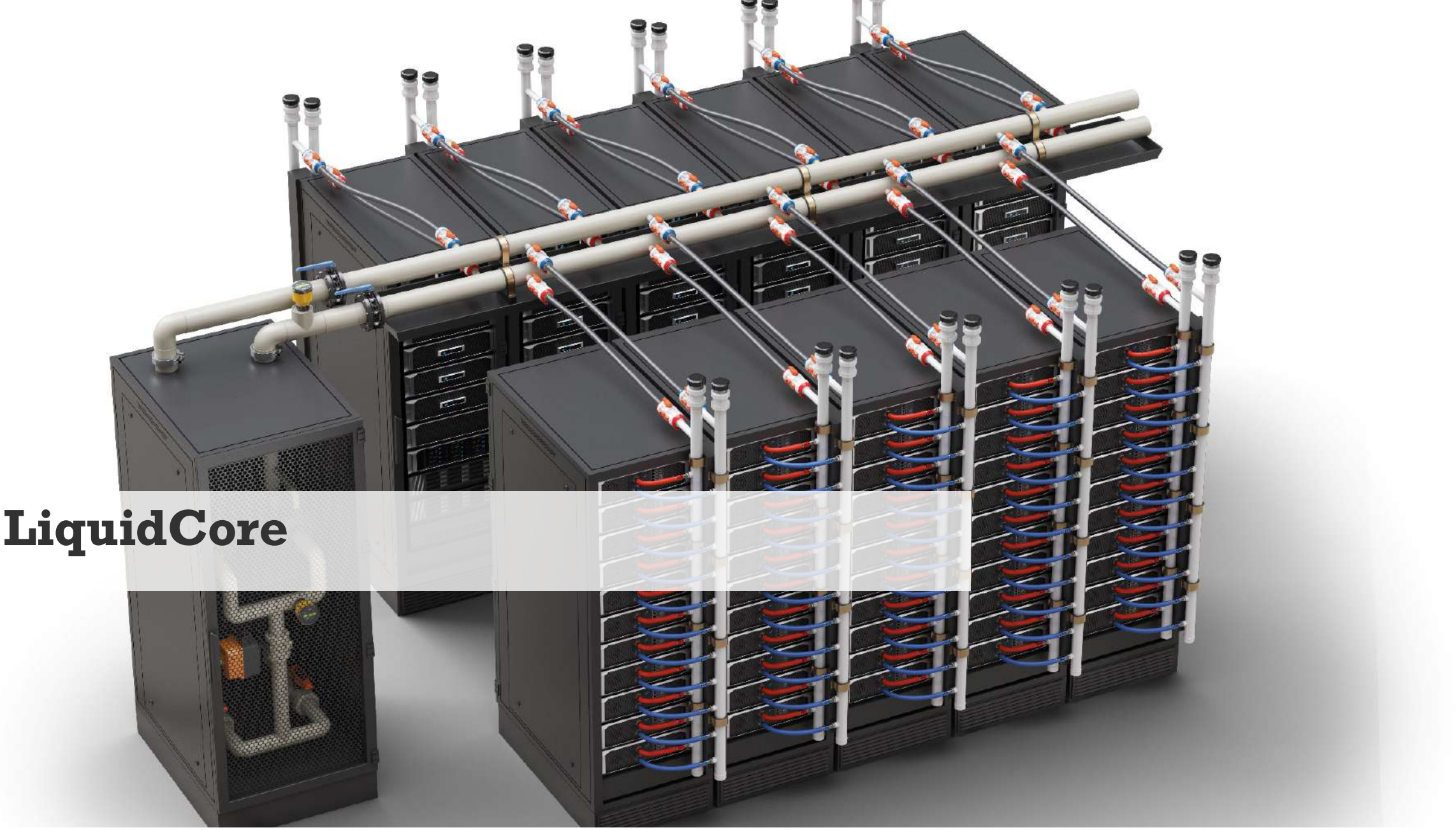
Water purification systems

Chemical Conveyance

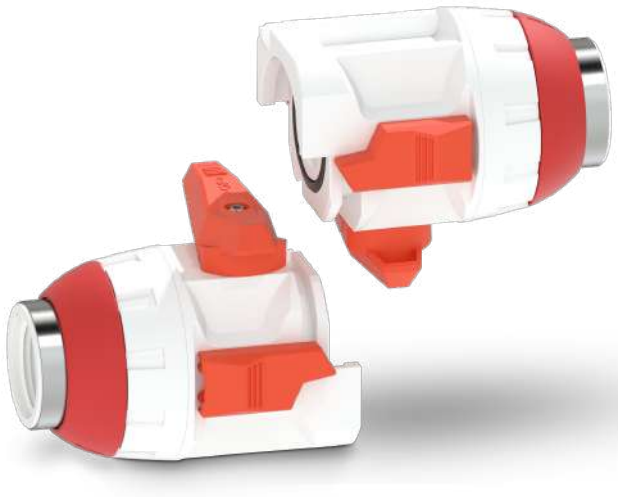
Ultrapure Water delivery

Treatment and control

GF LiquidCore



Plug-and-play connection to cooling pipelines



Patented dual interlock valve

With lever mechanism that prevents accidental decoupling.

55% less weight

From 1.8kg to 0.8kg, with same strength, performance, and reliability

25% better flow

Full-bore valve design for optimal flow and reduced pressure drop

Easy handling

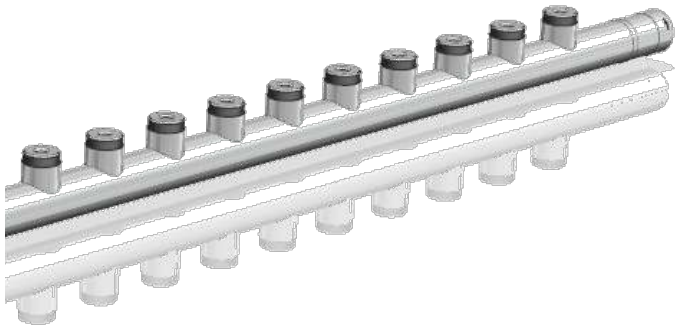
Safe, easy, and ergonomic to handle and color coding for supply/return lines.

100% reliable

Corrosion-free, proven design, and thoroughly tested for long service life.

Environmental Product Declaration

Bespoke Manifold Design for Uniform Coolant Flow and Optimal Performance



Consistent coolant Flow

100% Design Flexibility
Open design, compatible with variety of UQDs, possible to customize.

100% Quality Tested
Visual inspection and pressure test for every product before delivery.

100% Reliability
Non-metallic materials for long-lasting, high-performing solution.

50% Less Weight
Significantly lower weight than metal without compromising on quality or reliability

Outlet 1 : 2.2 l/min
Outlet 10 : 2.4 l/min
Outlet 25 : 2.4 l/min

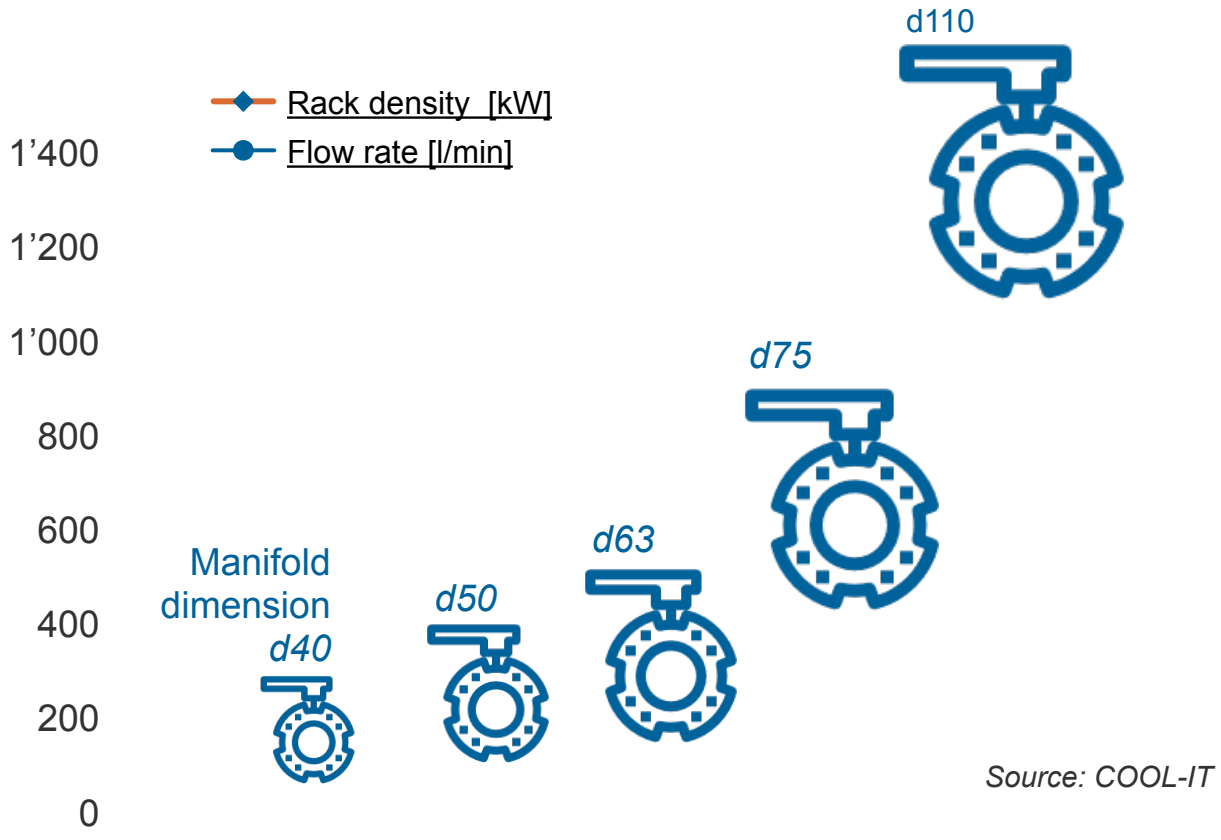
AI Rack Densities
Future Proofing Infrastrucute : A Challenge

Larger dimensions
to facilitate the flow

Weight
becoming critical design factor

Installation
increasing challenges

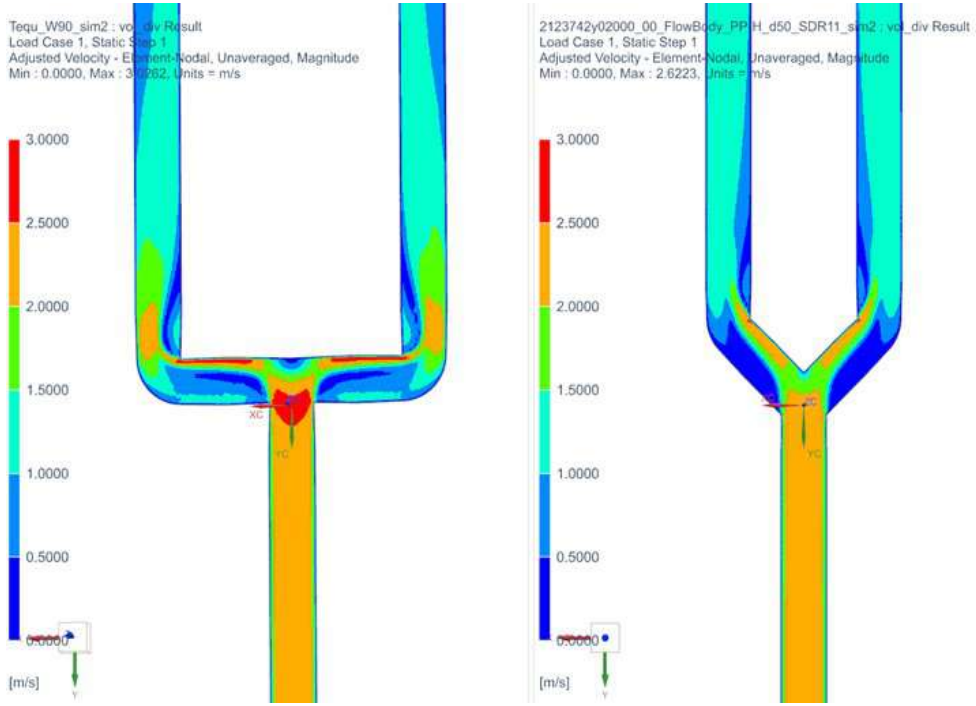
Rising rack power density is driving the scaling up flow



Source: COOL-IT

By mastering flow, we optimize the system performance

Piping system performance optimized by design



Source: GF Flow Solutions

+ Efficiency
Reduced complexity

+ Power consumption
Minimized pressure drop

+ Performance assured
Designed to match the requirement

+ Keep the Cold Plate Clean : Priority No. 1

Microsoft has demonstrated a way to cool silicon chips using microfluidics etched in the silicon that allow cooling liquid to flow directly onto the chip.

- Water is a better heat carrier and requires less energy to pump.
- Water is very corrosive to steels.
- Clean Cold Plate is priority – avoid any potential risk of contamination with particles

Source: Microsoft

+ **PG 25**

Water potentially as coolant instead of PG25
We work with PG manufs to Jointly test PG with GF LiquidCore

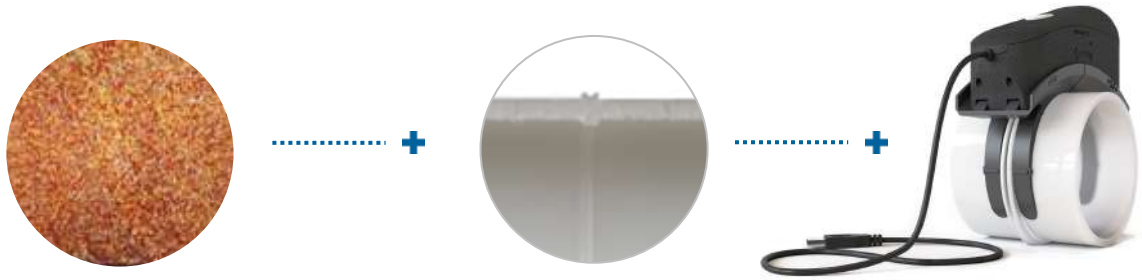
+ **Fluid purity**

becoming critical for maintaining the performance

+ Reliable welding is the foundation of leakage-proof cooling installations

+ Molecular bond

Restoring original pipe strength

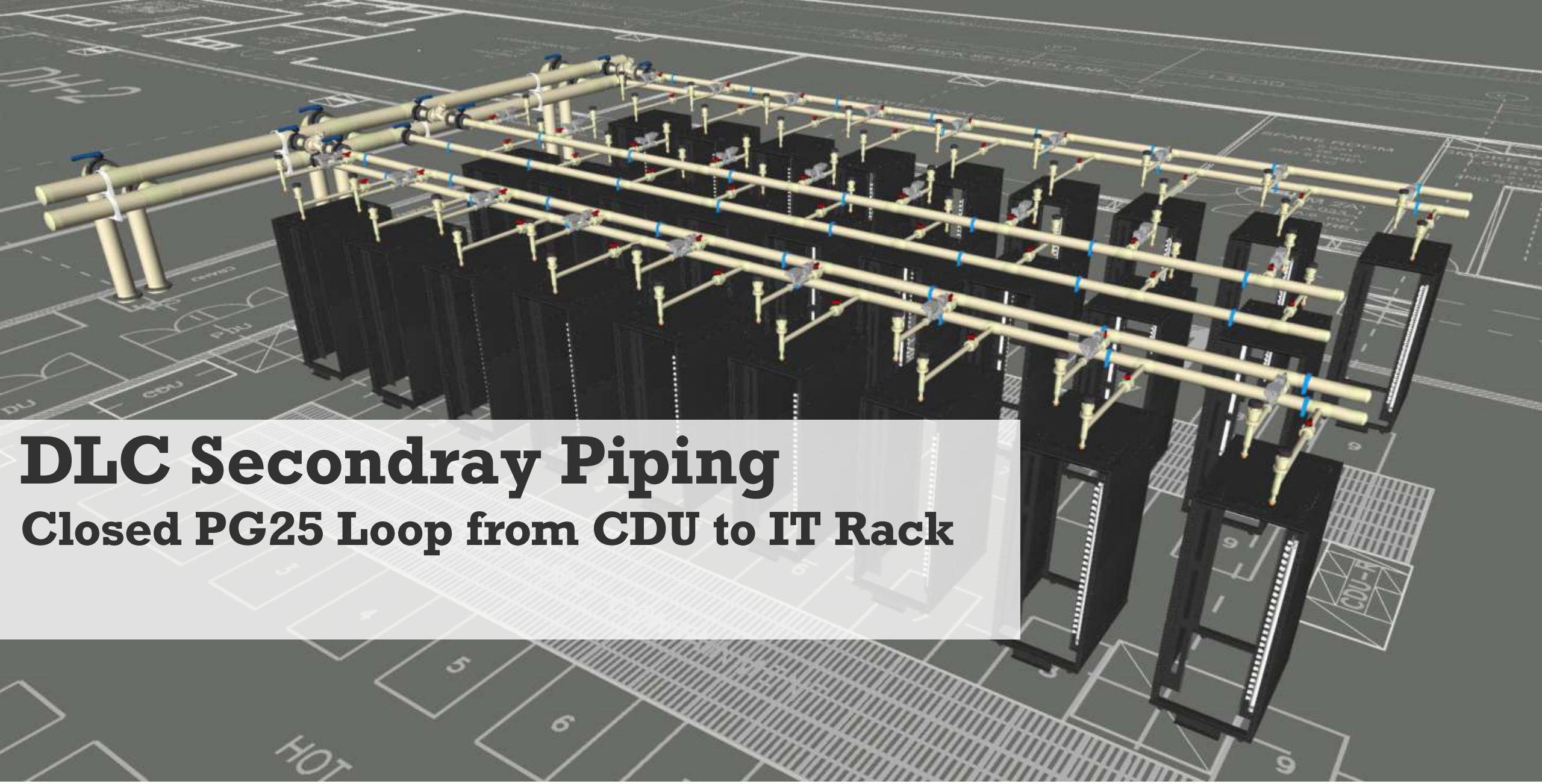


+ Smart Automation

precision without human slip-ups.

+ 1+ million welds annually

trusted by the industry

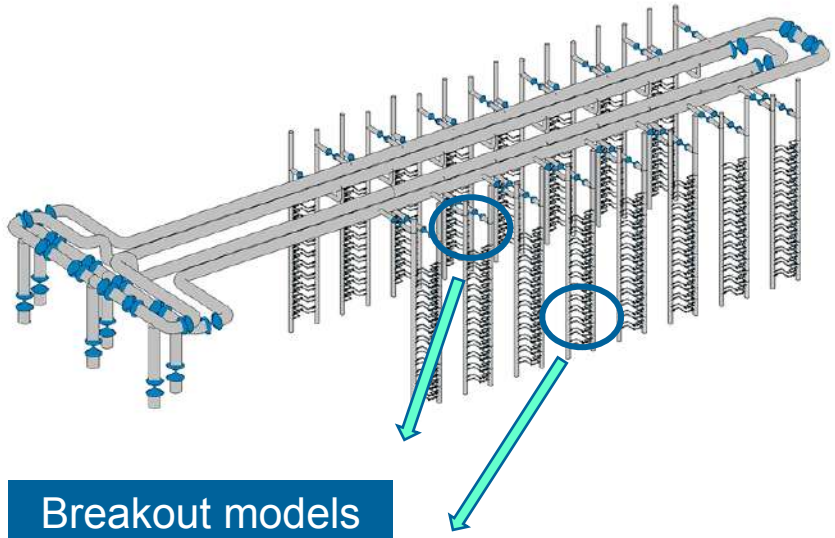


DLC Secondray Piping

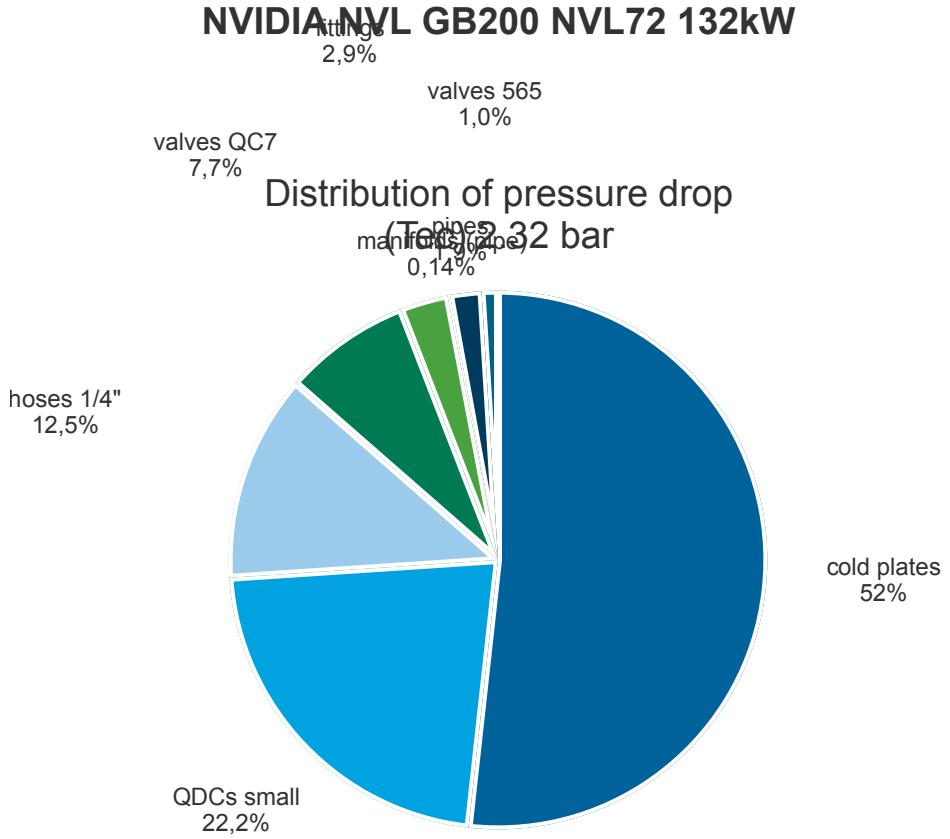
Closed PG25 Loop from CDU to IT Rack

System Analysis
Pressure Drop 52% in the Cold Plate

Technical loop
System Level:
GAE



Breakout models
Component
Level: TEC



Vertiv Liebert XDU 1350kW

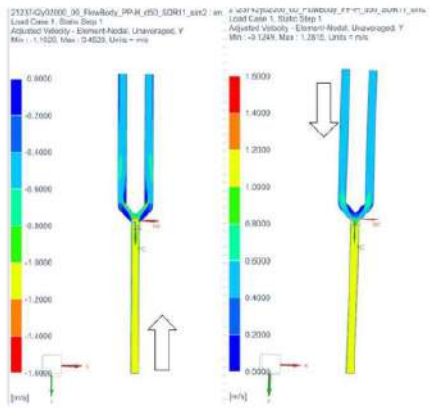
- with 1200 l/min
- Pressure drop over filter 0.7 bar
- max pressure drop 2.5 bar

Technical water – PG25 Secondary Loop

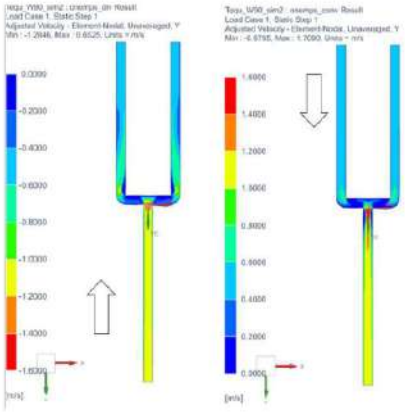
- End user required pipe layout design support
- End user required support on CFD analysis of custom component
- Commercial and performance evaluation of custom parts

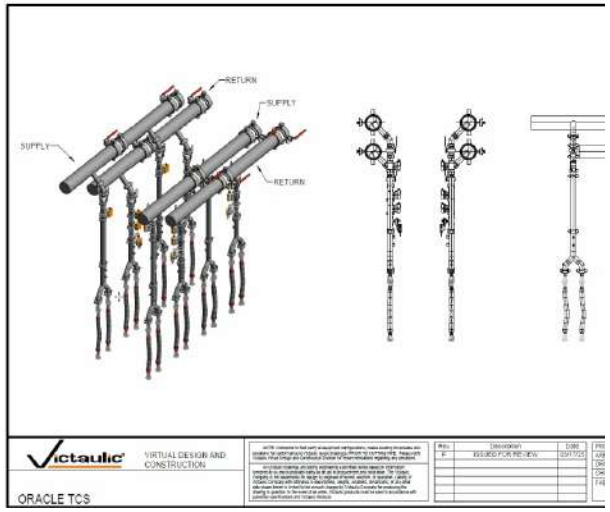
Modelling review

- Flow velocity evaluation of 45 degree tee with 45 elbows



- Flow velocity evaluation of 90 degree tee with 90 elbows





8.15.1 TCS connections shall be arranged such that they connect at high level to the back of the rack. Connections shall be arranged such that the 1" FD83 connections connect to the rack manifold using 90-degree adaptors. Connection points shall be arranged in the vertical. Final connection configuration to be finalized with Owner during design development.

8.15.2 There shall be an air vent at the top of each of the distribution manifolds. A drain shall be provided at the low point.

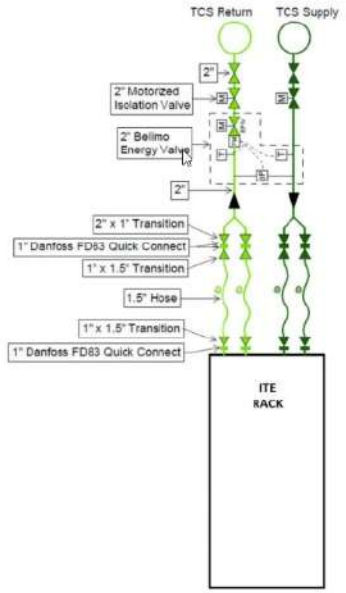
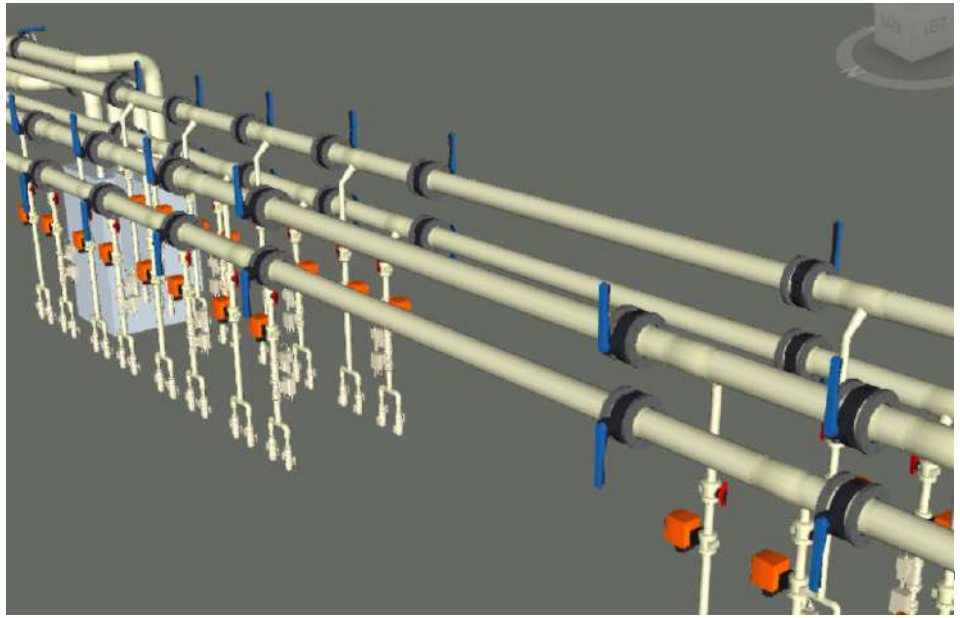
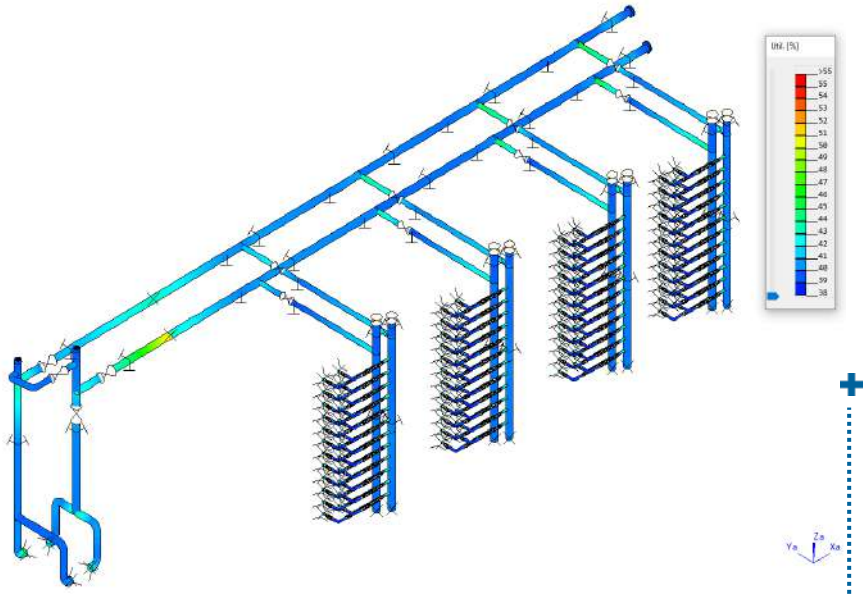


Figure 7: Typical ITE Rack Pipework Connection Detail 1

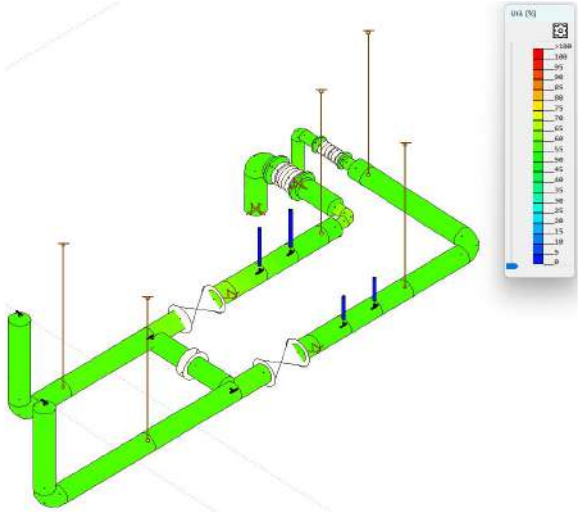


GF Engineering Support from Polymer Experts

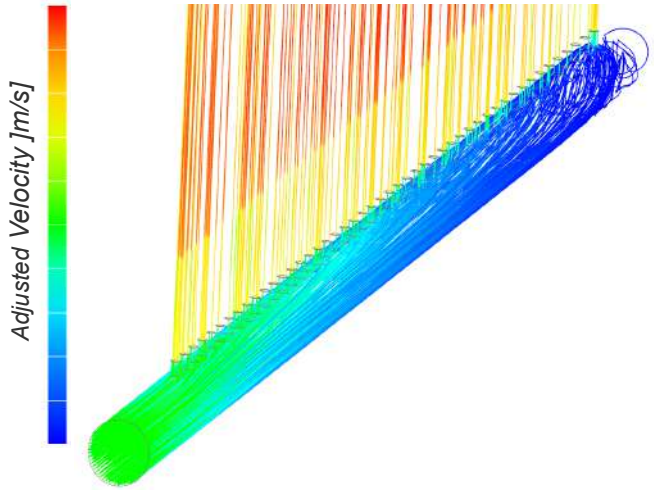
Pipework Layout, Dimensioning, Exp./Contraction



System level flow and stress analysis

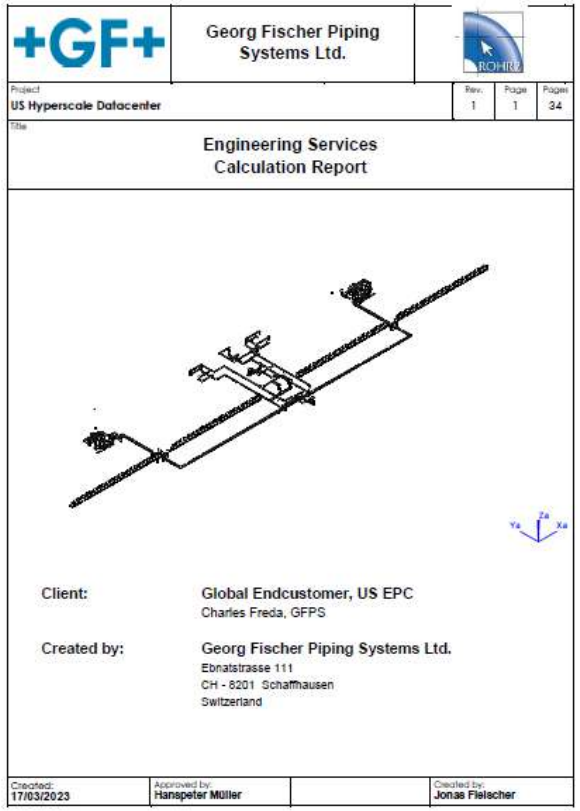


Pipe support concept for safe installations



Validated performance

GF Engineering Report



+GF+ Georg Fischer Piping Systems Ltd.

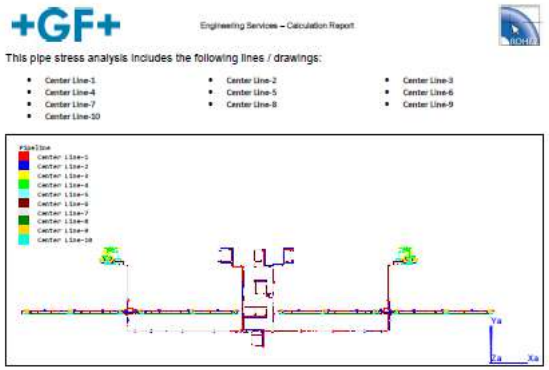
Project: US Hyperscale Datacenter | Rev. 1 | Page 1 | Pages 34

Title: Engineering Services Calculation Report

Client: Global Endcustomer, US EPC
Charles Freda, GFPS

Created by: Georg Fischer Piping Systems Ltd.
Ebnatstrasse 111
CH - 8201 Schaffhausen
Switzerland

Created: 17/03/2023 | Approved by: Hanspeter Müller | Created by: Jonas Fleischer



+GF+ Engineering Services – Calculation Report

This pipe stress analysis includes the following lines / drawings:

- Center Line-1
- Center Line-2
- Center Line-3
- Center Line-4
- Center Line-5
- Center Line-6
- Center Line-7
- Center Line-8
- Center Line-9
- Center Line-10

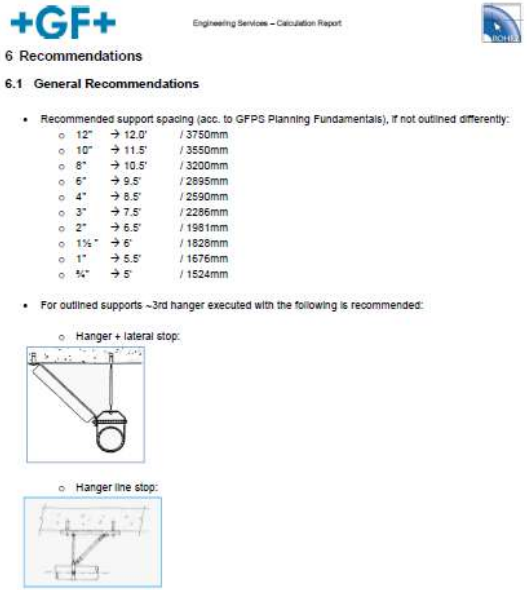
The following general parameters were considered:

- Density of medium:
  1000.0 kg/m³ / 62.4 lb/ft³
- Assembly temperature:
  20°C / ~70°F (~ambient)

Various modules and sections are being pre-fabricated in a shop, with an average ambient temperature during fabrication.

The density of medium is considered for the calculation of the line masses of the pipes. Thermal expansion is calculated due to the difference between assembly temperature and operation temperature.

Date: 2023-03-17 Page: 10 of 34 Rev. No.: 1



+GF+ Engineering Services – Calculation Report

6 Recommendations

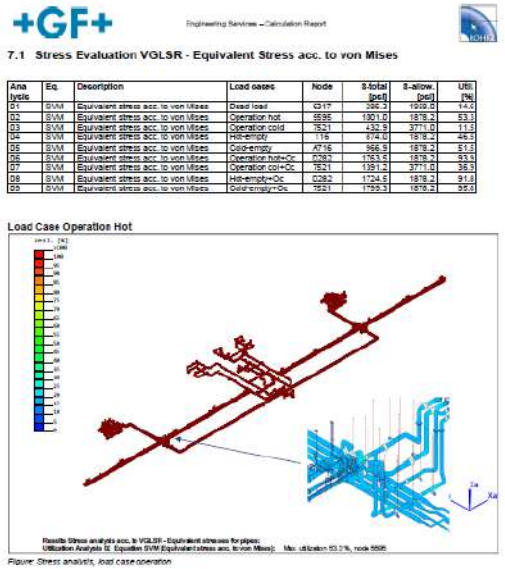
6.1 General Recommendations

- Recommended support spacing (acc. to GFPS Planning Fundamentals), if not outlined differently:
  - 12" → 12.0' / 3750mm
  - 10" → 11.5' / 3550mm
  - 8" → 10.5' / 3200mm
  - 6" → 9.5' / 2895mm
  - 4" → 8.5' / 2590mm
  - 3" → 7.5' / 2286mm
  - 2" → 6.5' / 1981mm
  - 1½" → 6' / 1828mm
  - 1" → 5.5' / 1676mm
  - ¾" → 5' / 1524mm
- For outlined supports ~3rd hanger executed with the following is recommended:
  - Hanger + lateral stop:

  - Hanger line stop:

- Movement of all outlined Metraflex V-Loops → min + / - 1.5"
- Additional valve support recommended for valves. Max. distance within 5 x d from valve to support

Date: 2023-03-17 Page: 17 of 34 Rev. No.: 1



+GF+ Engineering Services – Calculation Report

7.1 Stress Evaluation VGLSR - Equivalent Stress acc. to von Mises

Analysis	Eq.	Description	Load cases	Node	S-total [psi]	S-allow. [psi]	Util. [%]
01	SVM	Equivalent stress acc. to von Mises	Dead load	C317	396.3	1958.0	14.6
02	SVM	Equivalent stress acc. to von Mises	Operation hot	8595	1801.0	1878.2	53.3
03	SVM	Equivalent stress acc. to von Mises	Operation cold	7521	432.9	3771.0	11.5
04	SVM	Equivalent stress acc. to von Mises	Hil+empty	119	874.0	1878.2	46.5
05	SVM	Equivalent stress acc. to von Mises	Cold+empty	A716	966.9	1878.2	51.5
06	SVM	Equivalent stress acc. to von Mises	Operation hot+Oc	D282	1763.5	1878.2	93.9
07	SVM	Equivalent stress acc. to von Mises	Operation col+Oc	7521	1391.2	3771.0	36.9
08	SVM	Equivalent stress acc. to von Mises	Hil+empt+Oc	D282	1724.5	1878.2	91.8
09	SVM	Equivalent stress acc. to von Mises	Cold+empty+Oc	7521	1755.3	1878.2	93.6

Load Case Operation Hot

Figure: Stress analysis, load case operation

According to chapter 2.2 a minimum Safety-Factor of 2.0 is required (industry/ hot water applications).

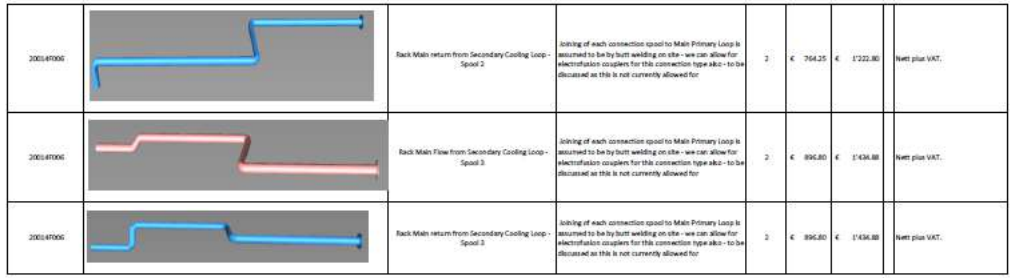
The maximum ratio of $S_{permissible}/S_{total}$ = 1878.2 / 1001.0 [psi] ≈2.0

The determined Safety-Factor does meet Georg Fischer Piping Systems' recommendations.

Operation cold is less demanding and therefore not shown.

Date: 2023-03-17 Page: 27 of 34 Rev. No.: 1

+ GF Quote for DLC Pre-fabricated 1.65m Spools incl. demarkation valve



200147006		Rack Main return from Secondary Cooling Loop - Spool 2	Joining of each connection spool to Main Primary Loop is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	2	€ 764.25	€ 1'222.80		Nett plus VAT.
200147006		Rack Main Flow from Secondary Cooling Loop - Spool 3	Joining of each connection spool to Main Primary Loop is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	2	€ 896.80	€ 1'434.88		Nett plus VAT.
200147006		Rack Main return from Secondary Cooling Loop - Spool 3	Joining of each connection spool to Main Primary Loop is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	2	€ 896.80	€ 1'434.88		Nett plus VAT.
					Total	€ 108'434.40		Nett plus VAT.

2) Fabrication against the provided information - Butterfly VALVES

Code	Description	Actuation	Comment	Quantity	Each	Total		
199E750G3	Buv S65L PVDF/PA-GF EPDM d110DN100	Manual		8	€ 196.89	€ 1'575.12		Nett plus VAT.
					Total	€ 1'575.12		Nett plus VAT.

3) Fabrication against the provided information - Bellmo Values

Code	Description	Actuation	Comment	Quantity	Each	Total		
	PICV Valves		Not part of GF supply					
					Total	€ 110'009.40		Nett plus VAT.

Please ensure our quotation reference is used on any correspondence regarding your quotation.

The take off provided by George Fischer Sales Ltd is indicative of the pipe routes shown on the drawing. It is the responsibility of the installer/purchaser to confirm quantities required to complete the installation

Changes to drawings will be subject to price review and re-quotation. Please note special items made to customer specifications e.g. fabrications are non-returnable
Prices are applicable to items and quantities quoted. Any changes may be subject to a price review.

Prices exclude installation, site visits, jointing equipment (unless detailed above) & training, nuts, bolts, washers, gaskets, pipe supports, consumables and lubricants. Process design, engineering calculations, O & M manuals, project specific quality plan

Whilst we make every endeavour to meet all your requirements, we provide our estimate in good faith and GF cannot be held responsible for any inaccuracies contained therein.

Cost includes delivery to GF distributor. Site delivery will be charged additionally
Order to be placed via a GF distributor of your choice

This estimate is valid for a period of 30 days from the date of this letter.

George Fischer standard terms and conditions of sale apply, these can be found here

Assuring you of our best attention at all times.

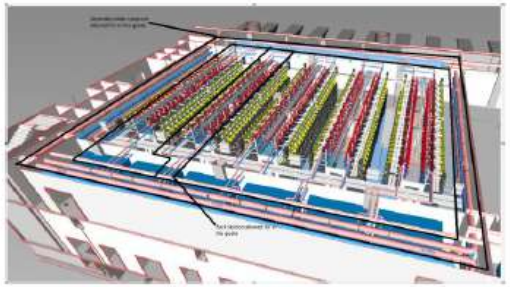
Yours faithfully

Odunayo Afolabi
Estimator & Proposals Engineer – GI. Global Industries

+GF+

Manfred Engelhard
Exyte Central Europe GmbH
Löwentorbogen 90
70376 Stuttgart

Quotation Date 11.09.2024
Quotation Ref GFENQ-420(0)

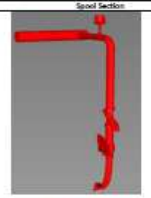
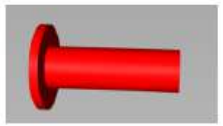
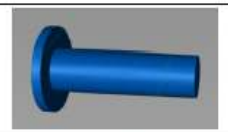


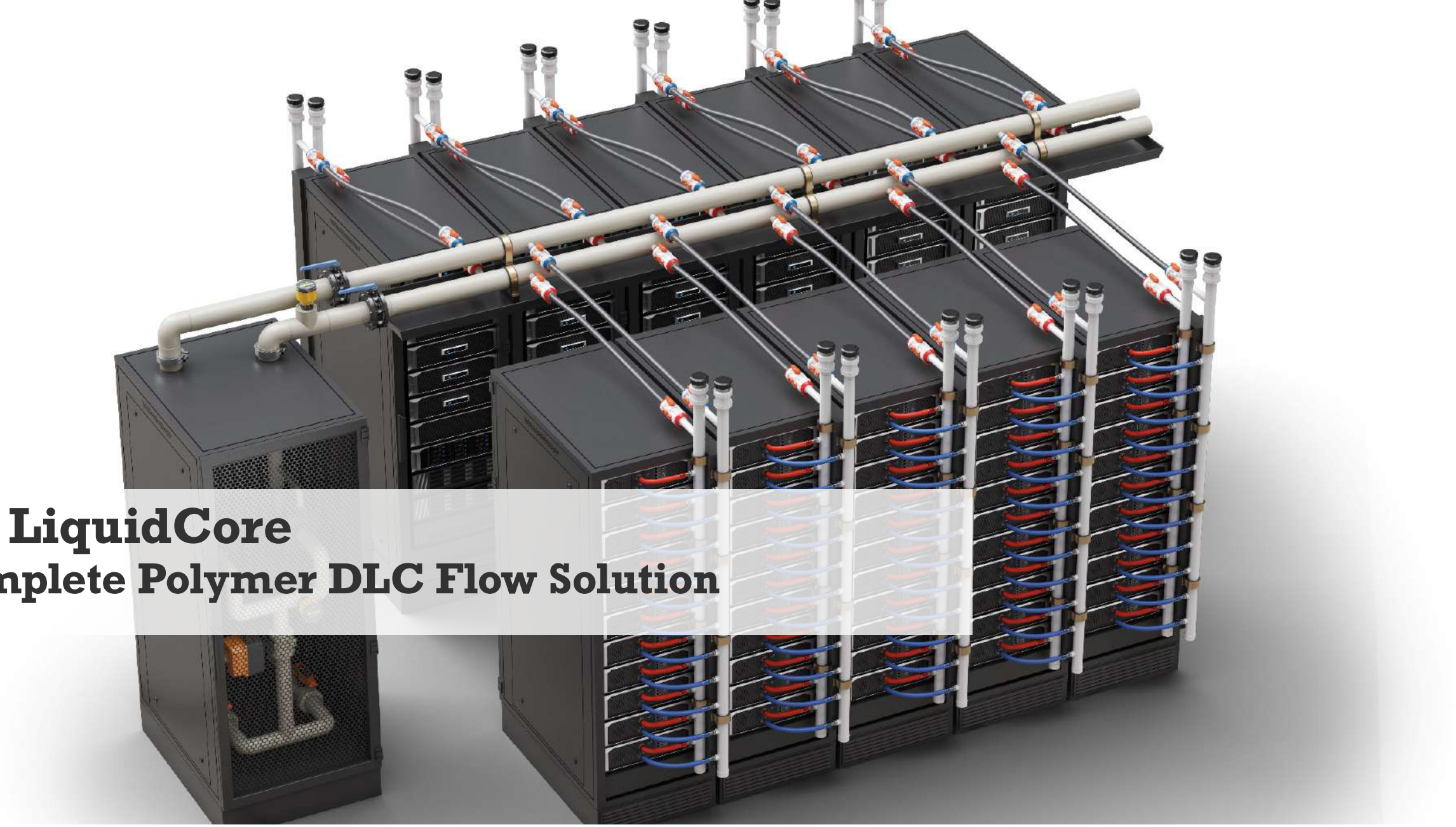
Dear Sir

Re: EXYTE_DLC_PIPING_08_2024 - Quotation prepared from model number - IDY-XX-M1-3-MO-KX-1000 - Federated Model (NWC)
PREFABRICATED PROGEF PP-H for rack connection to Primary Ring Main Piping - Main Primary Cooling Loop after CDU is not allowed for, only primary connection from Main Primary loop to rack is allowed for.

Pipe supports not included
The quote is based on a section of 48 Racks (24 racks per row) and can be multiplied by the total number of section required
Weld logs have been allowed for and will be provided along with weld maps
Pressure Testing and/or NDT not considered in quotation
End connections for spools : recommended Electrofusion - not included in quote
Copy of QA (dimension tolerance +/-2mm) will be provided with each fabrication
EN12201 2.2. Test Certs are allowed for - further material certs, cert of origin etc have not been allowed for and will be charged additionally
Spools are rated to 10 bar @ 20c as shown @ 1.6 safety factor
Welding is quoted as per DVS2207 - CNC butt weld and IR
No internal bead removal allowed for
No external bead removal allowed for
Backing rings are quoted currently as PP Steel type PN16 drilling

1) Fabrication against the provided information

Code	Spool Section	Description	Comment	Quantity	Each	Total		
200147006		Rack Branch_Flow - d110 main with d63 branch includes pipework, instrument fitting (instrument not included), threaded adaptors to connect to PICV 2" male R, isolation quoted as S46 type, final thread for hose connection is 2" male R, hose not included.	Joining of each connection spool is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	48	€ 1'496.06	€ 71'810.88		Nett plus VAT.
200147006		Rack Branch_Flow - d110 main with d63 branch includes pipework, isolation quoted as S46 type, final thread for hose connection is 2" male R, hose not included.	Joining of each connection spool is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	48	€ 966.60	€ 29'593.88		Nett plus VAT.
200147006		Rack Main Flow from Secondary Cooling Loop - Spool 1	Joining of each connection spool is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	4	€ 245.69	€ 626.96		Nett plus VAT.
200147006		Rack Main return from Secondary Cooling Loop - Spool 1	Joining of each connection spool is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	4	€ 245.69	€ 626.96		Nett plus VAT.
200147006		Rack Main Flow from Secondary Cooling Loop - Spool 2	Joining of each connection spool to Main Primary Loop is assumed to be by butt welding on site - we can allow for electrofusion couplers for this connection type also - to be discussed as this is not currently allowed for	2	€ 987.02	€ 1'579.25		Nett plus VAT.



GF LiquidCore
Complete Polymer DLC Flow Solution

Thank You Questions ? Can we help ?