Trade Media Article

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AI Data Centers: Why polymer piping matters in direct liquid cooling

As artificial intelligence drives unprecedented computing power, data centers face a growing challenge: removing massive amounts of heat efficiently and sustainably. This pushes operators to use the high thermal capacity of liquids and adopt direct liquid cooling (DLC) to handle rising rack densities and energy demands.

A new white paper from GF for data center designers, contractors, manufacturers, integrators and operators explores a critical factor in these advanced cooling architectures: the piping system that transports the coolant. *"The role of polymer piping in direct liquid cooling"* explains the importance of coolant purity and corrosion resistance, sustained hydraulic performance, infrared welding for mission-critical reliability and sustainability considerations: in short why the choice of piping material is becoming a strategic design decision for next-generation data centers.

Cooling infrastructure under pressure

Liquid cooling is rapidly gaining momentum because liquids can transfer heat far more effectively than air. In fact, water has a thermal capacity roughly 3,500 times greater than air, enabling reliable cooling for rack densities exceeding 100 kW.

However, the efficiency of a DLC system depends not only on cold plates and Coolant Distribution Units, but also on the infrastructure transporting the coolant. The piping system directly influences:

- coolant purity and contamination risks
- hydraulic performance and pressure loss
- system reliability and leak prevention
- installation time and operational sustainability

Cold plate microchannels are incredibly small and sensitive, maintaining high coolant purity is essential. Microscopic particles can clog these channels and compromise cooling performance, or worse, damage chips or cause downtime.

Why polymers are gaining ground

The paper examines the evolution of piping materials in data centers, from copper to stainless steel and now increasingly to high-performance polymers. Unlike metal piping, polymer systems offer inherent corrosion resistance, preventing the release of particles into the coolant loop over time. Their exceptionally smooth internal surfaces also reduce friction losses and minimize biofilm formation, helping maintain stable hydraulic performance throughout the system's lifetime.

Cleaner welding, faster commissioning

Connections are critical points in piping systems. The study therefore looks closely at infrared (IR) welding technology, a non-contact process used to create highly reliable polymer joints. Infrared welding enables homogeneous molecular bonding without filler materials or welding gases, eliminating contamination risks inside the piping loop. According to GF's data from millions of welds performed annually, the technology achieves extremely

high reliability with automated process control and digital traceability. Another advantage: polymer systems typically require significantly less flushing during commissioning compared with metal pipework, helping accelerate project timelines.

Sustainability benefits beyond the cooling loop
With energy consumption and carbon emissions under increasing scrutiny, the material choice for data center infrastructure also affects environmental performance. The white paper notes that polymer piping can significantly reduce embodied carbon compared to stainless steel systems while also lowering system weight. Lightweight piping simplifies logistics, enables larger prefabricated modules, and can shorten installation time on site. Lower thermal conductivity is another advantage, helping keep heat inside the cooling loop where it can potentially be recovered and reused, for example in district heating networks.

From theory to implementation
Beyond material science, the paper also examines how system design, pre-fabrication, and engineering services contribute to reliable DLC deployment. With more than three decades of experience in mission-critical piping environments such as microelectronics manufacturing, GF applies the same principles of purity, reliability, and process control to data center cooling infrastructure.

Download the full document
For data center designers, operators, and engineering partners evaluating the next generation of cooling technologies, the white paper provides a detailed look at the material, engineering, and sustainability considerations behind modern DLC systems.

Download the full white paper: The role of polymer piping in direct liquid cooling.

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Corporate Profile
With a rich history in industrial innovation since 1802, GF is reshaping the future of Flow Solutions by delivering Excellence in Flow through mission-critical products and solutions that enable the safe and sustainable transport of water and other fluids for Buildings, Industry and Infrastructure. Headquartered in Switzerland, GF employs around 13'300 professionals across 46 countries. In 2025, GF's Flow Solutions business generated sales of CHF 3 billion. GF is listed on the SIX Swiss Exchange.

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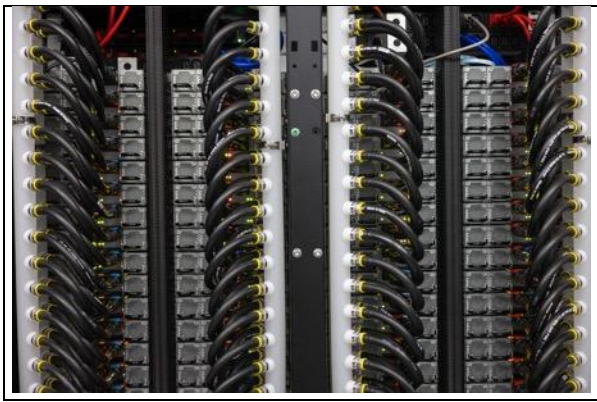
Pictures

	At the rack level, polymer manifolds enable controlled, contamination-free coolant distribution, preserving fluid quality and protecting sensitive IT hardware in liquid cooled environments. Source: GF

	In the technical cooling distribution system, engineered polymer piping solutions combined with high performance pre-fabrication ensure dimensional accuracy, repeatable quality, and efficient installation across large-scale deployments. Source: GF
	At the connection level, polymer-based Quick Connect Valves provide optimized flow paths and secure, leak-tight operation, demonstrating measurable performance advantages over metal solutions even in challenging interfaces. Source: GF