



VERTIV™



Liebert® VIC

Innovative & Highly Efficient
Liquid Immersion Cooling Solution
for High-Density Infrastructure



About Vertiv

Vertiv brings together hardware, software, analytic, and ongoing services to ensure its customers' vital applications run continuously, perform optimally, and grow with their business needs. Vertiv solves the most important challenges facing today's data centers, communication networks and commercial and industrial facilities with a portfolio of power, cooling, and IT infrastructure solutions and services that extends from the cloud to the edge of the network. Headquartered in Columbus, Ohio, USA, Vertiv employs around 20,000 people and does business in more than 130 countries. For more information, visit Vertiv.com

About GRC

GRC (Green Revolution Cooling) was founded in 2009 with a vision to change the way data centers are designed, built, and operated. GRC's original Carnot Jet system demonstrated how the technology could help companies grow their computing power easily, cost-effectively, and limitlessly through a dramatic leap in data center cooling capabilities. GRC has been granted 14 patents - with 8 pending. The company's patented immersion-cooling technology radically simplifies deployments of data center cooling infrastructure.

GLOBAL PRESENCE



UNITED STATES AND CANADA
 Mfg. and Assembly Location 7
 Service Centers 120+
 Service Field Engineers 850+
 Technical Support/Response 120+
 Customer Experience Centers/Labs 4



UNITED STATES

LATIN AMERICA
 Mfg. and Assembly Location 1
 Service Centers 20+
 Service Field Engineers 300+
 Technical Support/Response 25+
 Customer Experience Centers/Labs 2

EUROPE, MIDDLE EAST AND AFRICA
 Mfg. and Assembly Location 5
 Service Centers 70+
 Service Field Engineers 600+
 Technical Support/Response 95+
 Customer Experience Centers/Labs 6

ASIA PACIFIC
 Mfg. and Assembly Location 6
 Service Centers 60+
 Service Field Engineers 950+
 Technical Support/Response 90+
 Customer Experience Centers/Labs 5

SPAIN, SWEDEN, UNITED KINGDOM, FRANCE, NETHERLANDS, AUSTRIA AND ROMANIA

JAPAN, SINGAPORE AND AUSTRALIA

Increasing IT chip densities, a prime focus on energy efficiency and sustainability are the key drivers to explore the immersion cooling technology in high computing & high-density data center infrastructure. Vertiv and GRC together deliver an innovative liquid Immersion-cooling solution that can simplify the design, infrastructure, and operation of your high-density data center.



Cooling Requirements in Ultra High-Density Data Centers are Changing...

With the advancement of next-generation application architectures in AI, IoT, machine learning, virtual reality, and microservices, high-performance computing (HPC) equipment is already combining with co-processors in addition to existing servers to boost mission-critical workload sustainability. This results in drastic changes in data center load density.

Factors that make Liquid Immersion Cooling a viable option in high-density data centers

Increase in Rack Densities

Next-gen application architectures are consuming more power supply than ever, with rack densities reaching up to 100 kW/rack. Traditional cooling methods are not sufficient enough to cool these emerging systems.

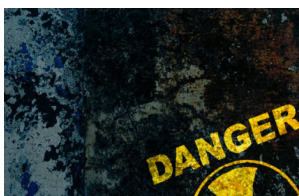


To Reduce PUE

Existing cooling systems consume a large part of the power supply in data centers, thus data center operators are relentlessly motivated to reduce PUE near to 1, and Immersion systems can help achieve this goal.

Space Constraints

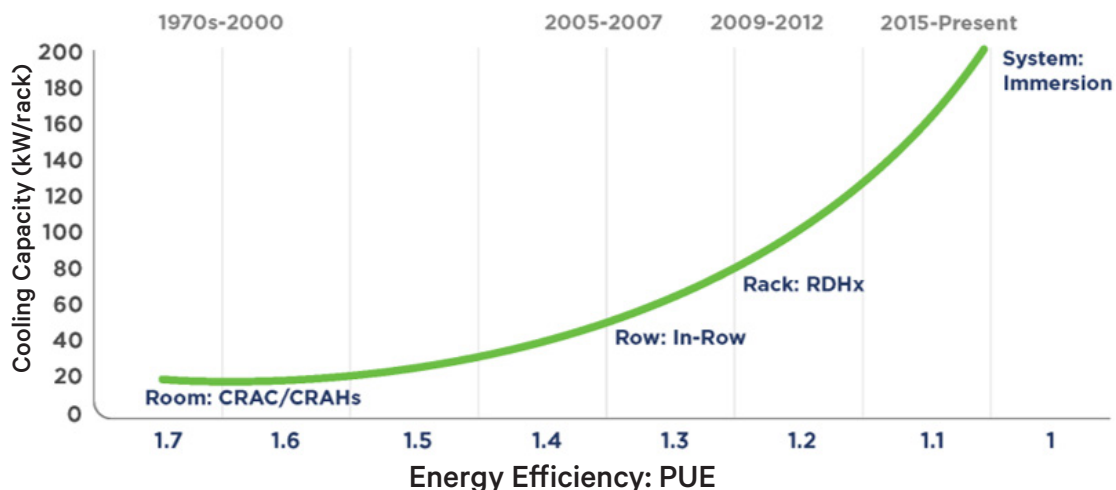
Space management within a data center is one of the major challenges faced by an IT manager. Single-phase immersion-cooling systems allow a reduction in the overall data center footprint by IT equipment compaction.



Uncontrolled Environments for IT

With the rapid expansion of data centers, equipment is being placed in varying and harsh environments. In such cases, single-phase liquid immersion-cooling systems offer protection from airborne contamination.

Evolution of the Data Center Leads to Immersion Cooling



Future-Proof Solutions For Your High-Density Data Center

“Vertiv, with GRC offers the industry's first innovative Liebert® VIC, single-phase immersion-cooling solutions, the coolest answer to power-hungry data centers. Liebert VIC breaks the heat barrier and takes your data center beyond limits. Compute Cooler, Run smarter without latency.”



Liebert® VIC ICEraQ System



Liebert® VIC Coolant Distribution Unit (CDU)

Liebert VIC solution is empowering the full computing potential with immersion cooling technology; where, servers are installed vertically in horizontal racks filled with a dielectric coolant, which is an excellent conductor of heat, but not of electricity. The coolant circulates between the racks and a coolant distribution unit (CDU) connected to a warm water loop, which may use a cooling tower or dry cooler, or a chiller return line, as the final form of heat removal.



Cost Effective



Future-Proof



Modular & Scalable



Fast & Flexible



Energy Efficient



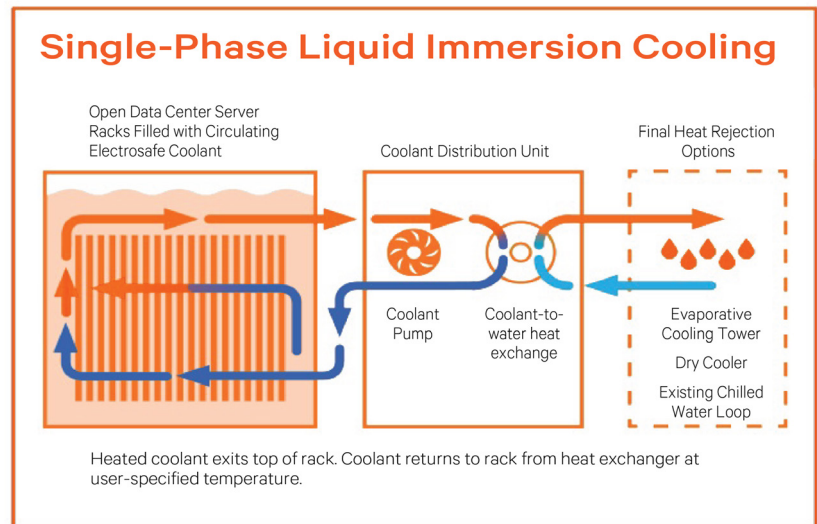
Environmentally Resilient

Liebert® VIC Liquid Immersion Cooling Enables You to:

- Scale easily, cost-effectively — and *limitlessly*
- Increase cooling capacity up to **100 kW** with warm water at 32 °C (89.6 °F)
- Achieve mechanical PUE approximately **1.03**

How Liebert VIC Liquid Immersion Cooling Works

The system is mainly composed of a Coolant Distribution Unit (CDU), horizontal racks, and connecting plumbing. The CDU has a built-in heat exchanger and pump setup. An external evaporating cooling tower cools the coolant and is fed into the racks where servers are immersed. After the heat exchange in coolant-filled racks, coolant is brought into the heat exchanger in the CDU with the help of the pump set-up; and the cycle goes on.

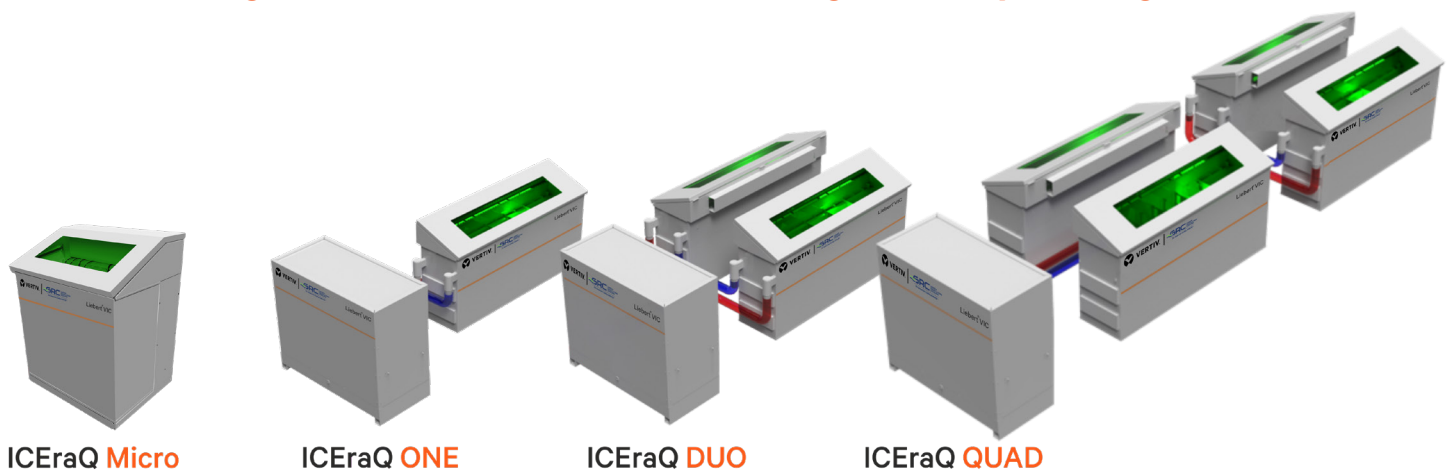


Liebert VIC solution delivers optimum results with the help of ElectroSafe Dielectric Liquid Coolants

- An odorless, non-toxic, single-phase coolant that is both electrically and chemically inert
- Does not need to be replaced over the life of the data center
- National Fire Protection Association (NFPA) 704 Diamond rates ElectroSafe as a 0-1-0 substance. This means that it poses no health hazard, has a high flash point, and is stable even under fire exposure conditions

ElectroSafe coolants are clean, odorless, and non-toxic fluids with a substantial amount of heat retention capacity than air by volume, immersing servers in the liquid enable cooling up to 100 kW with warm water at 32 °C (89.6 °F).

Variable Configurations Available for Flexible High-Density Cooling



Data Center Monitoring Software from Vertiv & GRC

Liebert® VIC solution comes prepackaged with a plethora of sensors and intelligent control systems. Whether it is running an AI or high-frequency trading operation, computing on the edge or on-premise, ensuring that the infrastructure is operating reliably and efficiently, is critical to managing costs and uptime.



Web Application



Configurable Email Alerts



Early Fault Detection



Integration with BMS & DCIM System



24x7 Monitoring Back up

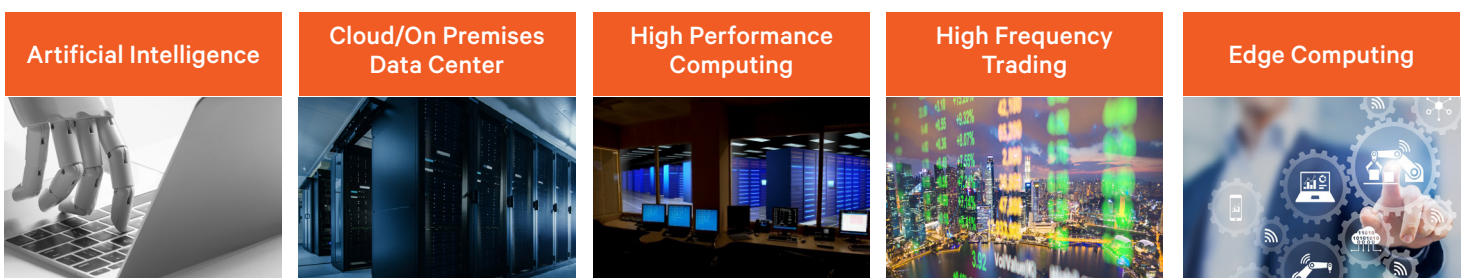
Comparison Landscape of Thermal Management Solutions

Comparison of key functionality among available thermal management solutions for ultra-high-density critical infrastructure

Key Features	Single Phase Immersion Liebert® VIC	2-Phase Immersion	RDHx
Improves Energy Efficiency	●	●	◐
High Density Cooling Performance	●	●	◐
Low Acquisition Cost	◑	◐	●
Reduces Complexity	●	◐	●
Improves Server Reliability	●	◑	◐
Enables Location Flexibility	●	●	◐
Global Warming Potential (GWP)	●	◐	●

● : Good, ◐ : Moderate, ◑ : Poor.

Potential Applications for Immersion Cooling



Technical Specifications

Product Specification	Micro	One	Duo	Quad
Number of Immersion Cooling Rack/s	1	1	2	4
Number of Cooling Distribution Units (CDU)	Built-in/Integrated	1	1	1
Warm water (Water @ 32 °C (89.6 °F))				
Cooling Capacity	25 kW	100 kW	100 kW	100 kW
Per Rack Density	25 kW	100 kW	50 kW	25 kW
Chilled-water (Water @ 13 °C (55.4 °F))				
Cooling Capacity	50 kW	200 kW	200 kW	200 kW
Per Rack Density	50 kW	200 kW	100 kW	50 kW
Mechanical PUE ¹	~1.03	~1.03	~1.03	~1.03
Redundancy ²	Coolant pumps: 2N Control system: 2N		Coolant pumps: 2N Control system: 2N	
Rack Dimensions (l x w x h)	24U:- 1.17 m x 0.87 m x 1.4351 m (46" x 34.3" x 56.5")	42U:- 2.2 m x 0.8 m x 1.5 m (85" x 30.5" x 60") 52U:- 2.6 m x 0.7 m x 1.4 m (103" x 28.3" x 54.3")		
Rack Floor Loading (Operational Weight)	24U:- 892.5 kg/m ² (182.8 lbs/ft ²)	42U:- 1,123 kg/m ² (230 lb/ft ²) 52U:- 952 kg/m ² (195 lb/ft ²)		
CDU* Dimensions (l x w x h) ³	Built-in/Integrated	1.6 m x 0.8 m x 1.5 m (63" x 30" x 58")		
CDU* Floor Loading (Operational Weight)	Built-in/Integrated	244 kg/m ² (50 lb/ft ²)		

* Above CDU data not applicable for underfloor CDU configuration.

Power & Water Specification

Final Heat Rejection Options ⁴	Flexible Options: <ul style="list-style-type: none"> • Adiabatic/evaporative cooling tower • Dry Cooler • Chilled water loop
Water Requirements for Micro	Possible water input temperatures 5 °C to 32 °C (41 °F to 89.6 °F) Recirculating water flow rate 6 m ³ /hr to 9 m ³ /hr Connections 38.1 mm FNPT or hose barb
Water Requirements for One/Duo/Quad	Possible water input temperatures 5 °C to 32 °C (41 °F to 89.6 °F) Recirculating water flow rate 21 m ³ /hr to 30 m ³ /hr Connections 50.8 mm FNPT or hose barb
Power Requirements for Micro	Two electrical feeds (primary & secondary) each with the following characteristics: <ul style="list-style-type: none"> • 3 Phase 200 VAC to 240 VAC or 380 VAC to 480 VAC, 50 Hz to 60 Hz • Max power consumption per feed 0.75 kW
Power Requirements for One/Duo/Quad	Two electrical feeds (primary & secondary) each with the following characteristics: <ul style="list-style-type: none"> • 3 Phase 200 VAC to 240 VAC or 380 VAC to 480 VAC, 50 Hz to 60 Hz • Max power consumption per feed 2.3 kW

Monitoring and Reporting (Micro/One/Duo/Quad)

Platform	Cloud-based DCIM and local DCIM hooks
Alerts	Configurable email alerts with PagerDuty application
DCIM/BMS Integration Protocols	Modbus, BACnet, and RESTful API
Data Measurements	<ul style="list-style-type: none"> • Heat load • Operating temperatures (water and coolant) • Operating pressures (water and coolant) • Power consumption • Pump speed • Rack temperatures • Liquid level (multiple locations) • System health, diagnostics, and early fault detection

1. These are general specification, please contact with Vertiv technical expert for specific performance data for your facility water connection.
2. Additional redundancy options available (only for One/Duo/Quad).
3. Under-floor and low profile CDUs available for space-constrained sites (only for One/Duo/Quad).
4. Low water use options available in climates where the design dry bulb temperature does not exceed 32 °C / 89.6 °F (only for One/Duo/Quad).
5. Liebert® VIC is available with the CE Certification.

