“BEYOND *AIR*…”

Cooling Redefined with Liquid Immersion

22 Aug 2024

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Group Overview

~ $50 M USD

POWER DISTRIBUTION

Switchgear

Transformers

EV CHARGING

THERMAL MANAGEMENT

Railway CAB AC

Liquid Immersion Cooling

Battery Thermal Management System

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Evolving Data Center Needs

Navigating GenAI & ML Boom

1. AI centric chipsets and server configurations with high TDP are fast becoming the new normal driving up operating expenses

2. Increased Complexity of GenAI and ML models is driving capacity & cooling demands

3.
- Increasing demand on key resources like Water, Electrical power and Space for GenAI

4.
- Many AI cluster requirements are projected to hit 80-100kW/rack

Global Impact

W.I.I.F.M ?

(https://www.goldmansachs.com/insights/articles/AI-poised-to-drive-160-increase-in-power-demand)

Elon Musk powers new 'World's Fastest AI Data Center" with gargantuan portable power generators to sidestep electricity supply constraints

News By Jowi Morales published July 24, 2024

Getting power permits is now the biggest issue with data centers, as local power supply infrastructure is strapped.

(Image credit: VoltaGrid / YouTube)

Elon Musk's Memphis Supercluster recently went online, and with a hundred thousand liquid-cooled H100 GPUs onboard, this data center will undoubtedly eat up a lot of power. With each H100 GPU consuming at least 700 watts, Musk's AI data center will need upwards of 70 megawatts of power to run all 100,000 GPUs concurrently — and that's before we add in all of the supporting servers.

(https://www.tomshardware.com/tech-industry/artificial-intelligence/elon-musks-new-worlds-fastest-ai-data-center-is-powered-by-massive-portable-power-generators-to-sidestep-electricity-supply-constraints)

AI brings soaring emissions for Google and Microsoft, a major contributor to climate change

JULY 12, 2024 · 6:12 AM ET

Dara Kerr

Google Vice President Majd Bakar speaks on stage during an annual conference in San Francisco with the back drop of a massive data center.

Researcher Jesse Dodge did some back-of-the-napkin math on the amount of energy AI chatbots use.

"One query to ChatGPT uses approximately as much electricity as could light one light bulb for about 20 minutes," he says. "So, you can imagine with

(https://www.npr.org/2024/07/12/g-s1-9545/ai-brings-soaring-emissions-for-google-and-microsoft-a-major-contributor-to-climate-change)

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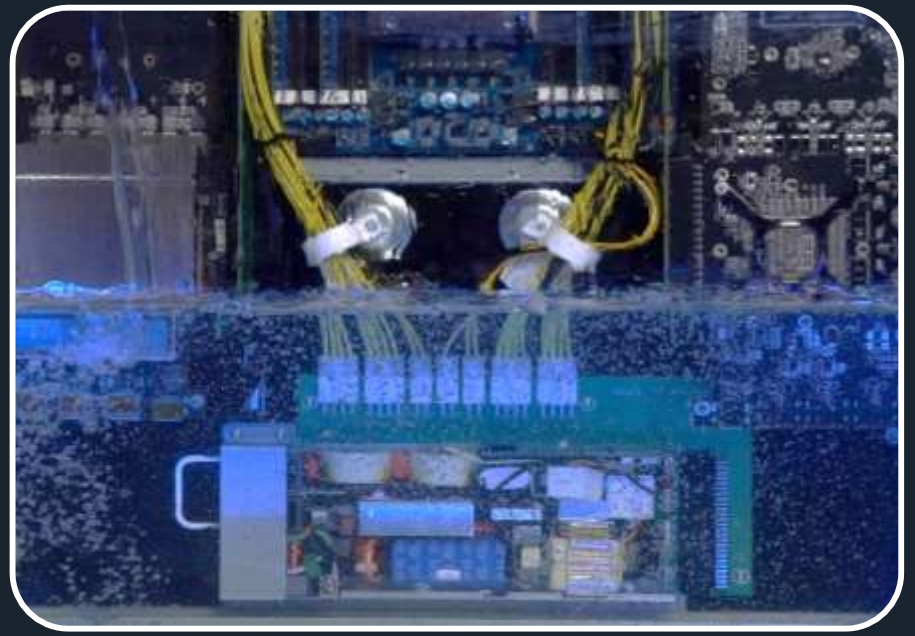
Immersion Cooling

- Immersion cooling is practice of fully submerging the electronic (IT) equipment in a thermally conductive dielectric coolant.
- Specially engineered Dielectric coolant (immersing medium) ensures >1500x heat carrying capability compared to Air.
- Unique behavior of very high electrical insulation strength and excellent thermal conductivity



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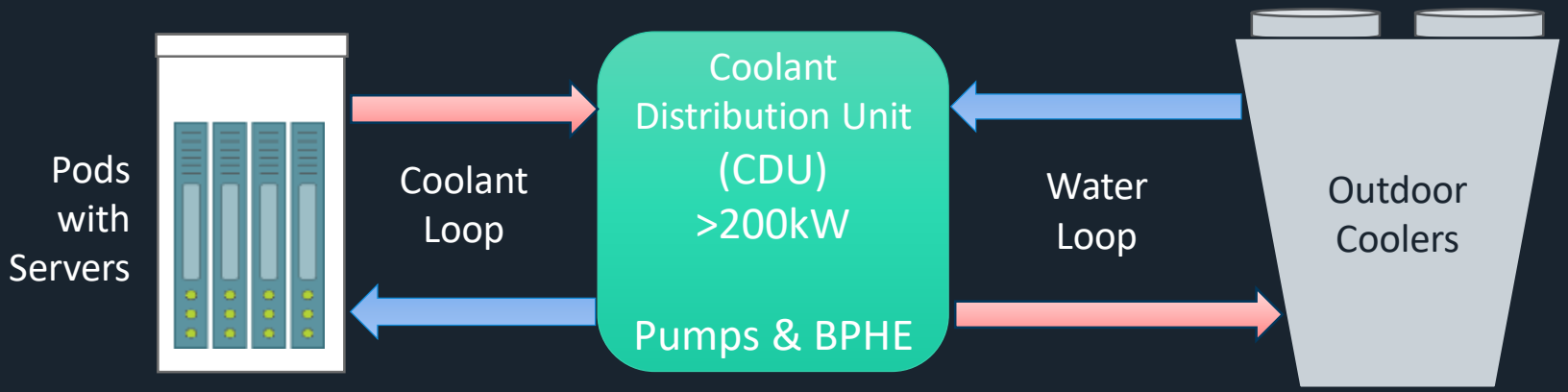
Immersion Cooling Overview



Working principle:

- Coolant circulation moves heat from servers to a heat exchanger and further to water loop.
- System can be configured to accept chilled water from existing facilities or Dry / Adiabatic coolers.

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Concerns Around Immersion

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Demystifying Immersion

Coolant

- Non-hazardous
- Up to 10yrs. Coolant life

- Readily Biodegradable
- Single Phase coolants typically do face any evaporative losses
- Coolant outlast 2-3 generations of hardware refresh
- End of Life – coolant upcycling / safe disposal support widely available
- Construction of equipment is per Oil & Gas Industry standards to ensure no leakage

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Demystifying Immersion

Coolant	Hardware concerns
• Non-hazardous • Up to 10yrs. Coolant life	• Immersion Ready Hardware • Retrofittable

- System Integrators offer Ready to Immerse / Retrofitted hardware solutions
- Warranty up to 5 years ensures lower concerns during typical hardware life cycle

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Demystifying Immersion

Coolant	Hardware concerns	Redundancy
• Non-hazardous • Up to 10yrs. Coolant life	• Immersion Ready Hardware • Retrofittable	• CDU's can be connected in Ring network • System more fault tolerant

- Immersion Bath are thermally stable environments
- Systems are more fault tolerant even in case of complete catastrophic failure
- CDU's & Pods can be interconnected in Ring network to ensure concurrent serviceability & higher uptime

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Demystifying Immersion

Coolant	Hardware concerns	Redundancy	Serviceability
• Non-hazardous • Up to 10yrs. Coolant life	• Immersion Ready Hardware • Retrofittable	• CDU's can be connected in Ring network • System more fault tolerant	• Open bath configuration allows easy access

- Servicing attachments for the Pods & Server hoisting
- Allows for quick access to Servers

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Demystifying Immersion

Coolant	Hardware concerns	Redundancy	Serviceability	Power Distribution
• Non-hazardous • Up to 10yrs. Coolant life	• Immersion Ready Hardware • Retrofittable	• CDU's can be connected in Ring network • System more fault tolerant	• Open bath configuration allows easy access	• In Pod Busbars solutions bring more flexibility to deployment

- Customized solutions per requirements
- Immersed bus bar solutions allow for larger deployments up to 200kW / pod

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Demystifying Immersion

Coolant	Hardware concerns	Redundancy	Serviceability	Power Distribution	Cost Impact
• Non-hazardous • Up to 10yrs. Coolant life	• Immersion Ready Hardware • Retrofittable	• CDU's can be connected in Ring network • System more fault tolerant	• Open bath configuration allows easy access	• In Pod Busbars solutions bring more flexibility to deployment	• Cheaper / comparable costs in majority cases

- Watt to Watt basis – Immersion is cost effective compared to Air cooled other technologies
- Triggers optimization of peripheral infrastructure across DC – UPS sizing, Electrical switchgear, Gensets etc.

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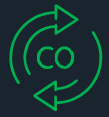
Why Immersion Cooling

Future Proofing DC

Ensures scalability and adaptability to demanding technological requirements such as **AI** and **HPC**



Sustainable Solution

Reduces carbon footprint by lowering energy consumption

Space Optimization

Allows for compact server arrangements, maximizing floor space utilization

Up to 200kW/Pod

Energy Efficient

~ PUE < 1.05

Climate Adaptability

Ensures consistent performance even in harsh & extreme climates of any region

Low OPEX

~Up to 95% reduction in cooling power

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Refroid Cooling Solutions

Portfolio snapshot

EcoPod

- 50kW to 200kW heat dissipation
- 24U and 42U rack form factor
- Easy Scalability

MiniPod

- Rapid deployable solution
- Edge ready Option
- 6kW heat dissipation with 8U rack space

ISOPod

- Containerized Data Centre Solution.
- Modular and Scalable
- Customized as per the User requirement
- Plug and Play Solution
- High Computing Power density per Sq. ft.

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Collaborating with Refroid

Customizable Solutions

Refroid's modular, rack-level cooling systems can be easily deployed in any data center.

Adaptable Controls

Self adapting algorithms that dynamically adjust the cooling process for optimal efficiency.

Coolant Flexibility

Refroid’s systems are compatible with wide range of coolants from Global & Domestic offerings

Reliability Focus

Redundant systems and fail-safe mechanisms ensure high fault-tolerance and better uptime.

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We are ready for your requirements

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