Risk and Reward: How to mitigate liquid cooling concerns in advanced data centers
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Problem Statement:
Whitepaper documenting detection and intervention techniques will help grow industry awareness and minimize risk in systems.
Risk Concerns

- Liquid may already exist in the data center but bringing it inside IT equipment causes customer concern
- Leak Detection, Mitigation and Intervention are important to data centers
- A Risk Analysis needs to be performed for a liquid cooled system including the risks around leaks
- Our whitepaper on Leak Detection, Mitigation and Intervention addresses these concerns by describing industry best practices with pros and cons of each technology
Definitions

- **Detection**: detecting the leak event
- **Mitigation**: preventing the likelihood of the leak event
- **Intervention**: acting on the leak event
- **Conductive Fluid**: Coolant fluids that conduct electric current where both negative and positive particles are present.
- **Non-Conductive Fluids**: Coolant fluids that are not capable of conducting electric current. Also known as di-electric fluid.
- And many more included in the whitepaper
Leak Detection and Mitigation

Examples of indirect detection include:
• Monitor changes in differential liquid coolant pressure over time
• Monitor changes in liquid coolant level in reservoir
• Optical sensor that monitor liquid coolant build up in target areas
• Turbidity sensors for refrigerant

Examples of direct detection include:
• Cable sensors
• Point leak detection sensors
Leak Intervention

- An intervention can be manual or automated based on a variety of detection methods.
- A manual intervention would occur when a notification went out to facility personnel that a leak has been detected.
- During an example automatic electrical intervention, a notification is sent of a leak event and an automatic electrical de-energization is done of the IT equipment.
- Optical sensors can be integrated into the ITE BMC for simplicity of installation and automatic reaction.
Dielectric Design Considerations

Due to non-conductive property, direct leak detection is limited to:

• Reservoir level
• Optical Sensors

Indirect leak detection can be achieved by:

• Changes in differential pressure over time
• Heat rejection capacity

See section 5.3 of Immersion Requirements Document for other design considerations.
Rewards

INCREASED RACK DENSITY
Enable 100% utilization of rack and data center spaces

OPTIMIZED PERFORMANCE
Facilitate peak performance for higher powered processors

MAXIMUM ENERGY EFFICIENCY
Significantly reduce total data center energy consumed and OpEx

OPEN POSSIBILITIES.
Key Learnings

- The best method for preventing a leak comes from engineering design principles and rigorous production testing.
- Installation and commissioning best practices play a significant role preventing leaks in equipment assembled on prem.
- The technology chosen to detect and mitigate leaks should be determined by the facilities fluid type, risk analysis, cost analysis and operation impact study.
- Liquid cooling is safe and reliable with many installations worldwide since the 1960s.
Call to Action

• Join the ACS Cold plate Calls: ACS Cold Plate » Open Compute Project

Additional Resources:
• Integration and Logistics Whitepaper: ocp-liquid-cooling-integration-and-logistics-white-paper-revision-1-0-1-pdf
• Immersion Requirements Document: ocp-acs-immersion-requirements-specification-1-pdf
Open Discussion