Service Oriented Immersion Cooling with 48V Power Solution

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Purpose

• In order to meet the demand of the fast-growing power consumption with energy saving

• Contribute the specifications and send a message to the ecosystem vendors to increase the interest to develop the commodities and components together for immersion cooling, such as redefine life/reliability, specific components…etc
Contents

- Existing Air Cooling Solution
- Immersion Cooling Solution
- Immersion Cooling Development
- Wiwynn 48V Immersion Cooling Solution
- Tank Management
- Investigation
Existing Air Cooling Solutions

Requirement

Cooling Airflow
- Fan Lower Ambient Temp.

Cold Water
- Cold Water for ASICs

Space
- Heatsink Radiator

Cooling Capability
- ASICs Power
- Traditional Heat Sink
- Enhanced Volume Air Cooling
- Loop Heat Pipe & Thermosiphon
- Water Assisted Air Cooling
- Rack Level Liquid Cooling
Existing Air Cooling Solutions

- Rack Level Liquid Cooling
- Enhanced Volume Air Cooling
- Loop Heat Pipe & Thermosiphon
- Water Assisted Air Cooling
- Traditional Heat Sink

Cooling Capability

ASICS Power

Immersion Cooling Solution with 48V

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Immersion Cooling

- Low Airflow Requirement
- Higher Ambient Temp.
- Higher Density
- Warm Water Cooling

Energy Saving

PUE

Air: 1.2~2
Immersion: 1.02~1.08

35°C
Immersion Cooling Development

~2017 ~2018 ~2019 ~2020 ~2021~

Prove
Immersion Cooling

2018 Optimize Tank for Immersion Cooling

2019 High Power Tank for Existing Board

2020 Tank Next Gen

2021~ Tank with Optimized Board

POC with Existing Board

Q2, 2018

POC Tioga Pass

Benchmarking Olympus

Q4, 2018

High Power Tank for Existing Board

Q2, 2019

48V Tank Tioga Pass 60 kW

Q2 2020

Tank with Optimized Board

White Papers

Q3, 2019

Specifications

Q4, 2019

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Wiwynn Seawolf Tank
48V Immersion Cooling Solution

A Service Oriented Immersion Cooling Tank with 48V Power Solution

Solution Features

<table>
<thead>
<tr>
<th>Dimension</th>
<th>1200mm(L) x 1200mm(W) x 1250mm(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Capability</td>
<td>60kW</td>
</tr>
<tr>
<td>Server Quantity</td>
<td>100 Nodes</td>
</tr>
<tr>
<td>Mother Board</td>
<td>OCP Server Board (Tioga Pass)</td>
</tr>
<tr>
<td>Power Input for Server</td>
<td>48 VDC by Bus Bar</td>
</tr>
<tr>
<td>Switch</td>
<td>4 Switches</td>
</tr>
</tbody>
</table>
Cartridge Design

- Two boards face to face in one cartridge < 1.5U
- No modification for MB
Board and Switch Matrix

Tank Top View

4 Switches

10 Cartridges * 5 Column
100 Boards

Front
Power Solution

Two 48V power shelves to support 60 kW (Optional)

Power bus bar for power delivery

Separated power deliver by 5 branches for each cartridge column
Active Condenser

- Trigger forced convection to direct vapor to contact the condenser during board maintenance.
Monitoring and Safety

- Temperature Sensors
  - Fluid/Vapor/Water
- Moisture Sensors
- Dehumidification
- Liquid Lever Sensor
- Pressure Sensor
- Bellows System
- Filter System & Pump
- Power Shelf & Power Meter

Monitoring

Reporting

Warning

Critical

Control

Safety

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Tank Management

Tank Controller

- Water Valve
  - Water Temperature
  - Liquid Temperature
  - Tank Pressure
  - System Power
  - Top Lid Detector

- Relief Valve
  - Tank Pressure
  - Top Lid Detector

- Active Condenser
  - Water Temperature
  - Liquid Temperature
  - Tank Pressure
  - Top Lid Detector

- Power Shelf
  - Liquid Level
  - Tank Pressure

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Tank Management Board

- Tank Cooling Control
- Power Management
- Node Management
- Interfaces

Redfish-based API

Web-based GUI

Goal:
Compatible with OCP Profiles
Friendly to the Existing Data Center

Tank Management Board

Tank Controller

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Tank Management

Touch Panel

Friendly User Interface

Wireless Remote Control

- Monitoring
- Reporting
- Warning
- Critical
- Control

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48V Immersion Cooling Solution

- Two Phase Immersion Cooling for Excellent PUE
- High Efficiency DC 48V Power Delivery System
- Advanced Condenser System for Low Vapor Leakage
- Tool-less Design, Automation, and Friendly UI with Easy Serviceability
- Tank Management for Safety
- Leverage Large Scale Deployed and Field Proven OCP Server Board
Design and Investigation

- Tank Management Board
- Cost Reduction
- Optimized Server Board

- Lower Emission Rate
- Serviceability
# Tank Specification

<table>
<thead>
<tr>
<th>Density</th>
<th></th>
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<tbody>
<tr>
<td>Compute density</td>
<td>42 kW/m², 35°C</td>
</tr>
<tr>
<td>Solution density</td>
<td>42 kW/m², 35°C</td>
</tr>
<tr>
<td>Solution footprint</td>
<td>21 kW/m², 35°C</td>
</tr>
<tr>
<td>ASHRAE density (W3)</td>
<td>24 kW/m², 32°C</td>
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<tr>
<td>Density per fluorocarbon volume</td>
<td>120 kW/m³</td>
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<table>
<thead>
<tr>
<th>Construction</th>
<th></th>
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<tbody>
<tr>
<td>Static load (Bare solution)</td>
<td>5.9 kN/m²</td>
</tr>
<tr>
<td>Static load (Full solution)</td>
<td>11.8 kN/m²</td>
</tr>
<tr>
<td>Static load (IT solution, Max)</td>
<td>14.8 kN/m²</td>
</tr>
<tr>
<td>Height clearance</td>
<td>2530 mm</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Efficiency</th>
<th></th>
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<tbody>
<tr>
<td>Non-IT power/kW</td>
<td>0 W</td>
</tr>
<tr>
<td>Non-IT power overhead</td>
<td>70 W</td>
</tr>
<tr>
<td>Thermal loss to air</td>
<td>TBU</td>
</tr>
<tr>
<td>Temperature delta (Min/max)</td>
<td>TBU</td>
</tr>
<tr>
<td>Highest cooling temp</td>
<td>60°C</td>
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</table>

<table>
<thead>
<tr>
<th>IT</th>
<th></th>
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<tbody>
<tr>
<td>IT chassis type</td>
<td>Immersion-optimized</td>
</tr>
<tr>
<td>Max chassis size</td>
<td>7.7”</td>
</tr>
<tr>
<td>Chassis capacity</td>
<td>0.75 U</td>
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<tr>
<td>IT brand compatibility</td>
<td>OCP/Wiwynn</td>
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