

Cooling AI Servers

AI represents the next generation of innovative technology and is poised to revolutionize core operations in nearly every industry. AI systems require substantial power, which generates significant waste heat. To maximize efficiency and achieve everything AI promises, operators of AI data centers need to optimize cooling systems for AI servers. Boyd creates solutions for all types of cooling methods and can help enterprise organizations enhance cooling in data center environments.

Use this resource to explore different cooling methods and how we can deliver more effective cooling for AI systems, including the pros and cons of each method in relation to AI systems.

Extreme Air Cooling

The most well-known cooling method, air cooled systems, have evolved over the years but the basic concept is the same: heat is removed from electronics systems as cold air is blown in and around hardware. Air cooled systems range from natural convection heat sinks to advanced air flow management systems utilizing custom fans and blowers. Extreme air cooling leverages integrated, two-phase components like heat pipes, vapor chambers, or thermosiphons that boost the efficiency of air cooling in a defined volume.

Pros:

- Cost effective
- Easy to install, maintain and troubleshoot
- Widely available

Cons:

- Limited cooling capacity
- Noise and vibration health and safety concern
- Energy inefficiencies and sustainability
- Challenging to scale as AI systems become more powerful



COMPONENTS INCLUDE:

- Heat sinks
- Integrated heat sinks and two-phase cooling
- Remote heat sinks
- Air baffles
- Fans and heat sinks
- Air filters
- Gaskets
- Air ducting
- Thermal insulation
- Adhesives
- EMI shielding
- Adhesive labeling
- Electrical insulation
- Thermal interface materials

Liquid Cooling

Liquid cooling systems are now prevalent across most advanced performance industries as the most compact, sustainable and efficient method to cool high-density heat loads. These systems transfer and dissipate extreme heat at a high rate, enabling high compute performance and power density levels that cannot be solved by traditional air-cooled systems.



Pros:

- Highly efficient heat dissipation
- Higher cooling capacity than air cooling
- Precise temperature control
- Quieter than air cooled systems for a safer data center
- Highly energy efficient and sustainable
- Easier to scale
- Lower total cost of operation

Cons:

- Higher start up or build out costs than air cooled systems
- Requires infrastructure upgrade to retrofit existing data centers
- More rigorous maintenance and service requirements

COMPONENTS INCLUDE:

- Liquid cold plates
- Coolant distribution units
- Liquid loops
- Manifolds with quick disconnects
- Thermal interface materials
- Gaskets
- EMI shielding
- Seals
- Thermal insulation

Immersion Cooling

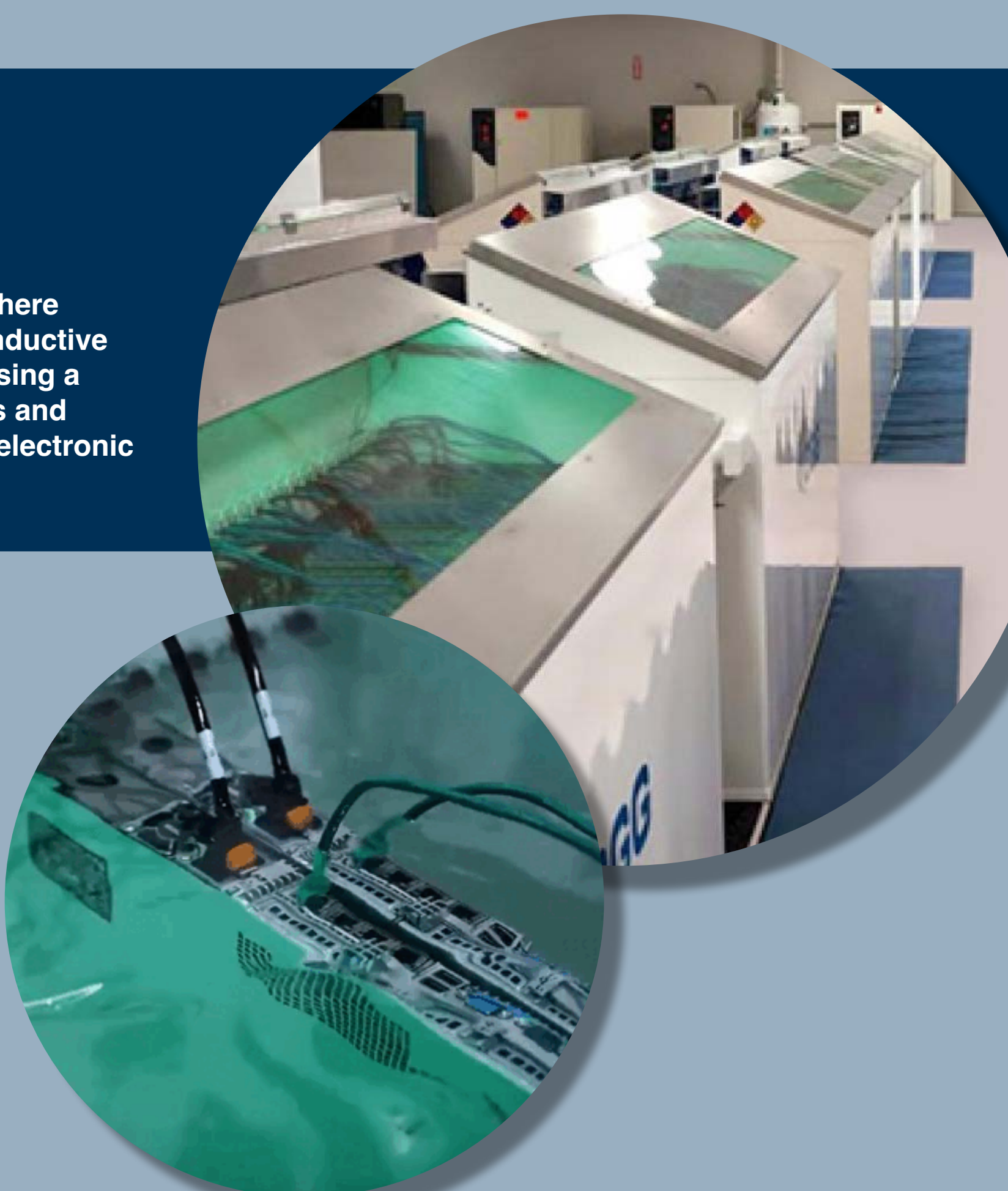
Immersion cooling is an innovative thermal management solution where high heat flux components are submerged in a tank of thermally conductive dielectric liquid and heat is transferred away from the heat source using a boiler plate. It enables greater reliability and longer product lifetimes and boosts cooling capacity to enable increased processing power and electronic density compared to other cooling technologies.

Pros:

- Highly efficient heat dissipation
- Can handle the highest of heat loads
- Precise temperature control
- Much more energy efficient
- More environmentally friendly
- Longevity, due to constant, even cooling for all components

Cons:

- Upfront costs are higher than air and liquid cooling systems
- Complex, requiring a high level of expertise in fluid dynamics, plumbing and maintenance
- Careful maintenance is essential
- Compatibility; not all AI servers are designed for immersion cooling



COMPONENTS INCLUDE:

- Dielectric fluid
- Phase change materials
- Circuit boards
- Heat exchangers
- Adhesive labels
- Seals
- Gaskets
- Adhesives

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For more information about cooling systems and which is right for you, contact the experts at Boyd.

Contact us to start your next project today.

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