Liquid-cooled heat exchanger



Overview

Liquid-cooled heat exchanger (liquid-liquid) | chillers Technical. PDF fileLiquid cooling heat exchanger unitsThe liquid flows through the heat exchanger.

Key Takeaways

A liquid-cooled heat exchanger transfers heat between two liquid streams without mixing them, optimizing thermal management in industrial and high-performance applications.

Overview

A liquid-cooled heat exchanger is a device designed to efficiently transfer thermal energy from a hot liquid to a cooler liquid while keeping the fluids separate, preventing contamination and maintaining process integrity. These systems are essential in industries such as chemical processing, pharmaceuticals, food production, petrochemicals, energy, and high-performance computing.

Mechanism and Design

Liquid heat exchangers operate by absorbing heat from the hot liquid, conducting it through a solid medium, and rejecting it into the cooler liquid. Common design features include: Counterflow configuration, where hot and cold liquids flow in opposite directions to maximize heat transfer efficiency. Brazed plate structures, which allow compact, high-efficiency heat exchange with materials like copper, stainless steel, or nickel for corrosion resistance.

Tube-fin or flat-tube designs, which increase surface area and enhance thermal performance without enlarging the system footprint.

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Types of Liquid-

Cooled Heat Exchangers

Plate Heat Exchangers – Compact, efficient, and suitable for low to medium pressures; ideal for water, glycol, or light solvents.

Shell-and-

Tube Heat Exchangers – Robust, suitable for high-pressure or high-viscosity fluids; widely used in chemical and energy industries. Spiral Heat Exchangers – Provide uniform flow and are resistant to fouling, suitable for viscous or particle-laden fluids. Brazed Plate Heat Exchangers – High thermal efficiency, compact, and often used in electronics cooling or precision applications.

Additive Manufactured Heat Exchangers – Customizable, lightweight, and optimized for complex fluid paths, improving heat transfer and reducing pressure loss.

Applications

Industrial Processes: Temperature control in chemical reactions, oil cooling, and process fluid heating.

Data Centers and A

I Systems: Direct-to-chip cooling for GPUs and AI accelerators, using modular liquid-to-air or liquid-to-liquid heat exchanger units to maintain safe operating temperatures. Hydraulic and Fuel Systems: Oil-to-water or fuel-to-coolant heat transfer for lubrication and temperature stabilization.

Design Considerations

Fluid Properties: Viscosity, fouling tendency, and chemical compatibility determine the choice of heat exchanger type. Pressure and Flow Rates: High-pressure applications may require shell-and-tube or tubular designs, while low-pressure systems can use gasketed plate exchangers. Thermal Efficiency: Optimized through counterflow arrangements, increased surface area, and precise flow path design.

Maintenance and Cleaning: Designs with wide free passages or modular components facilitate cleaning and reduce downtime.

Advantages

Efficient heat transfer in compact spaces. Precise temperature control for sensitive processes. Flexibility to handle corrosive, viscous, or reactive liquids.

Reduced energy consumption and improved system reliability. Liquid-cooled heat exchangers are critical for modern thermal management, offering high efficiency, durability, and adaptability across diverse industrial and technological applications.

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Article Content

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Liquid cooling heat exchanger units

The liquid flows through the heat exchanger, where the heat is released and carried away by chilled air from the cold aisle. The liquid coolant is then recirculated, maintaining a continuous cooling loop.

Liquid-Liquid Heat Exchangers

Liquid-liquid heat exchangers are critical for precise temperature control and efficient heat transfer in demanding applications. They support coolant-to-oil heat

Liquid-to-liquid heat exchanger • BOIXAC

A liquid-liquid heat exchanger is an industrial piece of equipment that transfers thermal energy between two liquid streams without mixing them, controlling

Heat Exchangers: Types, Equations & How They Work

Learn how heat exchangers work, including common types, flow arrangements, LMTD, NTU, fouling, design tradeoffs, and real engineering

Liquid Cooled Heat Exchangers: A Comprehensive Overview

Among the various methods employed, liquid cooled heat exchangers stand out for their effectiveness and versatility. These devices facilitate the transfer of heat from one fluid to another, with one of the

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The best heat transfer fluids for liquid cooling

The heat exchanger transfers heat between the liquid coolant and the system''s refrigerant gas. The refrigerant''s temperature must be lower than the

Liquid Series

Liquid Series thermoelectric cooler assemblies are used to cool or heat a coolant flowing through a liquid heat exchanger. The heat exchanger is designed for

How Nvidia''s New Cooling Technology Could Solve the AI Energy

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Nvidia''s new liquid-cooling technology could slash data center water usage and reduce cooling energy costs. Here''s what the Rubin platform means for AI, hyperscalers, and investors.

Schneider Electric Unveils Liquid Cooling Portfolio with Motivair ...

Motivair by Schneider Electric''s liquid and air-cooled solutions include megawatt-class Coolant Distribution Units (CDUs), ChilledDoor® rear door heat exchangers, and Dynamic® Cold

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Cooling the AI revolution: Technical advances in data

Modern high-performance chips generate heat levels that exceed the capabilities of traditional air cooling. This article examines the technical evolution

How do heat exchangers work?

An easy-to-understand introduction to how a heat exchanger passes heat energy from one fluid (liquid or gas) to another.

AWS builds new cooling system for Nvidia AI GPUs

AWS''s development of the In-Row Heat Exchanger follows a decades-long progression in cooling technology necessitated by increasingly powerful processors.

Data Center Heat Exchangers Market worth $14.40 billion by 2032 ...

According to MarketsandMarkets™, "Data Center Heat Exchangers Market by Type (Air-to-Air, Liquid-to-Liquid, Liquid-to-Air, Refrigerant-Based), Cooling Technology, Application, Data Center

Cold plate heat exchanger | Eaton

Cold plates and heat exchangers for liquid cooling systems Cold plates and heat exchangers define thermal performance in liquid cooling systems. Learn how design, cost and sizing decisions shape

Liquid Cooling Retrofits for AI Data Centers: What Is Deployable in ...

Liquid cooling retrofits are becoming a core question for data center owners as AI racks exceed conventional air-cooling limits. This post explains the deployable retrofit options in 2026,

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