Increased energy efficiency in data center cooling systems with precise temperature control

Benefits at a glance

- Prevention of server overheating
- Lower operational costs
- Improved overall energy efficiency
- Compliance with industry standards and regulations

Process conditions

- Different pipe sizes across the data center
- Chiller water / water/glycol mixture

The global demand for data centers is rapidly increasing due to the rise of AI and machine learning, which heavily rely on GPU chips that require up to 10 times more cooling compared to CPU chips. Additionally, the shift to cloud computing and the widespread adoption of digital solutions across various industries are driving this growth. The push for more energy-efficient and sustainable data centers further necessitates high-performance, large-scale data centers to manage and process substantial amounts of data in real-time.

Energy costs are a major concern in data center cooling systems, with cooling accounting for up to 40% of total energy consumption. Efficient temperature measurement and control are crucial to minimizing these costs and ensuring the smooth operation of servers and equipment. Accurate temperature data helps prevent overheating, optimize cooling systems, and reduce energy usage, thereby maintaining equipment reliability and lowering operational costs.

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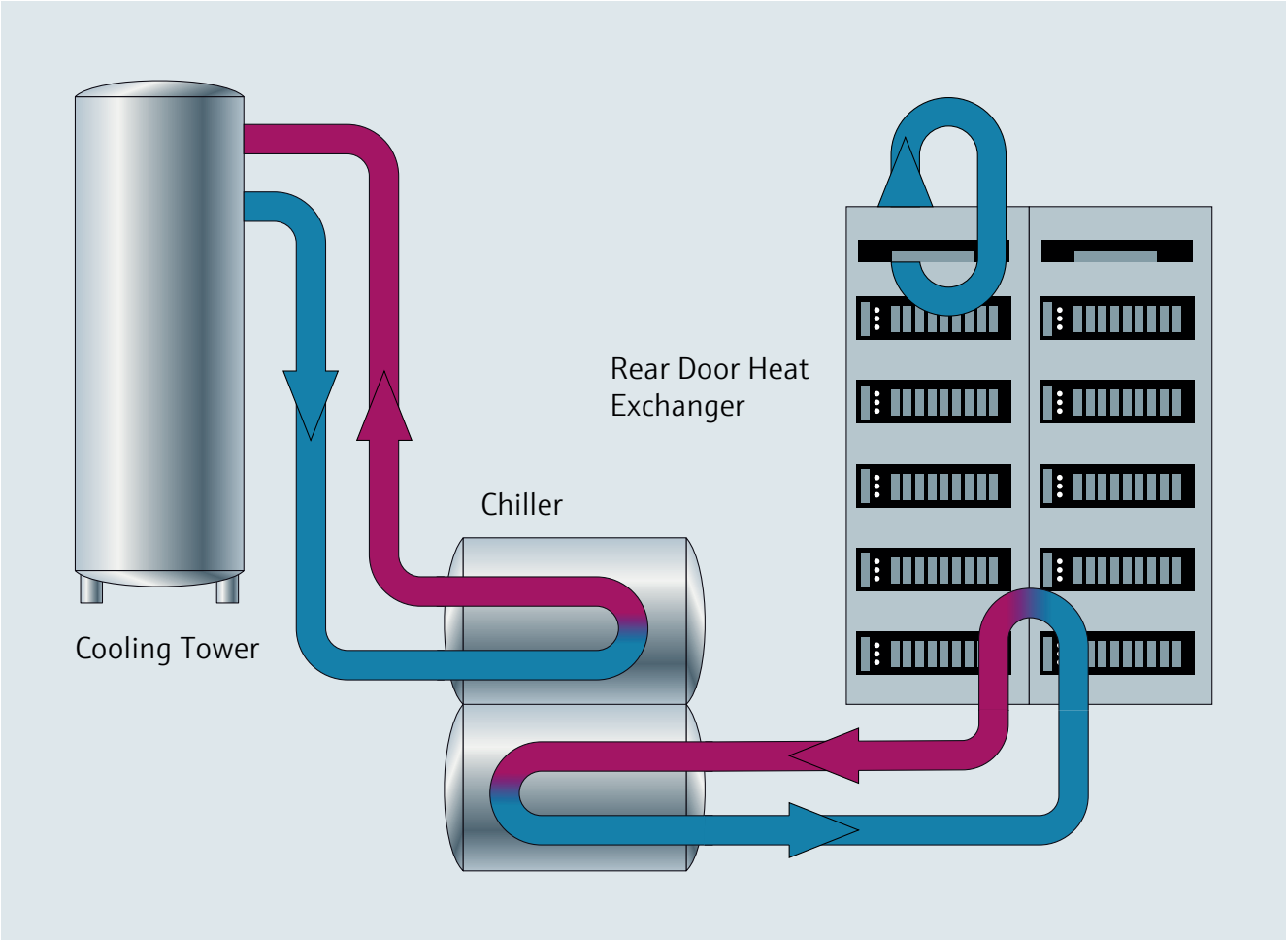

Data center cooling process

The challenge Today's data center cooling applications predominantly use advanced technologies such as liquid cooling, moving away from older methods like air cooling. In liquid cooling applications, maintaining consistent and efficient cooling across large, complex systems can be challenging. Variations in air and water flow, as well as changes in server heat output, can lead to areas being over- or under-cooled, causing inefficiency and potential overheating. Without consistent real-time data, cooling system performance can go unnoticed until failure or inefficiency causes significant issues.

Placing temperature sensors in optimal locations is also challenging due to the complex network of pipes and components. Expert knowledge is required to ensure sensors are accessible for maintenance and calibration without disrupting operations. Additionally, the liquid coolant can cause corrosion or contamination of temperature sensors over time, affecting their accuracy and lifespan. Selecting high-quality materials compatible with the coolant is essential to mitigate these effects.

Furthermore, liquid cooling systems require temperature sensors with fast response times to detect and react to rapid changes in temperature. Slow response times can lead to delayed adjustments in the cooling system, potentially causing overheating. These challenges highlight the importance of precise and reliable temperature measurement in maintaining efficient and effective cooling in data centers. Another challenge lies in the use of 2-wire RTD sensors (Resistance Temperature Detectors) in HVAC equipment. These sensors are popular due to their cost-effectiveness but are susceptible to inaccuracies caused by lead-wire resistance. This resistance can introduce errors in temperature measurements, especially over long distances or varying temperatures, leading to potential failures.

Our solution Endress+Hauser thermometers all use 3-wire and 4-wire RTD sensors. The 3-wire RTD adds an extra wire to help compensate for lead-wire resistance, while the 4-wire RTD completely eliminates the effect of lead-wire resistance. These advanced RTDs ensure reliable and repeatable measurements over time compared to the 2-wire RTDs used in HVAC equipment. This improvement contributes to better performance and optimization of data centers.

Additionally, Endress+Hauser has documented Mean Time Between Failure (MTBF) information to compare 3-wire / 4-wire RTDs with 2-wire RTDs used in HVAC equipment. MTBF represents the average time between failures of a system or component, with higher values indicating greater reliability and longer operational life.

iTHERM ModuLine TM152 (imperial) / TM151 (metric) invasive thermometer with barstock thermowell is the right choice compared to a hygienic thermowell or a direct contact sensor, as it is the most robust and reliable option. With iTHERM QuickNeck, the innovative divisible extension neck with quick release, access to the temperature insert and calibration is quick and easy. It is equipped with iTEMP TMT82, a temperature head transmitter with 4-20 mA HART communication signal. This transmitter has two universal sensor inputs, allowing the measurement to switch to the alternative sensor if one of the sensors fails.

The remotely installed displays RIA14, RIA45 and RIA15 contribute to energy cost management by providing real-time data and alerts. They allow data center operators or maintenance personnel to monitor temperature data in real-time from a centralized location, enabling proactive maintenance and adjustments to the cooling system. This can be especially useful in large data centers where the cooling skid might be located in a different area.

Result Endress+Hauser instruments reliably monitor and display the temperature of the liquid coolant in data center cooling skids. This accurate measurement helps maintain the desired temperature range for servers, preventing over-heating and potential equipment failure. With data center downtime costing an average of a high six-figure sum per second down, maintaining optimal temperatures is critical to business continuity.

With the large Endress+Hauser portfolio of thermometers and temperature transmitters, any common analog or digital communication protocol can be covered. Through our customizable engineered temperature solutions, we can offer solutions for virtually any installation.

The Endress+Hauser global production network ensures that we can deliver even the largest quantities on time. We supply our customers from plants in Europe, Asia and America – from the region, for the region.

iTHERM ModuLine TM152 (imperial) / TM151 (metric)

iTHERM QuickNeck

iTEMP TMT82

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