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## FlowCon Topic Letter

### Best Practice – Data Centers and how to overcome Key Challenges

Data centers are no longer niche technical facilities. They are core for everything from AI and cloud computing to healthcare, finance, and industrial automation. As computing density increases, so does the pressure on the cooling system. Therefore, cooling is today considered critical infrastructure. And while much attention is paid to GPU, CDU and rack design above the floor, long-term stability, efficiency, and sustainability are determined below the floor in the hydronic system.

This FlowCon Topic Letter focuses on the key challenges facing modern data centers: low  $\Delta T$ , rising energy costs, installation constraints, and sustainability compliance. It also outlines how an effective hydronic control strategy can make a measurable difference.

#### **The Core Areas: Efficiency, Complexity and Compliance**

Across global data center projects, three recurring challenges dominate conversations with designers, contractors, and operators.

The first is **low  $\Delta T$  syndrome**. When the design temperature difference between supply and return water collapses, cooling efficiency disappears with it. Pumps work harder, chillers operate inefficiently, and energy consumption rises without delivering more cooling capacity.

The second is **installation and operational complexity**. In data centers, space is limited, systems are dense and expansion is inevitable. Traditional solutions often leave no room for flexibility, serviceability, or future growth.

The third is **sustainability and compliance**. Today, data centers are measured and benchmarked on energy use and carbon footprint. Efficiency and impact must be documented, and solutions should support both current and future certification requirements.

These challenges are not independent. They are all rooted in hydronic design and control.

**Tip: Choose HVAC valve solutions which are pressure independent, flexible and hold documented LCA-data. This will help you overcome key challenges**

#### **Why Cooling Efficiency Matters**

Cooling alone can account for up to **40% of total data center energy consumption**<sup>1</sup>. Any inefficiency in the cooling loop directly affects operating costs, PUE, and CO<sub>2</sub> emissions. Improving cooling efficiency is therefore one of the most effective ways to reduce total energy use while protecting IT equipment. The key is not simply lowering temperatures but ensuring that cooling capacity is used optimally - which requires stable flow, good control and correctly maintained  $\Delta T$ .

A stable high  $\Delta T$  indicates that cooling energy is transferred efficiently from the HVAC system to the IT equipment. A low  $\Delta T$  is a clear sign of hydraulic imbalance, over-pumping, or lack of control. If low  $\Delta T$  occurs, this can be detected with correct placement of sensors, thermometers, and pressure test points and monitoring will make  $\Delta T$  deviations

<sup>1</sup> <https://www.energy.gov/articles/doe-announces-40-million-more-efficient-cooling-data-centers>

become visible early. Correcting low  $\Delta T$ , however, requires more than monitoring and measurement. It requires **active flow control**.

### **Going for Active Control and Flexibility**

Pressure independent control valves, PICVs, form the foundation of stable hydronic systems in data centers' HVAC cooling system. By maintaining a constant flow regardless of pressure fluctuations, PICVs eliminate overflow and support stable  $\Delta T$ . The result is predictable cooling capacity, lower pump speeds, reduced energy consumption, and long-term system stability - even as loads change, density increases, and future expansions are implemented. Taking this further,  $\Delta T$  control and pressure independent energy valves actively regulate flow based on temperature feedback. Flow is adjusted continuously to ensure that coils operate at their intended performance point.

And correct controlled flow is a prerequisite for meaningful optimization. Without it, control strategies, energy calculations, and sustainability targets cannot be reliably achieved. FlowCon focuses on securing stability at system level - in the day-to-day operation - where efficiency is either delivered or lost.

Adding flexibility to the equation gives an extra level of user-friendliness and easy project adaptation. Flexibility is to be understood to the widest extent possible: Flexibility in valve design with more pipe sizes possible for each valve size. Flexibility during installation with compact PICV designs, that are not limited in orientation or require additional straight pipe-work to work properly. Flexibility during operation where you can adjust flow adapting to new requirements. And Flexibility during maintenance is inherent with an insert based PICV solution; adding sectional isolation enables service and maintenance without shutting down critical systems. To summarize, flexibility mitigates risk, increases uptime and reduces lifetime cost.

It is a clear recommendation to consider control and flexibility when selecting your PICVs.

### **Engineered for Efficiency, Documented for Sustainability**

PUE remains an important benchmark for data centers, but it does not give the full picture. True efficiency goes beyond PUE and comes from viewing the data center as a connected ecosystem, where IT load, cooling, pumping, energy sourcing and heat excess is integrated with the immediate surroundings. This will show the real environmental impact.

Energy efficiency and sustainability must be engineered into every valve and documented:

- Low pressure loss reduces pump energy
- Pressure independent control prevents overflow
- Durable materials extend product life
- Insert solution facilitates easy serviceability
- Clever design minimizes material use and packaging
- Environmental Product Declarations, EPDs, provide verified LCA-data to support certifications such as LEED and BREEAM.

Sustainability is no longer about intent. It is about traceable performance and verified documentation and a commitment to the planet to consider and choose ideal valve solutions.

### **Need more Information....?**

Data centers will continue to grow, loads will continue to increase, and efficiency targets will tighten. At FlowCon, our goal is not just to supply components, but to be your data center PICV partner. We work alongside you to help you select the proper solution that meets project-specific performance needs and compliance requirements.

For expert advice on pressure independent cooling performance, flexible valve solutions and documented environmental impact matching your data center project, contact Nickolei Kroman, OEM Business Development Manager at FlowCon. Together with the entire FlowCon team, Nickolei can help you unlock the full potential of your cooling infrastructure, today and for the future.

<https://flowcon.com/about-flowcon/contact-us>