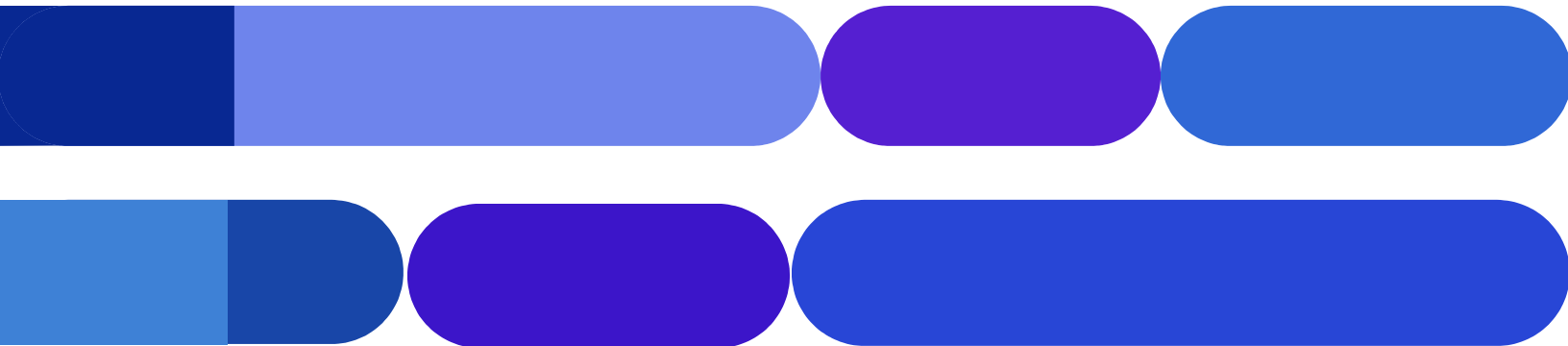




# Sustainability and The Criticality of Valve Selection in Data Centre Cooling Systems.

Leveraging Innovation for a Sustainable tomorrow



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# 01

## Executive Summary



Valve failure in data centres, particularly in cooling system configurations, can lead to critical operational disruption. These failures often manifest as temperature fluctuations and asymmetrical fluid flows which lead to overheating - resulting in downtime. Cooling systems are at the heart of data centre operations and account for a significant portion of total energy consumption. Appropriate valve selection coupled with effect valve management regimes are crucial for operational continuity and operational stability and critical in the prevention of expensive interruptions.

By leveraging innovative technologies, design engineers may prevent or significantly reduce the risk of expensive system failures. A key component of system design, particularly during the feasibility and scoping phase of any project, is the identification and selection of appropriate valve technologies. By remaining cognisant of market developments and innovations, the design engineer may avail her/himself of the most appropriate solutions.

### Introduction

The removal of heat is one of the most important yet least understood of critical data centre operations. The adoption of AI has caused a significant increase in energy consumption. Liquid cooling systems emerge as the go to solution , yet this is problematic as the environmental impact draws attention of stakeholders such as local communities, licenced water operators and regulators. The clarion call for Design Engineers to demonstrate attention to these issues, must be reflected throughout the design, build and operations phases of all projects.





# 02

## Global Water Crisis



- The impact of climate change raises concerns of DC operators over the water crisis in Europe. According to the EU commission 63% of land in Europe and the UK is severely impacted by drought, these data are corroborated by satellite analysis which evidences the depletion of groundwater aquifers. The UNCCD (United Nations Convention to Combat Desertification) predicts that by 2030 three quarters of the worlds population will be severely impacted by drought.
- Decisive government regulatory intervention on water usage is expected.
    - Imposing a water performance certificate for all properties
    - Increase cost of water through an ecological tax
  - In 2023 The UN Secretary General stated that a bold agenda for water management is required to stave off the adverse affects of climate change

### IMPACT OF DC LIQUID COOLING MARKET

The deployment of liquid cooling systems in Data Centres results in vast amounts of water usage. While other cooling systems offer satisfactory alternatives, liquid cooling present the most effective and efficient solution to a complex problem, albeit is a pricey one!

- According to a 2021 aqua-stat report, the average Google data centre consumed 1.7 million litres of water per day. That's equivalent to the daily needs of over 11,000 people
- It is estimated that a Data Centre uses 26 million litres of water per MW/yr. As 20% of all data centres use liquid cooling it is estimated that over 20 billion litres are used annually
- Last year 74 data centre operators and 23 associations signed the Climate Neutral Data Centre Pact (CNDCP), and committed to attempt to reduce water usage in line with its target.

Water usage in Litres for 1 MW data centre power capacity	Per Year	Per Hour
Estimate average	26.000.000	2.968



# 03

## Data Centres and Cooling

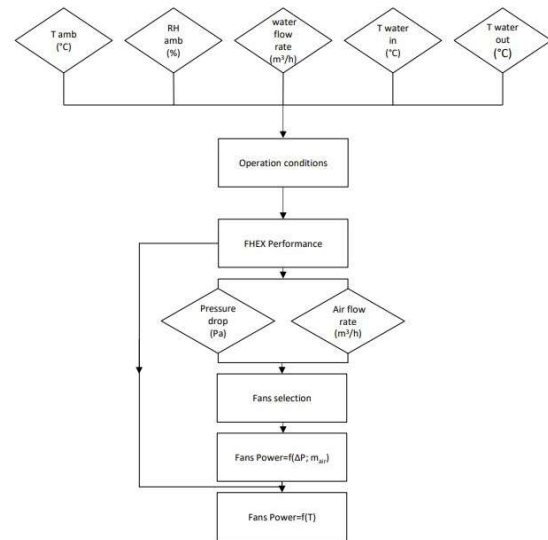


### Liquid Cooling

DC's employ advanced cooling systems to reduce risk, lower energy consumption and minimise impact on local water resources. High temperatures generated require effective temperature management. A mixture of Air Cooling (AC) and Water Cooling (WC) technologies are employed by designers to address the CDU generated heat processed by RDHX and PHEX. Parameters concerned with water monitoring, control and management are:

- Water Flow rate - typically set at 5-90 l/min monitored by flow sensor
- Pressure sensors typically with a range of 0-6 bar are positioned at inlet and outlet of each rack to determine differentials.
- Thermocouples positioned at the inlet and outlet inform on temperature differentials

### Calculating Power Consumption



Pressure sensors ranging from 3.73 - 373 bar are positioned on the AC circuit to measure any drop in pressure of the RDHXs and total pressure of the rack. Identical sensors are placed on the WC circuit to determine any drop at the CDUs location.

### Why monitor Pressure Differentials?

The presence of pressure differentials in DC cooling systems may indicate water loss. Water loss may be due to a range of factors including; cooling components, valves and wider system failure. Any change in pressure signals a potential reduction in water volume due to leakages. Such an occurrence, if unaddressed, would lead to system inefficiency, cause catastrophic equipment damage and inevitably high cost. The **Watts SOCLA anti-pollution non return valves** are designed to protect networks from backflow contamination certified to NF antipollution standards and compliant with EN 13959 and EN 1717, operating at pressures up to 16 bar and temperatures from -10°C to 100°C, manufactured with pressure differential monitoring capability.



# 04

## Valve Performance



### Non-Return Valves (NRV)

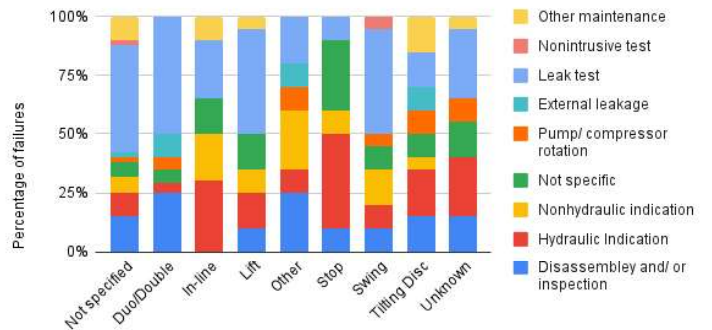
Non Return Valves are a critical component in data centre cooling systems. NRV are essential in preventing backflow by maintaining the consistent flow of coolant to crucial system infrastructure and thereby ensure efficient function. NRV's are vital for reliability and act to prevent potential damage that may be caused by a reverse flow to upstream water systems.

### ASME Independent Research

Independent research carried out by the American Society of Mechanical Engineers and Maintenance Committee Working Group on NRV's, sought to determine the optimum performance characteristics of NRV's. ASME sought to identify and determine The cause of failure, where such failure had been reported.

### Performance Characteristics

ASME - Distribution of NRV failures by valve type and discovery method



78% of NRV failures were discovered via programmatic means such as seat leakage testing. Of all identified significant failures component degradation was found to be a cause. Where discovered failures by hydraulic/non-hydraulic indication and pump compressor rotation 26% were found to go undetected prior to operational failure.

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# 05

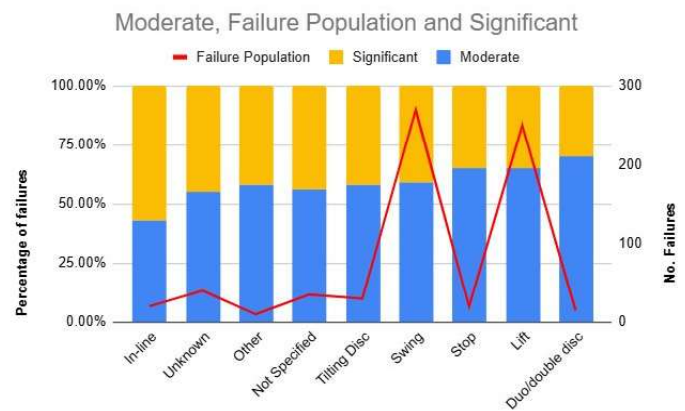
## Valve Failures



### Failure Areas

The study carried out by ASME found that the most common area of failure was related to the seating surface - due to internal leakages. In swing NRV and disc designs the hinge pin/arm areas or presence of foreign material were discovered as the main factors of failure. In tilting disc designs the hinge pin/arm area were responsible for 50% of all failures.

### Categorization of valve failures



# 06

## Areas of Degradation



The study carried out by ASME was aimed at analysing component performance. Degradation was determined by the failure of valve components rather than the impact of any failure upstream or downstream of the valve. Failure in this context should be seen in the context of the valve ability to perform to its design function. Two categories were defined by ASME:

**Moderate:** Failure to seat properly (excluding stuck open and restricted motion failures), includes moderate internal leakages, loose internal assembly -without associated problems such as stuck open.

**Significant:** Includes broken and/or detached internals, restricted motion, stuck open and stuck closed cases and where relief valves failed to meet set pressure.



# 07

## Solutions and Innovation



### Solutioning

Engineers at ASME assert that performance characteristics of NRV's vary considerably. Variation is dependent upon design and type. Since differences and variation in characteristics are often radical, the level to which environmental susceptibility will impact valve performance will differ.

While both designers and users have long based selection and decision making on assumption around the behaviour of a particular valve design performance under certain conditions, this approach was found to be risky and unsupported by the findings.

In addition, the approach taken to IST (in-service testing) practices, maintenance and probabilistic risk assessments (PRA) was found to be in need of attention as the potential to eliminate the costly risk of catastrophic failure, and/or improve the overall performance of system performance is present if these regimes are systematically deployed.

### Innovation

While attention to IST's, PRA's and system maintenance offers a reliable means of monitoring, identification and intervention, particularly in the case where a deterioration in performance is observed. A number of NRV component manufactures are leading the way through innovation.

Attention to areas of most concern, identified by the research carried out by ASME, has fuelled a iterative approach to R&D and has underpinned the development of new technologies aimed improving component functions and reliability, while offering the necessary level of risk alleviation necessary for designers and operators of DC's to reliably make informed procurement decisions.

Watts **iDROSET**<sup>®</sup> static balancing valves present an example of innovation solutioneering that presents the customer with greater levels of visibility and control. Installation of the **iDROSET**<sup>®</sup> ensures effective flow measure and efficiency system monitoring and control.



# 08

## Sustainability



### A Safe world is a More Sustainable World

The impact of climate change on local communities is a reality that industry across the globe are seeking to do their part by reducing the negative environmental impact caused by their operations.

#### Manufacturers

From the procurement of raw materials to the use of energy to produce a finished product, both supply chain and customers alike are calling for stricter adherence to the UN sustainability goals as a means to measure, reduce and control the negatives impacts that manufacturing processes may have on the environment, including people and local communities.

### Watts Hand Print

Watts is creating innovative products and smart solutions to protect, control, and conserve critical resources and is helping to educate customers to support them in reducing their footprint through use of our products.

- Invest in life cycle assessments (LCAs) to better design and manufacture with environmental impact in mind. This includes completing the following LCAs by 2025: All products in our largest facility and in our BLÜCHER facility. Two products in France One product in APMEA
- Drive greater transparency for our customers to the environmental impacts of our products through environmental product declarations (EPDs). Complete 50 EPDs by 2026.

### Our values lie at the heart of our approach to environmental governance!

At Watts, we engage in business practices that reflect our values and advance our efforts to promote an economically, socially, and environmentally sustainable future. We are committed to minimizing the impact of our global operations and supply chain on the environment, protecting the communities where we operate, and delivering innovative products and services that support our customers in doing the same.



# 09

## Conclusion



The importance of selecting the right partner that is able to support an effective a responsible procurement strategy, underpinned by effective monitoring, IST and PRA regimes, particularly in valve technologies used critical infrastructure cannot be overstated. For over 140 years Watts Water Technologies has led the way in research and design of water component technologies. Watts actively innovates in the field of Non-Return Vales, with a focus of preventing backflow and ensuring reliable system operations in Data Centres. **Contact our specialist team today for further information.**

## Reference


- Spotlight: European Data Centres. (2023). Savills Report on Operational Efficiency. Retrieved from [https://www.savills.com/research\\_articles](https://www.savills.com/research_articles).
- United Nations. (2021). FAO Global Information System on Water and Agriculture, retrieved from: <https://data.apps.fao.org/aquastat/?lang=en>.
- McElhaney, K. L. (2000). An analysis of check valve performance characteristics based on valve design.
- Casada, D.A, & Todd, M. D, (1993). A Characterisation of Check Valve Degradation and Failure Experience in the Nuclear Power Industry 1984 - 1990 Failures: NUREG/CR-5994 vol.1 Oak Ridge National Laboratory for US Nuclear Regulatory Commission.
- Watts Data Center Solutions: BAR, Socla Valpes, Microflex WATTS PRV Blucher, POWERSEAT: <https://www.watts.eu/en-gb/data-center-solutions>



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