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# [WHITE PAPER: MCV (MANUAL CONTROL VALVE)]

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## Executive Summary

The Open Compute Project Foundation (OCP) is a global organization dedicated to fostering the development and adoption of computing infrastructure, driving innovation in hardware and software design. Moreover, OCP seeks to assist organizations in harnessing the advantages of open technologies and methodologies to attain their objectives.

This document outlines the technical specifications for the Manual Control Valve (MCV) utilized in non-combustible single-phase (water/glycol) systems for liquid cooling in electronic systems. In liquid-cooled setups, fluid travels under pressure within a Technology Cooling System (TCS) fluid loop. The IT equipment loop connects to the TCS through a valve with adjustable opening rates. The MCV serves as a replacement for an automatic regulation valve used for flow distribution adjustments, overcoming certain drawbacks. Cost-effective, maintenance-free, reliable, and straightforward, the MCV is easy to adjust and doesn't require intricate filtering or the inclusion of shutoff valves for maintenance assurance. We believe this innovation holds significant potential within the Open Compute Project (OCP) Foundation's purview, offering enhancements to data center (DC) infrastructures.

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## 1. Introduction

The hydraulic circuit is crucial for the performance and efficiency of liquid-cooled systems. Therefore, the Manual Control Valve (MCV) concept holds significant potential for the Open Compute Project (OCP) community. Traditionally, ball valves or automatic regulation valves are employed for flow distribution adjustments. However, automatic regulation valves come with certain drawbacks, including the need for sophisticated filtering and shutoff valves for maintenance, and they are often bulky and expensive. In contrast, ball valves are cost-effective, maintenance-free, reliable, and simple. This is the basis for the MCV, which is built upon a standard commercial valve.

This white paper introduces the Manual Control Valve (MCV), a product developed by OVHcloud's research and development team. It provides a detailed description of the assembly parts of the valve and includes some use case examples in data centers (DCs).

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## 2. Compliance with Open Compute Project Tenets

Developed by OVHcloud's research and development team, this white paper unveils the technical specifications and merits of the MCV, emphasizing its alignment with key tenets of the Open Compute Project (OCP). As we investigate into its design and applications, we explore how the MCV embodies principles of openness, efficiency, impact, scalability, and sustainability, contributing to the advancement of liquid-cooled systems in the realm of data center infrastructure.

### 2.1 Openness

- The MCV is based on a standard commercial valve, emphasizing an open approach by utilizing readily available and commonly used components.
- The technical specifications for the MCV are defined in this document, providing transparency and openness in design and functionality.
- By introducing a cost-effective and accessible alternative to traditional automatic regulation valves, the MCV promotes new cost-effective technic for adjustments in liquid-cooled systems.

### 2.2 Efficiency

- The MCV is designed to improve the hydraulic circuit in liquid-cooled systems, enhancing overall system efficiency.
- The use of a ball valve, known for its simplicity, cost-effectiveness, and reliability, contributes to the efficiency of the MCV.
- As a replacement for automatic regulation valves with drawbacks such as the need for sophisticated filtering and shutoff valves, the MCV streamlines maintenance processes, reducing downtime and increasing operational efficiency.

### 2.3 Impact

- The MCV, based on standard commercial valves, can be easily integrated into existing liquid-cooled systems, allowing for scalability and broad applicability.
- As an innovation with simplicity and cost-effectiveness, the MCV has the potential for widespread adoption across different scales of data center infrastructures.

### 2.4 Scale

- Utilizing standard commercial valves, the MCV is designed for seamless integration into various liquid-cooled systems, allowing for scalability and broad applicability.

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- As an innovation that emphasizes simplicity and cost-effectiveness, the MCV is poised for widespread adoption across different scales of data center infrastructures.

## 2.5 Sustainability

- The MCV's design, which eliminates the need for complex filtering and additional shutoff valves, contributes to sustainability by reducing material requirements and simplifying maintenance processes.
- As liquid cooling becomes more prevalent in data centers, the MCV's impact on efficiency and simplicity aligns with sustainability goals by potentially reducing energy consumption and environmental impact.

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### 3. Description

The MCV concept can be deployed on a variety of ball valve sizes. For illustration purposes, an example using a 3/4-inch ball valve will be presented.

#### 3.1 Features & Dimensional Requirements

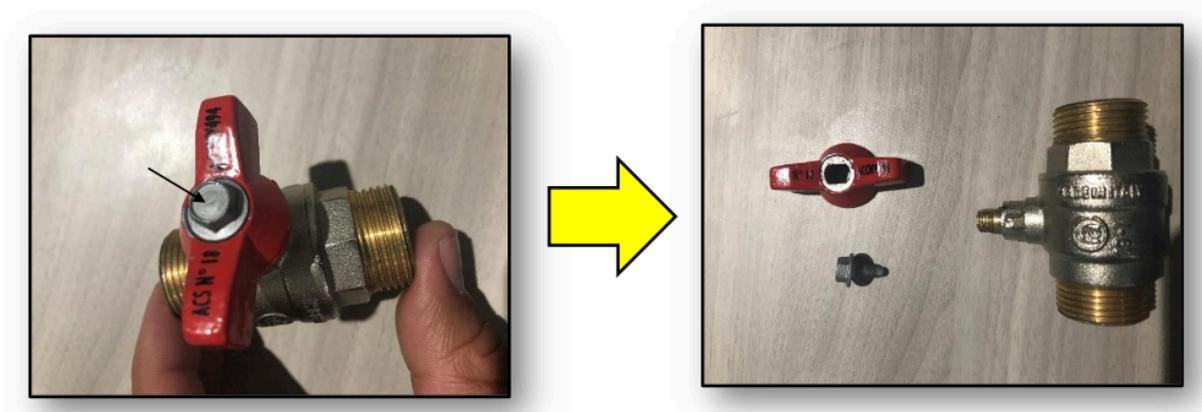
Table 1 shows the characteristics of a MCV using a 3/4" ball valve.

*Table 1. Specifications of example MCV*

Wetted materials	Brass
Connections	3/4" threaded connectors
Handle materials	Laser-cut and bent galvanized steel
Maximum fluid temperature	120°C
Minimum fluid temperature	-10°C
Maximum pressure	25 bar
Fluid	Water and water with glycol (0% to 50% mass glycol)

As mentioned earlier, the MCV is built upon a standard commercial ball valve featuring a hollow, perforated, and pivoting ball for regulating fluid flow rates. The original handle (*Figure 1*) must be replaced by an assembly of galvanized steel parts linked by bolts, washers, nuts, and one spring to ensure locking position as shown on *Figure 2* with an exploded view. *Figure 3* show an MCV assembly.

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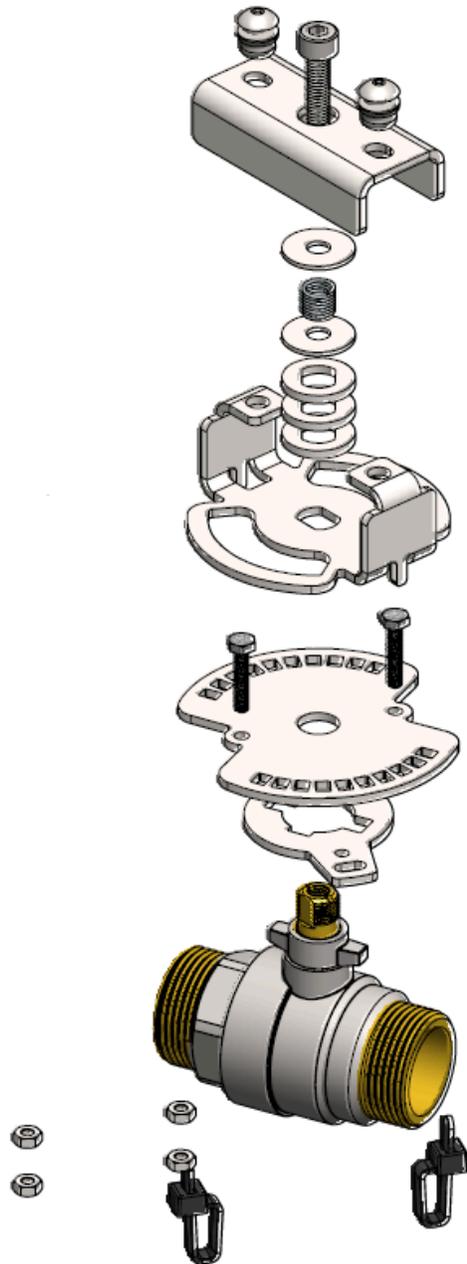


**Figure 1.** *The example valve with its original handle in place, then unscrewed.*

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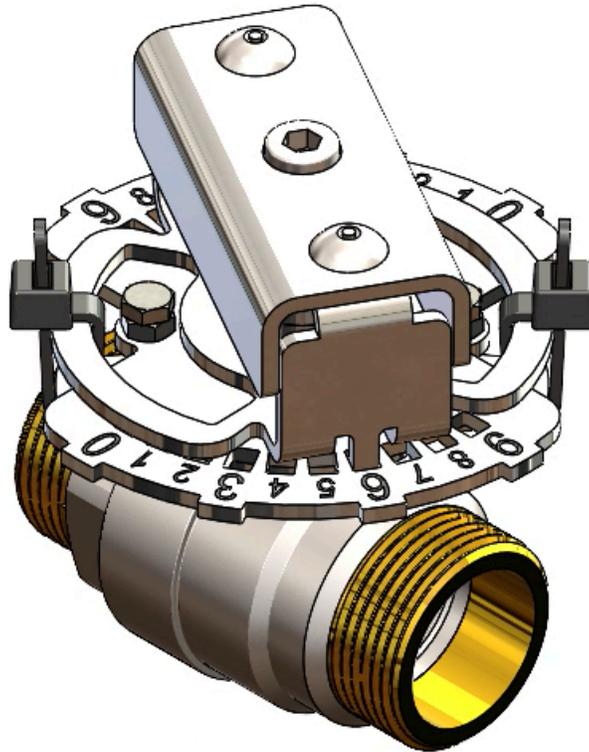
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**Figure 2.** *Exploded view of the assembly parts of the MCV.*

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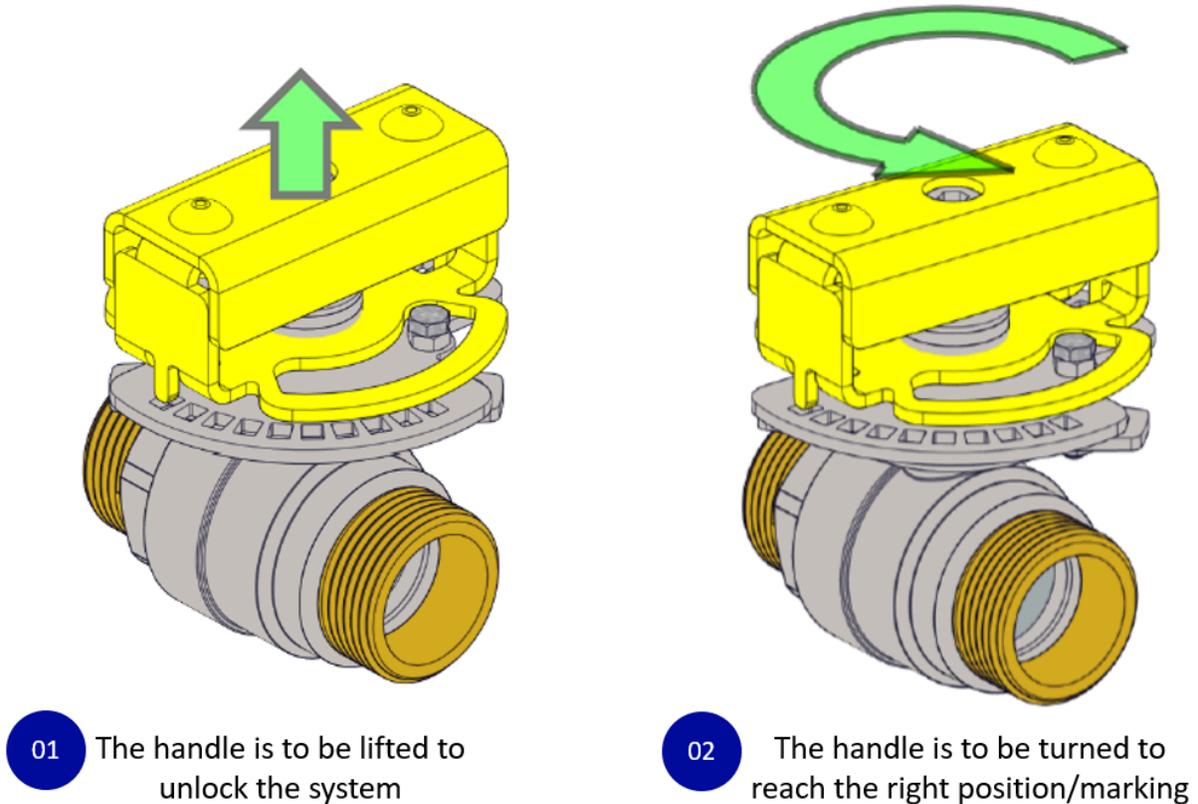
**Figure 3.** *Isometric view of the assembled MCV.*

In contrast to automatic control valves like Pressure Independent Control Valves (PICV), the MCV does not possess the same level of precision in regulation and lacks an automatic function. Nevertheless, it can serve as a substitute for PICVs in predefined engineered circuits. The laser marking of positions can be tailored to specific requirements. For security purposes, the position can be secured with either a collar or a padlock.

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### 3.2 Operations & Use Cases

The operation of the MCV is simple and follows the two stages of *Figure 4*.



**Figure 4.** Operation of the MCV.

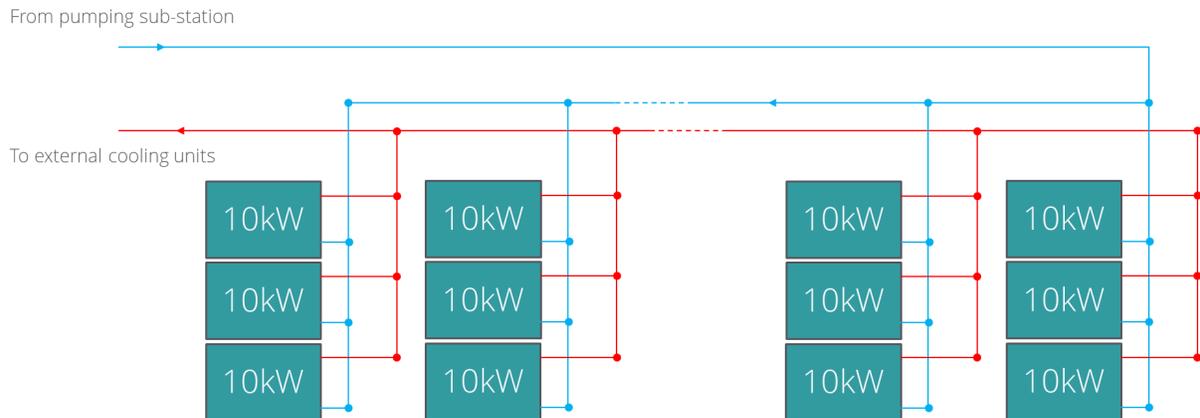
The desired position is maintained by the extruded pin, which is secured in the corresponding numbered opening through the force applied by the spring.

While the MCV is applicable to any cooling installation, three primary configurations are particularly noteworthy. The advantages of the MCV become more apparent, especially in larger Technology Cooling System (TCS) fluid loops, where it can be effectively installed on the return lines of:

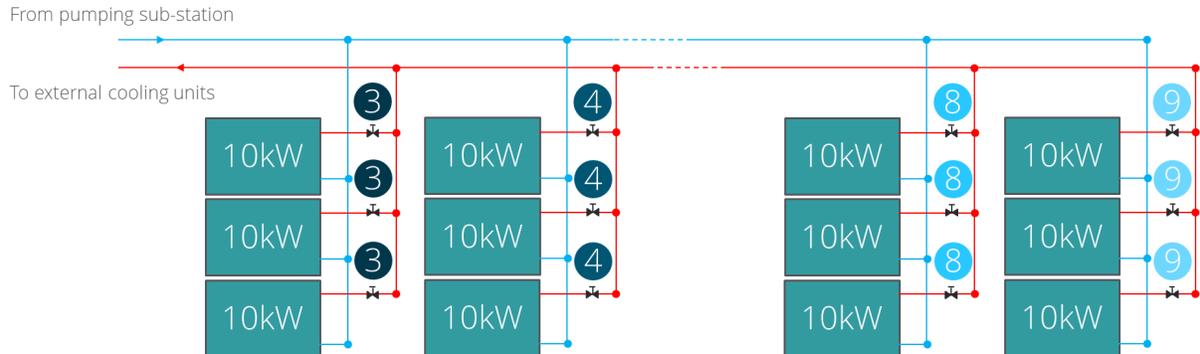
1. Large installations with a lot of server racks with similar installed power, where a Tichelmann loop (*Figure 5* (a)) is not feasible as it requires space and support for a long and large pipe (*Figure 5* (b))

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2. Large installations with server racks with discrepancy of the installed powers along the longitudinal flow distribution (*Figure 6*)
3. Large installations with server racks with discrepancy of the installed powers along the vertical flow distributions (*Figure 7*)

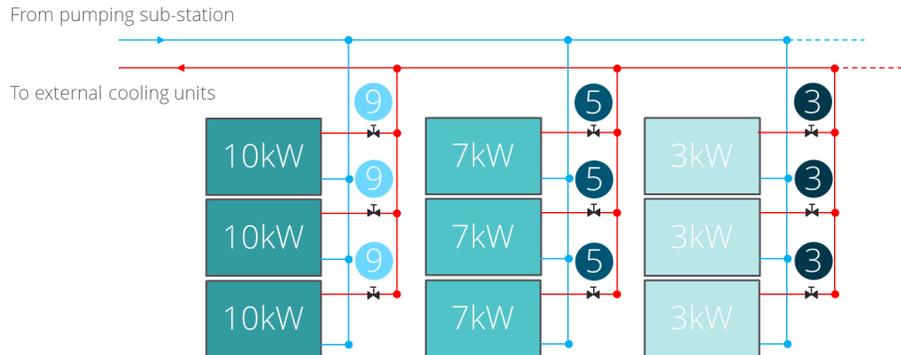


**Figure 5 (a)** large TCS fluid loop with lot of server racks of similar power, using a Tichelmann loop for even flow distribution.

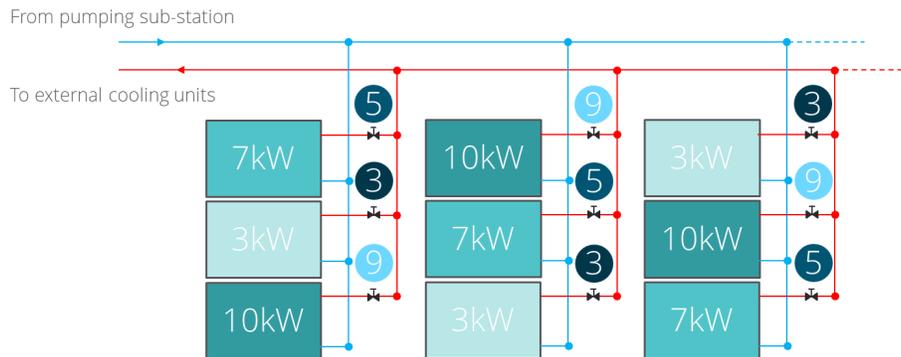


**Figure 5 (b)** large TCS fluid loop with lot of server racks of similar power, using MCV and the indexed positions of the valve for even flow distribution.

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**Figure 6.** TCS fluid loop with server racks of different power along the longitudinal path, using MCV and the indexed positions of the valve for even flow distribution.



**Figure 7.** TCS fluid loop with server racks of different power along the vertical paths, using MCV and the indexed positions of the valve for even flow distribution.

It is essential to have knowledge of the hydraulic curves illustrating the pressure drop of the selected valve at various opening angles. Additionally, understanding the hydraulic curves depicting the pressure drop of the IT equipment loop (e.g., plate heat exchangers, rear door heat exchangers, cooling distribution units) is crucial.

Moreover, the utilization of MCVs is most effective in extensive installations, particularly in massive data centers, where the configuration of the racks to be installed is well-documented over a period. In other words, the pressure drop is precisely defined based on the cooling circuit within the rack. The system can be simulated or tested before the final deployment in data centers.

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## 4. Conclusion

The MCV concept serves as an excellent method for regulating flow rate distribution, offering adaptability to various needs and use cases. This not only enhances performance on IT components but also improves the overall efficiency of cooling systems in data centers.

## 5. Glossary

DC: Data center

MCV: Manual control valve

PICV: Pressure independent control valve

TCS: Technology Cooling System

IT: Information Technology

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## 6. License

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## 7. About Open Compute Foundation

At the core of the Open Compute Project (OCP) is its Community of hyperscale data center operators, joined by telecom and colocation providers and enterprise IT users, working with vendors to develop open innovations that, when embedded in product are deployed from the cloud to the edge. The OCP Foundation is responsible for fostering and serving the OCP Community to meet the market and shape the future, taking hyperscale led innovations to everyone. Meeting the market is accomplished through open designs and best practices, and with data center facility and IT equipment embedding OCP Community-developed innovations for efficiency, at-scale operations and sustainability. Shaping the future

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includes investing in strategic initiatives that prepare the IT ecosystem for major changes, such as AI & ML, optics, advanced cooling techniques, and composable silicon. Learn more at [www.opencompute.org](http://www.opencompute.org).

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## 8. Appendix A. Tichelmann loop

The principle of the Tichelmann loop revolves around equalizing pressure drops in different branches of a closed hydraulic loop. This is achieved by outfitting each branch with identical piping (length, curves, and equipment). Consequently, each network branch will experience the same pressure drop, eliminating the necessity for balancing valves or additional equipment on the piping.

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