

No margin for error.

HVAC Solutions for Data Centres

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Introduction

Data reigns supreme in today's digital era, and the worldwide surge of data centres underscores their critical role in modern society.

When it comes to data centre operations, the integrity and security of invaluable data hinges on precise and unfailing temperature control. This falls under the responsibility of the HVAC system and, therefore, their flawless performance plays an intrinsic role in upholding the security and stability of this critical application.

But that's not all; beyond operating flawlessly and continuously, data centres face a progressive challenge to minimise energy consumption while transitioning towards carbon neutrality and adopting more sustainable energy sources.

As an HVAC expert with over 300 years of combined experience in 3 key system areas, IMI Hydronic is the perfect partner to help you tackle these and other challenges of HVAC systems in Data Centres.

We offer innovative products, reliable technologies, and personalised support from the design stage to installation and operation, ensuring that your HVAC system operates sustainably, and meets its specific climate control requirements accurately.

 IMI TA

 IMI PNEUMATEX

 IMI HEIMEIER

Since 1897

Balancing,
Control &
Actuation leader

Since 1909

Pressurisation &
Water Quality
leader

Since 1928

Thermostatic
Control leader

The Unique HVAC Demands of Data Centres

The distinctive needs of Data Centres arise from the intricate nature of their operations. They face the challenge of managing substantial heat generated by densely packed equipment, requiring advanced, reliable and energy-efficient cooling solutions. These particular demands stretch the boundaries of standard HVAC capabilities, necessitating expert knowledge and customised solutions.

1. Precision Cooling

Data Centres form sensitive ecosystems where maintaining precise temperature control is not just essential but **paramount**. The substantial heat produced by servers and networking equipment requires the implementation of precise cooling mechanisms to sustain optimal operating conditions.

Minor fluctuations in temperature can have a notable impact on **system performance** and, ultimately, compromise **the integrity of stored data**.

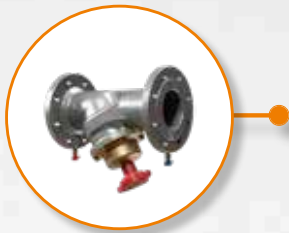
Product Solutions

Iconic Balancing Valves



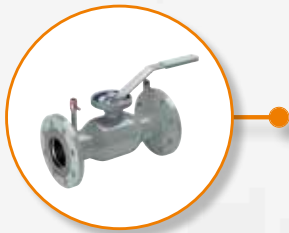
STAD Balancing valve (DN10 to DN50)

The iconic STAD balancing valve delivers exceptional accuracy and durability. Its user-friendly handwheel with a digital read-out ensures straightforward setting. Thanks to the precise correlation between the setting and the valve kv, you can expect accurate flow control, ensuring reliable balancing under varying flow conditions. Featuring self-sealing measuring points, it facilitates the use of the TA-Scope measuring instrument to validate the balancing process – without the risk of hot water splashes. Crafted from dezincification resistant AMETAL® alloy, it offers a robustness and durability.



STAF Balancing valve (DN20 to DN400)

The STAF flanged balancing valve offers precise and reliable balancing on the secondary side of heating and cooling systems. The digital read-out handwheel, self-sealing measuring points and a positive shut-off function simplifies precise balancing. Its cast iron (STAF) and ductile iron (STAF-SG) construction ensure reliability and versatility.



TA-BVS Balancing valve (DN15 to DN250)

The TA-BVS balancing valve incorporates various handwheel mechanisms to ensure reliable and safe operation: DN15-50 have a control handwheel that locks a set value, DN65-150 have a removable handle and DN200-250 are equipped with a manual gear. Its flange or welding end options cater to diverse requirements and the stainless-steel construction offers high-media resistance particularly suitable in industrial settings with high temperatures.

High-performance differential pressure controllers



STAP differential pressure controller (DN65 to DN100)

STAP is a compact and accurate differential pressure controller, perfect for the secondary side of heating and cooling systems. It keeps the differential pressure over the load constant ensuring accurate and stable modulating control, less risk of noise from control valves and easy balancing and commissioning. Self-sealing measuring points and a positive shut-off function simplifies validation, maintenance, and troubleshooting.



TA-PILOT-R differential pressure controller (DN65 to DN200)

The TA-PILOT-R is a high performing differential pressure controller, to be used in the return pipes in heating and cooling systems. It keeps a stable differential pressure over the load with unrivalled accuracy thanks to the PILOT technology providing superior control valve authority for modulating control valves. Its compact design and low weight are highly beneficial in high dimension installations – such as for Data Centre applications. Its measuring points enable pressure measurements for thorough system diagnostics.

Highly efficient and precise modulating control

Our iconic TA-Modulator is a pressure-independent balancing and control valve known for precision, reliability, and energy efficiency. Being pressure-independent means TA-Modulator is able to keep the flow through the valve constant regardless of the pressure oscillations in the system and guarantees high control authority. It controls the flow by modulating it, which eliminates the peaks and troughs from typical off-on control that result in temperature oscillations and higher pumping costs, helping to obtain significant energy savings.

TA-Modulators goes perfectly with our TA-Slider digital actuator. The valve's patented EQM characteristic in combination with the linear actuator offsets the non-linear characteristic of the terminal units enabling very stable and precise control, even in low flow conditions.

TA-Slider is a digital actuator, so it can be seamlessly connected to BMS systems or programmed via the Hytune smartphone app. This enables 10x more setting parameters, more accuracy in programming and up to 50% reduction in commissioning time from conventional actuators.



TA-Modulator PIBC with TA-Slider actuator in various dimensions (DN10 – DN200)

Liquid Cooling

As data centres continue to grow in power and complexity, the need for effective cooling methods is a constant challenge.

Liquid cooling is emerging as a modern and innovative solution as it excels in managing higher power densities. Unlike traditional air-cooled systems, which rely on hot air convection, liquid-cooled systems leverage liquids with superior heat conduction capabilities.

These configurations include water cooling with pumps, external radiators, and water as a coolant, as well as liquid immersion cooling, which efficiently reduces temperatures by submerging equipment in a thermally conductive liquid.

Opting for liquid cooling in Data Centres requires the expertise of professional cooling engineers who consider factors such as location, environmental conditions, usage models, and airflow protocols. Our expertise in HVAC systems allows us to navigate the complexities of liquid cooling effectively and work together to identify the most suitable products (pressure relief valves, shutoff valves, 3-way valves, etc.) that deliver on the specific cooling needs while ensuring the safety and reliability of this innovative application.



2. High energy efficiency

The high-load conditions required for effective and constant cooling leads to substantial power consumption, impacting both operational costs and environmental sustainability.

Various countries have implemented regulations and standards specifically tailored to data centers, including the *EU Code of Conduct for Data Centers*. These guidelines advocate for the utilisation of eco-friendly materials in construction and mandate the implementation of methods for measuring water and energy use. The goal is to assess the impact of the cooling infrastructure in relation to overall consumption. Data center operators must report this figure to the European Commission, which then imposes restrictions on energy use per square meter or per unit of computing power and sets targets for reducing carbon emissions. As data centers progress, adherence to these regulations becomes integral in influencing the design and operation of HVAC systems to ensure compliance.

Product Solutions Smart Valves

TA-Smart is an innovative balancing and control valve designed for heating and cooling applications built upon 3 core pillars: Control, Measurement and Communication.



TA-Smart (DN15 to DN125)



CONTROL

Versatility of valve control modes operating according to flow, power and valve position with outstanding controllability. A ΔT limitation function can be added to any of the control type, even in part-load system conditions.



MEASUREMENT

Continuous measurement of flow, valve position, return/supply temperatures, temperature difference, power and energy.



COMMUNICATION

Communicates and stores: BLE, bus, Analog, Cloud. Fully digitally configurable: HyTune mobile app, web app.

Dynamic Control Modes

TA-Smart features 4 distinct control modes, functioning based on flow, power, valve position, and Delta p, complemented by internal control feedback for comprehensive and autonomous smart control. The addition of a ΔT limitation function, applicable across all control types, effectively addresses the challenges posed by the Low Delta T syndrome, even in part-load system conditions.



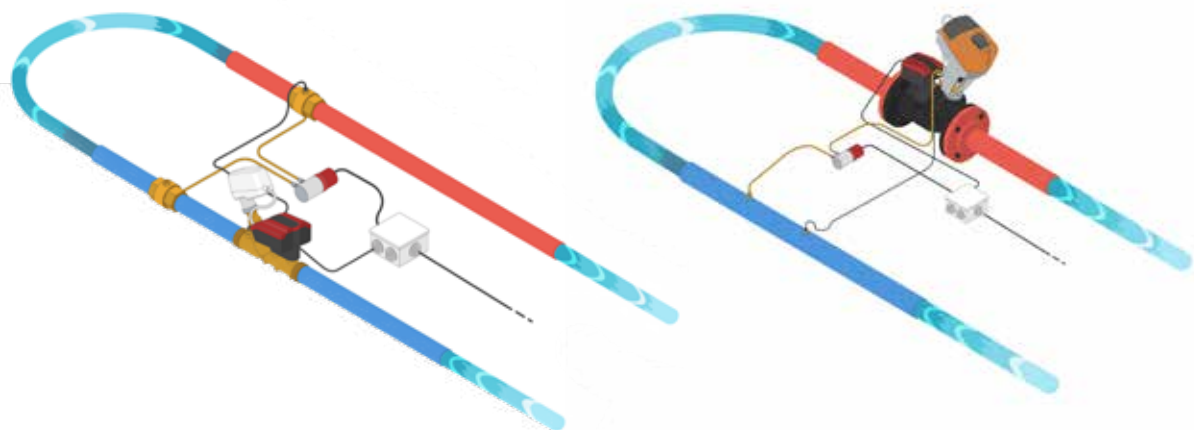
*A ΔT limitation function can be added to any of the 3 control modes. **Available with TA-Smart-Dp and Dp sensor.

In **flow control mode**, the TA-Smart valve measures the flow rate and feeds the actuator with the new target position to achieve the required flow. Target flow is adjusted by the controller in line with the programmable characteristic within the TA-Smart. Seamless communication with its actuator enables dynamic adjustments, ensuring the valve meets specific room requirements with efficiency.

In **power control mode**, TA-Smart carefully measures how much water is flowing through the valve and checks the temperature difference between the supply and return. This data enables the valve to precisely determine the power it delivers. When adjustments are necessary, it communicates with its actuator, fine-tuning control parameters to meet the specific room requirements.

In **position control mode**, the TA-Smart valve accurately adjusts its position to regulate the flow of water following input from the controller in the feedback loop.

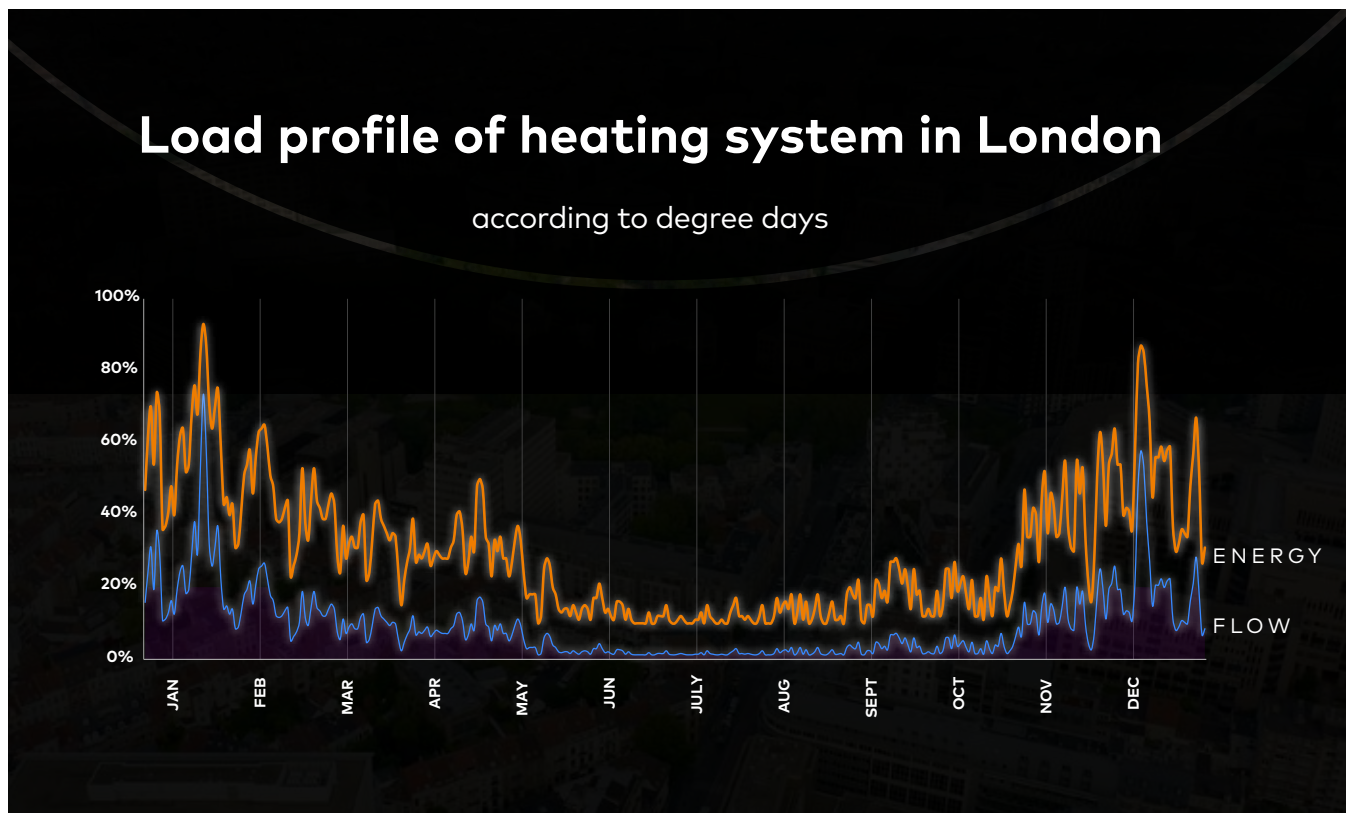
The **DP (Differential Pressure) control mode** is activated using a specialised TA-Smart DP version equipped with an external pressure sensor. This setup offers the advantages of a built-in differential pressure controller within the valve itself. Consequently, it eliminates the need for additional devices such as the STAP or TA-Pilot-R to maintain stable circuit pressure, crucial for effective control. Additionally, TA-Smart's measuring capabilities allow you to access operational data essential for system monitoring.



Control Precision

TA-Smart has the remarkable ability to manage flow rates as low as 0.5% of the nominal flow, even when facing differential pressures up to 400kPa. It retains exceptional control precision across low flows, which is a critical feature, considering that in many European countries, systems typically operate at about 20% flow (equivalent to 50% power) for close to 80% of their operational time.

Extreme weather conditions are rare during the heating and cooling seasons. Yet, heating and cooling systems are primarily designed to perform under these exceptional circumstances. TA-Smart's outstanding control precision ensures accurate temperature regulation all year round, not just during peak conditions.



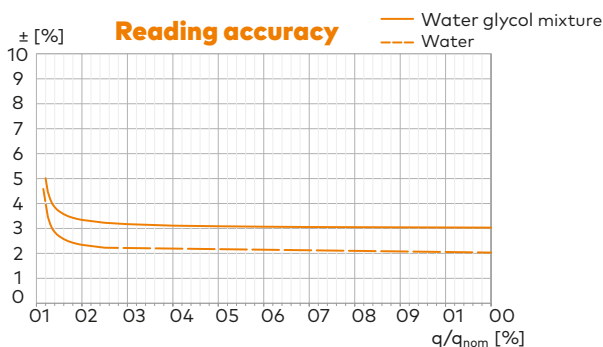
Measurement Accuracy

TA-Smart provides accurate and continuous measurement of key circuit data; flow, valve position, return/supply temperatures, temperature difference, power, and energy. Moreover, it ensures the seamless recording of this data even in the absence of BMS/internet communication.

Methodology and accuracy of measurement

$$P = k * q * \Delta T$$

<p>Flow measurement</p>	<p>TA-Smart uses Ultrasonic Flow measurement technology to guarantee high accuracy of flow measurement for all regimes at any temperature covering water-glycol mixtures up to 57%.</p>
<p>Temperature measurement</p>	<p>TA-Smart uses 2 Pt1000 EN 60751 class AA temperature sensors which are pair-calibrated to provide improved accuracy even at low ΔT.</p>
<p>Power measurement</p>	<p>Leveraging accurate flow and temperature measurement, TA-Smart provides accurate power measurement in both heating and cooling applications.</p>



Accuracy measurement operates under the following flow conditions:

Water: From 2% accuracy at 100% of q_{nom} to 2.4% accuracy at 5% of q_{nom} (according MID-Class 2 EN1434).

Water+glycol: From 3% accuracy at 100% of q_{nom} to 4% accuracy at 5% of q_{nom} (according to MID-Class 3 EN1434).

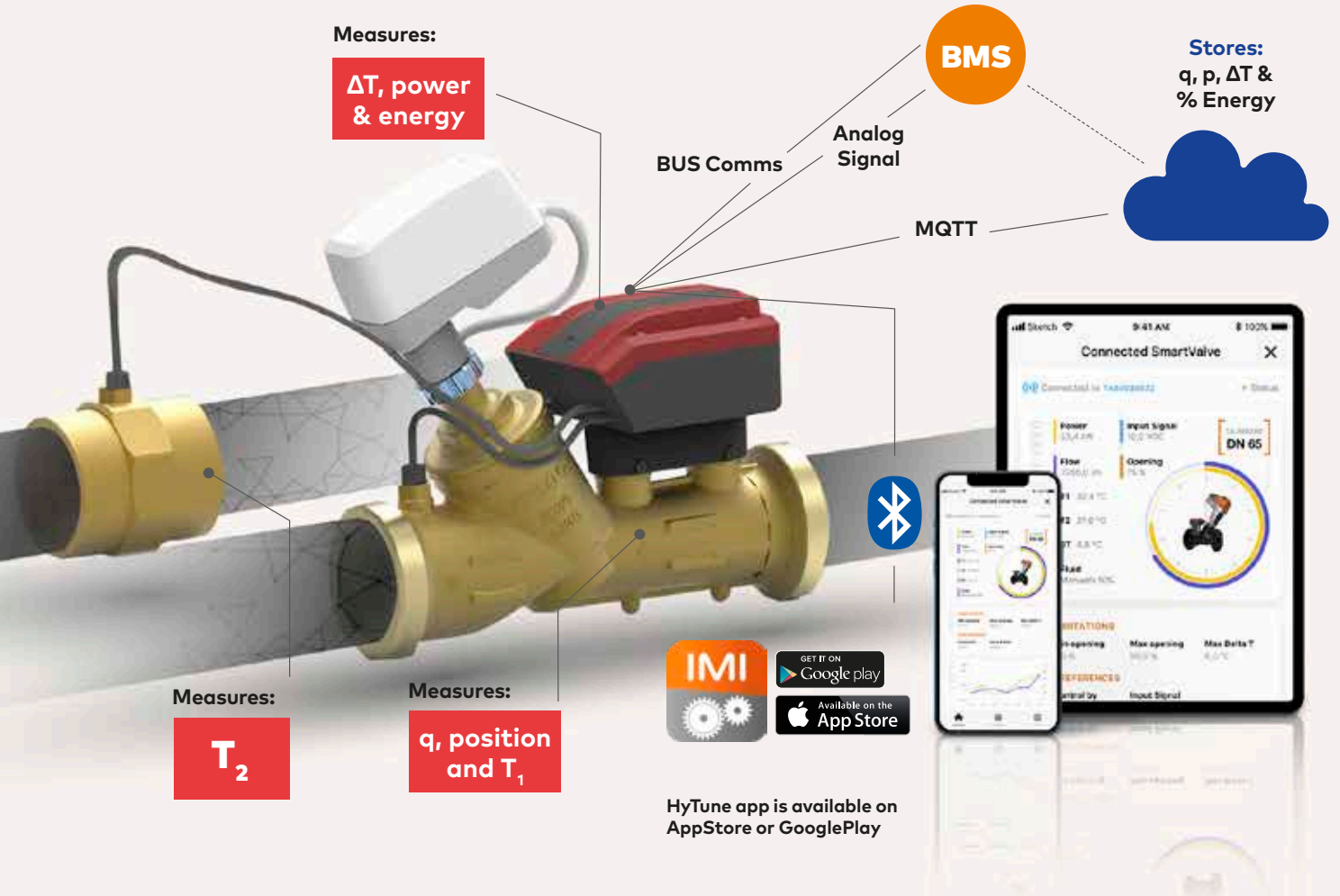
These accuracies are subject to the respect of required upstream straight pipe lengths (OD for TA-Smart DN 15-50 and 5D for TA-Smart DN 65-125).

This data measurement empowers not only the aforementioned intelligent autonomous control but also provides clear insights into this part of the system's operations. It facilitates the validation of system performance relative to the design parameters, enabling necessary optimisation adjustments. Similarly, troubleshooting leverages these measurements to understand system behavior, gather insights, and support confident decision-making.

The integrated measurement capability means TA-Smart meets energy monitoring requirements from certification labels and regulations **without the need to install additional components.**

Communication Versatility

TA-Smart consistently logs the key circuit data through diverse communication protocols such as BLE, BUS, Analog, and MQTT. This information is easily accessible on your smartphone using the HyTune app within Bluetooth range. Alternatively, when connected to the internet, it can be remotely accessed via the BMS or HyCloud web app. This ensures quick and transparent access to essential system parameters directly from the valve whenever needed.



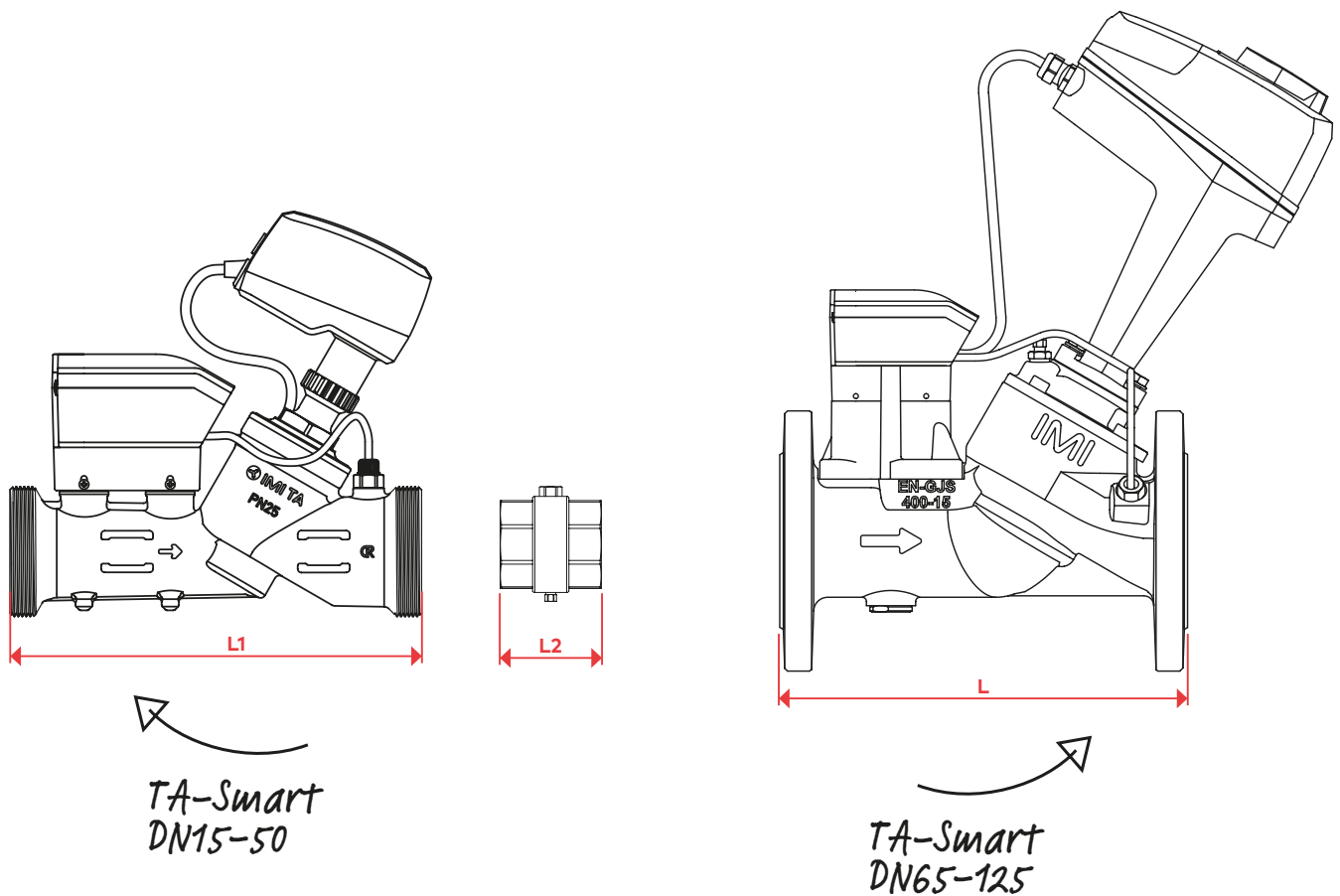
In high-security projects where data cannot be transmitted outside the facility, the cloud connection can be deactivated, allowing system monitoring to be conducted securely through the app within the controlled environment.



Compact size & Installation versatility

TA-Smart stands out for its exceptionally compact design, placing it at the forefront of the market. TA-Smart is as much as 80% smaller than comparative products and only has 2 bodies to be fitted with no space requirements upstream.

TA-Smart DN65-125, has a standard F1 face-to-face length, which allows for effortless retrofitting to existing valves without complicated additional fittings and pipe adjustments. This significantly improves installation, especially in renovation projects – enabling improved temperature control and energy monitoring through a single, quick replacement.



- Super compact size, the smallest of its kind
- Two bodies (only 4 fittings to mount)
- OD requirement upstream

DN	D	L1 [mm]	H [mm]	W [mm]
15	G3/4	167	173	97
20	G1	180	174	97
25	G1 1/4	187	174	97
32	G1 1/2	200	199	97
40	G2	218	198	97
50	G2 1/2	239	198	97

Very compact (up to 80% smaller than competitors' product)

- Ultra compact F1 length (Face-to-face length EN-558-1)
- Remote temperature sensor to be fitted separately

DN	D [mm]		No of bolts		L [mm]	H [mm]
	PN16	PN25	PN16	PN25		
65	185		4	8	290	377
80	200		8		310	380
100	220	235	8		350	435
125	250	270	8		400	440

Compact F1 length (up to 30% smaller than competitor's product)

3. No Margin for Error

Data Centres operate 24/7, requiring uninterrupted and flawless functionality of HVAC systems – in this context there is no margin for error. Reliable and robust HVAC solutions are therefore vital for continuous cooling and environmental control. To ensure protection against potential failures in this error-free application, it is crucial to choose products equipped with advanced protection features.

Product Solutions

Reliable Pressure Maintenance

Maintaining correct pressure in water-based HVAC systems is vital to account for temperature fluctuations that cause fluid volume to expand and contract. Excessive pressure can lead to pipe ruptures, while insufficient pressure allows air to enter the system – the biggest threat to the long-lasting functionality of water-based systems.



Our pressure maintenance range

A pressure maintenance system serves two primary purposes: ensuring consistent positive pressure throughout the system and preventing overpressure. The reliable performance of either is directly linked to the **air cushion's ability** to maintain a tight seal and the pressure control's long-term performance.

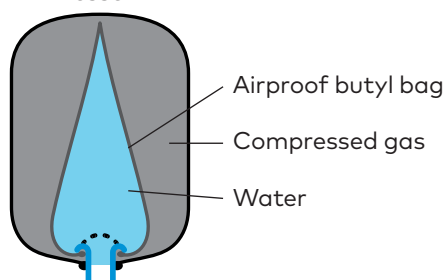
The bag makes the difference: Butyl Bag



Our expansion vessels stand out due to their innovative design featuring a specialised bag. Unlike traditional membrane vessels, our vessels prevent water from touching the metal walls of the vessel, ensuring enhanced durability and performance.

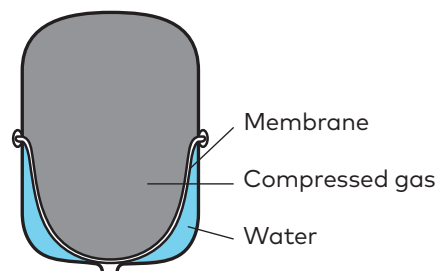
Made of butyl rubber, our bag has the market's lowest air diffusion rate, **surpassing any other comparable membrane material by 5 to 10 times**. This feature ensures that the initial pressure remains largely unaffected, contributing to optimal performance.

IMI Pneumatex vessel



All IMI Pneumatex expansion vessels have the advanced bag design and are equipped with the Butyl Bag.

Conventional vessel



Most expansion vessels available in the market use a membrane made of EPDM rubber (a type of synthetic rubber), that is more elastic and less resistant to diffusion. As a result, these vessels struggle to maintain the correct static pressure over time.

Connected Pressure Maintenance: BrainCube Connect

What further distinguishes our IMI Pneumatex pressure maintenance systems is the BrainCube Connect control unit.

The BrainCube facilitates easy access to critical system information for your pressure maintenance equipment via any connected device, whether you are on or off site. Its communications and connectivity versatility allows for seamless integration with your building management system (BMS) through the standardised Modbus protocol on RS485 (RTU). It also provides a direct on-site connection via Ethernet and the capability to link to the IMI Hydronic Web-Interface Cloud solution, giving you full visibility and control anytime, anywhere.

If a system fault is detected, an alert will be sent directly to the user, allowing remote access to system settings, adjustments, or specialised service. This provides total visibility and control, especially crucial for critical applications like hospitals and data centres, where there is no margin for error.

For maximum security projects where data cannot leave the premises, the cloud connection can be disabled. System information can be accessed directly through the BrainCube touchscreen, including water-make up counts, fill safe status, vacuum split details, pump running duration, and system low and high-pressure readings.

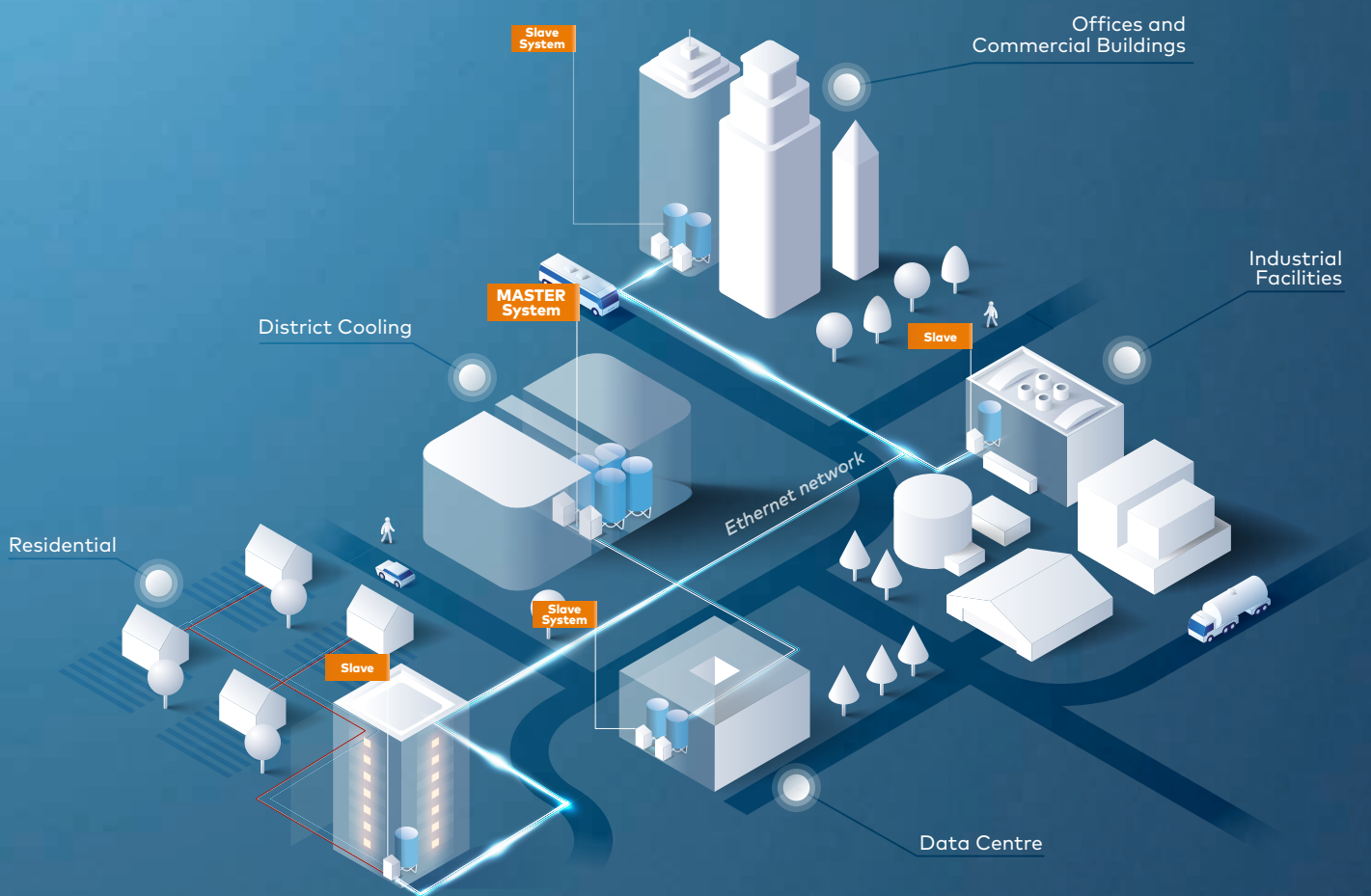


Our Compresso and Transero Connect range come equipped with BrainCube as a standard.

BrainCube tier-protection functionality: Master-Slave

Critical applications, such as Data Centres, frequently have multiple sub-power plants, often strategically located away from the main thermal power plant by even several kilometres apart. This can result from security considerations, such as tier-protection, or increased power demands necessitating additional installations beyond the original capacity.

Despite being placed at a distance, the multiple pressure maintenance systems still need to be hydraulically connected to ensure precise control over the system's static pressure, water levels and redundancy.



The IMI Pneumatex Master-Slave operation with Ethernet-Multicast communication replaces the need to cable the dedicated infrastructure, with the possibility of using existing private or public (TCP-IP) networks for seamless communication between various pressure maintenance devices.

The BrainCube control unit features advanced Master-Slave functionality for seamless interaction between pressure maintenance and vacuum degassing machines. Our latest enhancement leverages existing Ethernet networks to sustain this communication, streamlining operations by removing the necessity of intricate wiring. By deploying Ethernet-Multicast technology, connection of substations is now facilitated without distance limitations — as long as an internet or VPN connection is present. This refined approach minimises complexity, making the establishment of sub-power plants more efficient via internet or pre-existing Ethernet infrastructures.

Fighting Air & Dirt

Air, primarily composed of nitrogen and oxygen, poses the biggest threat to water-based heating and cooling systems. It infiltrates HVAC systems through mains water during initial fill-up and subsequent refilling via the water make-up device. Negative pressure conditions caused by factors like poor pressurisation, inadequate water reserve, or incorrect initial pressure may also result in air infiltration.



Typical consequences from poor water quality management

The presence of air has severe consequences, including disruptive flow noise and reduced cooling transfer. The problems don't end there, because air once inside reacts with metal components in the system leading to erosion and corrosion of expensive equipment. These rust and dirt deposits will travel and accumulate in the system causing obstructions, premature failures and reduced overall system efficiency.

None of these consequences are worth the risk for a building that must operate continuously and flawlessly. Ensuring the prompt and effective removal of air and dirt should be a top priority.

Removing Air

Achieving optimal air removal from your HVAC system requires precision, utilising the appropriate product combination.



Zeparo ZUT

Air pockets and free gases can be efficiently removed by installing automatic vents at the highest points of the system, specifically at the top of the main risers. This enables the safe and automatic evacuation of accumulated air.

In systems with lower water temperatures the air becomes more tightly bonded to the water molecules. This makes it impossible to separate air effectively using separators or automatic air vents. In such cases, vacuum degassers are the only reliable method to remove air.

As gases enter the system from the mains, rich in gas due to water make-up, it is imperative to degas the make-up water before it enters the system and potentially causes damage.



Vento Connect

IMI Pneumatex's vacuum degassers offer unparalleled efficiency in the market. These degassers utilise Cyclonic Vacuum Degassing technology, which employs pressure and flow restriction to create a concentrated spiral vortex that effectively concentrates and then removes. As flow speed decreases, air bubbles naturally rise to the top and can be easily eliminated. It is recommended to install vacuum degassers near the expansion vessel, at the system return, and safeguard them with a dirt separator equipped with a powerful magnetic rod. Vento cyclonic vacuum degassers have the function of managing make-up water, which is degassed before it is sent into the system.

Removing Dirt

To address dirt in HVAC systems effectively, it is crucial to consider their composition, size, and the water velocity conditions. While typical strainers and filters capture large dirt and sludge particles, they can become clogged over time, leading to increased pressure drop (Δp) and reduced effectiveness. On the other hand, dirt separators maintain particle separation consistently, preventing excessive dirt buildup and minimising interference with Δp .

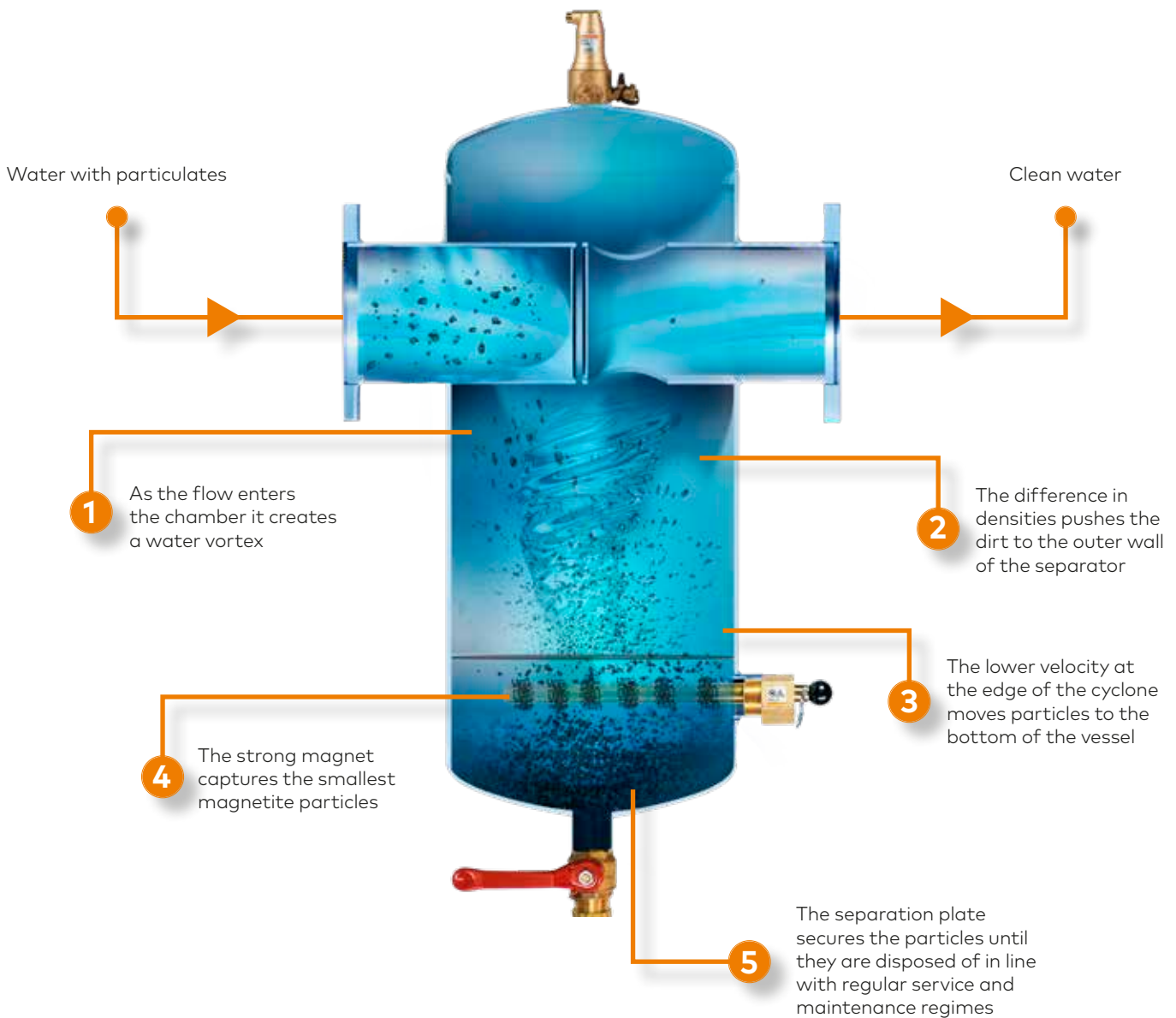


Zeparo Cyclone Max
(launching in June 2024)

IMI Pneumatex's Zeparo Cyclone Max equipped with Cyclonic Dirt Separation Technology stands out in the market as the leading solution for dirt separation. It is the sole technology capable of effectively removing dirt at all water speeds and pipe sizes.

Cyclonic Technology effectively eliminates up to 95% of dirt, capturing even small particles (5-10 μm) in a single cycle to prevent their circulation and adherence to equipment.

How Cyclone Dirt Separation Technology works:



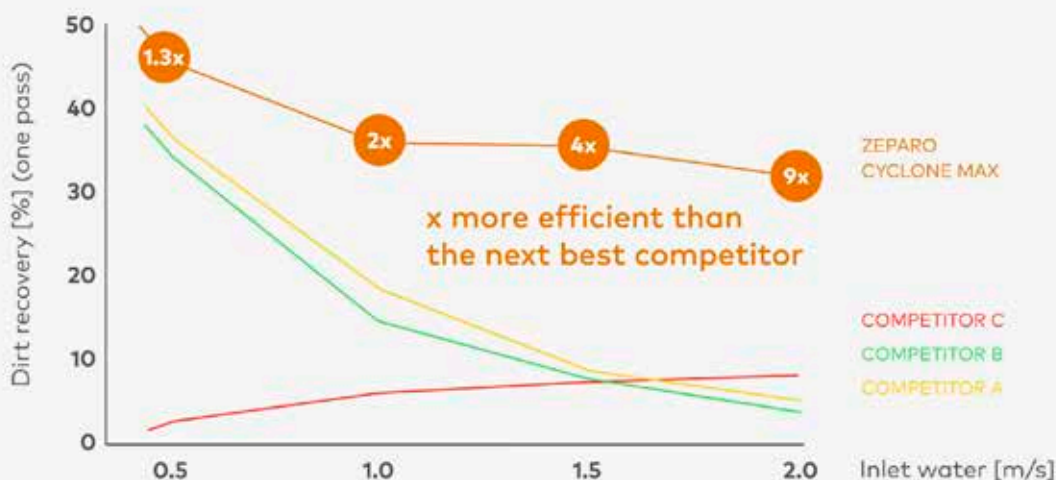
Upon entering the chamber of the separator, the water flow undergoes a centrifugal force, generating a water vortex that exerts considerable pressure on dirt particles, forcefully propelling them toward the separator's outer wall. The lower velocity around the periphery of the cyclone allows gravity to assist in moving the particles downward to the bottom of the separator. A retarding plate at the bottom ensures the dirt particles remain captured in the chamber until they are disposed of.

The Cyclone effect remains consistent regardless of the positioning — horizontal or vertical. Moreover, it maintains high separation efficiency even in high flow conditions and with large DN's — setting it apart from gravitational separation technologies offered by other manufacturers. This makes the Cyclone Range from IMI Pneumatex the most versatile and reliable dirt separator in the market, regardless of positioning, dimension, or flow conditions.

Separation efficiency proof of performance

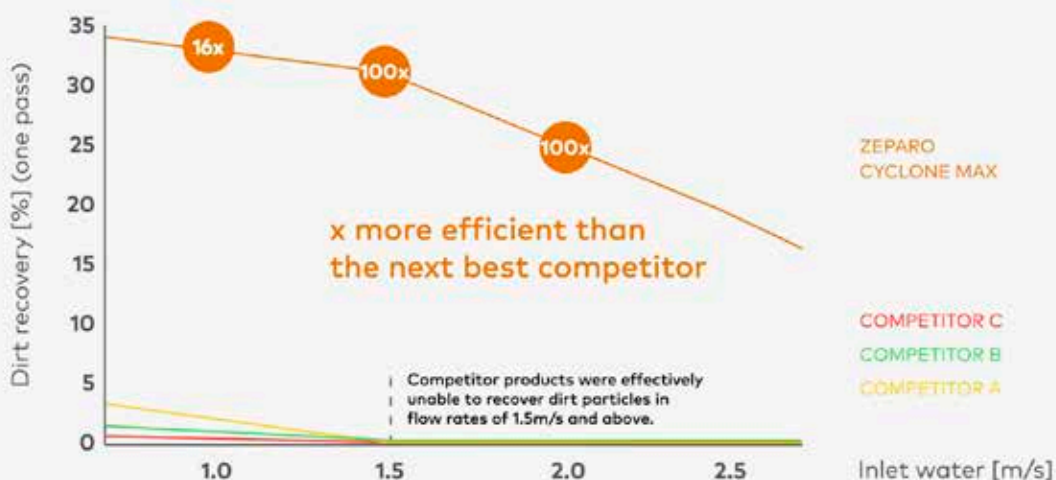
A study was conducted to test the separation efficiency of Zeparo Cyclone Max against 3 competitors to assess the separation efficiency of particles from 5 to 300 µm in diameter is just one cycle. The findings unequivocally show the superiority of Cyclonic Dirt technology across different dimensions and flow conditions. Particularly noteworthy was the remarkable performance of Zeparo Cyclone Max for the large DN's & high flow applications, where competitors simply were unable to deliver any separation performance.

Separation Efficiency DN65



Separation efficiency of particles from 5 to 300 µm in diameter is just one cycle

Separation Efficiency DN200

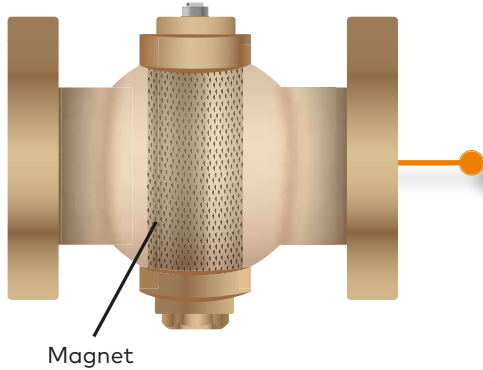


Separation efficiency of particles from 5 to 300 µm in diameter is just one cycle

X times Zeparo Cyclone Max performs better than competition

Removing Magnetite

Magnetite particles, being light and very small ($<0.5\mu\text{m}$), necessitate specialised magnets for effective separation. For systems facing specific and severe magnetite challenges, the installation of dedicated magnetic separators is imperative.



The magnet rod in the Ferro Cleaner occupies its entire height.

Ferro Cleaner outperforms competitors due to its advanced magnet design, ensuring correct polarisation (North to North, South to South), optimal spacing, and larger diameters for increased mass. This design enhances the magnetic range in water and improves surface adhesion for effective particle attraction.

Power Outage Protection

Power outages or momentary disruptions may be unavoidable at times, but their impact on the HVAC system can be minimised. Installing actuators with a fail-safe function, such as TA-Slider, helps mitigate this risk.

The fail-safe feature ensures that, in the event of a power failure, the actuator automatically moves to a predefined position, maintaining the desired safety status of the flow. With the user-friendly HyTune smartphone app, you can conveniently and accurately monitor and configure crucial parameters, including the emergency position, time delay for position change, and the overall health status of the actuator, and resume normal operations after a power failure.



In this example, after a power supply breakage, the valve remained at its closed position not enabling a minimum flow to prevent pipe freezing. This led to repair costs 242 k€ and a shutdown of the HVAC system.

4. Enhancing Safety and Data Protection

As a trusted provider of HVAC systems, we understand the critical importance of data center security and the confidential aspects that come with it. We are committed to excellence and adhere to the highest industry standards through the implementation of robust security measures.

Our advanced HVAC solutions safeguard vital data and assets, ensuring their utmost security. Our connected products, such as TA-Smart and the BrainCube control panel, deliver heightened safety for mission-critical applications. Featuring comprehensive protocols for physical security, regular maintenance, network security, and backups, our smart connected features guarantee the highest level of protection for your data. Additionally, in projects where data must remain within the facility, our cloud connection can be deactivated, ensuring secure system monitoring within the controlled environment.

Throughout every project phase, we uphold the highest standards to safeguard customer confidentiality and respect client information. We fully acknowledge and adhere to strict data protection and confidentiality requirements. Rest assured, we are fully committed to maintaining strict compliance and reliability. Leveraging our extensive experience across numerous projects, we excel in adapting to various levels of security, ensuring flexibility to meet your specific needs.

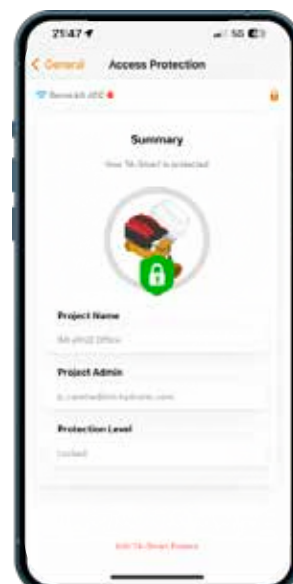
Product Solutions

Access Control Feature – TA-Smart

The updated Access Control feature from **TA-Smart** prevents unauthorised access to **TA-Smart** devices by anyone just within its Bluetooth range.

The project owner can grant access to specific users for **TA-Smarts** related to a certain project via the **HyCloud portal**. The access can be granted at various levels of access such as full access, viewer, and service.

Once connected, the person will have to validate their access to the **TA-Smart** device with the **HyTune app** using their email address. Upon every connection, an authentication token will need to be verified for access to be granted.



5. Design Complexity

HVAC solutions for data centres demand precision and scalability. Regardless of the data center size, from expansive hyperscale to small-medium facilities, our expert team specialises in customising HVAC system designs to seamlessly integrate with your operations.

New Build Design

When it comes to new data centres projects, we collaborate closely with your chosen stakeholders to deliver highly efficient system designs, expertly selecting and integrating HVAC products for a holistic system solution. Our experts are committed to creating applications that manage growing demands with an unwavering focus on efficiency and dependability.

To optimise design efficiency, we use Building Information Modeling (BIM) powered by ThorbiQ. Our BIM Application Suite provides over 550 product options and 1,800 articles, allowing designers to integrate 3D models into their plans easily. We support the entire design lifecycle, from initial planning to on-site execution, ensuring seamless installation and product commissioning, all while maintaining cost-effectiveness.

Modular Prefabricated Data Centres

In the realm of modular prefabricated data centres, we stand at the forefront with innovative SMART valves, Pressurisation, and Degassers, setting new standards for efficiency, sustainability and cost-efficiency. Our partnership guarantees flawless integration of HVAC components into your prefab systems, emphasising rapid deployment and energy-efficient designs. This approach effectively addresses customisation and size challenges, facilitating smooth project progression, even for applications without on-site welding. Engineered for optimal performance and adaptability, our products deliver space efficiency and remain fully compatible with the evolving needs of modular prefabricated data centres.





HyPerformance Renovation / Retro-fit Design

When it comes to renovations, we take a unique approach that prioritises sustainability without compromising efficiency. Our team will guide you through every step of the process, conducting thorough on-site assessments and taking precise measurements of your system. By identifying specific challenges, we can develop energy-efficient upgrade strategies that not only minimise costs but also maximise operational performance and energy efficiency.

Our products are meticulously designed for retrofit applications, taking into consideration size, construction, and ease of commissioning. This ensures seamless integration into existing applications with a strong focus on adaptability, scalability, and sustainability.

By taking this holistic HyPerformance system approach, we have successfully solved critical performance challenges and reduced energy consumption in buildings by up to 50%.





**Reference
Cases**

**Our products
and expertise in action**

Delivering a High Performant HVAC Solution with high confidentiality for a Large Tech Company

Project overview:

Our client, a leading large Tech company based in the US, required a high-performing HVAC system that not only met their stringent security standards but also maximised energy efficiency. As a trusted partner, IMI was tasked with delivering a reliable and efficient HVAC system for their Data Centres.

Customer's challenges:

1. Ensure high-efficiency balancing solution for multiple Data Centres.
2. Meet the exceptional security standards and requirements of the Tech company.
3. Collaborate with stakeholders – IMI, the final customer, a large Tech company, and a leading ventilation equipment manufacturer - to design and implement the optimal solution.

Key Benefits:

1. Enhanced energy efficiency: Our solution will enable the Tech company to maximise energy efficiency in their HVAC systems, resulting in reduced operational costs.
2. Exceptional security standards: Our advanced balancing solution not only meets but surpasses the rigorous security standards required by the customer.
3. Reliable partnership: We provide ongoing support, ensuring seamless delivery and integration of our valve solution with the client's axial fan coils for cooling of CRAC units at the customers' Data Centre facilities.

Solution:

To address the client's challenges and unique requirements, our dedicated R&D team worked closely with the Ventilation Engineering team. After a thorough analysis, we recommended the implementation of our TA-Modulator PIBCV valves and the TA Slider actuators.

Results:

We have been diligently working on implementing the recommended solution, which aims to improve performance and security for the client. This commitment to quality and innovation has fostered a strong partnership with our valued customer.

Our ability to deliver a high-performing solution while meeting the stringent security standards of a leading large Tech company is a testament to our expertise, collaborative approach, and commitment to customer satisfaction. By providing cutting-edge HVAC solutions, we empower our customers to achieve their business goals while optimising energy efficiency and maintaining exceptional security standards.

Achieving optimal hydronic control in CRAC units in an existing Sydney Data Centre

Project overview:

The mechanical contractor had designed the chilled water circuit with only isolation valves in the field. Additionally, it incorporated Dp remote sensors to enable VSD control on the main chilled water pumps. With this approach, they rely on a plug-and-play commissioning and self-balancing solution provided by the installed CRAC (Computer Room Air Conditioning) units.

Each Power Train Unit (PTU) consists of 4 CRAC units, resulting in a total of 24x PTUs. These CRAC units are specifically designed to regulate temperature and humidity in computer rooms or data centres.

Customer's challenges:

The CRAC units supplier faces the following problems:

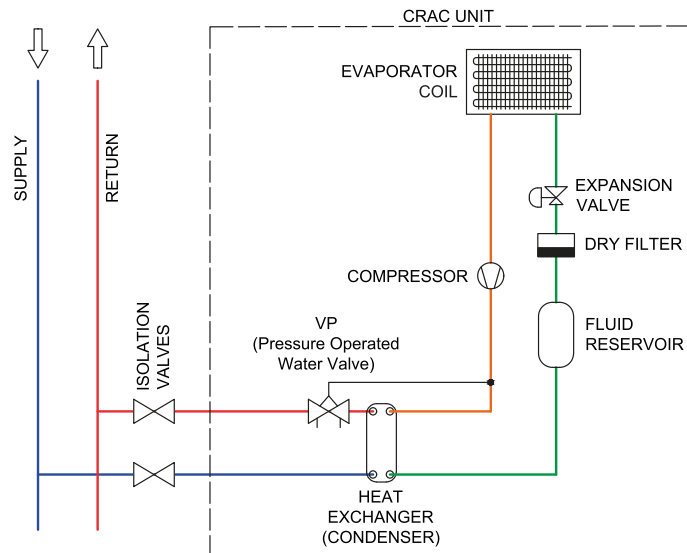
1. Stable Differential Pressure Requirement:

The CRAC units supplier needs to ensure a stable differential pressure for the CRAC unit's "VP" control valve. This valve operates based on gas pressure within the refrigeration circuit and must accurately regulate water flow on the plate heat exchanger (water-cooled condenser of the CRAC unit). The proper operation of the CRAC unit depends on maintaining the heat rejection process efficiently.

2. Limitations on Hydronic Solutions and Space:

Despite their expertise, the CRAC unit supplier isn't allowed to propose any hydronic solution that would require changes to the existing piping network layout of the chilled water system.

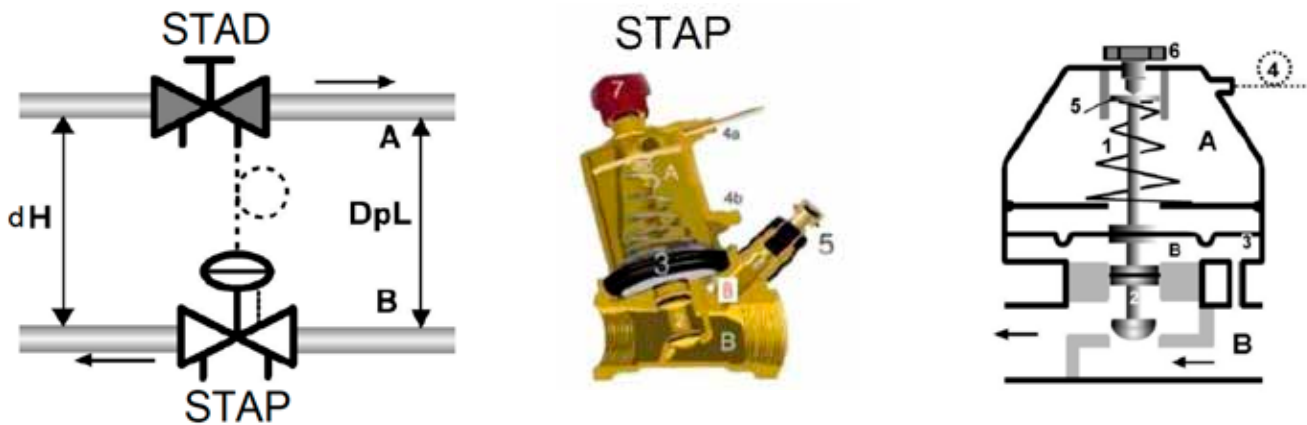
As a result, the flow control must be resolved within the limited space provided by the CRAC unit's housing.



Solution:

To ensure a high level of control performance, specifically high valve authority for modulation control, it is important to maintain a constant differential pressure (Dp) on the control device. This helps accurately regulate the flow rate for the coil and prevents disturbances in the behaviour of the hydronic system, such as differential pressure fluctuations caused by the operating of control devices.

Function of STAP (Differential Pressure Controller): The primary role of STAP is to maintain a practically constant differential pressure (DpL) across the circuit, regardless of changes in the primary differential pressure (dH).



Our dedicated technical team proposed two solutions incorporating STAP:

Option 1:

STAD Manual balancing valve + STAP Differential pressure controller before the 2-way VP valve and coil

The STAD valve should be commissioned to meet the full load design flow rate of the CRAC unit.

The STAP valve is connected to the STAD valve through a capillary line, which monitors the pressure across the condenser heat exchanger. The internal spring of the STAP valve modulates to maintain the differential pressure across the condenser heat exchanger and VP valve.

Option 2:

STAD Manual balancing valve + STAP Differential pressure controller across the 2-way VP valve

The STAD valve should be commissioned to meet the full load design flow rate of the CRAC unit.

The STAP valve is connected to the STAD valve through a capillary line, which monitors the pressure across the VP valve. The internal spring of STAP modulates to maintain the differential pressure across the VP valve.

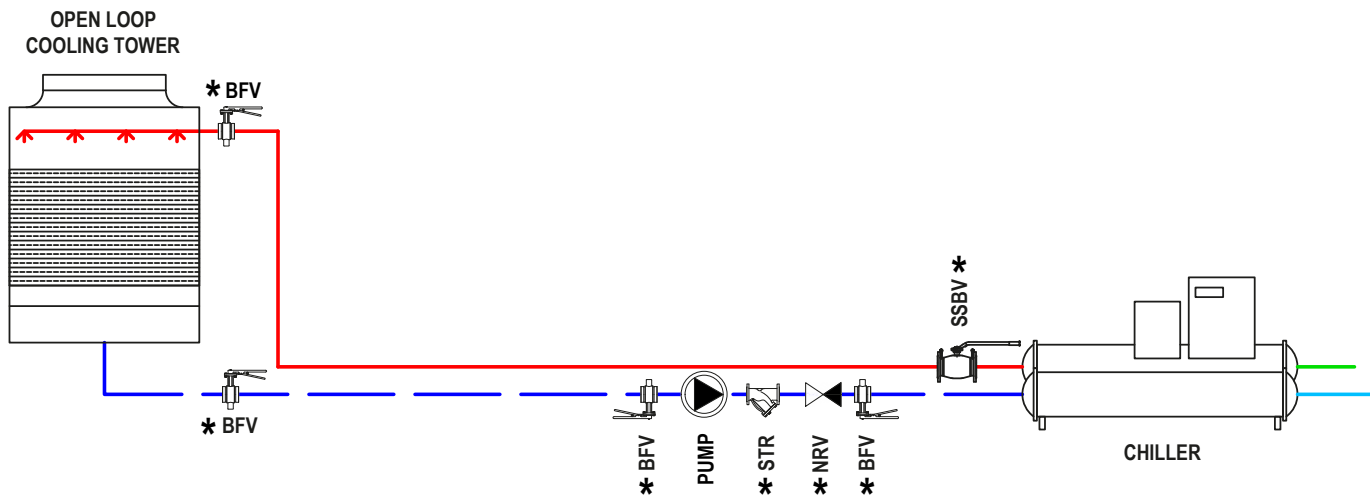
Option 2 offers even higher authority and control performance compared to Option 1 because the differential pressure of the coil is not part of the STAP's stabilising differential pressure (DpL). As a result, more effective control performance can be achieved.

Results:

After careful consideration, the client ultimately selects Option 1 due to space limitations inside the housing of the CRAC unit.

HVAC Applications








Classification I. (Uptime Institute - Tier I.)
 Redundancy: NONE



Legend:






- Condenser Water Return
- Condenser Water Supply
- Evaporator Water Return
- Evaporator Water Supply

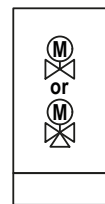
— Make-up water

-  Butterfly Valve
-  Strainer
-  Stainless Steel Balancing Valve
-  Pump
-  Non Return Valve
-  Microbubble and Dirt Separator
-  2 way electronic differential pressure controller

Tier I. classification requirements:

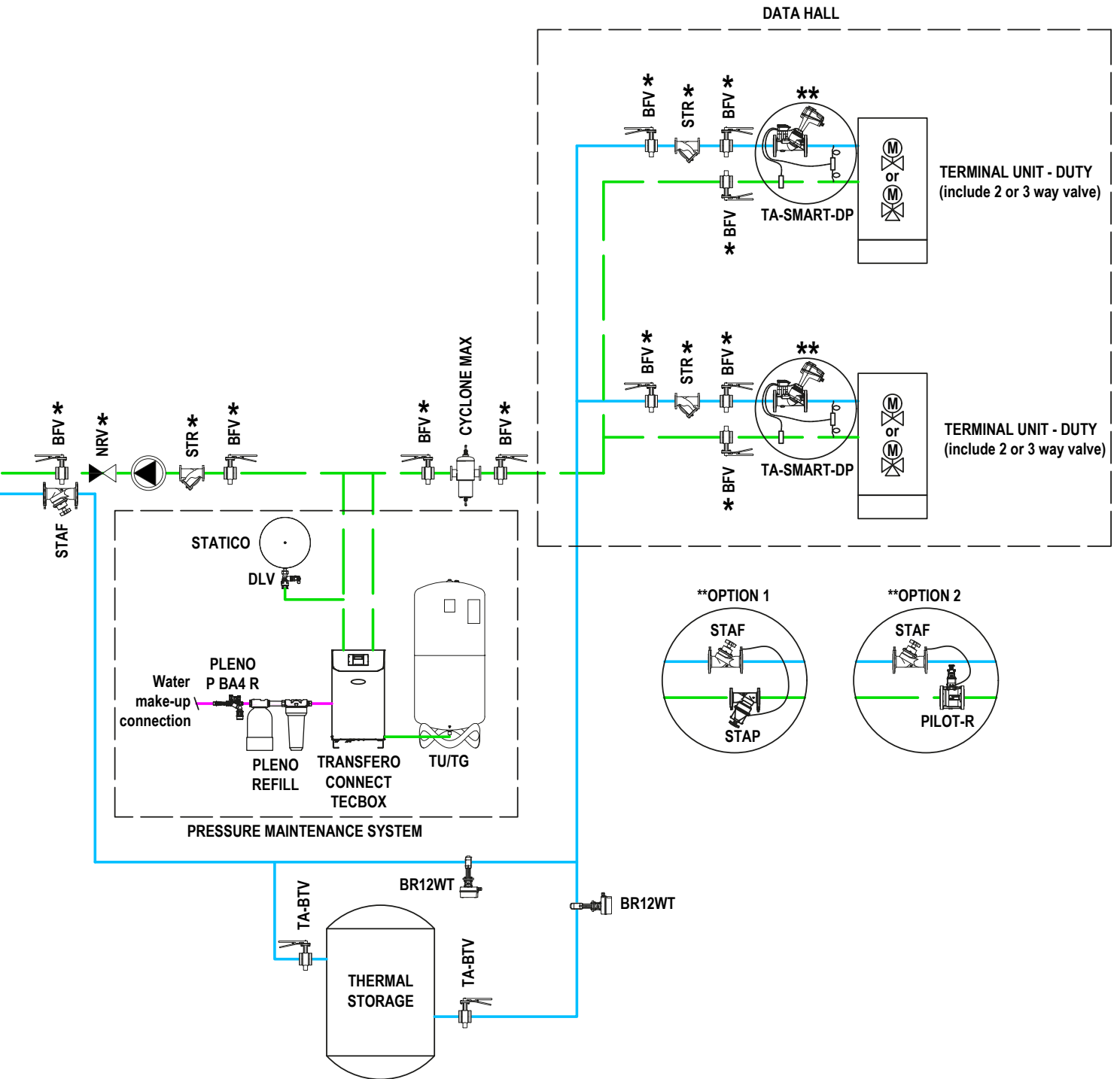
A Tier I data center is the basic capacity level with infrastructure to support information technology for an office setting and beyond. The facility will have to shut down completely for preventive maintenance and repairs, and failure to do so increases the risk of unplanned disruptions and severe consequences from system failure.

-  Differential Pressure Controller
-  Pressure Maintenance System
-  Softening or Demineralisation Module
-  Back Flow Preventer
-  Balancing Valve



- Terminal units can be:**
- CRAH (Computer Room Air Handler)
 - Row-based cooling
 - CDU (Cooling Distribution Unit) with Rear Door Cooling
 - CDU (Cooling Distribution Unit) with Direct Chip Liquid Cooling

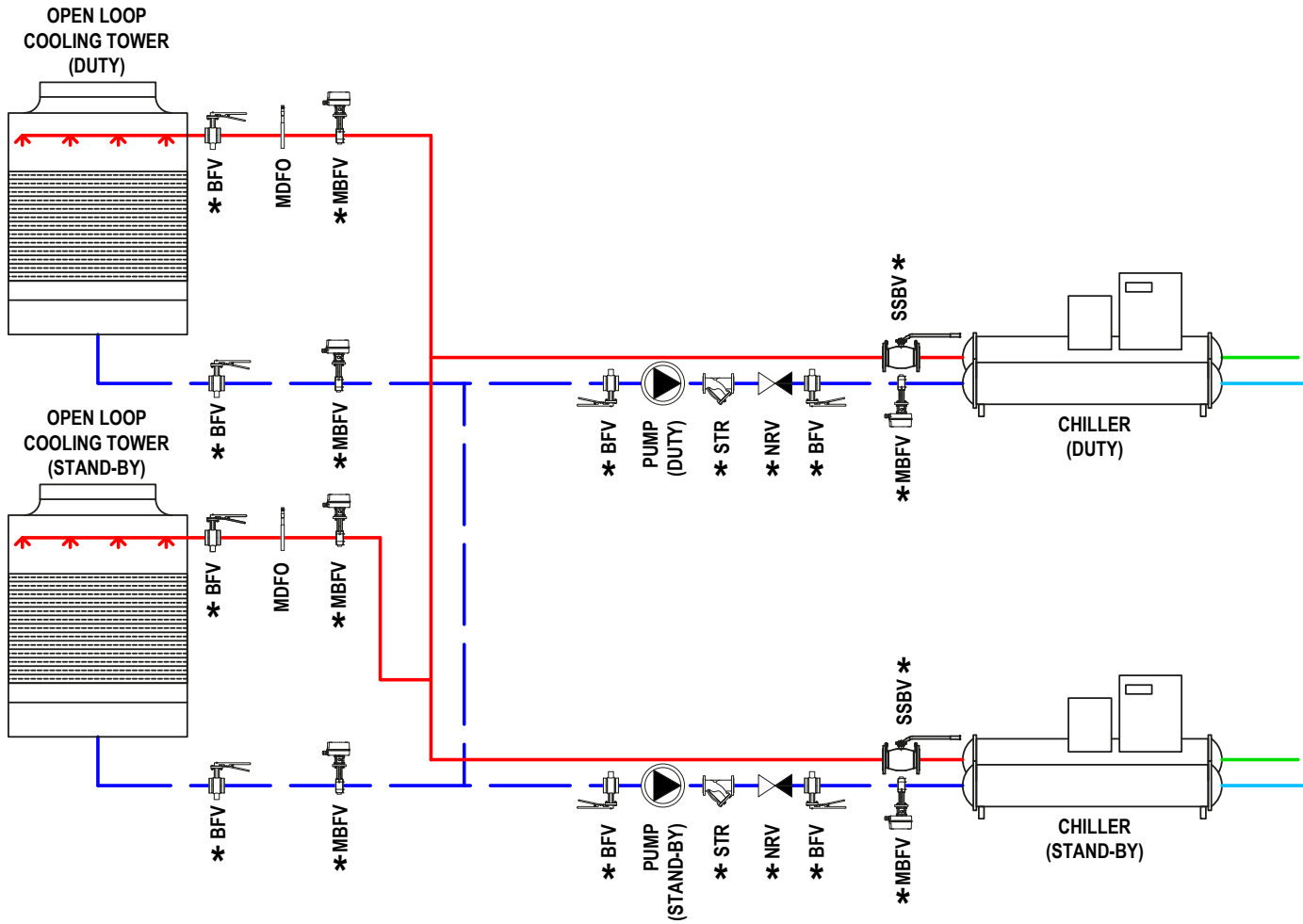
* For the application in the current system, please contact the local IMI-Hydronic representative



The HVAC system schematics provided serve as illustrations for typical applications in Data Centres. Nevertheless, if you seek tailored solutions precisely aligned with your specific needs and requirements, our expert team stands ready to assist you. Feel free to reach out if you have any questions or would like to engage in a detailed discussion about your project.

Classification II. (Uptime Institute - Tier II.)

Redundancy: Partial N+1 (Cooling Units)

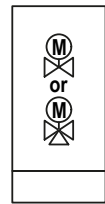


Legend:

- Condenser Water Return
- Condenser Water Supply
- Evaporator Water Return
- Evaporator Water Supply
- Make-up water

- Butterfly Valve
- Measuring Orifice
- Motorized Butterfly Valve
- Strainer
- Stainless Steel Balancing Valve
- Pump
- Non Return Valve
- Microbubble and Dirt Separator

- Differential Pressure Controller
- Pressure Maintenance System
- Softening or Demineralisation Module
- Back Flow Preventer
- Balancing Valve
- 2 way electronic differential pressure controller

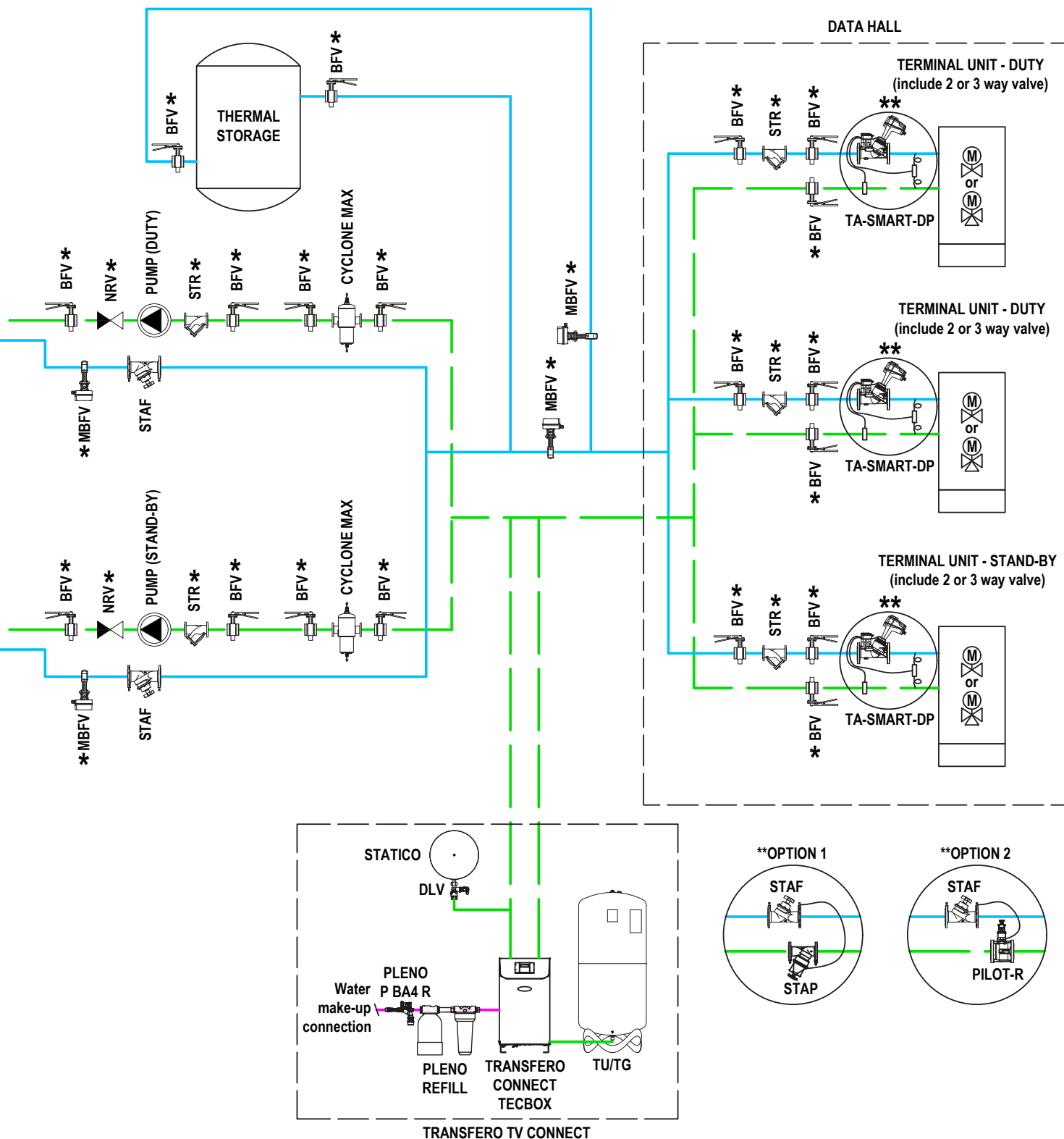


- Terminal units can be:**
- CRAH (Computer Room Air Handler)
 - Row-based cooling
 - CDU (Cooling Distribution Unit) with Rear Door Cooling
 - CDU (Cooling Distribution Unit) with Direct Chip Liquid Cooling

Tier II. classification requirements:

Tier II. facilities cover redundant capacity components for power and cooling that provide better maintenance opportunities and safety against disruptions. The distribution path of Tier II serves a critical environment, and the components can be removed without shutting it down. Like a Tier I facility, unexpected shutdown of a Tier II data center will affect the system.

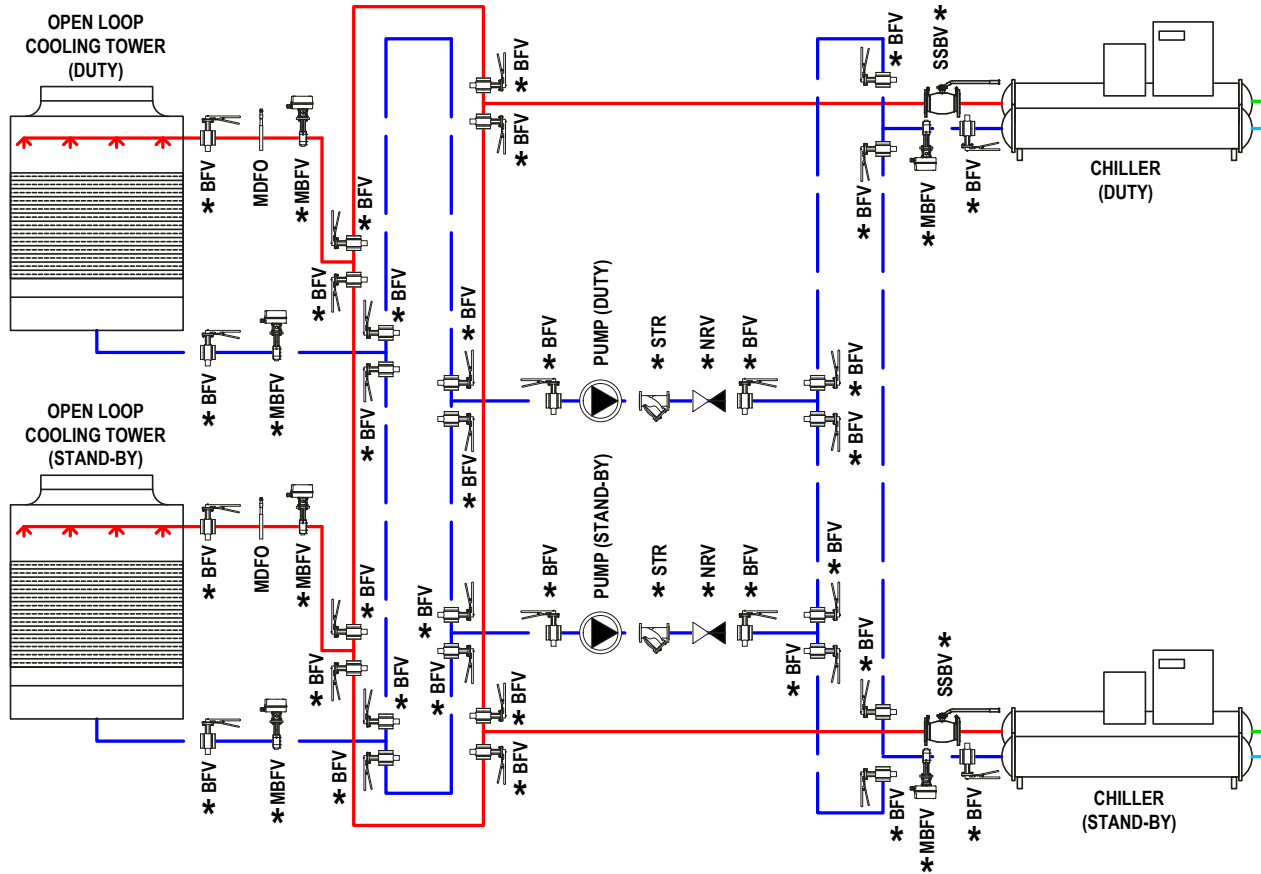
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Classification III. (Uptime Institute - Tier III.)

Redundancy: Full N+1

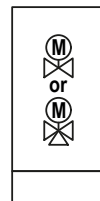


Legend:

- Condenser Water Return
- Condenser Water Supply
- Evaporator Water Return
- Evaporator Water Supply
- Make-up water

- Butterfly Valve
- Measuring Orifice
- Motorized Butterfly Valve
- Strainer
- Stainless Steel Balancing Valve
- Pump
- Non Return Valve
- Microbubble and Dirt Separator

- Differential Pressure Controller
- Pressure Maintenance System
- Softening or Demineralisation Module
- Back Flow Preventer
- Balancing Valve
- 2 way electronic differential pressure controller

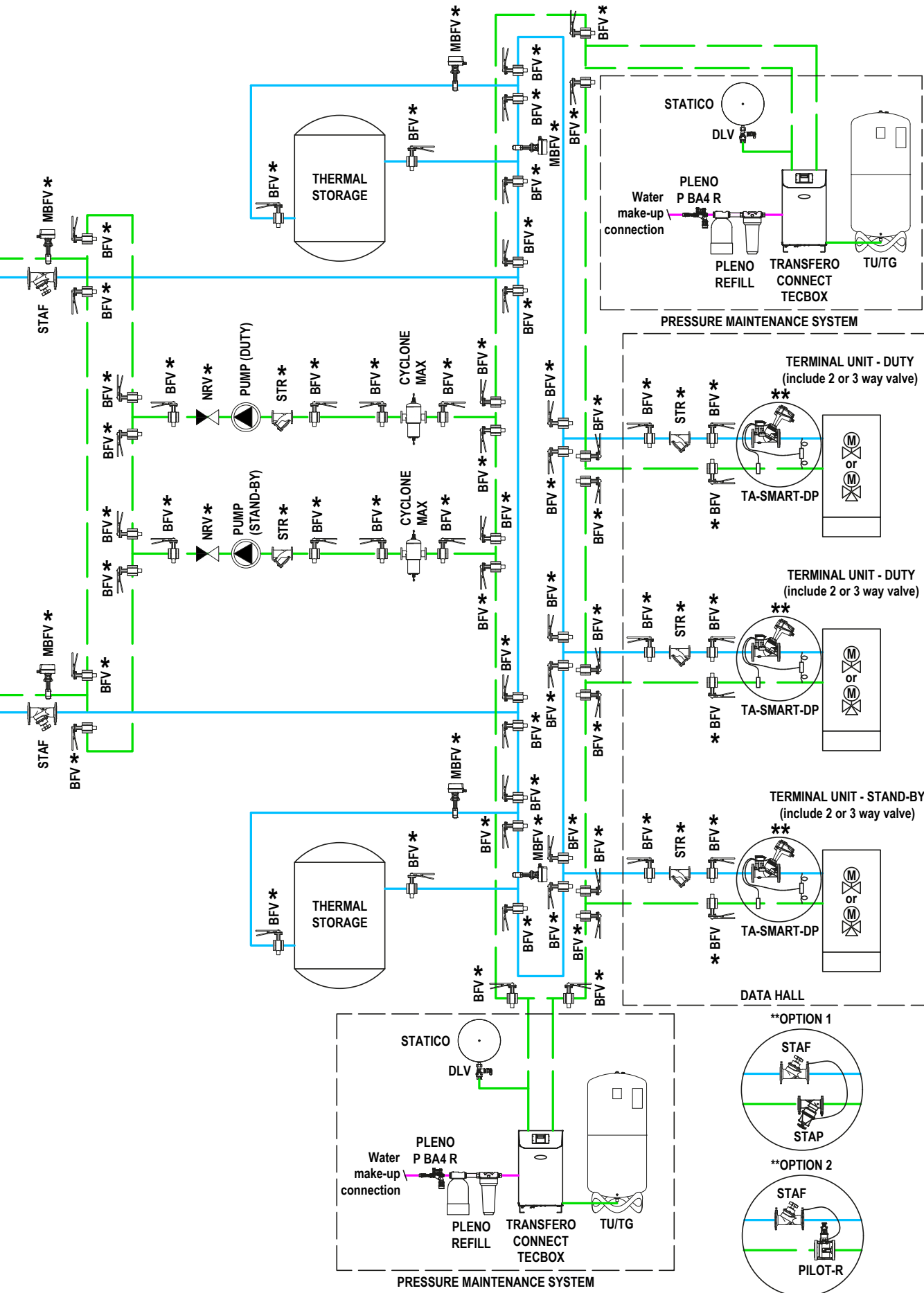


- Terminal units can be:**
- CRAH (Computer Room Air Handler)
 - Row-based cooling
 - CDU (Cooling Distribution Unit) with Rear Door Cooling
 - CDU (Cooling Distribution Unit) with Direct Chip Liquid Cooling

Tier III. classification requirements:

A Tier III data center is concurrently maintainable with redundant components as a key differentiator, with redundant distribution paths to serve the critical environment. Unlike Tier I and Tier II, these facilities require no shutdowns when equipment needs maintenance or replacement. The components of Tier III are added to Tier II components so that any part can be shut down without impacting IT operation.

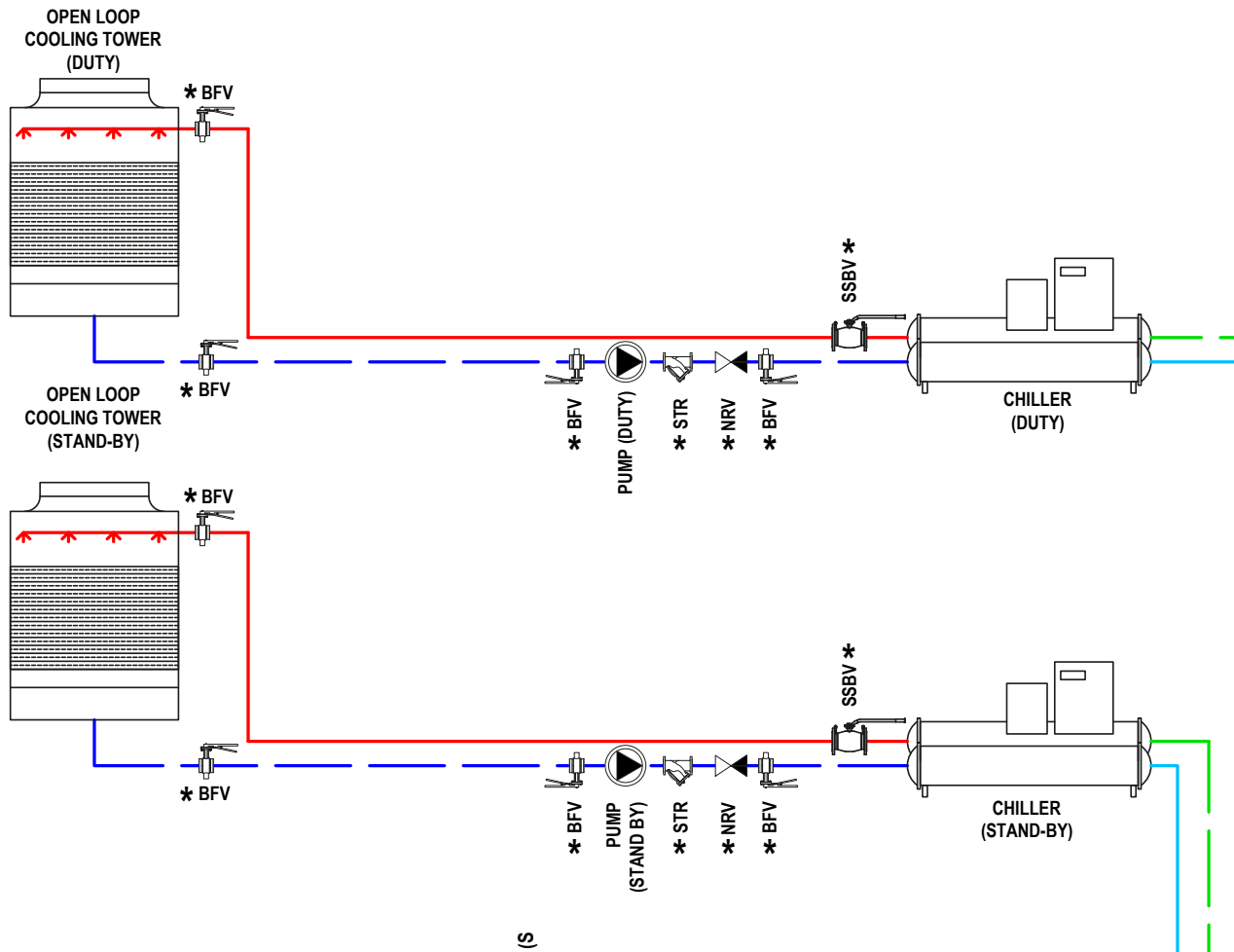
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Classification IV. (Uptime Institute - Tier IV.)

Redundancy: 2N



Legend:

- Condenser Water Return
- Condenser Water Supply
- Evaporator Water Return
- Evaporator Water Supply
- Make-up water

- Butterfly Valve
- Measuring Orifice
- Motorized Butterfly Valve
- Strainer
- Stainless Steel Balancing Valve
- Pump
- Non Return Valve
- Microbubble and Dirt Separator

- Differential Pressure Controller
- Pressure Maintenance System
- Softening or Demineralisation Module
- Back Flow Preventer
- Balancing Valve
- 2 way electronic differential pressure controller

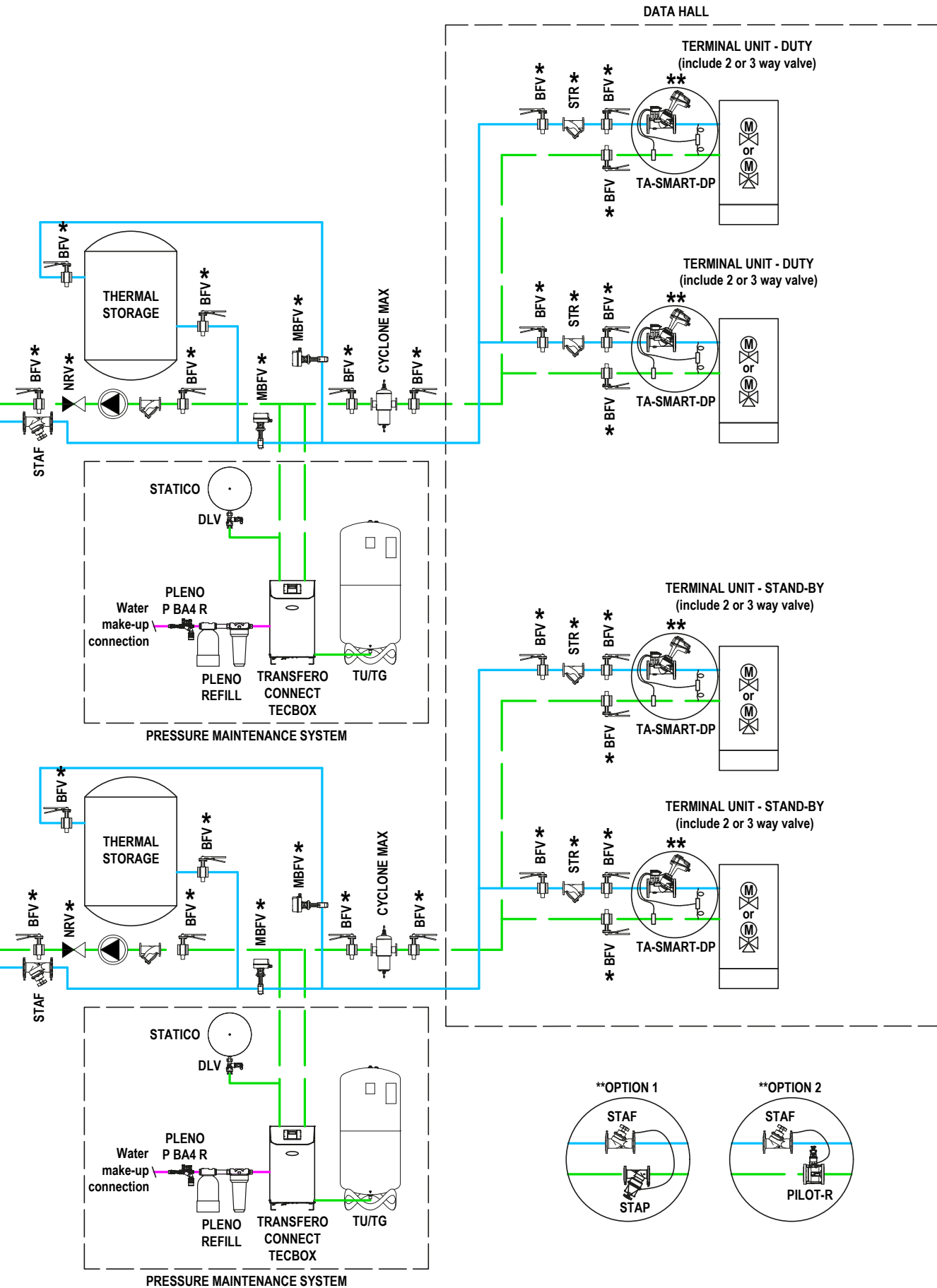
Terminal units can be:

- CRAH (Computer Room Air Handler)
- Row-based cooling
- CDU (Cooling Distribution Unit) with Rear Door Cooling
- CDU (Cooling Distribution Unit) with Direct Chip Liquid Cooling

Tier IV. classification requirements:

A Tier IV data center has several independent and physically isolated systems that act as redundant capacity components and distribution paths. The separation is necessary to prevent an event from compromising both systems. Tier IV facilities add fault tolerance to the Tier III topology. When a piece of equipment fails, or there is an interruption in the distribution path, IT operations will not be affected.

* For the application in the current system, please contact the local IMI-Hydronic representative



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