IMI Hydronic Engineering

Hydronic HVAC Systems in Healthcare Facilities

Common Challenges & Solutions

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IMI Hydronic Engineering

Introduction

The growing interest in healthcare facilities gives rise to the need to modernize and refurbish the existing building stock as well as to invest in additional construction.

The performance of any healthcare building is intrinsically linked to their HVAC ecosystem, as accurate indoor temperature and air quality are critical for their operation. However, for each of these projects - renovation or new construction – HVAC systems come with their own set of challenges.

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 the challenges that come with the renovation and new build of healthcare facilities. We offer innovative products, reliable technologies, and personal support from the design stage all the way to the system start-up.

IMI TA	**Since 1897** Balancing, Control & Actuation leader
IMI PNEUMATEX	**Since 1909** Pressurisation & water quality leader
IMI HEIMEIER	**Since 1928** Thermostatic control leader

Renovation Projects

The renovation of healthcare facilities does not only require finding solutions to individual system problems but also ensuring the improvement of the global system operation as a whole. To achieve this, both current building conditions, such as existing pipe work, and the desired depth of renovation need to be addressed.

Below we review **the most common HVAC problems** in healthcare facilities and explain what **solutions** IMI HE can provide to tackle them efficiently and effectively.

System Noise

Inability to achieve the right indoor temperature

Mitigation of operational risks

Renovation expertise


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System Noise

Disrupting system noise is the result of vibrations across valves and the pipework. If you want to meet all required noise regulations, specific for hospital and surgery rooms, you have to be aware of different noise sources:

- Air and dirt circulating in radiators and pipes
- High flow speed or too high-pressure drop in valves

Air vents, dirt separation and degassing solutions help to maintain the system "clean" and to avoid air bubbles that, when passing through valves and radiators, lead to system noise. Added bonus is that it will also increase system efficiency and create not only a silent but also a high performing heating and cooling system.

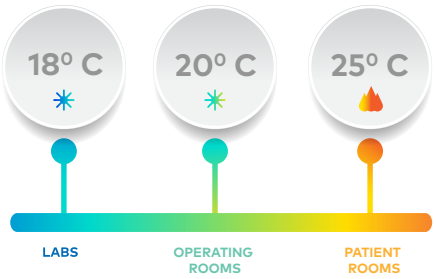
Oxygen in the system reacts with metal components leading to rust built up that clogs pipes and significantly reduces efficiency and durability of equipment.

Installing **DP controllers** on the horizontal line (floor circuit) helps to control the available pressure and if needed rectifies the pressure interval entering that specific zone. This helps to correct any overflow you might have that would lead to a too big pressure drop on control valve, resulting in vibration and noise. Proper balancing of the system is also critical to prevent overflow situations in the first place.

A combined solution would be to install a Pressure Independent Valve, which would do the work of automatic balancing and DP controller. Basically, you will have all in one!

Inability to achieve the right indoor temperature

Different zones of healthcare facilities have very different temperature requirements (e.g., labs, operating rooms, patient rooms) which need to be precisely respected for safe & comfortable operation.



Accurate delivery of temperature is also intrinsically linked to energy optimization, given that 1°C too hot or too cold can already increase energy consumption by 6-11%. As hospitals are amongst the most energy-intensive buildings, with annual consumption 5 to 7 times higher than conventional office buildings, optimizing the right delivery of temperature can have a significant impact on energy bills.

A switch from constant to variable flow control ensures that only the necessary amount of flow is delivered to meet the requirements of the terminal unit. This in order to improve the compatibility between production and distribution and to optimize the return temperature. This adaptability is particularly interesting because you don't always need 100% of the power all time. In fact, most buildings operate under 20% of flow during 80% of the heating/cooling season.

Valve solutions with Equal Percentage Characteristic (EQM) also ensure they can still precisely control the flow even during those low flow conditions (which is not always the case for most valves in the market) to help guarantee the right room temperature, at all times.

When an old building gets a new outer insulation and facade as well as new windows, the inside conditions change. In this case, it becomes necessary to recalculate the heat loss of the building, to re-set the temperature drop of a referential terminal unit and to recalculate the terminal unit flows, hydronic balancing calculations, and to reconfigure valves and differential pressure controllers.

With intelligent **Flow Control Technologies,** such as AFC (Automatic Flow Control), in terminal unit solutions and **Pressure Independent Valves** (which have built-in DP controllers) complex calculations for hydronic balancing are no longer necessary as these technologies adjust automatically the design flow independently to the differential pressure variation, making them time-savers and cost-efficient solutions.

Mitigation of operational risks

SAFETY REQUIREMENTS

An easy renovation upgrade is to switch old thermostatic heads. Not only they do not fulfil new requirements for clean rooms and operating theatres, but they are also inefficient. **New thermostatic heads can save up to 28% in energy consumption in comparison to manual ones.** In addition, they have the smooth & seamless surfaces and lock settings that meet the necessary safety standards.

FIGHTING BACTERIA

Hot water systems can struggle with bacteria such as Legionella, which is sometimes solved by adding chemical additives to the water. However, these chemical additives should be the last resort because they can damage inner parts of important components like valves. The solution is to keep the system water temperature above 50°C (even better above 55°C) and periodically heat the water to 70 - 80°C to allow a heat disinfection. Removing worn-out insulation, avoiding zones with too low flow and static water as well as "blind arms" circuits also help fighting bacteria.

MITIGATING POWER FAILURE

Power disorders or energy outage can sometimes be inevitable but their consequences to the HVAC system can be mitigated.

Installing actuators with a fail-safe function, like **TA-Slider**, mitigates this risk. With the fail-safe feature, the actuator moves to a predefined position in case of a power failure, ensuring that the safety status of your flow is achieved as desired. With our smartphone app **HyTune**, you can conveniently and accurately view and configure the emergency position, the time delay for change of position and the health status of the actuator. as well as resume 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.

Renovation expertise

Thanks to our long-lasting experience in renovation projects, we will support you from the design stage to the final commissioning. We will help you make the necessary HVAC layout changes and technological upgrades. In order to not only make the system efficient and effective and complaint with today's regulatory requirements but also maximizing the usage of existing pipework and minimizing down-time.

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IMI Hydronic Engineering

Expertise applied

Outram Community

Hospital renovation

The Outram Community Hospital (OCH) is part of the Singhealth Community Hospital group in Singapore. It is a 19-story building with 545 patient beds and hosts various rehabilitation spaces, construction was finalized in 2019.

IMI Hydronic was tasked to do a full system analysis with the aim to optimize the pump consumption and ensure the optimal performance of the installed products providing a comfortable indoor environment for all users of the hospital.

To begin a team of IMI Hydronic experts ran a preliminary analysis at several points of the Hydronic system, including all the terminal units – FCU, AHU - as well as local circuits, control valve authorities and chiller efficiency.

Data was collected using our TA-SCOPE, a state-of-the-art diagnostic measuring instrument. TA-Scope allowed the team to measure flow rates and pressure drops from each IMI TA-balancing valve at each of the AHUs and across the terminal units across the entire system. Once the data was collected and analysed, a comparison to the original system design was carried out. Traditionally, this would have been very hard to obtain but given we did very hard to obtain, but because we did the system design in the first place we had all the information.

The data gathered was inputted into the HySelect software where the Hydronic team was able to simplify complex hydronic calculations and determine the most optimized pump setting to ensure the right pump head and flow rates were delivered to all terminal units and to deliver the right temperature to all the different areas of the hospital.

During the testing and commissioning of the hydronic system, we were able to validate that the numbers from the Hyselect calculation tool were the same as the measurements done real-time on the site, which gave the customers full peace of mind. Thanks to the optimization activity put in place, the OCH was able to reach a Chiller Efficiency that is within the parameters for Singapore's GreenMark to achieve LEED Platinum Certification.

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SingHealth
Outram Community Hospital

New Build Projects

The new build of a healthcare facility requires a meticulous system design. The correct selection and sizing of products ensures accurate delivery of temperature, reliability in all conditions and durability. But it doesn't stop there, a diligent project follow-up during the installation and commissioning phases ensure that the system start-up matches design conditions for smooth operation for many years to come.

Below we highlight the critical considerations for a good Hydronic HVAC system design and smooth operation in healthcare facilities.

Smart HVAC System

Good Design & Planning Saves Precious Time Later

Confidence in Commissioning & System Start-up


IMI Hydronic Engineering
No margin for error

Smart HVAC System

A Smart HVAC system offers multiple benefits including easy & transparent access to critical system parameters, remote troubleshooting and automation of operation for better delivery of comfort and energy efficiency.

Our digital actuator connects the controls' system to all BMS systems so that system operation can be monitored and analysed and equipment to be controlled. An intelligent Hydronic HVAC system is responsible for controlling all relevant parameters in order to achieve optimal indoor conditions, especially the air temperature in critical areas. For further energy savings, digitally programmable binary input also enables to link the controls' system to other fixtures, just as windows, to stop heating & cooling when they are opened.

Taking smart systems to a whole new level is **our connected valve (TA-Smart)**, which has an internal control feedback. It continuously measures the flow, difference in temperature and power and logs this information in a smartphone app – even without BMS communication – for transparent circuit insights on the palm of your hand. In addition, it communicates that data to its own actuator to change its input signal to ensure it is always delivering on the desired levels; for full smart autonomous control! Because it measures power with high accuracy, **TA-Smart** can also be used for energy metering purposes by zone.

Just like our smart controls solution, our pressurization equipment also has connectivity capabilities. It can be integrated into the BMS (Modbus RTU and TCP-IP) or allow for live viewing of information via its **BrainCube** connect control panel.

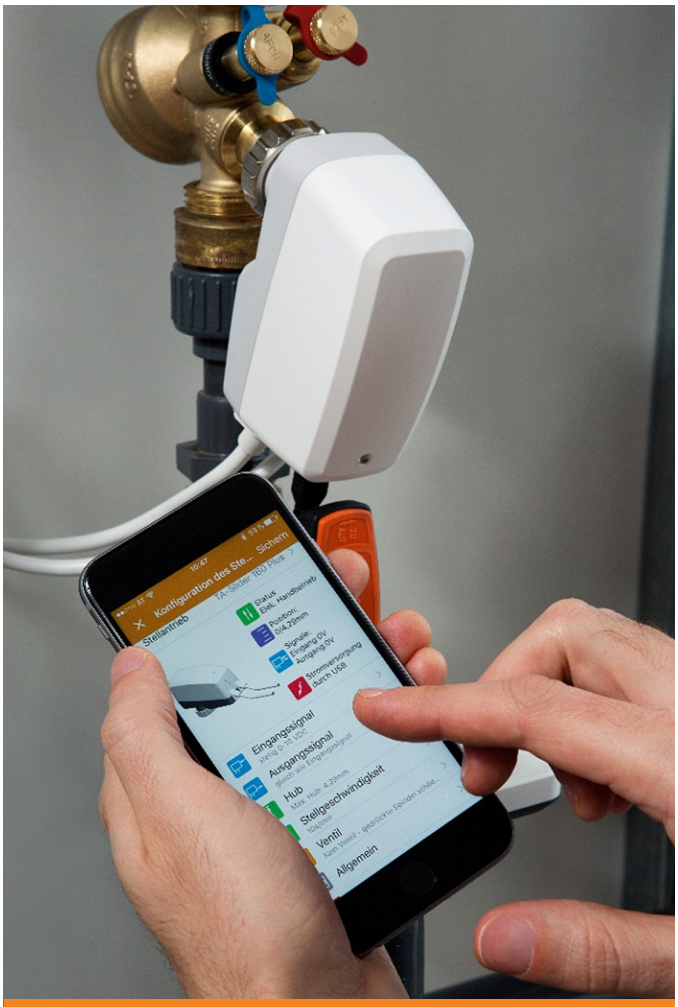
The pressure maintenance equipment is vital for the operation of an HVAC system thus having the possibility of 24/7 remote access and operation of critical system parameters can make all difference in troubleshooting situations. For example, BrainCube can flag system leaks and send an alert message to a smartphone, so that adjustments can be made remotely before the problem gets worse.

Good Design & Planning Saves Precious Time Later

Our products have been cleverly designed to have fewer variants, more installation possibilities and adapt to real on-site conditions, saving you precious time and mitigating risk.

Our control solutions are fully configurable via our smartphone app **HyTune**, so you don't have to climb into dark ceilings with screwdrivers to set DIP switches. It includes over 200 settings to allow full on-site adapt-ability. The "copy and paste" function allows to replicate actuator configurations with only few clicks.

Our dedicated team of technical experts will work alongside you to support you at this crucial step.



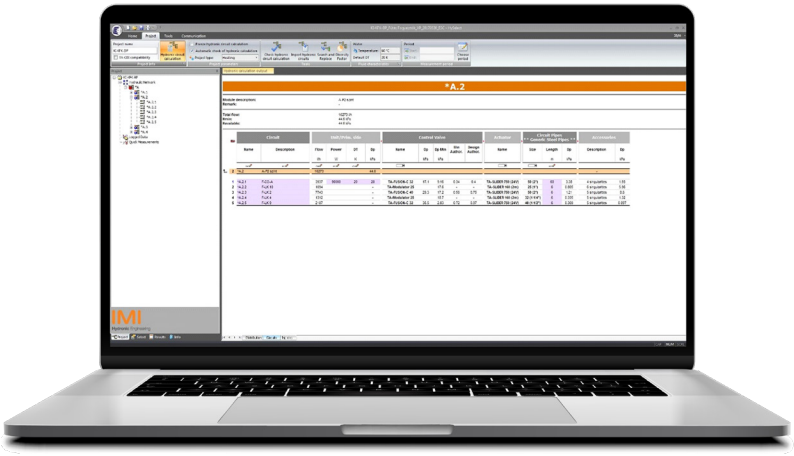
The **TA-Slider** actuator is fully configurable via the **HyTune app**

Confidence in Commissioning & System Start-up

System start up is a lot smoother if the system design and product sizing were done well in the beginning. Our digital software tools simplify system design, product selection and sizing. This information can then be uploaded directly to your TA-Scope measurement instrument for validation of system conditions.

In case additional support is needed, our centralized technical team, the Engineering Support Center, is available to revise your HVAC drawings and support you with hydronic calculations, product selection & sizing. This highly technical team has already helped hundreds of customers to develop or optimize their system designs.

HySelect software for free product selection & sizing support



Find out more
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IMI Hydronic Engineering

Expertise applied

Tirol Kliniken hospital complex project:

This project consisted of the full construction of a new hospital complex for Tirol Kliniken in Innsbruck, Austria.

IMI Hydronic Engineering won the project in April 2018, and it was finalized in August of that same year. The role of IMI was to plan, execute, and carry out the commissioning as well as providing the necessary products for the whole HVAC system of the new building.

The IMI Hydronic team in Austria started by carrying out a complete calculation of the pipe network with the support of the Engineering Support Centre (ESC). Once calculated, we could plan the best solution for the client, including product selection, sizing, pressure drops, valve KV values and other settings.

Due to the size of the building, it was essential to have a system that would provide sufficient flow, with adequate pressurisation. We installed Pressure Independent Balancing & Control Valves (PIBCV), with built-in differential pressure controller which provides high control authority, accurate controls stability and allows for seamless system balancing. Its independent EQM characteristics enable accurate controlling of every very small flow, providing the right indoor temperature during the entire heating season.

The customer opted for a full underfloor heating system which was a very extensive network. Therefore, we decided to use balancing valves and differential pressure controllers for the risers in combination with the underfloor heating distribution equipped with **Automatic Flow Control (AFC) technology.** This unique technology allows for hydraulic balancing in a straightforward operation and without complex calculations, which was essential to the client in terms of ease of management.

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