Flexible commissioning – the way forward for fan coil and chilled beam systems

Introduction

Marflow's 'flexible commissioning' package opens the doors for a whole new approach to the design, installation, commissioning and operation of fan coil and chilled beam systems. As such, it delivers significant benefits throughout the life cycle of the installation – for all stakeholders.

Benefits for specifiers

- Greater flexibility in system design
- Simplified system design with minimum CAD time
- Minimal number of system components to reduce complexity and cost
- Improved quality control through pre-fabrication and pre-testing
- Added-value solution for the end user

Benefits for installers

- Savings on site time
- Reduced risk of errors in installation and call-backs, retentions etc
- Less reliance on highly skilled operatives
- Ability to deploy skilled staff more effectively
- Added-value solution for the end user

Benefits for end users

- Reduced capital outlay
- Quicker project completion with minimum disruption
- Improved comfort and energy performance
- Inherent flexibility to easily reconfigure system to changes in workspace(s)

What is flexible commissioning?

Traditionally, changing the configuration of a fan coil or chilled beam system, and subsequently re-commissioning the system, has been extremely disruptive and expensive. In particular, it has required specialist engineers to access the ceiling void to make all necessary adjustments, so that very often staff would have to be moved from the area while the work was carried out.

As the modern workplace has become increasingly mobile and flexible, this has proved to be a major concern for building operators. Maximum efficiency will only be maintained if the systems are adjusted each time the workspace changes, but the associated disruption and expense has often deterred people from making these changes. The result is that many systems now fail to maintain their design performance as building operators compromise and follow the path of least resistance.

In contrast, variable refrigerant flow (VRF) systems can be adjusted and re-commissioned from a central PC with no disruption and minimal expense. However, many specifiers and building operators have concerns about distribution of refrigerant within the building and would prefer to use hydronic systems where possible.

The flexible commissioning concept exploits the characteristics of addressable pressure independent two-port control valves (PICVs) and the ability to adjust these valves from a remote location through a BMS or BACnet system.

Use of addressable PICVs can be quickly and easily adjusted to suit different circumstances, creating a dynamic regime that gives building and energy managers far greater control of both energy optimisation and comfort levels.

Consequently the flexible commissioning concept gives building operators comparable flexibility to VRF systems and enables them to maintain optimum performance for their systems. The detail of flexible or remote commissioning is discussed in more detail towards the end of this document.

Responding to change

For example, such a system enables water flows to be quickly and easily adjusted in relation to increasing or decreasing heating and cooling loads in a workspace, without the need for specialist commissioning skills. These changes may be the result of variation in internal heat gains through changing occupancy patterns, increases in IT equipment or re-configuration of spaces.

Low carbon technologies

Similarly, in a situation where heating and cooling are provided by a heat pump, use of an addressable valve will enable water volumes to be adjusted in direct response to changes in heating and cooling loads throughout the year. In this way, the same coil can be used for heating or cooling for most of the year, adjusting water volumes to compensate for the varying outputs of the heat pump.

Reduced maintenance

This enhanced flexibility can also help to reduce maintenance requirements. For instance, when valves are fixed at a minimal position, the orifice may be so small that dirt and air can become trapped. Conventionally, the only way to free any dirt particles larger than the set orifice is to manually open the valves to allow the dirt through. However, with a dynamic system the simple expedient of setting valves to open fully for a few seconds once a week will eliminate blockage problems by flushing through any accumulated dirt particles.

Where Marflow Hydronic Systems (MHS) adds value

MHS has developed tried and tested processes to take much of the 'donkey work' out of fan coil and chilled beam systems and help to ensure that all of the benefits described above are realised in the most efficient and cost-effective fashion. From initial design through to handover and ongoing operation, we can help deliver the best solution for all parties to the project.

For all projects, MHS's purpose-designed software brings all valve information and hydronic performance data into a single, purpose-designed spreadsheet package that is continually updated, with any changes being distributed to all relevant parties.

Xterminator

The MHS Xterminator unit combines the innovative new EVOPICV pressure independent control valve with flow regulation, flow measurement, differential pressure control, flushing bypass and drain valve. This very compact unit can fit directly onto the fan coil unit, due to MHS's unique 40mm centre design. If fitted with a TRV head or actuator it then has temperature control of the terminal unit.

The manifold system

As an alternative to installing individual valve assemblies at each terminal unit, the units can be connecting to a manifold system that houses all of the valves for a group of, typically up to six, terminal units in a single, insulated box.

This has several advantages:

- All flushing and pipework testing can be carried out before the pipework to the terminal units is complete.
- The commissioning engineer can access perhaps up to six fan coils in one location, achieving major time savings.
- With a properly considered control solution the need to revisit each manifold more than once is unnecessary, often reducing the commissioning process to a 'read and record' exercise.
- Use of an insulated box enclosing the manifold system greatly improves the insulation of the system, reduces onsite insulation work and helps reduce energy consumption.
- The box also provides a suitable location to store information about the local system and can be used during the commissioning stage and beyond.

Single Station Balancing (SSB)

Even greater advantages are achieved when a manifold system fitted with pressure independent valves is combined with the Single Station Balancing

(SSB) technique that MHS is proposing as best practice for commissioning variable volume systems.

With conventional proportional balancing, the commissioning engineer needs to balance the entire system before problem circuits can be identified. Once those problems have been resolved the whole system then needs to be balanced again, leading to a lengthy process that can impact on the whole construction schedule.

The innovative SSB method is different because it uses a ‘subtraction’ technique to identify problem valves. This is based on knowing the design flow rates for each individual valve and, therefore, the total flow rate for that fan coil group.

Assuming all the valves are functioning correctly, isolating each valve will have a predictable effect on the total flow rate for the remaining valves. Where an unexpected result is observed it is a simple matter of elimination to quickly identify the valve that causes this, enabling the commissioning engineer to home in on the problem area.

Flexible/remote commissioning

The functionality of the EVOPICV makes it possible to program the valve characteristics or the valve performance curve into the fan coil unit controller. Once the performance curve is in the controller, design flow values can be entered on the front end (PC) and downloaded to the appropriate controller. The processor-controlled valve actuator ensures that the disc moves to the correct position. Any discrepancies between the design flow and actual flow can be made by entering the percentage adjustment calculated remotely.

Crucially, it is also this capability that makes it possible to make further adjustments after commissioning and handover, when the building is occupied and the environmental conditions are known. And, as discussed above, such adjustments can continue to be made through the life of the installation.

The BMS/Bacnet controller, housed in its own case, can be wired to the actuator via pluggable leads and sockets within the assembly to reduce installation time and the risk of connection errors. A power plug socket is provided for mains power to the controller and to allow switched power to the fan on the fan coil unit. A plugged cable is also provided from the controller to the fan coil unit supplying power and the temperature sensor. The communication cable to the BMS is also a pluggable connection.

The controller used by the system provides two accurately time controlled outputs to control the valve actuators within 1/900th of a second. It communicates with other controllers via a BACnet MS/TP network, which also enables communications with a PC, so that system software can be configured and updated without directly accessing the controller.

Conclusion

At a time when building operators are under considerable pressure to improve energy efficiency and reduce carbon emissions, the flexible commissioning methodology provides the tools to ensure their air conditioning is responsive, adaptable and maintains efficiency through the life of the system. It also makes it easier for them to introduce low carbon technologies, such as heat pumps, to existing systems without major disruption or expense.