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ALL SYSTEMS GO

Preparing for launch with building commissioning



ALL SYSTEMS GO

When it comes time to hand over the keys to a building, how can you be sure that the systems will operate as intended? **Sean McGowan** opens a door onto the vital work of commissioning.

Commissioning is vital in ensuring a building's HVAC services operate as designed and intended at the completion of an installation. We asked three experts about the challenges of this process: Mark Jacobson M.AIRAH, commissioning and integration manager at Flowtech National; Neil Caswell M.AIRAH, managing director at Engineering Commissioning Services; and William Lane F.AIRAH, working director at Air-Con-Tech.

For those in need of reminding, what is commissioning?

William Lane: Commissioning is the art of installing breath into nut and bolts. In its broadest form it can be described as the finale in a play – the culmination of all that has been performed before.

Neil Caswell: Commissioning is basically the process by which we take a system or equipment from conceptual design through to fully operational status. It includes a range of tests that should be undertaken to verify that the performance meets the design intent.

Mark Jacobson: Commissioning is more than just “bringing static equipment into operation” and “performance validation against the specification” It is integral to the life-cycle of a project and starts with project design philosophies, is strengthened with good design and provides a beneficial legacy over the years of operation.

Why is commissioning so important?

MJ: The act of commissioning, when delivered correctly, ensures a facility delivers not only on its “design intent” but provides a healthy environment for people and building services systems alike. A well-commissioned facility will not only last longer, but will perform better and add value to all stakeholders. When delivered poorly, the design intent (and associated efficiencies) is ineffectual and the facility can be plagued with a wide range of problems that further drive up the cost of the asset. A dollar effectively invested in commissioning can overcome a multitude of lifelong operational

and performance costs that mount up year on year over the life of the building.

NC: Without carrying out a step-by-step commissioning process it is often difficult, if not impossible, to tell whether a system is operating properly. Without testing, measuring and verifying the performance it leaves doubt as to how the system is working and how it may be impacting on other systems it interacts with.

WL: Commissioning ensures a return on investment for the owner, ensures the system has obtained the original design intent as described by the design engineer, and ensures longevity of the plant and energy savings at an acceptable level.

In your experience, does the average HVAC tradesperson know about commissioning and the importance of it?

NC: The average HVAC tradesperson usually knows about the commissioning process as it relates to

their part of the overall building services installation. However, the interaction between their own system and building services in general isn't as well understood. In addition, there aren't many contractors who fully understand the interdependency between their own trade and others.

WL: From my experience the commissioning process is the thing that happens at the end of the project that enables final payment to be awarded. Because commissioning is a non-tangible item it is very easily overlooked as not important.

MJ: I have found that there are two types of people in construction: those who have been burnt by poor commissioning outcomes and work proactively to overcome these problems, and those who are yet to be burnt. This proactive approach is evident when a project is managed by staff who understand what commissioning implications are incurred as a result of changes during the design and construction phases.

How can the work of tradespeople negatively impact on the commissioning process? Are there common issues you see on projects?

NC: It isn't that unusual to find that the tradespeople haven't done any checks of their system prior to "getting it working". Quality inspections, pre-commissioning checks and the like are often skipped to save time. We are all familiar with the time pressures at the commissioning stage of a project!

Unfortunately, this means that when a problem is discovered, the investigation and rectification work usually takes far longer than if they had done a more thorough job in the first place.

TRAINING REQUIRED

As lead author of AIRAH's two DA manuals on commissioning – DA04 and DA24 – William Lane is passionate about seeing commissioning technicians appropriately trained, and ensuring these skills are kept up to date.

He proposes the following four levels of accreditation that would provide easily recognised, and uniform, standards for the industry to indirectly improve overall workmanship quality.

The **introductory technician** should be skilled in the following:

- *Air balancing:* Methodology used, understanding of air conditioning components
- *Water balancing:* Methodology used, understanding of hydronic components
- *Psychrometrics:* Understanding the properties of air and effect of humidity
- *Test instrumentation:* Understanding the accuracy of the test instrumentation
- *Job and personal safety:* Understanding the risks to personal safety (OH&S)

The **novice technician** should have the above skills, plus:

- *Refrigeration:* Knowledge of components, electrical supply, and controls

- *Electrical:* Wiring diagrams and schematics, overload protection devices
- *System components:* Understanding all components used in air conditioning systems
- *Controls:* Electrical schematics, plus electronic and pneumatic controls

The **senior technician** should have the above skills, plus:

- *Plumbing:* Installation of components, gas, water, steam
- *Customer liaison:* Good presentation and highly skilled communication
- *Documentation of results:* Ensure that the results are true and accurate

The **master technician** should have the above skills, plus:

- *Steam:* Properties of steam, safety when using steam

"Ongoing training must be part of the accreditation to ensure that the technician is keeping abreast of the ever-changing technology within the industry," proposes Lane.

"This could be by 12 hours over two years at recognised training courses that would help advance their knowledge and career within the industry." ■

A US report found median whole-building energy savings of 16 per cent for existing buildings and 13 per cent for new construction when commissioning was properly completed.



THE GOOD, THE BAD AND THE UGLY

THE GOOD

"A site manager assures me that the water-balancing valves are accessible because he has personally reached each one and had also moved a few access panels so we (the commissioning technician) would have a free run at the balance – which we did." – Mark Jacobson.

"We were building a multi-storey building with an individual AHU per façade and time was very tight on the project. However, the builder decided to use the 'business-as-usual' approach and have the ceiling fixer teams working on one floor at a time, which meant that the HVAC team was always waiting on ceilings so they could get grilles fixed, etc. After discussions, we ended up splitting up the ceiling fixer teams and concentrating on grid and tiles on multiple floors on a single façade, allowing the grilles to go in and the AHU to be run up earlier to enable a rough balance to get started. We shaved a fair amount of time off the program and allowed the balancing guys to get onto the systems much earlier than might otherwise have happened." – Neil Caswell.

THE BAD

"Started a 50 per cent flow test on a helipad deluge system, and when the spray heads 'let go' due to the holding bolts not being of sufficient strength, it was back to the drawing board for the designers. The last thing you need is a spray head hitting a helicopter blade when it is on fire!" – Mark Jacobson.

"I've had many issues over the years where inspection and pre-commissioning haven't been done properly – issues like closed dampers, fans rotating the wrong way, valves in backwards etc. – that should have been picked up much earlier in the process. It reminds me of the first rule of commissioning, taught to me by my boss back then, to never assume anything." – Neil Caswell.

THE UGLY

"A builder refused to accept that a stair pressurisation shaft was leaking and that we needed a bigger fan. When the photos came back of entire row of bricks missing in the shaft, the builder was then convinced it was not a fan issue." – Mark Jacobson.

"I was working as a commissioning manager for the Health Authority on a large new hospital development. The ventilation systems were put up for verification, so I reviewed the paperwork and all seemed to be in order. Then we went out onsite to record some velocities. Onsite, we couldn't get any consistency between the readings recorded and the actual velocities as it was continually surging. So, we went back to basics and I went on the roof to check the fan. Guess what? The fan hadn't been wired up and was only free-wheeling with the wind! Yet, the balancing guys had been struggling for two days, trying to get the system 'in balance.'" – Neil Caswell ■

MJ: The biggest issue facing all phases of a project is time. When the information that flows to the field is incomplete or assumed, we can only rely on the experience of the tradespeople. If this experience does not align with the design, performance, or operational requirements, commissioning will also suffer to varying degrees.

Another recurring issue faced by services and commissioning tradespersons is the lack of adequate access. Not only is this a legal requirement, but subsequent activities such as maintenance are also put at risk if this plant is not serviced correctly.

WL: With the lack of accountability towards the installation's acceptable standards, at times decisions are made by the installer that suit the profit margins obtainable. Common issues include a lack of professionalism with regards to acceptable installation practices, flexible ducting too long, cushion heads not the correct size, light air boots and linear slot boots not sealed correctly, not providing balancing dampers for air and water systems alike, and the installation as-built different to the original design.

What are the barriers to better commissioning outcomes?

MJ: Basically, education and the move from commissioning activities becoming the project float on the schedule.

Owners should demand that the commissioning schedule be protected to ensure the process is undertaken and validated correctly without the need to commission the project over split shifts and weekends to achieve completion. One approach could come in the form of a construction practical completion and then the commissioning phase is undertaken to deliver a project performance practical completion. Pharmaceutical, data centres, oil and gas all adopt this process successfully, and I would argue that the facilities we deliver are no less important.

NC: The first thing that springs to mind is that commissioning needs to be recognised as one of the most important stages of construction and shouldn't be compressed to save time. Commissioning needs structure to be effective; it's a step-by-step process with one test following another. It isn't possible to have multiple tests going on at the same time and be effective.

The other issue that I have encountered is that the "hands-on" aspect of commissioning is usually at the end of a project, when everyone has their mind set on the next job. In addition, many trades are trying to preserve whatever profit they may have made – or are minimising their losses. As a result, it is appealing to cut corners with the commissioning process to save time and money. This then leaves us with a building that isn't performing as well as it should, with issues being resolved during the defects liability period (DLP) and the building owners or clients thinking we don't know how to properly commission their building!

WL: Industry awareness of the importance of the commissioning process and the training of competent technicians with the skill sets to suit the task at hand. Making the technician fully accountable for any/all test results they submit. And the time available to perform the task of commissioning – which may also be due to inclement weather or a lack of funding.

How can these barriers be overcome, particularly by engineers, trades and commissioning specialists working together?

WL: Training of the technician to enable a better understanding of the complexities within the design of the system. A closer working

relationship with the commissioning tech and design engineer (a hand-in-glove approach). Registration of the technician to certify their ability to perform the task at hand. And publication to the general audience of the importance of commissioning, and government involvement to help regulate the importance of commissioning.

MJ: Until commissioning is actively included throughout life of a project, we will continue to “relive” past failures. The definition of insanity is doing the same things over and over again and expecting a different outcome. The same is true if we don't embrace commissioning as a design, construction, performance, and operation activity, not just a necessary evil at the end of a project schedule.

NC: It's amazing what communication and collaboration can do! When the engineers, trades and commissioning teams work together, the needs of the commissioning process can be embedded in the design from the start. There is a fairly fixed amount of time needed to properly commission a new building and that needs to be recognised and adhered to. It isn't possible to just “throw labour” at commissioning – 3,000 hours of commissioning can't be done by 3,000 people in one hour!

What impact will the new Standards Australia Technical Specification on Building Commissioning have on setting a new bar in the industry?

NC: My hope is that commissioning will take on a greater importance within the completion of a building and allow the trades time to properly complete the works. By putting a structured approach together, it aims to build a framework for success.

MJ: This Technical Specification will enable all owners, designers, and construction stakeholders to understand what delivery process is required to achieve an effective commissioning management model when developing the principal's project requirements (PPR) and the basis of design (BoD) documentation. These documents are then disseminated among the design and delivery team and will ensure commissioning is integral throughout the entire project life-cycle.

What about AIRAH's two DA manuals related to system balancing – DA04 and DA24?

NC: The two DAs detail the process involved with air and water balancing and are a valuable resource for the HVAC or balancing technicians. The Technical Specification doesn't go into the detail of commissioning individual services, but rather provides a best-practice framework for building commissioning. Therefore, the DA guides should be read together with the Technical Specification to determine the best way to approach commissioning.

MJ: There is a plethora of information available and this can often be overwhelming when it does not have to be. These AIRAH manuals are a good point of reference that will allow the reader to understand the underpinning and application of these areas of commissioning. As with the Technical Specification above, these DA manuals were developed in consultation with the industry, so the content has a solid foundation and they are very “usable” documents.

WL: As the lead author on both manuals, I believe they are a great start to bring a better understanding of what is an acceptable standard to performing these tasks. ■



At the end of a project, people are often focusing more on the next job than commissioning.

DO IT BY THE BOOKS

AIRAH recently released two new/updated Design Application (DA) manuals:
DA04 Air System Balancing – in HVAC and
DA24 Hydronic System Balancing – in HVAC.

For more information go to
www.airah.org.au/DA_Manuals