

Total building commissioning of healthcare facilities

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Abstract

Healthcare facilities are generally commissioned according to standards laid down by NEBBS or the consultant engineers. This commissioning process is normally only concerned with the physical functioning of the building services and is aimed at ensuring the installed services are operating according to the engineer's specifications. This paper will take a broader view of commissioning within the healthcare sector and explore the range of issues associated with the start up of a new building. It is no longer acceptable just to conduct a thorough clean, commonly called a hospital clean, and consider that as adequate for patient occupation.

The range of issues that should be addressed includes fungal and bacterial contamination, air movement and vectors such as dust. Air flow direction, pressurisation and separations all need to be measured, adjusted or confirmed and documented in a cohesive manner together with biological commissioning prior to patient occupation. High risk areas such as ICU, theatres, isolation rooms, haematology/oncology and CSSD must undergo a more rigorous level of commissioning that should include involvement from infection control staff. Only then can we have confidence that the commissioning process is creating as safe an environment as is possible in a setting with increasing patient morbidity.

Introduction

It is a well acknowledged fact that the physical healthcare environment can impact on patient wellbeing. So the question is, are you satisfied with the performance of new buildings and major renovations? Although a BCA requirement is essential services maintenance, buildings and renovations are often not being well designed or constructed to be maintained. For a number of reasons, buildings are all too often handed over not functioning according to the design intent. Further, no national standards exist for the systematic and comprehensive commissioning of buildings.

Why is total building commissioning (TBC) unheard of in Australia when it is a mandatory requirement on most US Federal Government contracts? TBC can draw some parallels to the old clerk of works system with its principal function to act as the owner's representative throughout each phase of the project. TBC should have a strong role in the overseeing of design, construction and system integration, providing a systematic approach to ensure design intent and owner requirements are met, and also to constantly review quality control systems.

There are currently two types of commissioning in Australia:

1. Building commissioning refers to completion for occupation by the contractor from a physical facility viewpoint. Typically the activities include the successful running of all plant and equipment.
2. Operational commissioning refers to activities undertaken leading up to handover of the building to the users. Typical activities include familiarisation of staff with safety, security and communications systems. (DHSV Capital Management Guidelines – Commissioning of Facilities).

Current commissioning practice consists only of testing, adjusting and balancing, however, this approach does not take a holistic approach.

The concept of total building commissioning represents a fundamental shift in attitude toward quality control. The practice does not consider just mechanical, electrical and control systems in isolation but includes all major functional components of the building such as structural elements, exterior enclosure system, roofing system, life safety elements, security system, lifts, plumbing and technology systems.

Traditional commissioning can make mechanical and control systems operate correctly but total building commissioning aims to ensure the integrated performance of all essential elements of the complete building. The more complex or unique a building's systems are, the greater the risk of poor or inadequate systems integration. Complex buildings such as hospital projects challenge quality assurance, despite the expertise of project team personnel.

The total building commissioning approach

The commissioning of new buildings will be most effective when considered throughout the planning stages and as early as schematic design. Commissioning planning ideally starts at concept design and extends to handover. Whole-of-building approach, focus on critical systems integration, independent validation of system performance, systematic process for validation of commissioning and independent inspections during the process are the hallmarks of TBC. The following steps are those described by ASHRAE and the US General Services Administration Public Building Service.

Commissioning during pre-design

Commissioning during this stage should ensure that the owner project requirements are developed, the scope and budget for the commissioning process is identified, the initial commissioning plan is developed and the pre-design phase commissioning process activities are accepted. The commissioning agent (CA) will work with the owner to establish the parameters and expectations for the

commissioning process. The CA will normally have a limited input and review role in this phase.

Commissioning during design

Commissioning during this stage should ensure that the design phase plan developed during pre-design is updated, the owner project requirements are updated and the basis of design (BOD) is verified. The commissioning agent (CA) will outline the scope of design requirements and design intent, describe the systems to be installed, outline the documentation requirements for each party involved in the commissioning process, define subsequent commissioning procedures and document the process.

Commissioning during construction

Commissioning during this stage should ensure all systems are provided and installed as specified and all systems are started and function correctly. The CA completes the commissioning plan at the beginning of the construction phase. Using project schedules, a review of the contractor submittals and operation and maintenance manuals is conducted. The CA writes detailed functional performance test plans for each system and piece of equipment involved in the commissioning process.

The CA makes site visits to observe construction, noting details that might affect equipment and system performance

or operation; then coordinates with the various contractors to perform the pre-functional performance tests. The CA oversees all start-up tests and ensures that pre-functional performance tests and checklists are completed and all deficiencies resolved.

Commissioning during acceptance

Commissioning during this stage should ensure all systems are performance tested, that the commissioning plan requirements are met, operator training is started and operation and maintenance documents are handed over. Using the functional performance test plans, the CA observes and verifies the proper operation of equipment, systems, and controls per contract documents; and that corrective measures are taken, ensuring the presence of complete operation and maintenance manuals.

The actual performance testing is usually carried out by the various contractors. Shortly after the functional performance tests are complete, the CA finishes a final commissioning report, including all documentation, and submits it to the owner. Training for the building operation staff generally occurs near the end of the acceptance phase or shortly after the building is occupied. The training should be done by the installing contractors, designers, and manufacturers' representatives and may include the CA. The CA should be involved in establishing the training needs of the building operation and maintenance staff and ensuring those needs are met.



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Commissioning during occupancy and operations

Commissioning during this stage should ensure that training is complete, systems receive functional opposite season verification and outstanding performance issues are resolved.

Post-acceptance phase

Building operation and maintenance staff ensure the proper functioning of the facility's systems, adapt the system to changing occupancy and use, maintain a history of the facility, and document all changes. The CA can be involved in establishing the documentation methods for this phase and in reviewing performance and recommending improvements.

An Australian perspective

Currently no Australian guidelines exist for total building commissioning. Given the need for a system that would improve construction outcomes and increase value for money, the question is – why don't we? With the current trend of increasing requirements for sustainability, particularly in government buildings, in combination with competing interests for scarce resources, is there a place for TBC to co-exist with sustainability? Some people involved in the building process will argue that there are already too many consultants involved; and it is widely recognised that at times there can be friction created by the competing interests of the consultants. This view can be the most solid basis for arguing the need for a system that has the sole objective of representing the owner and increasing quality.

Conclusion

The overall objective of the development of a nationally recognised and accepted guideline would be to provide a framework for total building commissioning as a system, much more than simply the commissioning of HVAC systems (most likely published in sections covering specific system types).

References

1. Department of Human Services Victoria. Capital Management Guidelines – Commissioning of Facilities
2. Building Commissioning Guidelines – a source book on building systems performance <http://www.energydesignresources.com/category/commissioning/>
3. The Building Commissioning Guide, US General Services Administration Public Building Service. April 2006 http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_OVERVIEW&contentId=15163&noc=T
4. ASHRAE Applications Handbook. Chapter 42 – New Building Commissioning
5. Carl N. Lawson. Overview of Total Building Commissioning Process. www.cibse.org/pdfs/Construction%20of%20TBCx%20req.pdf

Further information is available from the following web based sources

Commissioning Guidelines

State of California Guide to Commissioning

<http://www.documents.dgs.ca.gov/green/commissioninguidenew.pdf>

State of California Guide to Commissioning Existing Buildings

<http://www.documents.dgs.ca.gov/green/commissioninguideexisting.pdf>

Energy Design Resources Commissioning Guidelines

<http://www.energydesignresources.com/resource/37/>

ASHRAE Guideline 0-2005 - The Commissioning Process

<http://resourcecenter.ashrae.org/store/ashrae/newstore.cgi?it emid=25141&view=item&categoryid=310&categoryparent=310 &page=1&loginid=4477051>

Strategies for Improving Persistence of Commissioning Benefits (2003)

<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220&>

Reports and Papers

The Cost-Effectiveness of Commercial-Buildings Commissioning - Summary (LBNL 2004)

<http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html>

The Cost-Effectiveness of Commercial-Buildings Commissioning - Main Report (LBNL 2004)

<http://eetd.lbl.gov/emills/PUBS/PDF/Cx-Costs-Benefits.pdf>

Organisations

California Commissioning Collaborative (CCC)

<http://www.cacx.org/>

Building Commissioning Association (BCA)

<http://www.bcx.org/>

Portland Energy Conservation, Inc. (PECI)

<http://www.peci.org/library.htm>

Tools & Resources

Commissioning Assistant Commissioning Tool

<http://www.ctg-net.com/edr2002/cx/>

Leadership in Energy & Environmental Design-New Construction v2.2 Reference Guide

<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220&>

California Energy Commission's Public Interest Energy Research (PIER) Program

<http://www.energy.ca.gov/pier/>