

Building Commissioning Validation Process for Facility Planning, Ownership Enhances Performance

By Gene Sieve, PE, LEED® AP,
and Dana Fontaine, LEED® AP, CxA

Rising energy costs and a focus on indoor air quality have increased building owner awareness of deficiencies in building system performance. A key method of enhancing the performance of new or existing building systems is to perform building commissioning.

Commissioning is a process of testing the energy-consuming systems within a building or facility. It results in optimal building performance, reduced energy use, and improved indoor air quality, occupant comfort and productivity. Building commissioning is also a prerequisite for a facility to apply for Leadership in Energy and Environmental Design (LEED®) certification from the U.S. Green Building Council (USGBC).

Commissioning is loosely defined as “bringing into working condition.” It has long been used in the shipping industry to mark the point when a warship is placed into active service. Building commissioning is similar in that it is the process of ensuring a building’s varied systems are designed, installed and tested to perform according to design and operational needs. Building commissioning services traditionally involve heating and cooling systems, but those services have recently expanded to include electrical systems, emergency power, lighting, building envelopes, technology infrastructure and life safety systems.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines commissioning as “a holistic process that spans from pre-design planning to post-construction operation and can be thought of as a checks-and-balances system.” See Table 1.

When and Why

Commissioning is a quality assurance process and should be utilized throughout the life cycle

Goals of Commissioning

- Define and document requirements clearly at the outset of each phase and update throughout the process
- Verify and document compliance at each completion level
- Establish and document commissioning process tasks for subsequent phase delivery team members
- Deliver buildings and construction projects that meet the owner’s needs at completion
- Verify that operation and maintenance personnel and occupants are properly trained
- Maintain facility performance across its life cycle

Table 1: Commissioning goals as defined by ASHRAE.

of a project. This assurance is needed not only at the beginning of a building’s life but also during renovation projects or the ongoing operation of a building. ASHRAE specifies that commissioning work begins with planning and includes design, construction, startup, acceptance and training.

Benefits

Why should facility owners or managers consider commissioning services for their buildings in today’s complex construction market? (See Figure 1.) In addition to being a prerequisite to becoming LEED® certified, commissioning benefits also include:

- Fewer change orders and additional claims
- Fewer deficiencies at substantial completion
- Fewer project delays
- Managed startup procedures
- Shorter building turnover transition periods
- Less post-occupancy corrective work
- Minimized impact from design changes
- Improved indoor air quality and occupant productivity
- Better operation, maintenance and reliability

Definitions

Commissioning

Building commissioning provides documented confirmation that building systems function according to criteria set forth in the project documents to satisfy the owner’s operational needs.

Retrocommissioning

Retrocommissioning is a systematic process for investigating, analyzing and optimizing the performance of building systems by improving their operation and maintenance to ensure their continued performance over time.

Recommissioning

Recommissioning is ideally part of an ongoing operations and maintenance program for buildings previously commissioned during construction or retrocommissioned, reapplying the original commissioning tests.

Source: Building Commissioning Association

- Lower energy and operation costs
- Value-added construction quality
- Complete documentation
- Well-trained operations/maintenance staff

A Customized Process

ASHRAE reports that facility owners are experiencing shorter life spans on equipment and noticing substandard building accommodations and performance, resulting in poor indoor environmental quality and uncomfortable building conditions.

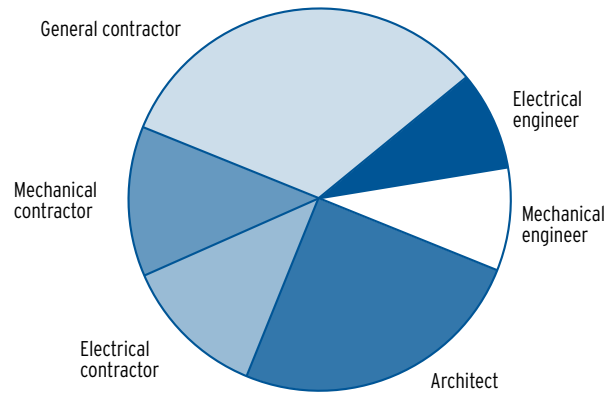
Commissioning services at Burns & McDonnell typically focus on energy-consuming systems such as heating, ventilating and air conditioning (HVAC) systems; electrical systems such as emergency power, life safety and technology infrastructure; and general construction elements such as building envelope assemblies (walls, glass and roof systems).

The Burns & McDonnell commissioning process is based on a phased delivery approach. It follows a structured methodology, as prompted by ASHRAE guidelines, for implementing the commissioning process for a building's energy-consuming systems. It follows a project team approach for all participants, including the owner, contractors, design team and commissioning authority. Baselines are developed for ongoing building operations to be used over the building's life cycle, and benchmarks are created for potential recommissioning and continuous commissioning activities.

Commissioning efforts typically include multiphase involvement in a project's pre-design, design, construction and startup. Burns & McDonnell performs commissioning services in the pre-design, design, construction and occupancy phases. During the pre-design phase, the owner's project requirements are developed and defined, and the initial commissioning plan is developed.

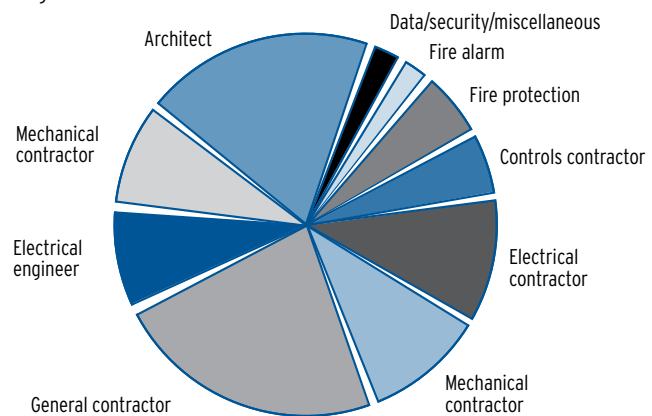
Next, during the design phase, a basis of design document is created to document how each criterion in the owner's project requirements is implemented in the design.

Contract holders a few decades ago:



Contract holders in today's construction project:

Gaps between disciplines result in poor coordination, lost details, delays in schedule and increased change orders.



Commissioning:

Fills gaps in coordination, encompasses all disciplines

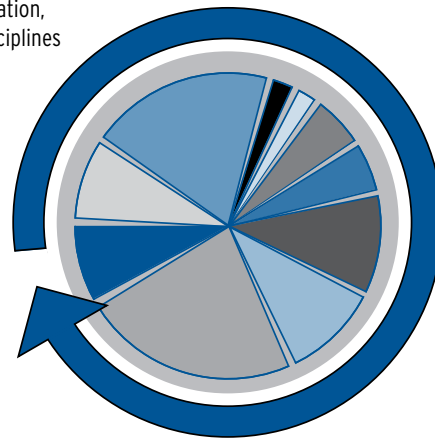


Figure 1: Contract complexity.

This document guides the commissioning team in updating the commissioning plan, developing the commissioning schedule and creating commissioning specifications. Design reviews are performed periodically by the commissioning team to confirm that design



Gene Sieve, PE, LEED® AP, is the manager of the Burns & McDonnell Minneapolis-St. Paul office and director of building commissioning services. He has 18 years of mechanical engineering design and project management experience in a variety of project types, including institutional, commercial, healthcare, military and industrial projects. He has a bachelor's degree in mechanical engineering from South Dakota State University and is a LEED® accredited professional.



Dana Fontaine, LEED® AP, CxA, is the program manager for Burns & McDonnell's building commissioning services. He is a Certified Commissioning Authority (CxA) as established by the Building Commissioning Association and a LEED® accredited professional. He has more than 17 years of experience in the HVAC industry as a project manager and commissioning agent for commercial, healthcare, institutional and industrial clients.

decisions impacting the long-term performance and maintainability of the facility meet the owner's objectives.

Startup checklists and functional performance tests are then created for construction-phase execution to thoroughly validate system performance.

Throughout the project's construction phase, commissioning team meetings and site observations are conducted to review progress and identify issues that may impact the systems. Execution of the performance checklists and tests are witnessed by the commissioning team, and the results are formally documented. These results provide the data to form the performance benchmarks used by building owners and operators throughout the life cycle of a building.

A commissioning report is created during the construction phase, and testing and balancing reports are reviewed. Operation and maintenance manuals also are compiled and reviewed for accuracy and serve as the living document for the building operators. Systems manuals build on the operation and maintenance manuals as a reference for operational benchmarks and as a tool to manage day-to-day operations of the facility. A systems manual is an invaluable tool for defining the performance benchmarks required for ongoing commissioning efforts.

During the occupancy and operations phase, a walkthrough 10 months after occupation of the facility identifies performance deficiencies experienced by the owner before the contractor's warranty expires.

In addition to all necessary checks, schedules and reports, Burns & McDonnell also develops and facilitates training sessions for all involved in the construction and maintenance of the facility. The training sessions can be videotaped for future training needs.

Certification & Guidelines

Projects that seek LEED® certification require the commissioning authority to engage

More Information

Additional resources on commissioning, certification and guidelines can be found online:

- **Burns & McDonnell**
www.burnsmcd.com/commissioning
- **Building Commissioning Association**
www.bcxa.org
- **Portland Energy Conservation Inc.**
www.peci.org
- **American Society of Heating, Refrigerating and Air-Conditioning Engineers**
www.ashrae.org
- **AABC Commissioning Group (ACG)**
www.commissioning.org

in the certification process. This effort involves documenting specific aspects of the commissioning process for the USGBC. The council has recognized the value that commissioning contributes to successful long-term facility ownership. This value has been endorsed by the opportunity to earn an additional LEED® credit through building commissioning in the soon-to-be-released LEED® certification for Healthcare (LEED-HC). This additional credit will focus on the commissioning of the building envelope for healthcare facilities.

ASHRAE guideline 0-2005, The Commissioning Process, is an integral part of the National Institute of Building Sciences (NIBS) total building commissioning guideline initiative. While it is focused on the commissioning process, supplementary guidelines for specific systems and assemblies are being developed as a part of the ASHRAE and NIBS Total Commissioning Process. These technical guidelines will focus on roofing, lighting, fire, life safety, interior, envelopes, plumbing and more. ASHRAE guideline 0-2005 forms the foundation for all future guidelines. Currently, ASHRAE guideline 1 for HVAC and refrigeration systems is in progress, and NIBS guideline 3, Exterior Enclosure Technical Requirements for Commissioning, was recently released. Other guidelines are in development.

For more information, please e-mail: gsieve@burnsmcd.com or dfontaine@burnsmcd.com