

Commissioning

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Emphasis on long-term systems performance, lower life cycle costs, improved safety and environmental quality, and integrated "green" building strategies make clients increasingly interested in confirming that their buildings perform as intended.

Building commissioning services ensure that all systems in the constructed building operate and perform as intended. Such services evolved from the commissioning services offered by mechanical engineering firms beginning in the 1980s to shake down the controls and equipment in automated HVAC systems. This expanded level of commissioning is still in its infancy as a professional service.

The trend toward the integration of more complex building systems and components is driving a market for more comprehensive system performance assurance services that address the total building. Ideally, building commissioning will encompass a quality assurance program that starts at schematic design, is extended through building construction, and continues throughout the life of the building. A comprehensive commissioning program ensures that all building systems—not only HVAC but lighting, plumbing, fire safety, elevators, and other systems—are well designed, constructed as designed, and performing as intended.

When it is performed on older buildings experiencing operational performance problems, commissioning is sometimes called "recommissioning" or "retrocommissioning." Or the service may be called for in connection with a building renovation or addition. Commissioning in conjunction with a renovation or addition follows essentially the same process as is used for new buildings.

Commissioning services can be provided by those who initially designed the building or by an independent party that has no connection to any member of the building team. Using the designer to perform this service should not pose a conflict of interest as long as the client is fully aware that the designer is evaluating his or her own work.

While most of those who offer the services are qualified, some firms specializing in commissioning are basically testing and balancing contractors without professional training. Indoor air quality,

Summary

COMMISSIONING SERVICES

Why a Client May Need These Services

- ▶ When constructing large and complex facilities
- ▶ When facility environmental tolerances are highly critical
- ▶ To ensure that building energy use is in line with predicted usage
- ▶ To validate that building performance meets mandated requirements

Knowledge and Skills Required

- ▶ Familiarity with building operation and maintenance factors
- ▶ Knowledge of HVAC, power, lighting, security, and control systems
- ▶ Knowledge of system testing methods, procedures, and protocols
- ▶ Familiarity with applicable building codes and regulations

Representative Process Tasks

- ▶ Prepare design intent narrative
- ▶ Develop commissioning plan and specifications
- ▶ Coordinate commissioning requirements for systems
- ▶ Review submittals for commissioning items
- ▶ Observe construction, installation, start-up, testing, etc.
- ▶ Identify system adjustments to comply with design
- ▶ Submit final report

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▶ Ideally, the building commissioning process begins during building design. The goal is to include considerations of facility operations throughout design and construction so potential problems can be identified early. See *Building Design* (18.3).

industrial hygiene, and other issues that could affect occupant health are at stake when systems performance assurance is conducted, so it is important that these services be conducted by qualified professionals. Although there is no official certification process, owners and building designers who use available screening criteria have been able to hire competent professionals to provide commissioning services.

The emerging market for building commissioning services will continue to be stimulated by the emphasis on long-term performance and life cycle costs, mandates related to safety and indoor air quality, increased attention to human comfort, and the increasing sophistication of building systems.

CLIENT NEEDS

Although most clients like the commissioning concept, many will balk at having to pay for this service because they assume that the building should operate as designed once it is constructed. The architect must explain that building systems and components need to go through a shakedown period in which they are fine-tuned to operate optimally with one another. When the building owner is willing to have operations personnel assume responsibility for building systems operations during construction and continue through a thorough building acceptance program, then systems performance assurance services may not be required, or the task may be shared between operations personnel and the commissioning team. However, operations personnel are not always qualified to take on these services without the assistance and/or oversight of a commissioning professional. Many clients will understand the value of the continued involvement of building design professionals to ensure that systems are performing optimally and that maintenance personnel are trained before operations are handed over to the owner.

Clients who are planning to construct complex facilities often are particularly receptive to systems performance assurance services. Those where operations are critical (e.g., laboratories, hospitals, industrial facilities, etc.) are especially good prospects. Other clients may be concerned about particular aspects of systems performance—for example, they may want to be sure they achieve energy performance goals in order to reduce operating costs.

Some organizations will want to comply with organizational goals or government mandates. General Services Administration (GSA) regulations require federal agencies to ensure the performance of their facilities. The military has always had a rigorous start-up program for its facilities, and the Federal Aviation Administration (FAA) has a complete program as well. Some states are also beginning to require systems performance assurance for their facilities.

An increasing number of corporate facility managers request systems performance assurance services from their architect-engineer (A/E) or engineer-architect (E/A) consultants. In other cases the in-house facilities staff will conduct the systems performance process themselves. Developers should be encouraged to commission their projects as a way to improve project performance.

Fees for commissioning services vary with the square footage and the complexity of the building systems and range from 0.5 to 6.0 percent of project construction cost. Typical office buildings fall closer to the 0.5 percent mark, while more complex facilities such as laboratories may reach the 6.0 percent mark.

Related services include preparation of building design construction documents, facility surveys, and postoccupancy assessments; energy monitoring; indoor air quality monitoring; facility management; and operations and maintenance training, including development of training manuals.

SKILLS

Architects are well qualified to lead commissioning teams since they traditionally serve as team leaders and generally have the most cross-cutting knowledge of building systems. A commissioning process guided by a team including specialists in each area is an excellent addition to any project plan and is a good addition to partnering processes as well.

▶ Energy monitoring services can validate the overall energy performance of a building as well as the performance of individual systems.

Collectively, the team must have a thorough understanding of what buildings and building systems can and cannot do. Knowledge of building control systems is extremely important. The assembled team must have expertise in building design; in HVAC, power, lighting, security, elevators, plumbing, and fire protection and control systems; and in applicable building codes and regulations.

A typical team might be led by an experienced project manager, who can think like a building owner, understand the dynamics of total building performance, and communicate well. As previously noted, architects are particularly well qualified to lead commissioning teams because of their valuable cross-disciplinary perspective on building systems integration. An experienced mechanical engineer can contribute in-depth understanding of building thermodynamics and mechanical systems. A controls specialist who understands automated building control systems is frequently required. Testing and balancing specialists, mechanical components technicians, and operations or facility personnel round out the team.

For projects that involve complex electrical systems, an electrical engineer may have to be added to the team. A technician who specializes in load tests also will be needed. Other specialists may include fire protection technicians, industrial hygienists, structural engineers, interior designers, landscape architects, and general contractors.

PROCESS

The scope of work for building commissioning services will depend on the complexity of the building systems involved and the point in the design-and-construction timeline when the services are initiated. Ideally, the systems performance team will be involved during the planning and design phase so the team members can gain a thorough understanding of the owner's program and requirements. Unfortunately, some owners want the service to begin at the start of construction or even following completion. Designers can overcome the resistance to inclusion of commissioning during design by emphasizing to their clients that beginning later can significantly increase the cost of the process. It is less costly to make changes on paper than on the job site.

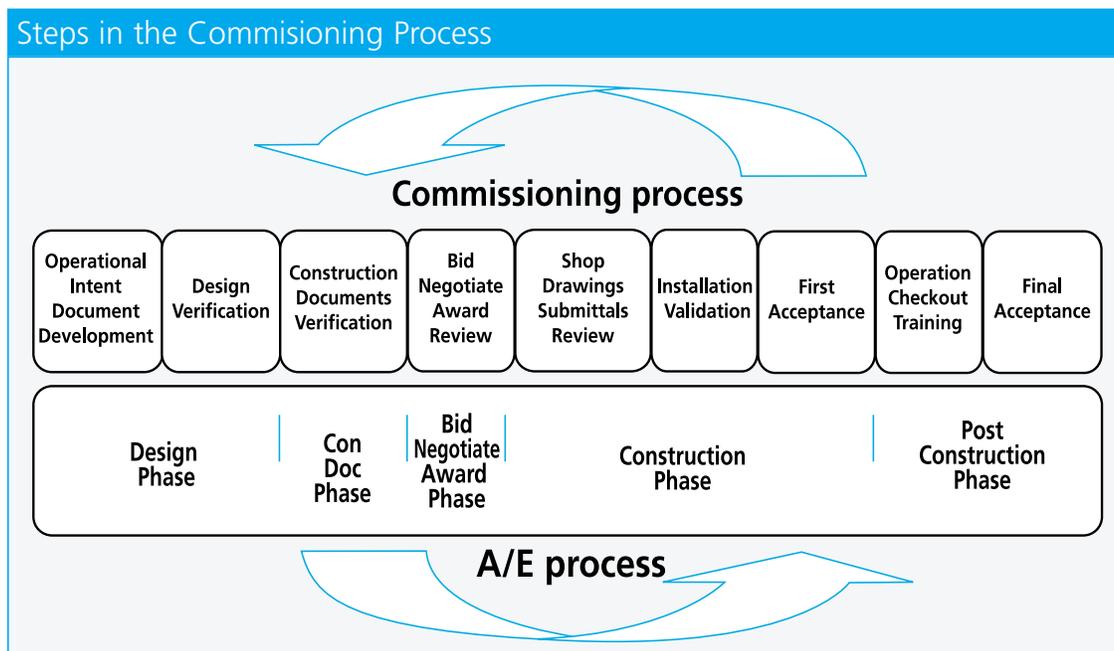
In discussing the scope of services with the client, the role of the owner's operations and maintenance staff needs to be clarified. It is also important that all parties understand the goals of the systems performance assurance process. Most clients will agree that the goal is to get the building systems to perform as intended and to demonstrate a satisfactory level of control for the operation of the building.

▶ **Postoccupancy evaluation services may uncover problems that could be related to indoor air quality issues.**

▶ **Some myths surrounding building commissioning include the following:**

- Commissioning is an end-of-construction activity.
- Commissioning can fix poor design and construction.
- Specifications include all commissioning tasks.
- The prime assumption: if the contract documents are followed explicitly and all field quality control tests are passed, the facility will function according to the owner's program and the designer's intent.

Adapted from Michael J. King, FCSI, CCS, "Commissioning Myths," The Construction Specifier (August 1998)



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When considering the duration of the building commissioning contract, consider that in most climates, the performance assurance process must continue for at least 12 months after occupancy (or at least include seasonal testing) so that the performance of the HVAC systems can be evaluated through all four seasons.

The first step in developing a building commissioning program is to understand the owner's program and what the owner's requirements are for building performance. One of the most important roles that designers play in the commissioning process (regardless of who manages the process) is to develop the "design intent" narrative for the project. If the team was not involved during project planning, this can be accomplished by a review of the project's programming documents and discussions with the client and the building operators.

Next, the facility design should be reviewed so the team will understand which elements in the building require performance assurance.

The building commissioning specifications are then developed, closely coordinating the various systems requirements. Ideally, the commissioning team should be consulted during the planning and design phase so that the commissioning specifications can be included in the project specifications as contractor requirements. Most commissioning scopes that begin during design will require the A/E to develop a detailed design intent narrative.

During construction the team can review submittals for commissioning items. The plans and schedule for commissioning activities can be finalized, and the commissioning team can coordinate the contractor's system performance assurance activities. The team also will observe construction, installation, start-up, testing, and balancing to verify the achievement of performance requirements. Finally, the team ensures that facility staff is trained and that the operations and maintenance manuals are adequate.

After construction, the commissioning team will create a punch list of items that require adjustment, optimization, or modification. The designer updates the building documentation to indicate set-point adjustments, systems modifications, and provisions for ongoing training of operator and maintenance personnel.

The usual deliverables include a systems performance assurance plan, test procedures, test documentation forms, test reports, a final report, and a training program.

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The AIA provides a contract document designed especially for these types of architectural services. The AIA suggests a two-part agreement:

B102–2007, Standard Form of Agreement Between Owner and Architect without a Predefined Scope of Architect’s Services provides terms and conditions only.

B211–2007, Standard Form of Architect’s Services: Commissioning provides the architect’s scope of services only.

Together they equal a complete owner-architect agreement.

AIA Document B211TM–2007 requires that the architect, based on the owner’s identification of systems to be commissioned, develop a commissioning plan, a design intent document, and commissioning specifications. It also requires that the architect review the contractor’s submittals and other documentation related to the systems to be commissioned, observe and document performance tests, train operators, and prepare a final commissioning report. B211–2007 is a scope of services document only and may not be used as a stand-alone owner/architect agreement. NOTE: B211–2007 replaces AIA Document B211TM–2004 (expired May 31, 2009).

For more information about AIA Contract Documents, visit www.aia.org/contractdocs/about

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