

## Commissioning

### *Don't I Pay the Engineers/Contractors to Do That?*

By Eli Baumgardner, PE, CPMP, LEED AP

Whether discussing new or renovated building systems, owners often ask me “Why should I pay a commissioning agent to perform additional verification on my systems? What’s the ROI?”

These are valid questions. Many owners think the verification of building systems operations is the responsibility of the engineers and contractors hired to design and install these systems; and to some extent they’re right.

However, a closer look at the building systems design and installation process reveals the gaps in these expectations.

#### **Behind the Scenes**

There are many definitions of commissioning. Per the National Institute of Building Sciences (NIBS), commissioning is a “systematic process of assuring by verification and documentation, from the design phase to a minimum of one year after construction, that all facility systems perform interactively in accordance with the design documentation and intent and in accordance with the owner’s operational needs, including preparation of operation personnel.”

Systems to be commissioned can include HVAC, electrical, communications or any other building system component that the team deems vital or important. In essence, a commissioning agent provides the quality assurance that verifies the system components—from air handlers to chillers, switchboards to outlets—work as they were intended individually and together. Again, some might say, isn’t that what the engineers and contractors should be doing?

Typically, the engineer conveys a building system design based on specifications, performance and efficiency expectations. The contractors install the system per the

engineer’s specifications. However, until it’s constructed and turned on, the owner and project team will not really know how that system will operate.

Every building system includes a complex network of heating, ventilation, cooling, electrical, lighting, control and cabling systems. A mechanical contractor might coordinate with the electrical, plumbing and fire systems contractors, but he or she rarely worries about how it all works together.

The engineer might get paid for construction administration during installation—but he or she doesn’t test the system to see if it’s performing as expected. The contractor will install, test and balance the system, even checking water flow through coils and air flow through fans, etc. A controls contractor will likely test the entire building automation system (BAS) and program the overall BAS, but will probably not test the emergency power system.

Bottom line, none of these parties—the engineers, contractors or controls specialists—look at the interaction of all these building systems elements as a whole. None of them knows exactly how the building will operate once built and occupied; and nobody is perfect, which means that the design doesn’t always get implemented as intended. Also, contractors focus on their particular trades and typically do not consider systems interactions to answer questions like “When the power is cut, does the generator turn on? And does the HVAC system respond accordingly?”

That’s where commissioning agents enter! In today’s environment, owners hire a commissioning agent for a number of reasons: experience with previous jobs, to gain sustainability certification points or, more recently, because it’s required by code.

### Commissioning ROI

A commissioning agent evaluates building systems holistically, drawing on a broad base of skills. For example, I'm a mechanical engineer by education with considerable hands-on training in building operations, from both an engineering and an operational perspective. We're engineers, but we are also technical and operational systems experts who are able to troubleshoot issues and understand how problems might occur.

Here's a typical example of a commissioning process at work. In one case, we discovered that the chilled water system wasn't staging properly during functional performance testing. Normally, this type of problem indicates that this part of the sequence of operations was not verified. In this case, the stage up and stage down were not mutually exclusive, creating a condition whereby the chillers would stage up then stage down immediately after. In this case, the chillers were cycling continuously. The engineer recommended a solution that was implemented by the contractors. Then the opposite happened. The chillers wouldn't stage down. During an on-site review, NV5 was informed of the solution that the engineer gave the contractors, and identified it as the most likely reason for the chillers not staging down. Our expertise ultimately helped resolve the issue.

In another case, NV5 was functionally testing an addition to an existing building. At the start of testing it is our standard practice to verify system graphics, to ensure that they are in compliance with the project specifications (i.e. the owner's requirements). We identified several pieces of information that were not being provided. The response from the contractor was that they were matching the existing graphics, which did not meet the requirements of the current project.

In a similar case, NV5 was functionally testing a chiller replacement project. The sequence of operations was intended to be based on the previous chiller installation. During testing, we identified several parts of the sequence that were either not programmed or not operating properly. One particular item related to a chilled water temperature setpoint reset condition. It

was demonstrated that the sequence would not work as programmed, to which the contractor responded, "The program was copied from the last chiller, as intended, and we are not changing it." When this issue was presented to the owner, the owner replied that that part of the sequence never worked on the previously installed chiller and the program needed to be fixed.

Some believe that if contractors and engineers did their job to design and install as intended, the commissioning agent would be out of a job. I've been commissioning for well over a decade and I'm here to tell you that that doesn't happen, in part because the definitions for quality assurance and quality control have been misinterpreted. Too often, we assume the two terms are the same.

According to the American Society of Quality, quality control is an evaluation to indicate the necessary corrective responses. Assurance is the planned and systematic implementation of activities in a quality system so that quality requirements for a product or service will be fulfilled.

The contractor should be doing quality control on a day-to-day basis. The commissioning agent is the quality assurance. We don't check everything. Instead we focus most of our efforts on the more complicated systems such as air handling sequences.

It's important to note that a commissioning agent doesn't eliminate the chance of any problems. Nothing replaces a good construction manager or general contractor. We're simply providing authoritative third party verification.

### Lifecycle Commissioning

Commissioning agents review the operability, maintainability and accessibility of the schematic design. In an optimal situation, a commissioning agent is involved throughout the lifecycle of a building system's design and installation. In the earliest system schematic design stages, the agent can help review designs or ensure the implementation of owner requirements through installation and total system commissioning. These might range from meeting appropriate

temperature conditions in patient rooms of a hospital, to environmental requirements to meet sustainability levels in a manufacturing facility.

During construction review, the commissioning agent will verify installation, placement, and systems operation. These are the things that quality contractors will do and the commissioning agent should work collaboratively with the contractor so as not to duplicate effort. A commissioning agent will also write a functional performance summary and test sequences.

At NV5, we call this Lifecycle Commissioning® a systematic, engineering-based process that optimizes building efficiency from initial project concept to decommissioning.

However, if an owner chooses to use a commissioning agent whether across the lifecycle of a building system development or as a quality assurance measure after construction, the benefits will be multi-faceted. The owner will have fewer call-backs, change orders and RFIs, and, most importantly, a system that performs to the energy efficiency standards that meet expectations.

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