

Healthcare Facility Commissioning: The Gap Between Desired Building Performance and Minimum Code Requirements

Introduction

The requirements for the design and construction of new hospitals and healthcare facilities are typically identified in the state code of regulations. These requirements can be included as part of commercial building requirements with specific sections developed for healthcare facilities. Additional requirements may also be included in supplemental documents and guidelines which are adopted by the state and local jurisdictions, such as the Facility Guidelines Institute's (FGI) Guidelines for Design and Construction of Health Care Facilities

Building commissioning requirements for commercial buildings are slowly being accepted throughout the country. This progression is occurring through the adoption of energy and green codes, such as the International Energy Conservation Code (IECC) and the International Green Construction Code (IGCC). The Joint Commission uses these guidelines, where applicable, to determine the accreditation of hospitals. The practice of commissioning, however, is excluded from the mandatory requirements in some states, such as California. This article will look deeper into the gaps between commissioning best practices and minimum code requirements for new facilities, using California as a basis for this comparison.

California State Codes and Testing Requirements

State commissioning requirements for commercial buildings were first mandated with the addition of the 2010 California Green Building Standards Code (Title 24, Part 11), better known as CALgreen. Within this state specific green code, commissioning requirements were included for new buildings over 10,000 sf. The commissioning requirements were more recently moved from CALgreen into the 2013 California Energy Code (Title 24, Part 6). While the CA Energy Code governs just about every other type of commercial facility, hospitals and acute care facilities are exempt from the Energy Code. The energy intensive nature of hospitals coupled with one of the most stringent energy codes in the U.S. made it impractical to enforce the state's Energy Code on acute care facilities. These facilities are still required to meet the remainder of the California Code of Regulations Title 24, including the building, electrical, mechanical, plumbing, and fire codes.

Table 1: Commissioning Requirements for California Healthcare facilities

Designation	Type of Facility	Enforcing Agency	Commissioning Required
OSHPD 1	Acute care hospitals and acute psychiatric hospitals	OSHPD	No
OSHPD 2	Skilled nursing and intermediate care facilities	OSHPD	No
OSHPD 3	Licensed clinics and hospital outpatient facilities	Local Bldg Dept	Yes
OSHPD 4	Correctional treatment centers	OSHPD	No

The Office of Statewide Health Planning and Development (OSHPD) is responsible for the enforcement of the codes concerning acute care and skilled nursing healthcare facilities. Though commissioning is not required, OSHPD fully understands that it is important that all systems work properly to provide safe

and efficient facilities for staff and patients alike. Therefore OSHPD has developed the Test, Inspection and Observation Program (TIO). The TIO Program covers all of the testing already required by the applicable codes but organizes them in a manner more easily visible to the entire project team. Where these tests are unevenly enforced by varying jurisdictions for commercial buildings, OSHPD attempts to strictly and uniformly enforce the testing requirements to the satisfaction of the designated inspector. The testing requirements are focused on OSHPD 1 and OSHPD 2 facilities, with the most tests required for acute care facilities. The number of tests and inspections for structural systems diminishes significantly between OSHPD 1 and 2 facilities, however the electrical, mechanical, and plumbing scope remains exactly the same. These are the systems that are most frequently targeted for commissioning.

Table 2: California OSHPD Test, Inspection and Observation Program Tests

Discipline/Trade	OSHPD 1		OSHPD 2	
	*Identified Tests	*Identified Special Inspections	*Identified Tests	*Identified Special Inspections
Architectural	0	5	0	4
Structural	41	43	20	19
Electrical	6	0	6	0
Mechanical	13	2	13	2
Plumbing	17	2	17	2
Fire Protection	16	7	15	7
Other	3	0	3	0
Total	96	59	74	34

*not all tests and special inspections applicable to all buildings.

The list of tests can be found at: http://www.oshpd.ca.gov/FDD/Plan_Review/tio.html

The mandatory tests cover a comprehensive list of items but are generally focused on individual systems such as: grounding, boilers, ventilation, isolation rooms, and medical gas and vacuum systems. These tests are essential, but do not go beyond factory start-up testing for major equipment. They also cover test and balance for critical constant volume isolation and operating rooms. There are no requirements for testing interoperability between systems and lighting control systems are conspicuously absent from the list. Superior healthcare facility design and construction professionals find ways to transcend these minimum requirements, but is it time to mandate commissioning for healthcare facilities in states that have no requirement?

ASHE Healthcare Facility Commissioning Guidelines

The American Society for Healthcare Engineering (ASHE) recognizes the benefits of commissioning. The ASHE released the Healthcare Facility Commissioning (HFCx) Guideline in 2010, which follows general commissioning best practices but includes some specific requirements for healthcare facilities. ASHE's leadership in providing these guidelines has considerably raised commissioning awareness and many

hospital systems now voluntarily include commissioning on new buildings and major renovation projects.

The systems covered within ASHE's HFCx Guideline are highly comprehensive and includes 15 categories: building envelope, life safety, HVAC systems, controls, plumbing systems, medical gas and other specialty systems, electrical systems, fire alarm systems, information technology, fire protection systems, interior and exterior lighting, refrigeration, vertical transport, and materials and pharmaceutical handling. The fact that this list may be too comprehensive to mandate in any code indicates how much work should go into the commissioning of a facility if the owner really wants the new or renovated facility to operate as intended from day one.

The HFCx Guideline's procedure for the commissioning process is patently similar to available recommended procedures from leading commissioning organizations but the HFCx Guidelines procedure includes two distinct areas not specifically addressed in "typical" commissioning efforts:

- ***Integrated Systems Testing*** (under emergency power): Provide testing of all critical systems through the transition to emergency power to ensure proper systems start-up after loss of power and maintain interoperability with associated systems, i.e. air handling units and exhaust fans to maintain space pressurization.
- ***Transition to Operational Sustainability and integration of Dashboards***: Through the close interaction and feedback from its membership, ASHE recognized that budget situations at most hospitals have forced facility staffing levels to decline by more than 40 percent over the past 20 years. Simply maintaining operations is a challenge for most hospitals, to say nothing of checking the energy efficiency of systems. The HFCx Guideline puts a focus on the development of dashboard tools to help the maintenance facility quickly identify areas needing attention. Dashboard tools, along with fault detection and diagnostics (FDD) tools have continually matured over the last decade to the point of being considered essential parts of the HFCx Guideline strategies to keep facilities running and operational long after the construction phase ends.

Required system tests under OSHPD's TIO program do share some overlap with pre-functional commissioning checklists and functional performance testing, so an integrated commissioning plan can accomplish both efficiently. One major difference between code required testing and commissioning is the range of loads considered. Individual system testing is often completed at design conditions and often represented by the peak annual requirement. Commissioning testing is a dynamic process and should include testing system performance at various load conditions as sometimes the most issues occur at minimum loading conditions, such as chiller surging or cycling during cold evenings when cooling loads approach minimum chiller loads. Commissioning also includes transitions from primary to secondary equipment, which helps determine the speed of the transition required to ensure the continuous needs of the facility can be met.

ASHE's HFCx Guideline may be one of several templates considered if more states and jurisdictions decide to adopt commissioning requirements for hospitals and healthcare facilities. The HFCx Guideline is steadily gaining visibility in the healthcare industry and its recommended process is worthy of consideration for any hospital or healthcare facility committed to conducting mandatory or voluntary commissioning for new facilities or major renovations.

Benefits of Commissioning over Testing

There is still a significant contingent of hospital owners and developers who choose to forgo formal building commissioning and continue to rely on the code required testing to ensure a properly operating facility. The main objection to commissioning is the perceived costs of doing so, especially in an environment where regulatory requirements are already responsible for significant seismic upgrades to existing hospitals. Additionally, the challenges of the current healthcare insurance and hospital reimbursement landscape have led many hospitals to seek every opportunity to reduce costs.

Financial Benefits

The proponents of hospital commissioning understand the initial costs are an investment which will pay off in the short term with reduced energy costs and less frequent occupant complaints. Commissioning benefits have been well documented in studies such as the 2009 report from the Lawrence Berkeley National Laboratory¹ which indicates median energy savings of 13% for new buildings with a payback range of 1.1 to 4.2 years in other commercial sector buildings which have successfully undergone the process. Such a study has not been completed specifically for hospitals but it can be reasonably inferred that similar levels of savings and payback can be maintained in the continuous operating environments of hospitals; remember efficiency savings increase with longer system run time.

Operational Benefits

There are various ways in which the commissioning process can be of great benefit to the hospital's operations and maintenance staff. Commissioning provides a measured and verified performance baseline. It offers data collection and trending tools to track the ongoing performance of systems commissioned while also offering training for ongoing maintenance and optimization of systems performance. Finally, commissioning ensure that primary and secondary systems work properly in tandem which saves the facilities staff from months or years of troubleshooting.

Growing Importance of Commissioning

As control strategies for systems gain sophistication and more systems become interdependent, the current mandatory testing protocols will no longer suffice to ensure proper hospital operations. More systems are moving away from constant speed operation, such as operating room airflow control, to variable flow systems that will be dynamic throughout the day based on schedule and specific occupant needs. Much of the innovations target reliability, staff/patient comfort, and energy efficiency. These endeavors show no signs of slowing down and may only accelerate as technological advancements afford more opportunities for systems optimization in the future.

¹ Evan Mills, Ph.D. "Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions" (Lawrence Berkeley National Laboratory), 2009