

Commissioning for Schools

The complexity of building systems continues to increase through time—as does the impact of their interactions. A single architect can no longer oversee the entire process. And simply assuming that each individual contractor is doing their job carries too great a risk.

One study of sixty new nonresidential buildings found more than half with controls problems, forty percent with malfunctioning HVAC equipment, and one-third with sensors that didn't work properly. In many of the buildings, equipment called for in the plans and specifications was actually missing. A quarter had energy management and control systems (EMCS) with economizers or variable speed drives that didn't run right.¹

Some level of commissioning is necessary to achieve a high performance school.

What Is It?

Commissioning is a systematic process of ensuring that building systems interact and perform as specified, as intended, and according to the school's operational needs. It results in increased energy efficiency, reduced change orders, better maintainability, and improved occupant comfort and productivity.

Ideally, a full commissioning process is part of every project. However, complete commissioning may not be cost-effective for small projects.

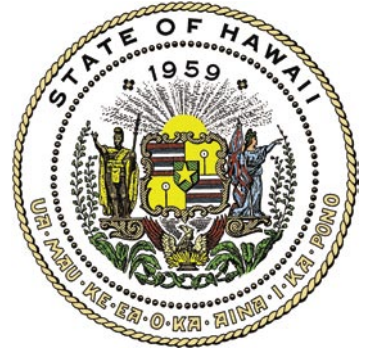
The Two Tiers

Basic: The following projects should include at least basic commissioning.

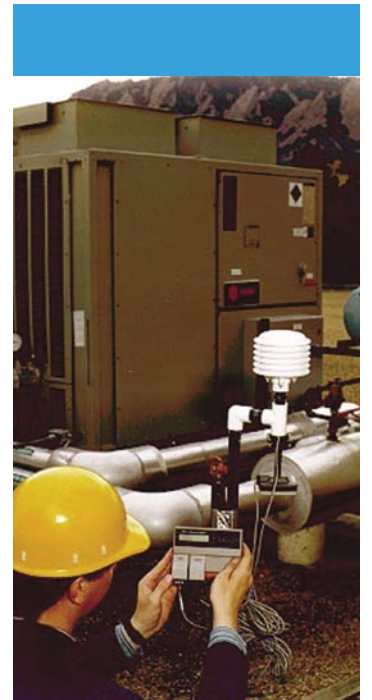
- New construction projects that cover 5,000 ft² or more of floor area.
- Renovation projects that cost \$1,000,000 or more AND cover 5,000 ft² or more of floor area AND include HVAC system replacement, building control system installation or upgrade, or lighting system controls.

Basic commissioning services may be performed by a third party or someone in-house, however, whoever assumes the role of commissioning agent should perform the following tasks:

- Verify that lighting controls have been installed per design and are functioning as intended. This includes occupancy sensors, daylighting controls, multi-level switching, and automatic time clocks.
- Make sure that ventilation and air conditioning equipment has been installed per design and that outdoor air flow, supply air flow, fluid flow, and controls function as specified in the design criteria.
- Ensure that any and all energy management and control systems (EMCSs) perform the sequence of operations and provide trend logs per design. Also establish that sensors are calibrated.
- Confirm that a complete guide has been provided to operations and maintenance staff.
- Check to see that an operating brief has been given to school administrators and teachers.
- Make certain that operating staff have been trained.



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Technician captures performance data in the field.

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¹ Piette, M.A. et al, "Quantifying Energy Savings from Commissioning: Preliminary Results from the Pacific Northwest" (Lawrence Berkeley National Laboratories 1994).

Additional: The following projects should include the additional level of commissioning.

- New construction projects that cover 30,000 ft² or more of floor area.
- *Renovation* projects that cost \$5,000,000 or more AND cover 50,000 ft² or more of floor area AND include HVAC system replacement, building control system installation or upgrade, or lighting system controls.

Additional commissioning services should be performed by a third-party commissioning agent rather than someone in-house. In order to be effective, the agent should be retained at the schematic design phase or earlier. The commissioning agent should perform the following tasks:

- Establish and follow a commissioning plan.
- Develop design intent and basis of design documentation.
- Review the design prior to the construction documents phase.
- Make sure that commissioning requirements are included in the construction documents.
- Examine the construction documents just prior to completion.
- Conduct a selective review of contractor submittals of commissioned equipment.
- Verify installation, functional performance, training, and documentation.
- Author a system and energy management manual and distribute it to building owner and manager.
- Have a contract in place for a near-warranty-end or post-occupancy review.
- Complete a commissioning report.

How Much Will It Cost?

Commissioning pays for itself. Some of the savings created by commissioning are rarely quantified: first-cost (such as equipment downsizing), ongoing non-energy benefits, reduced change-orders, and correcting causes of premature equipment breakdown. One study showed median one-time, non-energy benefits at \$0.18/ft² for ten renovation projects and \$1.24/ft² for twenty-two new construction projects. The more frequently quantified costs showed median whole-building energy savings of 15% and payback times of 0.7 years for renovation projects. New construction payback time was 4.8 years.²

It makes good economic sense, therefore, to set aside some money in your budget for commissioning. Some guidelines follow.

Critical Systems	Basic Commissioning	Additional Commissioning
Air Conditioning	\$0.10/ft ²	\$0.35/ft ²
Energy Management and Control System (EMCS)	\$0.10/ft ²	\$0.30/ft ²
Lighting: Occupancy Sensors	\$0.03/ft ²	\$0.05/ft ²
Lighting: Daylighting Controls	\$0.10/ft ²	\$0.25/ft ²
Lighting: Time-of-Day Controls	\$0.02/ft ²	\$0.05/ft ²
Other Systems	Basic Commissioning	Additional Commissioning
Natural Ventilation	\$0.01/ft ²	\$0.05/ft ²
Water Heating	\$0.01/ft ²	\$0.05/ft ²
Swimming Pool	\$0.01/ft ²	\$0.10/ft ²
Kitchen Equipment	\$0.01/ft ²	\$0.10/ft ²
Security	\$0.01/ft ²	\$0.10/ft ²
Clocks	\$0.01/ft ²	\$0.05/ft ²
Fire Alarm	\$0.01/ft ²	\$0.10/ft ²

² Mills, E. et al, "The Cost-Effectiveness of Commercial-Building Commissioning" (Lawrence Berkeley National Laboratory 2004).