

FACILITIES COMMISSIONING BEST PRACTICES

Presented by:

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Best Practices Quiz

When will the Facilities Manager find out that an air conditioning system can not operate at full load?

A. Before it is needed.

Or

B. On the hottest day of the year!



Why Commission?

As LEED 2009 states:



The “Benefits of commissioning include reduced energy use, lower operating costs, fewer contractor callbacks, better building documentation, improved occupant productivity and verification that the systems perform in accordance with the owner’s project requirements.”

What is the Commissioning “Quality Process”?

- It starts with a plan before the design is complete.
- It includes assisting the design team with reviews and experiences.
- Examination of submittals from installers for the desired qualities.
- Construction inspections to ensure proper equipment installation.
- Verify proper operation through rigorous testing.
- Follow-up on testing issues until resolved.
- Ensure that O&M manuals are adequate and complete.
- Make sure the operating staff is properly trained.

Isn't Commissioning Just Good Quality Control?

ASHRAE defines the commissioning process as
“A quality focused **process** for enhancing the
delivery of a project.”

LEED states the intent of commissioning is “to
verify that the project’s energy related
systems are installed and calibrated
according to the owner’s project
requirements, basis of design and
construction documents.

Commissioning is a quality process performed
as part of the construction process, not quality
control after construction is complete.



The Phases of Commissioning



Pre-Design Phase

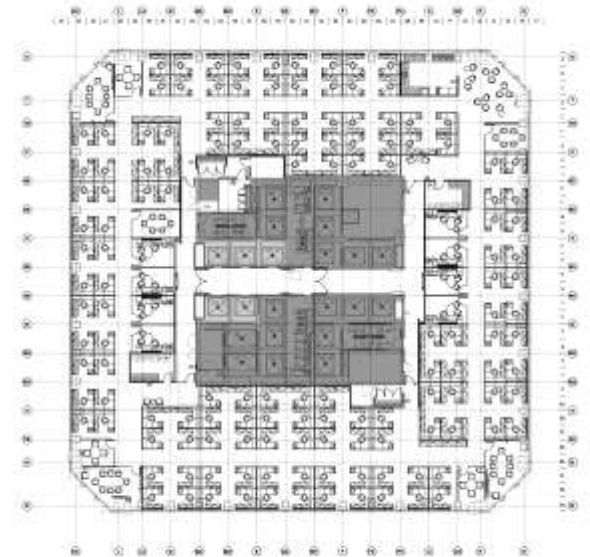
Design Phase

Construction Phase

Operations Phase

Pre-Design Phase Typical Elements

- ✓ Commissioning Kickoff Meeting
 - ✓ Assemble the team and determine responsibilities
- ✓ Owners Project Requirements (OPR)
 - ✓ Document what is expected from the facility
- ✓ Basis of Design (BOD)
 - ✓ How the OPR will be accomplished
- ✓ Commissioning Plan
 - ✓ How the facility will be commissioned
- ✓ Issues Log
 - ✓ Tracking issues to resolution



Pre-Design Phase Best Practices

- ✓ The Owner's Project Requirements need to be developed and vetted by the team to ensure that all the owner's needs for the facility are completely addressed.
 - ✓ What temperature conditions as expected in the space? - If 72 degrees is the desired indoor condition, a system designed for 75 degrees may not be able to provide it on a design day.
 - ✓ What is the expected occupancy? - A school that is only partially occupied during the summer may not need air conditioning throughout the facility.
 - ✓ Review the OPR with the O&M Staff, they know best how they actually operate their facilities!



Pre-Design Phase Best Practices cont.

- ✓ Requirements for the Systems Manual should be included in the OPR so that the items that the contractors are responsible for providing can be included in the specifications.
- ✓ Requirements for training should be included in the OPR so that the items that the contractors are responsible for providing can be included in the specifications for the contractors to buy out from the equipment vendors.

Pre-Design Phase Best Practices cont.

- ✓ The Basis of Design should be reviewed by the team to ensure that a clear and concise narrative is included in it so it can provide guidance during the reviews of the drawings and specifications.
 - ✓ If a hydronic cooling system is being provided questions can be raised about whether the cooling tower will require winterization and who will provide it. O&M Staff or outside contractor?
 - ✓ Involve the O&M staff to provide input on what they can and can not provide!

Design Phase Typical Elements

- ✓ Design Documents Review
 - ✓ Compare with the OPR and BOD
- ✓ Design Issues Report
 - ✓ Track the issues to resolution
- ✓ Commissioning Specifications
 - ✓ Scope of work of commissioning for contractors
- ✓ Commissioning Plan Update
 - ✓ Details on commissioning the equipment in the design

Design Phase Best Practices

- ✓ Plans and Specifications need to be reviewed to ensure that the design meets the Owner's Project Requirements. The review especially needs to look at the O&M and Training requirements in the design.
 - ✓ O&M manuals and information required should be specified.
 - ✓ O&M Manuals should be requested before project completion so they can be reviewed and then used during training.
 - ✓ The contents of the O&M Manuals needs to be specified. They should include not only maintenance and repair information but also normal operating procedures, emergency operating procedures, troubleshooting and adjustments.

Design Phase Best Practices cont.

- ✓ The type of training required should be specified. Durations, whether in the classroom or field or both, and instructor qualifications required need to be included. Do you want the sales rep to provide the instruction or someone with hands on experience from the factory who really knows how the equipment works?
- ✓ The type of closeout information desired also needs to be specified. Do you really want a pile of red-lined drawings? Or actual updated as-built cad drawings on computer media (CD, Flash Drive etc.)?



Design Phase Best Practices cont.

- ✓ At a minimum one design review prior to final CDs and a back check of the final CDs should be performed which will also help to satisfy some LEED requirements. Ideally a review should be performed during each step of the design, SD, DD, and CD.
- ✓ Critical to effective commissioning is to make sure that commissioning is specified. All of the commissioning requirements of the contractors need to be specified clearly to avoid gaps. If the commissioning authority is not brought on until the systems are ready for testing and commissioning has not been specified the contractors may not cooperate or may demand extra compensation for the commissioning activities.

Construction Phase Typical Elements

- ✓ Contractors Kickoff Meeting
 - ✓ How commissioning will work
- ✓ Submittal Review
 - ✓ Compare with OPR and BOD
- ✓ Installation Inspections
 - ✓ Find issues early while still easy to correct
- ✓ Test Scripting
 - ✓ Incorporate submittal information
- ✓ Performance Testing
 - ✓ Verify equipment operation and conformance to OPR and BOD

Construction Phase Best Practices

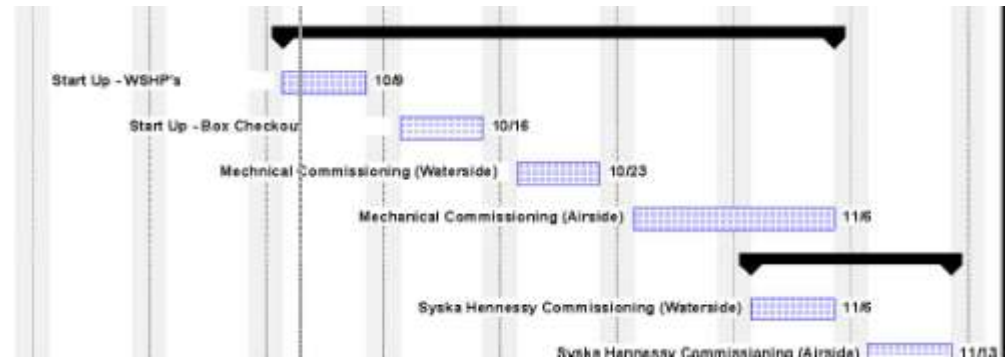


- ✓ The Commissioning Authority needs to be provided with the submittals for all of the equipment being commissioned so that they can be reviewed for any discrepancies with the OPR and BOD and also can be used to prepare equipment specific testing scripts.
- ✓ The contractors or vendors should also be supplying start-up checklists for review even if not included in the equipment submittals so they can be vetted by the Commissioning Authority and the team to ensure that the procedures followed will make the equipment ready for testing.

Construction Phase Best Practices

- ✓ The Commissioning Authority needs to be kept up to date on the progress of the project and the schedule so timely inspections can be performed and issues can be caught while they are still easily remedied before things get closed up.

18	Mechanical	25 days	Mon 10/6/09	Fri 11/6/09
19	Start Up - WSHP's	5 days	Mon 10/5/09	Fri 10/9/09
20	Start Up - Box Checkout	5 days	Mon 10/12/09	Fri 10/16/09
21	Commissioning (Waterside)	5 days	Mon 10/19/09	Fri 10/23/09
22	Commissioning (Airside)	10 days	Mon 10/26/09	Fri 11/6/09
23	SYSKA HENNESSY	10 days	Mon 11/2/09	Fri 11/13/09
24	Syska Hennessy Commissioning (Waterside)	5 days	Mon 11/2/09	Fri 11/6/09
25	Syska Hennessy Commissioning (Airside)	5 days	Mon 11/9/09	Fri 11/13/09



Construction Phase Best Practices

- ✓ The commissioning scripts should be vetted through the team and the contractors/vendors to ensure that the testing protocols are agreed to by all parties involved before testing begins.
- ✓ The O&M Staff should be involved in the testing since it is the best time to see the equipment actually used and is helpful in training them on the proper operation and use of the equipment.



Operations Phase Typical Elements

- ✓ O&M Manual Review
 - ✓ Verify inclusion of the necessary information
- ✓ Systems Manual
 - ✓ A guide for optimal operation of the commissioned systems
- ✓ Training Review
 - ✓ Verify that the staff understands how to best operate the equipment
- ✓ Seasonal Testing
 - ✓ Performance of testing that was deferred due to seasonal conditions
- ✓ Post Occupancy Warranty Review
 - ✓ Operational review of the systems prior to warranty expiration

Operations Phase Best Practices

- ✓ The O&M Manuals should be provided before substantial completion. They can then be reviewed by the team and used as a training aide which will familiarize the O&M Staff with their contents and use.
- ✓ For each system being commissioned a training syllabus should be submitted for review to ensure that the training is complete and covers all the necessary procedures including normal operation, emergency operation, troubleshooting, adjustments, maintenance and repairs.



Operations Phase Best Practices cont.

- ✓ The Systems Manual needs to be prepared and vetted by the team to ensure that the O&M Staff has all the information they need to properly and efficiently operate the commissioned systems.
- ✓ Having both the CM and the O&M Staff in a warranty review meeting facilitates getting any open issues resolved in a timely manner. Holding the warranty review meeting on site at the facility provides an opportunity to walk down any lingering issues and get them resolved





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Existing Building Commissioning

What is Existing Building Commissioning?

LEED States that Existing Building Commissioning:

- “Involves developing a building operation plan that identifies current operating requirements and needs, conducting tests to determine whether building systems are performing optimally in accordance with the plan, and making any necessary repairs or changes.

Phases of Existing Building Commissioning



Planning Phase

Investigation Phase

Implementation Phase

Planning Phase Typical Elements

- ✓ Site Survey
 - ✓ Walk through facility and observe operating conditions
- ✓ Obtain and Review Design Documentation
 - ✓ Review the original design of the facility
- ✓ Document Energy Use
 - ✓ Gather energy bills and metering information
- ✓ Identify Operational and Energy Use Issues
 - ✓ Ask for complaints about operation and energy use
- ✓ Develop Retro-Commissioning Plan
 - ✓ Develop a testing and operations verification plan

Planning Phase Best Practices

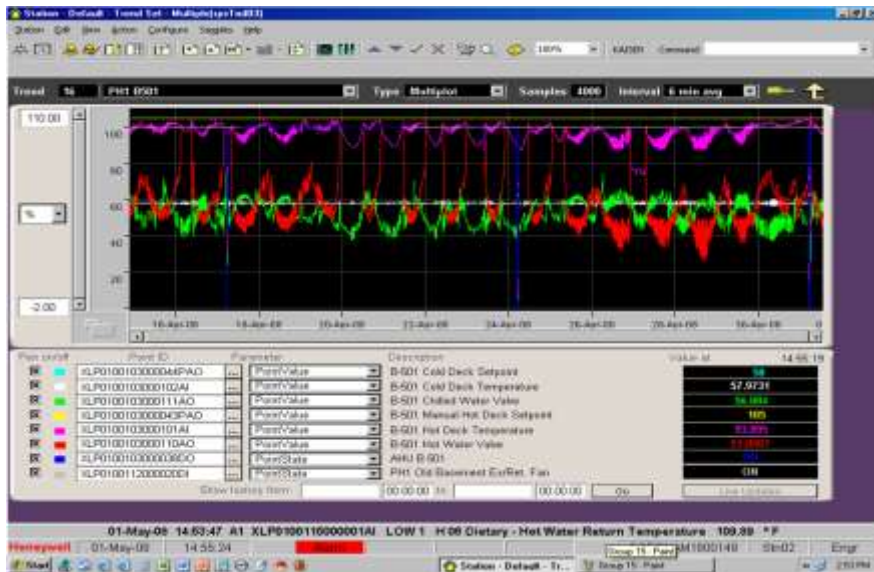
- ✓ Gather as much information as is available on the building and then gather some more.
- ✓ Get as many years of energy usage data as is available to cover as many different weather scenarios as possible.
- ✓ Interview the O&M Staff to find out how the building really operates.
- ✓ Plan on hiring the Building Automation System provider to operate the BAS system, they will be needed to provide the proper access to the programming.
- ✓ Look for redlines of the design documentation.



Investigation Phase Typical Elements

- ✓ Implement trend logging and data monitoring
 - ✓ Record the facility operating deficiencies
- ✓ Develop Test Scripts
 - ✓ Script tests to diagnose the operating deficiencies.
- ✓ Implement Testing.
 - ✓ Test and record the issues found.
- ✓ Review Issues.
 - ✓ Review the issues and develop repair and modification recommendations

Investigation Phase Best Practices



- ✓ Use the BAS system as much as possible for trend logging and data recording.
- ✓ Use portable data loggers for spaces without BAS sensors.
- ✓ Hire a good TAB contractor to check flows and identify leaks.
- ✓ Have the team review the functional scripts before testing to ensure all parties agree with the testing.

Implementation Phase Typical Elements

- ✓ Implement no/low cost recommendations
 - ✓ Begin immediate energy savings and operational improvement
- ✓ Develop scope of work for capital improvements
 - ✓ Review cost benefit ratio to determine best use of capital
- ✓ Provide operator training on the implemented improvements
 - ✓ Maximize energy savings and operational benefits
- ✓ Monitor energy usage
 - ✓ Confirm energy improvements savings
- ✓ Provide recommendations for future improvements
 - ✓ Recommendations for additional savings

Implementation Phase Best Practices



- ✓ Most low or no cost measures to implement involve the BAS system so program access will most likely be needed. A properly trained employee (and seat license) or the BAS vendor will be needed to implement them.
- ✓ Training of the operating staff on the operation and use of the implemented improvements is critical to maintaining the energy savings and operational improvements over the long term.

Facilities Commissioning Best Practices

As with Facility design, there are few absolute right and wrong solutions. The Commissioning “Best Practice” for a given facility depends upon many (often conflicting or competing) variables.

What is most important, is plan ahead, select a solution, and then execute in a high quality manner.

Thank You!

Comments and Questions?

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