

BGS COMMISSIONING GUIDELINES

MAY 2012

PART 1 - GENERAL REQUIREMENTS

1.1 Preamble

- A. As you work on projects and something comes up that should either be included, or which simply does not work, bring it to the attention of Teigh Southworth, for inclusion/editing of the document for future projects. (Project Managers should delete this paragraph.)

1.2 Purpose

- A. Everybody inherently “knows” what building commissioning should mean. Although a number of organizations have published definitions of building commissioning, a specific, industry-accepted definition of commissioning has not emerged. The lack of a standard, however, does not mask the consensus on the importance of commissioning building systems and the general agreement that building commissioning leads to occupant comfort, energy savings, maintainability, and extended system life.
- B. Historically, the term "commissioning" has referred to the process by which the heating, ventilation and air conditioning (HVAC) systems of a building were tested and balanced according to established standards prior to acceptance by the building owner. Today’s use of commissioning recognizes the integrated nature of all building systems’ performance, which impact sustainability, workplace productivity, and security. Because all building systems are integrated, a deficiency in one or more components can result in sub-optimal operation and performance among other components
- C. Essentially, “commissioning” is what a good A & E consulting team already does for an Owner when they manage a project well from design development through the one year warranty period. All close out documents have to be complete. All building systems have to be working properly and in concert with all others. All known construction problems have to be corrected. The owner’s staff has to know how to operate and maintain the building.
- D. As building systems have become more complex and contractors more specialized, the traditional methods for building start-up and final acceptance have proven inadequate. Building Commissioning fills this gap by applying a comprehensive written plan of testing, approvals and acceptances that begins with the Basis of Design (BOD) preparation and extends throughout the design construction and warranty processes. Correctly implemented, it provides fewer change orders, smoother building turnover, improved energy performance, increased systems reliability and reduced expenditures for Operations & Maintenance (O&M)

- E. The following definition conveys the spirit of most building commission definitions and contains many, if not all, of the essential elements:
1. Building Commissioning is the systematic process of assuring by verification and documentation, from design phase to a minimum of one year after construction, that all facility systems perform interactively in accordance with design documentation and intent, and in accordance with the owner's operational needs, including training of operating personnel. The goals of Commissioning are to improve the building delivery process, to provide a safe and healthy facility; to improve energy performance; to reduce operating costs; to provide O&M staff orientation and training; and to improve systems documentation.

1.3 Goals

- A. Total Building Commissioning, as it has emerged in the public and private sectors, is a cradle-to-grave systematic process of ensuring that facility systems are planned, designed, installed, tested, and capable of being operated and maintained to perform according to the design intent and the owner's needs. The Total Commissioning process is optimally applied to all phases of a construction project - program planning, design, construction/installation, acceptance and post-acceptance/occupancy. Commissioning team involvement begins at the earliest stages of project planning, where its expertise is applied by defining performance expectations in such areas as sustainability, workplace productivity, security, safety, maintainability, user friendliness, product quality and reliability, ergonomics and projected life cycle costs. The commissioning team is then involved in monitoring design and construction decisions to ensure goal attainment for the quality of workmanship, specification adherence and code compliance. Commissioning tests and inspection procedures are also conducted for quality assurance and system acceptance. The team plans, monitors, and validates that the maintenance/operations personnel and contractors are fully trained and prepared to properly operate the new building systems. Following acceptance, the quality team monitors the installed system to ensure that there are no latent installation defects or degradation of system performance and operational quality.
- B. This rigorous commissioning process is intended to provide the following benefits::
1. Ensure that a new or a fully modernized facility begins its life with systems at optimal productivity.
 2. Improve the likelihood that the facility will maintain this level of performance.
 3. Restore an existing facility to high productivity.
 4. Ensure that facility renovations and equipment upgrades function as designed
 5. Improve the building occupant productivity.
 6. Lower utility bills through energy savings.
 7. Improve the environmental/health conditions and occupant comfort.
 8. Improve the systems and equipment function.
 9. Improve the building operation and maintenance.
 10. Provide better building documentation.
 11. Shorten the occupancy transition period.

- 12. Significantly extend the equipment/systems life cycle.
- 13. LEED Certification.
- 14. In a nutshell: make the building function the way the occupants intended.

C. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council, is a consensus-based, market-driven rating system that can serve both as criteria and as measurement for our building projects. Using LEED as a goal in design criteria will help us to apply principles of sustainable design and development to the siting, design, and construction of our facilities. Evaluation and documentation of building features with specific LEED criteria can earn award levels of LEED Certified, Silver, Gold or Platinum.

1.4 Who does it

A. The entire project development and delivery team, including the owner, design team, and contractors, and possibly a third party commissioning agent, shall be involved in the building commissioning process from the early design phase through post occupancy. The Architect is responsible for appointing a Commissioning Coordinator (CC) who shall serve as the facilitator, coordinator, and advocate of building commissioning by bringing the project team together to plan, evaluate, test and reconcile performance goal issues. This may be the Architect, a member of the Architects staff, or some other third party.

1.5 What needs to be commissioned

A. At the very least, if it moves, or affects something else that moves, it should be commissioned. For example, but not limited to:

- | | |
|-------------------------|----------------------------------|
| 1. Flag poles | b. Walk in Coolers |
| 2. Doors and Hardware | c. Heat Pumps |
| 3. Windows | 8. Heat Exchangers |
| 4. Bathroom accessories | 9. Boilers |
| 5. Pumps | 10. Furnaces |
| a. Domestic water | 11. HVAC Controls |
| b. Sewer | 12. Plumbing Fixtures |
| c. HVAC | 13. Fire Safety |
| 6. Air Handlers | 14. Card Readers |
| a. Central Station | 15. Lights |
| b. Fan Coils | 16. Motors |
| c. Exhaust Fans | 17. Transformers |
| 7. Refrigeration | 18. Generators |
| a. Chillers | 19. Switchgear |
| | 20. Laboratory Specific Services |

PART 2 - PRODUCTS, FORMS

2.1 Documents

A. Basis of Design or Statement of Design Intent

1. The BOD document is normally prepared by the design team in the early stages of a project, once there is a clear understanding of the owner's expectations as to how the building is to operate. The BOD is a dynamic document that includes quantifiable design values. The BOD is used to determine whether or not the building meets the owner's expectations.

B. Specifications

1. The Construction Specification Institute (CSI) has assigned commissioning to section number 01810.
 - a. Division 1 - 01810 Commissioning General Provisions
 - 1) Defines commissioning process and the roles and responsibilities of various team members.
 - 2) Should be referenced in Part 1, Related Sections, for each section that requires commissioning.
 - 3) Contains reference to sections to be commissioned.
 - b. Divisions to be Commissioned
 - 1) Use xx995 section, for example 15995, Mechanical Systems Commissioning.
 - 2) Contains detailed commissioning requirements and any required system readiness checklists (SRC) or verification test procedures (VTP).
 - 3) Should be referenced in Part 1, Related Sections, for each section that requires commissioning.
 - 4) Contains reference to sections to be commissioned.

2.2 Forms

A. Labor and Industry Forms

1. Substantial Completion
2. Occupancy Permit
3. Final Elevator Inspection
4. Final Boiler Inspection
5. Final Plumbing Inspection
6. Final Electrical Inspection

B. System Readiness Checklists

1. The SRC's are detailed checklists for documenting that each system is prepared for testing.

2. Sample SRC:

Air Handling Units

AHU-1

- Unit is accessible for service.
- Equipment labels are installed per specifications.
- Filters are installed, accessible and removable.
- Control wiring and devices are installed.
- Supply power is installed and disconnect is accessible.
- Overloads and/or fusing is appropriate.
- Damper actuators are installed.
- Discharge air, return air and mixed air temperature sensors are installed.
- All ductwork is installed.
- Piping, valves and insulation are complete.
- Lubrication has been applied.
- Smoke dampers are installed, have access panels and are normally open.
- Unit installation is complete and ready for functional testing.

C. Verification Test Procedures

1. The VTP's are a detailed set of instructions and acceptable results for thoroughly testing each system.
 - a. BGS Burner Startup Form
 - b. BGS DDC Point by Point Ringout

2. Sample VTP:

Occupied Modes

Air Handling Unit Occupied Mode Tests

1. Place the system in the occupied mode.
2. Verify by physical inspection that the return air fan only starts first and then the supply air fan starts, the dampers modulate and the heating valve modulates after a 15 second delay.
3. Verify BAS displays the correct status for the air handling units.

Return fan starts first, 15 second delay for other components.

	AHU-1	
Supply Fan	ON	
Return Fan	ON	
SAT	55°F	
RAT	78°F	
MAT	85°F	
OSA Damper	10%	
RA Damper	100%	

Exhaust Damper	80%	
Pre Filter Status	.125 “	
Final Filter Status	.25”	
Heating Valve %	0%	
Chilled Water Valve %	85%	

4. Verify hot water loop is up to temperature and record loop temperatures.
5. Supply Air Temperature Control: Set the discharge air temperature set point to create to demand for heating, record values, then increase set point and verify heating valve responds and unit controls to new set point.

Heating loop supply temperature start of tests _____ °F

Heating loop return temperature start of tests _____ °F

Unit	SP1	SAT1	SP2	SAT2	Controls?
AHU-1					

2.3 Close Out Documents

- A. O&M Manuals
- B. Submittal Log
- C. As Builts

PART 3 - EXECUTION

3.1 Design

- A. During the program phase, the functional, operational and occupant requirements of the facility are defined; construction budgets are planned; and a project management plan is developed. During the initial phase of design the CC shall ensure the BOD, and a preliminary commissioning plan are prepared.
- B. During subsequent development and design work the design shall be compared with the BOD to ensure the project is meeting the owners desires, when/if those desires change the BOD shall be updated to reflect these new concepts. The commissioning plan and commissioning specifications are prepared along with the Specifications and Drawings.
- C. Review for Constructability
- D. Review for conflicts:
 1. Between the Specifications and the Drawings.

2. Between specification sections
3. Between drawings

3.2 Construction

- A. The CC shall ensure the entire design team visits the site in a timely fashion and verifies the correct installation of the components in their respective field, as the components are being installed, that systems are being installed to meet the BOD, and that systems which operate in concert with other building components or systems will function as intended. (It is much easier to make corrections as items are being installed than it is to wait until punchlist inspection when the occupants are virtually on the steps waiting to move in.)
- B. That all changes are in keeping with the BOD, affect of changes are considered with relation to other systems they impact, and are documented in the commissioning plan.
- C. During the acceptance phase, performance testing is conducted to verify that performance of the systems meet the objectives defined in the design intent. Building system O&M documentation is reviewed and approved and maintenance staff is trained on O&M procedures.
- D. During the post-acceptance or occupancy phase, performance testing is continued to account for dynamic changes that occur in a facility over time including seasonal variation.

3.3 Training

- A. A building cannot be expected to operate in the most energy-efficient and economical manner if the personnel in charge of operating and maintaining the building systems are unfamiliar with how to service the equipment and do not fully understand how and why the systems operate the way they do. This is especially true as systems become more and more complicated, sophisticated, and integrated with one another. The commissioning process coordinates and provides the necessary equipment and systems training for the owner and the building operators.
- B. The CC coordinates and documents all specified contractor-provided training sessions. Prior to each training session, the CC will review the training agenda with the owner and the building operators to confirm that the training session will meet their needs and expectations.
- C. Systems training is provided by the CC to give an in-depth description and understanding of the design intent and how the building operates as a system.
- D. Following the equipment and systems training sessions, the building operators have the option to participate in the verification-testing phase of the commissioning process. This is the opportunity to get practical hands-on experience of operating the equipment and reinforces what was learned during the equipment and systems training sessions.

3.4 Warranty

- A. Prior to the close of the warranty period, the design team and project manager, revisit the site to conduct a warrantee inspection, and if necessary subsequent re-commissioning.

PART 4 - Additional Resources

4.1 The following sites may be of assistance:

http://www.eere.energy.gov/buildings/highperformance/pdfs/sustainable_guide/sustainable_guide_front.pdf

http://www.eere.energy.gov/buildings/highperformance/pdfs/sustainable_guide/sustainable_guide_ch9.pdf

<http://sustainable.state.fl.us/fdi/edesign/resource/totalbcx/guidemod/docs/01may98.html>

<http://www.rebuild.org/attachments/guidebooks/commissioningguide.pdf>

ASHRAE Guideline 1 The HVAC Commissioning Process

PART 5 - Definitions

5.1 The following acronyms are used in this document:

Basis of Design (BOD)

Commissioning Coordinator (CC)

Construction Specification Institute (CSI)

Heating, Ventilation And Air Conditioning (HVAC)

Operations & Maintenance (O&M)

Leadership in Energy and Environmental Design (LEED)

System Readiness Checklists (SRC)

Verification Test Procedures (VTP)