

**State of Washington DES Managed Projects
COMMISSIONING GUIDELINES**

1. Terms

- PM DES Project Manager
- A/E Consulting Architect and/or Engineer
- CA Commissioning Agent
- WSEC Washington State Energy Code
- DES Department of Enterprise Services
- LEED Leadership in Energy and Environmental Design
- OPR Owner Project Requirements
- RCW Revised Code of Washington

2. Purpose

Each project has unique issues and goals that may affect the commissioning process. This document is intended to facilitate discussion and agreement among the commissioning team (owner, PM, A/E and CA). These commissioning guidelines help establish the project commissioning requirements, including those requirements to be specified in the construction documents.

3. Goal

The goal of commissioning is to ensure that the facility's mechanical, electrical and other designated systems' performance (as documented by the A/E's basis of design) meets the owner's functional criteria and operational needs (as documented by the OPR). The commissioning process provides documentation and verification of the performance of the facility's designated systems. For the process to work successfully it is important to have good communications among the commissioning team and to keep all parties involved and informed of all pertinent decisions.

4. Applicability

Building Commissioning is required as part of the LEED Silver standard for new building construction and renovations per RCW 39.35D. The WA State Energy Code requires completing a "Commissioning Compliance Checklist" for all projects that require a mechanical permit. Link to the checklist is "http://neec.net/sites/default/files/neec_codes/forms12/C408-Commissioning-Checklist.pdf". Attachment 1 is a copy of the current commissioning compliance checklist.

Early in the design process, the owner, A/E, PM and CA should meet to discuss commissioning required by LEED and the WA State Energy Code as well as commissioning that is good practice and addresses owner concerns. The commissioning sample rate should be discussed and documented. The sample rate should be based upon system complexity, system importance, owner input and CA experience. The sample rate may be as low as 10% for system components that have low complexity and relatively low importance (for example 15% of VAV boxes serving offices/classroom spaces may be commissioned and the rest have trend data evaluated). ASHRAE Cx Process Guidelines provides detailed sample rate guidance.

Attachment 2 is a list of systems that should be considered for the commissioning process. The AE and CA should review the WSEC, LEED requirements and good practice then make commissioning recommendations to the owner and PM to ensure all appropriate systems are properly commissioned

5. **On-Call Commissioning List**

The DES Energy Group maintains an on-call commissioning list. These commissioning providers are prequalified and approved each biennium. DES project managers may use these providers for their client's projects commissioning requirements.

6. **Basic Fee or Additional Service**

Commissioning is considered an additional professional service. The time spent by the A/E in preparing for the commissioning activities are considered an additional service.

7. **Design Record – OPR and A/E's Basis of Design**

During predesign, the project's design record should be developed by the A/E in consultation with the owner and PM. The design record consists of owner's project requirements and the project's basis for design.

- The owner project requirements (OPR) are written documentation of the functional requirements of the facility and the expectations of how it will be used and operated. This is the owner's requirements for a successful building. In order for the project to be successful, these requirements must be documented and achieved by the design team.
- The project's basis of design is the documentation of the primary decision making process and assumptions behind design decisions made to meet the OPR. The basis of design consists of design narratives and design rationale.
 - The design narratives are the written descriptions and discussions of the design concepts and features the A/E proposes to meet the owner's OPR.
 - The design rationale is the basis, rationale and assumptions for calculations, decisions and systems selected.

The design record should be reviewed and updated by the A/E in consultation with the owner, PM and CA at each design phase. The CA should confirm that the OPR is met by the A/E's basis of design. The design record is a tool to develop design intent and verification that it has been met. For further information link to: http://web.stanford.edu/group/narratives/classes/08-09/CEE215/ReferenceLibrary/Design%20Intent_Basis%20of%20Design/Design%20Intent%20and%20Basis%20of%20Design_Clarification.pdf.

8. **Description and Responsibilities**

The process of commissioning is a team effort involving the PM, owner, A/E, contractors and CA. The parties responsible for the various tasks involved in the commissioning process differ with each project and depend on the size of the facility and the complexity of systems and controls. Smaller projects may have overlapping or interchangeable roles for the team members. Flexibility is essential when defining responsibilities of the team members so that the needs of each individual project can be met. The following description of roles and responsibilities of team members would be typical for larger projects.

- **Project Manager (PM):** the Department of Enterprise Services is the contracting authority for design and construction of public works projects for state owned facilities for numerous state agencies. The PM is the owner's representative.
 - The PM manages the A/E agreement, the construction contract, and the commissioning contract.
 - The PM oversees and provides input at each stage of the commissioning process. The PM reviews the OPR and A/E's basis of design (at each design stage) and participates in resolving discrepancies.
 - The PM will work cooperatively with the CA, owner, contractor and the A/E to resolve commissioning issues and provide a properly commissioned project.

- **Owner:** defines the functional and operational use of the facility, such as the occupancy schedules, ventilation requirements for the various areas of the facility, control settings, and lighting requirements.
 - DESIGN PHASE: The owner will provide comprehensive information as to functional and programmatic requirements for the building. This information will be developed by the A/E into the OPR. The owner will review and approve changes to the OPR and A/E's basis of design at each design phase. The owner must authorize work performed by the A/E or CA and approve the costs.
 - ACCEPTANCE PHASE: The owner will make final decisions regarding results of commissioning activities. It is recommended that building operators attend and participate in field commissioning activities. The Owner will arrange for facility maintenance personnel to attend training sessions
 - The owner will work cooperatively with the CA, PM, contractor and the A/E to resolve commissioning issues and provide a properly commissioned project.

- **Architect/Engineer (A/E):** The A/E reviews and approves construction activities, shop drawings, mock-ups, operation and maintenance manuals, as-built drawings and other contract documentation.
 - DESIGN PHASE: The A/E works with the owner to develop and document the OPR and then provides the basis of design which is intended to meet the OPR. These documents are developed in the predesign phase, then reviewed and modified as necessary at each design phase by the A/E.
 - ACCEPTANCE PHASE: The A/E team will include in the project specifications instructions to the contractor describing the contractor's responsibilities in the commissioning process. These instructions will be reviewed and approved by the CA.
 - The A/E will work cooperatively with the CA, PM, contractor and the owner to resolve commissioning issues and provide a properly commissioned project.

- **Contractor:** assist with the development and execution of the functional performance test procedures for all systems. The contractor also helps facilitate the commissioning schedule to keep the project proceeding smoothly. The contractor verifies the systems are ready for commissioning.

- CONSTRUCTION PHASE: The contractor will prepare the operation and maintenance manuals and review and approve the commissioning plan. The contractor documents the installation and start-up of systems as indicated in the construction documents and manufacturer's submittals.
- ACCEPTANCE PHASE: A representative of the sub-contractor for each applicable trade will carry out performance testing under the observation of the CA. Contractor will correct discrepancies between the construction documents and the commissioning results. The contractor will provide training for owner's personnel.
- WARRANTY PERIOD: The contractor will identify owner's warranty responsibilities required to maintain validity of warranty, explicitly listing time schedules and procedures for any routine maintenance. The contractor will coordinate with warrantors to determine specific requirements to maintain the validity of the warranty.
- No part of these instructions shall be construed to relieve the contractor of any responsibility assigned under the construction contract.
- The contractor will work cooperatively with the CA, A/E, PM and the owner to resolve commissioning issues and provide a properly commissioned project.

• **Commissioning Agent (CA):** an independent agent, who acts as representative to the owner, and is typically not associated with the A/E or contractor. The CA is typically selected by the owner and PM during the predesign or design development phase.

- DESIGN PHASE: The CA will review and approve the OPR and A/E's basis of design and participate in resolving discrepancies (at each design phase). The CA will prepare a commissioning plan, provide the A/E with a complete description of the commissioning requirements, and review design documents for coordination of requirements as well as accessibility and maintainability of equipment and systems. The CA will also review plans and specifications to ensure energy code compliance testing and requirements are included. The CA will provide commissioning specifications to be included in the contract documents.
- CONSTRUCTION PHASE: The CA will review contractor's submittals for compliance with commissioning needs, witness specific installation activities, provide observation reports and conduct commissioning meetings as indicated in the commissioning plan.
- ACCEPTANCE PHASE: The CA is responsible for the following:
 - § Coordinate with the contractor to schedule the field commissioning. The CA will lead commissioning efforts until functions of all systems have been fully demonstrated and are accepted by the A/E and owner.
 - § Inspect equipment and systems to ensure accessibility and maintainability.
 - § Commission compliance testing required by the energy code.
 - § Review the operation and maintenance manuals for compliance with commissioning requirements.
 - § Report to the A/E, owner, contractor and PM the results of all commissioning activities and recommend how to correct deficiencies.
 - § Prepare written progress reports of results of performance testing and correction of deficiencies.
 - § Review the material used to train the owner's personnel.

- The CA will work cooperatively with the contractor, A/E, PM and the owner to resolve commissioning issues and provide a properly commissioned project.
- WARRANTY PERIOD: The CA will perform recommissioning of appropriate systems during warranty period at change of seasons. At completion of commissioning, the CA will prepare a final written report describing results of all performance testing and corrective actions recommended.

9. **Training**

Training should proceed as documented in the commissioning plan and as discussed and approved by the owner, AE, PM and CA.

Typically the contractor will explain special features and intricacies of system operation to the building operating personnel during training sessions. Items covered should include control systems, HVAC system operation, set points, sequence of operations, safety features, hazards to be aware of, precautions to be observed to avoid damage to equipment and any necessary seasonal adjustments. This information should be clearly stated in the O&M Manuals for reference. Training sessions may be recorded.

ATTACHMENT 1

FIGURE C408.1.2.1
COMMISSIONING COMPLIANCE CHECKLIST

Project Information	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Project Name:</td> </tr> <tr> <td style="padding: 2px;">Project Address:</td> </tr> <tr> <td style="padding: 2px;">Commissioning Authority:</td> </tr> </table>	Project Name:	Project Address:	Commissioning Authority:
Project Name:				
Project Address:				
Commissioning Authority:				
Commissioning Plan (Section C408.1.1)	<input type="checkbox"/> Commissioning Plan was used during construction and included items below <ul style="list-style-type: none"> • A narrative description of activities and the personnel intended to accomplish each one • Measurable criteria for performance • Functions to be tested 			
Systems Balancing (Section C408.2.2)	<input type="checkbox"/> Systems Balancing has been completed <ul style="list-style-type: none"> • Air and Hydronic systems are proportionately balanced in a manner to first minimize throttling losses • Test ports are provided on each pump for measuring pressure across the pump. 			
Functional Testing (Sections C208.2.3,) C408.3.1, C408.4.1.3 and C408.5.1	<input type="checkbox"/> HVAC Equipment Functional Testing has been completed (Section C408.2.3.1) HVAC equipment has been tested to demonstrate the installation and operation of components, systems and system-to-system interfacing relationships in accordance with approved plans and specifications			
	<input type="checkbox"/> HVAC Controls Functional Testing has been completed (Section C408.2.3.2) HVAC controls have been tested to ensure that control devices are calibrated, adjusted and operate properly. Sequences of operation have been functionally tested to ensure they operate in accordance with approved plans and specifications			
	<input type="checkbox"/> Economizers Functional Testing has been completed (Section C408.2.3.3) Economizers operate in accordance with manufacturer's specifications			
	<input type="checkbox"/> Lighting Controls Functional Testing has been completed (Section C408.3.1) Lighting controls have been tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications			
	<input type="checkbox"/> Service Water Heating System Functional Testing has been completed (Section C408.4.1) Service water heating equipment has been tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications			
	<input type="checkbox"/> Pool and Spa Functional Testing has been completed (Section C408.4.1.3) Pools and spas have been tested to ensure service water heating equipment, time switches and heat recovery equipment are calibrated, adjusted and operate in accordance with approved plans and specifications			
	<input type="checkbox"/> Metering System Functional Testing has been completed (Section C408.5.1) Energy source meters, energy end-use meters, the energy metering data acquisition system and required display are calibrated adjusted and operate in accordance with approved plans and specifications			
Supporting Documents (Section 408.1.3.2)	<input type="checkbox"/> Manuals, record documents and training have been completed or are scheduled <ul style="list-style-type: none"> • System documentation has been provided to the owner or scheduled date: _____ • Record documents have been submitted to owner or scheduled date: _____ • Training has been completed or scheduled date: _____ 			
Commissioning Report (Section C408.1.2)	<input type="checkbox"/> Preliminary Commissioning Report submitted to Owner and includes items below <ul style="list-style-type: none"> • Deficiencies found during testing required by this section which have not been corrected at the time of report preparation • Deferred tests, which cannot be performed at the time of report preparation due to climatic conditions. 			
Certification	<input type="checkbox"/> I hereby certify that all requirements for Commissioning have been completed in accordance with the Washington State Energy Code, including all items above. <div style="display: flex; justify-content: space-between; border-top: 1px dashed black; padding-top: 5px;"> _____ _____ </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> Building Owner or Owner's Representative Date </div>			

ATTACHMENT 2

This attachment contains systems listed by specification division number that should be considered for the commissioning process. Those required by WSEC or LEED are indicated with a note as indicated below.

[1] The Washington State Energy Code, Commercial Provisions (WSEC) requires commissioning of the following systems:

- C403 Mechanical Systems
- C404 Service Hot Water Heating
- C405 Electrical Power and Lighting Systems
- C409 Energy Metering and Energy Consumption Management

[2] USGBC LEED BD+C New Construction V4 – Fundamental Commissioning and Verification, requires commissioning of the following systems:

- Mechanical, including HVAC&R equipment and controls
- Plumbing, including domestic hot water systems, pumps, and controls
- Electrical, including service, distribution, lighting, and controls, including daylighting controls
- Renewable energy systems

[3] USGBC LEED BD+C New Construction V4 – Enhanced Commissioning – Option 2, requires commissioning of the Building Envelope (for two LEED points)

USGBC also recommends commissioning the following systems:

- Life Safety Systems
- Communication and data systems
- Fire protection and fire alarm systems
- Process equipment

Divisions 03 to 10 – Building Envelope [3]

- Include envelope requirements in OPR, BOD, and perform Design Review [2, 3]
- Air barrier testing [1]
- Slab-on-grade
- Basement walls
- Opaque wall systems
- Roof systems
- Plaza decks over occupied spaces
- Windows and glazed wall systems
- Entrances
- Soffits and projections
- Automatic doors

Division 11- Equipment

- Walk-in Cooler/Freezer refrigeration [2]
- Dock levelers

Division 14 – Vertical Transport

- Elevators and Escalators

Division 21 – Fire Protection

- Wet and dry pipe sprinklers
- Chemical and gas fire suppression
- Pumps

Division 22 - Plumbing

- Domestic hot water and circulation [1,2]
- Solar domestic water [2]
- Pumps [2]
- Pools and spas [1]
- Piping and fixtures
- Air compressors
- Medical vacuum and gases
- Waste, drain and vent
- Water conditioning
- Water wells

Division 23 – HVAC [1,2]

- All air moving equipment
- All terminal heating & cooling equipment
- Ductwork
- Hydronic & steam piping and accessories
- Water treatment
- HVAC pumps
- Central heat/cool sources (boilers, chillers, cooling towers, heatpumps, geothermal)
- VRF (Variable Refrigerant Flow) systems
- Dust collector
- Laboratory fume hoods and flow systems
- Variable frequency drives
- Egress pressurization
- Building pressurization
- Fire and smoke dampers
- Automated energy management and temperature controls
- Instrumentation (gauges, thermometers, etc.)
- Testing adjusting and balancing verification
- Indoor air quality
- Equipment sound & vibration control

Division 26 – Electrical Systems

- Lighting control (occupancy sensors, daylight control, low voltage panels) [1,2]
- Meters [1]
- Photovoltaics [2]
- Service and distribution [2]
- Emergency power systems
- UPS systems
- Power quality systems

Division 27 - Communications

- Data infrastructure
- Telephones
- Intercom
- Clocks

Division 28 – Electronic Safety and Security

- Fire and smoke alarms
- Security systems
- Access control
- Closed circuit TV

Division 32 – Exterior Improvements

- Irrigation and controls