

SECTION 23 08 02 - FUNDAMENTAL BUILDING COMMISSIONING GENERAL  
REQUIREMENTS - LEED

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The work required under this Section shall conform to the requirements of "Division 01, General Requirements," "Conditions of the Contract" and "Supplementary Conditions." Specific attention is called to the "Division 23 General Requirements" located in Section 23 00 10.
- B. The intent of the commissioning program for work specified within the contract documents is to insure that all means and methods and equipment, whether Owner furnished or Contractor furnished, is installed and performs in accordance with the contract documents, manufacturer's instructions and all applicable codes and requirements. Additionally, it is attended to insure the following:
  - 1. Equipment has not been subjected to damage during shipment or installation.
  - 2. Equipment is in accordance with the specifications.
  - 3. A benchmark is established for routine maintenance and troubleshooting.
  - 4. Successful start-up without last minute interruptions and delays.
  - 5. Each system component is installed satisfactorily and will perform its function reliably throughout the life of the systems.
  - 6. Each system component is installed and operating to support the design performance benchmarks of the building system as a whole. The whole building system may consist of critical static and active systems, e.g., insulation effectiveness, infiltration performance, pump efficiencies, boiler and chiller efficiencies, and appropriate delivery of thermal energy, etc.
- C. The Commissioning Authority (and the Third Party Independent Reviewer) shall be required to be a certified LEED Accredited Professional as recognized by the United States Green Building Council and be a registered Professional Engineer within the state that the project is located.

**D. Fundamental Building Commissioning Requirements**

- 1. Commissioning services provider will be directly contracted to Loudoun County.
- 2. Provide a separate alternate price to provide the commissioning requirements as specified herein. Refer to Section 23 00 00 for additional requirements.

1.2 RESPONSIBILITIES

- A. The responsibilities of various parties in the coordination and commissioning process are provided in this section, and in Sections 22 08 02 and 26 08 02. The responsibilities of the Commissioning Authority (, the Third Party Independent Reviewer) and the Contractor are specified in this section and in Sections 22 08 02 and 26 08 02. The Contractor specified herein shall be responsible for fully coordinating the commissioning process of

both the Division 21, 22, 23, 25, 26 and 28 Contractors as specified in this Section 23 08 02 and in Sections 22 08 02 and 26 08 02. It is noted that the services for the Owner and the Mechanical and Electrical Engineers of Record are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed herein to clarify the coordination and commissioning process.

B. Owner's Representative or the Owner's Designee:

1. Assign Owner Representative or Owner Designee and Maintenance personnel and schedule them to participate in the submittal review meetings, progress meetings, training sessions and inspections including, but not limited to:
  - a. Submittal review sessions.
  - b. Pre-commissioning coordination meeting and approval of Commissioning Program/Schedule.
  - c. Functional testing and performance verification of static and active systems necessary to meet the building performance goals.
  - d. Owner's training session and demonstrations upon substantial completion of the project.
  - e. Final review and acceptance meeting.
2. Provide technicians for video taping of training sessions for future use of maintenance staff.

C. Mechanical and Electrical Engineers of Record:

1. Attend initial pre-commissioning coordination meeting to be scheduled by the Contractor.
2. The Engineer of Record shall review access and maintenance accessibility for each piece of equipment during the shop drawing review process. These requirements of the Engineer of Record shall only occur after the Contractor has first reviewed and approved the maintenance accessibility for each piece of equipment during the shop drawing review process. All equipment access and maintenance requirements shall be clearly indicated on the shop drawings prior to review by the Engineer of Record.
3. The Engineer of Record shall review access and maintenance accessibility for each piece of equipment at a later date based on the actual installation of each piece of equipment. These requirements of the Engineer of Record shall only occur after the Contractor has first reviewed and approved the access and maintenance accessibility requirements of each piece of equipment based on the actual installation.

D. Commissioning Authority (CA):

1. Incorporate the LEED program commissioning requirements in accordance the LEED Energy and Atmosphere Prerequisite 1 "Fundamental Commissioning of the Building Energy Systems" to address the following:

- a. Develop the Design Criteria: Issue a list to document Owner's requirements and basis of design for each commissioned feature or system, and for features or systems that significantly interact with the commissioned features. This list will be called the Design Criteria Document, and shall address the Owner's requirements for HVAC, lighting, indoor environment, energy efficiency, and environmental responsiveness of the facility. In addition the document shall also address ideas, objectives, and criteria that are considered important to the Owner. The Commissioning Authority shall meet with the Owner in order to understand all of the Owner's requirements and goals before issuing this document.
- b. Commissioning Plan: The Commissioning Authority shall assemble the components of the commissioning plan provided by the Contractor, combine these components with the components to be provided by the CA and issue the commissioning plan. The following components shall be provided by the CA and issued in the commissioning plan:
  - 1) A brief overview of the commissioning process.
  - 2) An outline of the commissioning process scope including submittal review, observation, start up, testing, training, O&M documentation and warranty period activities.
- c. Installation Observation: The Commissioning Authority shall sufficiently observe the installation of each type of commissioned feature and system to ensure that they are properly installed according to the contract documents.
- d. Start-Up and Checkout: The Contractor shall perform start-up and checkout for all commissioned features in accordance with the Division 21, 22, 23, 25, 26 and 28 specifications and as described herein. The Commissioning Authority shall apply sampling techniques to verify that start-up and initial checkout of all commissioned equipment is successfully completed. The Commissioning Authority shall review the Contractor's start-up and checkout results and documentation and include comments to this documentation in the final commissioning report.
- e. Functional Testing: Written, repeatable test procedures prepared specifically for the project will be performed by the Contractor to functionally test components and systems in accordance with the Division 21, 22, 23, 25, 26 and 28 specifications and as described herein. The functional test procedures will be prepared by the Contractor and shall be reviewed by the Commissioning Authority. The Commissioning Authority shall witness these performance tests and provide written documentation that these tests occurred to be included in the final commissioning report. The following requirements shall be addressed by the Commissioning Authority:
  - 1) The Commissioning Authority must be sure that the control system has successfully passed a complete point-to-point checkout and that each control point is commanding, reporting, and controlling according to the intended purpose.

- 2) The Commissioning Authority shall apply sampling techniques to verify that all sensors have been calibrated to ensure that the reported value in the control system represents the actual local value.
  - 3) The Commissioning Authority shall apply sampling techniques to verify that all actuators have been adjusted to fully close and open dampers and valves and that reported positions in the controls system are correct by visual observation.
- f. Training: Training will be conducted for all commissioned features and systems by the Contractor in accordance with the Division 21, 22, 23, 25, 26 and 28 specifications and as described herein. The Commissioning Authority shall witness this training and provide written verification that training was conducted for all commissioned features and systems to be included in the final commissioning report.
- g. Operation and Maintenance (O&M) Manuals: O&M manuals will be prepared by the Contractor as described herein. The CA shall review the O&M manuals and provide comments as required.
- h. Commissioning Report: The CA shall issue the commissioning report after all but seasonal deferred functional testing is complete. The report shall include a list of each commissioned feature or system and the response comments of the CA regarding the feature or system's compliance with the contract documents. In addition, the commissioning report shall include a written list of all outstanding issues and any testing that is not complete and is scheduled for a later date due to seasonal conditions. The commissioning report shall include a list of any compromises in the environmentally responsive features. The commissioning report shall include and address the following for each commissioned feature or system:
- 1) Meeting the design intent.
  - 2) Meeting the specifications.
  - 3) Ensure proper installation.
  - 4) Functional performance and efficiency.
  - 5) O&M documentation.
  - 6) Operator training.
- i. Recommissioning Management Manual: The Commissioning Authority shall assemble the components of the recommissioning management manual provided by the Contractor, combine these components with the components to be provided by the CA, and issue the recommissioning management manual. The following components shall be provided by the CA and issued in the recommissioning manual:
- 1) Final version of the Design Criteria with the owner's requirements and design basis narratives.

- 2) A description and rational for all energy and water saving features and strategies with operating guidelines and caveats about their function and maintenance relative to energy use.
  - 3) Guidelines for establishing and tracking benchmarks for whole building energy use and equipment efficiencies of cooling, heating, and service hot water equipment.
  - 4) Guidelines for energy accounting including assurance that future renovations and equipment upgrades will not result in decreased energy efficiency and maintaining the owner's requirements.
- j. Near-Warranty End or Post Occupancy Review: The CA shall return to the site 10 months into the warranty period and review the current building operation with the building staff. The CA shall issue a written report addressing the condition of the outstanding issues related to the original seasonal commissioning. In addition, the CA shall review with the building staff any concerns or issues that they have in operating the building as originally intended. The CA shall issue a written report identifying these concerns with suggested improvements to be included in the O&M manuals. The CA shall assist the building staff in developing reports, documents, and requests for services to remedy outstanding issues
2. Execute the commissioning program as outlined above, through attendance at all meetings, tests, demonstrations, training events and performance verifications described in the contract documents. The Commissioning Authority shall prepare minutes of commissioning events attended, and send copies to all attendees and the Owner's Representative, within 5 working days of the event.
- E. Third Party Independent Reviewer (TPIR):
1. Incorporate the LEED program commissioning requirements in accordance the LEED Energy and Atmosphere Credit 3 "Enhanced Commissioning" to address the following:
    - a. Design Review: The TPIR shall review the design documents before the construction document phase to verify that each commissioned feature or system meets the owner's requirements relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Issue a written report to document findings and recommendations.
    - b. Construction Documents Review: The TPIR shall review the construction documents before the construction document phase to verify that commissioning is adequately specified, that each commissioned feature or system can be commissioned and meets the design intent relative to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. Issue a written report to document findings and recommendations.
    - c. Focused Submittal Review: The TPIR shall review the contractor's submittals of all commissioned features and systems to verify that the

feature being provided will meet the specifications and the owner's requirements.

F. Contractor:

1. Include the cost for all of the coordination and commissioning requirements specified herein in the contract price as a separate line item price.
2. Include commissioning requirements in the MEP subcontracts and ensure full cooperation of all parties in the commissioning program.
3. Coordinate the interface of the commissioning program to other elements within the specifications, including deficiency tracking and correction.
4. Schedule and attend the commissioning coordination, training, and demonstration meetings. These meetings shall be attended by the appropriate Contractors, the Commissioning Authority, and the Owner's representative.
5. Provide a complete list of all the selected Contractors required for the various commissioning events indicated herein minimally consisting of the name, firm, phone number and trade specialty.
6. Incorporate the LEED program commissioning requirements in accordance the LEED Energy Prerequisite 1 "Fundamental Commissioning of the Building Energy Systems" in accordance with the following:
  - a. Commissioning Plan: The Commissioning Authority will assemble and issue the commissioning plan. The Contractor shall cooperate fully with the CA and provide the CA with the following components to be part of the commissioning plan:
    - 1) A list of all commissioned features and systems.
    - 2) Identification of the primary commissioning participants and their responsibilities.
    - 3) A description of the management, communication, and reporting of the commissioning plan.
    - 4) List of the expected written work products.
    - 5) An activity schedule.
    - 6) A description of the work and scope of testing.
  - b. Start-Up and Checkout: The Contractor shall perform start-up and checkout for all commissioned features in accordance with the Division 21, 22, 23, 25, 26 and 28 specifications, manufacturer's recommendations, relevant subcontractors recommendations, and as described herein. The Contractor shall document this start-up and checkout and issue the results and documentation in a binder.
  - c. Functional Testing: The Contractor shall schedule and perform the written, repeatable test procedures prepared specifically for the project to

functionally test all commissioned features and systems in accordance with the Division 21, 22, 23, 25, 26 and 28 specifications and as described herein. The Contractor shall test all larger equipment individually; however, sampling techniques can be used for similar units that are numerous. The Contractor shall develop the functional performance test procedures for all MEP related systems and components by using the contract documents in addition to the appropriate Contractor's and equipment manufacturer's recommendations. The functional performance test procedures shall be a comprehensive and itemized list to include, but not be limited to, all proposed testing procedures, start-up procedures, close-out procedures, Owner related acceptance procedures, warrantee required procedures, specific manufacturer's procedures, code, permit, and regulatory agency testing and acceptance procedures, and proper sequence of operations including start-up, shutdown, unoccupied and manual modes, modulation up and down of the units range of capacity, power failure, alarms, component (unit and pump) staging and back-up upon failure, interlocks with other equipment, and sensor and actuator calibrations. The functional performance testing procedures shall be multiple written documents to be submitted for review through the shop drawing process.

The documents shall be provided with fill in the blank areas, check off areas, remarks column, required correction column, estimated start and finish date, estimated number of hours required, personnel required from each subcontractor and equipment manufacturer, calibrated test equipment with model number and last calibration date, result confirmation, final device settings, acceptable values, date, time, witnesses, list of all related submittals/shop drawings, etc. The functional test procedures shall be reviewed by the Commission Authority.

- d. Training: The Contractor shall schedule and perform Owner training and demonstration sessions for all MEP related systems and components by using the contract documents in addition to the appropriate Contractor's and equipment manufacturer's recommendations. These training and demonstration sessions are to be attended by the appropriate Contractors, Owner's representative, the Commissioning Authority, and the appropriate equipment suppliers and miscellaneous equipment representatives as necessary. The format should follow the outline in the project O&M Manuals. To ensure proper operation of all equipment, all equipment shall need to be fully tested by the Contractors and be completely commissioned by the Contractors prior to any of the Owner training and demonstration sessions. The Commissioning Authority will witness this training and provide written verification that training was conducted for all commissioned features and systems. The Contractor shall address the following with training:

- 1) General purpose of the system (design intent).
- 2) Use of the O&M Manuals.
- 3) Review of control drawings and schematics.
- 4) Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, trouble shooting, and alarms.

- 5) Interactions with other systems, adjustments and optimizing methods for energy conservation, relevant health and safety issues.
  - 6) Special maintenance and replacement sources.
  - 7) Tenant interaction issues.
  - 8) Discussion of how feature or system is environmentally responsive.
- e. Operation and Maintenance (O&M) Manuals: The Contractor shall issue operation and maintenance manuals for all commissioned features and systems in accordance with the Division 21, 22, 23, 25, 26 and 28 specifications and as described herein. The CA will review these O&M manuals.
7. Execute the commissioning program as outlined above, through the organization, scheduling, and attendance of all meetings, tests, demonstrations, training events and performance verifications described in the contract documents. Organizational responsibilities include preparation of agendas, attendance lists, and arrangements for facilities and timely notification to participants for each commissioning event. The Contractor shall act as chairman of all commissioning events and assure execution of all agenda items.
  8. Schedule a pre-commissioning coordination meeting within 30 days of the award of the contract, at a site and time suitable to all parties. This pre-commissioning meeting will be for the purpose of reviewing the complete commissioning program and establishing a milestone schedule for sequence of equipment installation and startup, performance testing, Owner training, etc. This meeting shall be attended by the appropriate Contractors, the CA, the Engineer of Record and the Owner's Representatives. Prepare necessary preliminary schedule for O&M Manual submission, training sessions, equipment start-up, and job completion for use by the Commissioning Authority. Update schedule as appropriate throughout the construction period.
  9. Contractor shall inspect all equipment immediately upon delivery to the job site and prior to installation to insure the equipment has not been subjected to damage during shipment.
  10. Comply with all specification sections of Division 21, 22, 23, 25, 26 and 28.
  11. Ensure cooperation and participation of specialty subcontractors as necessary to support the Commissioning Authority and commissioning program.
  12. Ensure cooperation and participation of major equipment manufacturers in their representatives as necessary to support the Commissioning Authority and commissioning program.
  13. Provide written certification that the following work has been completed in accordance with the contract documents and that all equipment and systems are functioning as designed. Where the work has been subcontracted, the subcontractor shall be responsible for the initial certification with the Contractor recertifying that he has inspected the work and that it has been completed and

functioning as designed. This certification must be submitted to the Commissioning Authority prior to the final verification.

- a. All Division 21, 22, 23 and 25 equipment including, but not limited to, make-up water systems, water treatment systems, and HVAC equipment including all water chilling units, pumps, cooling towers, heat exchangers, fans, air handling units, ductwork, dampers, terminals, etc.
- b. Refrigeration equipment, pumping systems and heat rejection equipment.
- c. Firestopping in the fire-rated construction, including but not limited to fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
- d. Non-dedicated systems using the air handling units for purging.
- e. The complete automatic temperature control system as related to the control of the HVAC equipment.

END OF SECTION 23 08 02