

COMMISSIONING STATEMENT OF WORK

PART 7 – COMMISSIONING

A. Systems to Commission shall include, but are not limited to the following:

1. The entire HVAC system consisting of boilers, chillers, pumps, piping, and air distribution systems.
2. Building Automation System consisting of HVAC direct digital controls.
3. Life Safety System consisting of the fire alarm system, and fire/smoke dampers, emergency lighting, etc.
4. Plumbing system consisting of domestic hot water, cold water, waste and vent piping systems; domestic hot water heating system and plumbing fixtures/valves.
5. Energy applications (analysis and construction) relative to the building envelope (i.e., walls, doors, windows, roofing system, etc).
6. Electrical systems consist of lighting & receptacle systems, electrical panels, transformers, motor control centers, electrical motors and other electrical items (non-emergency power).
 - a. Security System

B. Commissioning Plan & Schedule:

1. A project schedule and planning phase information will be made available to the CX for the development of a comprehensive commissioning plan (i.e., construction phase, acceptance phase, post acceptance phase, etc).
2. The CX shall develop a commissioning plan that defines the commissioning process for the various phases of project development. This plan shall include a schedule of commissioning process activities and identify the parties that will perform these activities.
3. The commissioning plan shall be updated as the project progresses, and more information is available or when the project requirements change.
4. The CX shall work with the design team to integrate the commissioning process into the contract documents so as to describe the Contractor's responsibilities.

C. Basis of Design:

The CX and members from the Project Team shall establish the project design intent. The CX shall verify the facilities functional needs and environmental needs are clearly described. The CX shall verify the requirements outlined in the Design Statement of Work are being followed and maintain the project design intent throughout all phases of the project.

D. Design Review:

1. The CX shall review the 70%, and 99% design submittal documents to verify that the design achieves the project intent and project requirements. The final construction documents (100%) will be reviewed by the CX to verify the project intent requirements have been incorporated.
2. Design review meetings will be held to discuss all documented review comments with the design team. The CX shall communicate with the designers throughout the design process to verify that all comments and concerns are addressed.

E. Pre-Construction Preparation:

1. The CX shall coordinate with the Project Team to develop a consensus for the communication channels to be used during this project. The CX shall document the outcome of this coordination effort and provide team members with the results.

2. At the Pre-Construction meeting the CX will provide an overview of the commissioning process and the activities that are to be accomplished by the general construction contractor and subcontractors.

F. Construction Verification:

1. A preparatory meeting prior to the beginning each definable segment of work to be commissioned will be conducted to discuss the details on how the commissioning process will be implemented in accordance with the Commissioning plan. Also, submittal data and contract requirements will be reviewed. This meeting will involve the general construction contractor, appropriate subcontractor foreman, construction managers, inspectors, project managers and design team representative. The CX shall provide the general construction contractor and the appropriate Project Team members a listing of the anticipated preparatory meetings.
2. The CX shall develop a construction checklist and provide an electronic database to track the progress of the installation and verify the completion of these checklists. The owner's representative and construction contractor will ensure that the documents are filled out properly, the on-site procedures for the construction checklists are followed, and the checklists are scanned into the database.
3. Once a month during the anticipated construction process the CX will visit the site and go through the process with the owner's representative and contractor to verify the commissioning process is followed and that issues are resolved as they are detected. The day-to-day follow up will be the responsibility of the contractor. The CA shall document each site visit.
4. The construction components, equipment, controls and tests will be checked on a periodic basis by the CX, using sampling of checklists completion and construction completion to verify that quality is being achieved and the equipment, systems, controls and submittal data meets the project intent and the construction documents.
5. The CX's verification of different systems will utilize statistical sampling and spot checks as appropriate to verify that the contractor's quality control process and the LDOE quality assurance process is working and achieving the desired results.

G. Review of Submittals:

1. The CX shall provide during the pre-construction meeting a listing of contractor's submittals (shop drawings & manufactures data) that will be reviewed by the CX. Also, the CX shall provide the contractor a list detailing material required during submittal development for the System and O&M manuals.
2. The CX shall provide comments and suggestions to the submittals acceptance authority and verify that all comments are addressed.

H. Training:

1. The CX shall review the contractors proposed training forms and agenda(s) so as to verify the training is representative of the installed systems and beneficial to the Users.
2. The CX will attend key training sessions to verify that they are conducted properly and guide the contractor in understanding what is expected from the training sessions.
3. At the end of the training sessions, the training will be evaluated by the CX and if the need for more training is identified, an additional training schedule will be developed.

I. System Performance Test:

1. The CX shall develop a schedule for the functional performance tests (FPT). The CX will develop the necessary procedures to verify that the systems deliver what is expected in the project intent and construction documents.
2. Based on statistical sampling, the building and its components will be tested to ensure that they meet the project intent. This will include sample testing of specific system performance test (e.g., TAB, controls, fire

alarm and etc).

3. The findings from the system performance tests will be evaluated and results will be summarized by the CX in a report with recommendations for further improvements and a summary of how any issues were resolved shall be provided.

J. Systems Manual:

1. The CX shall review the Contractors O&M documents for compliance with the contract documents.
2. Using the information from the submittals, the CX shall develop an electronic system manual in PDF format. The electronic system manual shall include all systems and components within the facility as defined by the project specifications. The systems should include as a minimum all mechanical, electrical, controls, fire alarm, fire protection, security, architectural, communications, information technology, food service equipment, water, sewer, irrigation, and etc. This manual will describe all the systems in a logical manner and will link all information for the systems and components together. This manual shall be fully searchable by using simple text functions. Data (submittals, record drawings, installation information, O&M checklists, troubleshooting guide, manufacturer's information and etc) can be accessed just by clicking on the object or word, and data specifically about that object will be displayed. System graphical representations (i.e., control ladder diagrams, system piping schematics, piping/equipment layouts, fire alarm/fire sprinkler system schematics and etc), warranty information and test reports shall be included.
3. Using the information gathered, the final systems manual will be developed, including scanning in data that could not be obtained from manufacturers and vendors.

K. Commissioning Report:

1. All the documents, experiences, and issues will be summarized as well as the benefits derived from this commissioning process. The initial report will be delivered prior to acceptance of the facility.
2. After the facility has been in operation for at least six months the CX shall attend a lessons learned meeting that will be facilitated by the CI. The experience gained during this project and suggestions and ideas for improvement that could be implemented on future projects will be discussed. The outcome of this meeting shall be documented by the CI and distributed to all attendees.
3. The final commissioning report will be revised to include additional comments and experiences of the project team. This report will be delivered after the 1-year warranty period. All of the information and the result of the project will be compiled into this final report.

L. A Re-commissioning Management Manual shall be provided. It shall include the following as a minimum and shall be delivered with the initial commissioning report:

1. As-built sequence of operation and control drawings. Including a listing of time-of-day schedules, and a frequency of review for relevance and energy efficiency.
2. Final version of the design basis narrative, including description of each system.
3. Guidelines for establishing and tracking benchmarks for whole building energy use and equipment efficiencies.
4. A description of all energy and water saving features with operating and maintenance instructions relative to energy use.
5. Seasonal start-up and shutdown operation procedures.
6. Recommendations for recalibration frequency of control components.
7. A list of all user adjustable set points and reset schedules with a discussion of each and the range of reasonable adjustments with energy implications.
8. Plans for continuous commissioning or recommended frequency for re-commissioning by equipment type.

9. Include a schedule frequency to review various set points and reset schedules to ensure they are current, relevant and efficient values.
10. Guidelines for energy accounting.
11. A copy of diagnostic tool with use descriptions to assist facility staff
12. A copy of the commissioning report

M. Operation and Warranty Review

1. During the first year of operation the CX will meet with the users to verify that the operation of the building is as intended at the 12-month warranty.
2. During the first year of operation the CX shall serve as a resource on the installation and design. The CX shall provide 8 hours of phone support.
3. Based on the observations during the first years of operations, suggestions on how to further improve the current system will be documented in the final report.

3. Project Deliverables

The key deliverables for this project are:

- a. Commissioning Plan
- b. Design Review Comments
- c. Functional Performance Test Forms (sample blank and completed forms)
- d. Trip Reports
- e. Systems Manual (electronic copy)
- f. Training Agendas
- g. Training Material
- h. System Optimization Opportunities
- i. Initial Commissioning Report
- j. Re-commissioning Management Manual
- k. Final Report

4. Commissioning Firm Qualifications:

- A. The Commissioning Authority shall be regularly engaged in commissioning services as one of their primary services. The firm shall have on staff an engineer who will be the Commissioning Authority (CX). This individual shall have a minimum of 6 years experience satisfying the following requirements:
 1. Have acted as the principal commissioning authority on at least three projects within the last three years with similar systems as to the project being proposed.
 2. Knowledge of construction methodologies and quality control process.
 3. Experience in the operation and troubleshooting of HVAC systems, energy management and controls systems, lighting controls systems, building electrical systems, fire alarm systems, data systems and security systems.
 4. Knowledge in testing and balancing hydronic/air systems.
 5. Experience in monitoring and analyzing system operation, and equipment start-up requirements.
 6. Knowledge in building/equipment operation and maintenance.
 7. Design experience incorporating energy usage, heating/cooling load calculations and specifying energy-efficient equipment.

8. Knowledge of ASHRAE Guideline-0 requirements and USGBC's LEED Green Building Rating System and Guiding Principles for Sustainable Federal Buildings.
- B. The Commissioning Authority shall have sufficient experienced personnel and capability to sustain loss of assigned personnel without compromising quality and timeliness of performance.
- C. The Commissioning Authority shall be an independent contractor and not an employee or subcontractor of the Contractor or any other subcontractor on this project.

End of Statement of Work