SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

Latest Update: 5.8.2017 See Underlined Text for Edits.

(Architect shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Delete paragraphs not applicable to the project, and note some pertinent editor's comments in this section by the University. Also turn off "Underlines".)

PART I – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the administrative requirements related to commissioning and includes the following:

1. Definitions
2. Coordination
3. Quality control
4. Submittals
5. Design review and documentation
6. Test equipment
7. Commissioning process
8. Commissioning scope meetings
9. Commissioning plans
10. Submittal review
11. Commissioning controls coordination meeting
12. Startup/Pre functional check lists
13. Functional performance testing
14. Issue log
15. Operations and maintenance training
16. Final commissioning report
17. Deferred seasonal testing
18. Team responsibilities

B. The Owner, Architect/Engineer, and Commissioning Agent are not responsible for construction means, methods, job safety, or management function related to commissioning on the job site.

1. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

2. The mention of a subcontractor is not meant to usurp the Contractor's responsibility to assign the work.

C. Related Sections:

1. 014000 Quality Requirements
2. 017700 Closeout Procedures
3. 017900 Demonstration and Training
4. 210000 General Requirements Fire Protection Systems
5. 210800 Commissioning Fire Protection Systems
6. 220000 General Requirements Plumbing Systems
7. 220800 Commissioning Plumbing Systems
8. 230000 General Requirements HVAC Systems
9. 230800 Commissioning HVAC Systems
10. 260000 General Requirements Electrical Systems
11. 260800 Commissioning Electrical System

1.3 DEFINITONS

A. Basis of Design (BOD): The Basis of Design document is a specific Commissioning document that describes the systems, components, conditions and methods chosen by the design engineer to meet the requirements of the project. Some reiteration of the Owner's Project Requirements may be included.

B. Commissioning (Cx): Commissioning is a comprehensive and systematic process to verify that the building systems perform as designed to meet the Owner's requirements. Commissioning during the construction, acceptance and warranty phases is intended to achieve the following specific objectives:

1. Verify and document that the equipment is installed and started per manufacturer's recommendations, industry accepted minimum standards, and the Contract Documents.

2. Verify and document that the equipment and systems receive complete operational checkout by installing contractors.

3. Verify and document equipment and system performance.

4. Verify the completeness of the Operations and Maintenance materials.

5. Ensure that the Owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

6. The commissioning process does not take away from or reduce the responsibility of the systems designers or installing contractors to provide a finished and fully functioning product.

C. Commissioning Agent (CxA): The commissioning agent develops the functional test procedures in a sequential written form, coordinates, oversees, and documents the actual testing, which is usually performed by the installing contractor or vendor. Functional Performance Tests are performed after pre-functional checklists and startup is complete.

D. Commissioning Plan: The commissioning plan is an overall plan that provides the structure, schedule, and coordination planning for the commissioning process.

E. Deficiency: A deficiency is a condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the Contract Documents, does not perform properly, or is not complying with the Owner's Project Requirements.

F. Owner's Project Requirements (OPR): The OPR is a specific Commissioning document that is updated throughout the project that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the Owner. It is initially the outcome of the programming and conceptual design process.

G. Functional Performance Test (FPT): The FPT is a test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g. the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failure, unoccupied, varying outside air temperatures, fire alarm power failure, and any other operational sequence included in the system design. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The CxA develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. Functional Performance Tests are performed after prefunctional checklists and startup is complete.

H. Prefunctional Checklist: The pre-functional check list is a list of items to inspect and elementary component test to conduct to verify proper installation of equipment, provided by the CxA to the contractor. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g. belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated). However, some prefunctional checklist items entail system testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word "prefunctional" refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist.

I. Warranty Period: The warranty period is for the entire project, including equipment components. Warranty begins at Substantial Completion and extends for two years, unless specifically noted otherwise in the Contract Documents and accepted submittals.

J. Abbreviations: The following are common abbreviations used in the Commissioning Specification:

1. A/E - Architect and Engineers
2. CxA - Commissioning Agent
3. CC - Controls Contractor
4. Cx Plan - Commissioning Plan document
5. FPT - Functional Performance Test
6. CM/GC - Construction Manager/General Contractor <Edit for Project>
7. MEP – Mechanical, Electrical, Plumbing
8. PM - Project Manager (University)
9. Subs - Subcontractors to the General Contractor
10. TAB - Test and Balance Contractor

1.4 COORDINATION

A. Perform commissioning services to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.

B. Commissioning Agent (CxA) shall provide overall coordination and management of the commissioning program as specified herein.

C. Commissioning Team: The commissioning process will require the cooperation of the Contractor, subcontractors, vendors, Architect/Engineer, Commissioning Agent, and Owner. The commissioning team shall be comprised of the following. Team member responsibilities are listed in Part 3 of this section.

1. Construction Manager:

a. Project Manager
b. Test Engineer
c. Subcontractors: As appropriate to product or system being commissioned

1) Specialty Contractor Representatives
2) Controls Representative

2. Commissioning Agent:

a. Project Manager
b. Project Technicians

3. Owner Representative(s)

4. Architect/Engineer:

    a. Architect
    b. MEP Engineers
    c. Specialty Consultant(s)

D. Progress Meetings: Attend construction job-site meetings, as necessary, to monitor construction and commissioning progress. Coordinate with contractor to address coordination, deficiency resolution, and planning issues.

1. Plan and coordinate additional meetings as needed based on work progress.

E. Site Observations: Perform site visits as necessary to observe component and system installations.

F. Functional Testing Coordination:

1. Equipment shall not be "temporarily" started for commissioning.
2. Functional performance testing shall not begin until pre-functional check, start-up, and TAB are completed for a given system.
3. The controls system and equipment controls shall not be functionally tested until all points have been calibrated and pre-functional checklists are complete.

1.5 QUALITY CONTROL

A. Engage commissioning service personnel that specialize in the types of inspections and tests to be performed.

B. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems of the systems to be commissioned.

1.6 SUBMITTALS

A. Basis of Design and Owner's Project Requirements:

1. CxA shall review BOD and OPR updates made necessary during the work to reflect the progress on the components and systems.

B. Cx Meeting Minutes:

1. CxA shall prepare meeting minutes and provide to Owner's PM for distribution.

C. Commissioning Plan:

1. Update as necessary during the work to reflect the progress on the components and systems.

D. Functional Performance Test Forms:

1. Submit no later than thirty (30) calendar days prior to testing, or two (2) weeks after acceptance of ATC submittal.

E. Issues Log: Issue logs document items of non-compliance in materials, installation or operation. Document the results from start-up/pre-functional checklists, functional performance testing, and on-site observations. Include details of the components or systems found to be non-compliant with the drawings, specifications, and approved submittals. Team member responsibilities related to issues identified during commissioning are covered in Part 3 of this specification.

1. Update as necessary during the work to reflect the progress on the components and systems.

F. Final Commissioning Report: Compile a final commissioning report summarizing all the tasks, findings, conclusions, and recommendations of the commissioning process. Indicate the actual performance of the building systems in reference to the OPR and contract documents. Include completed pre-functional inspection checklists, functional performance testing records, Issues Log, and a summary of commissioning activities.

G. O&M Submittals:

1. Training Verification:

a. Dates, Start and Finish Times, and Locations
b. Outline of the Training Agenda
c. Names and qualifications of presenters
d. Completed sign-in sheet from training sessions

1.7 DESIGN REVIEW AND DOCUMENTATION

A. Document Basis of Design and Project Requirements as they relate to project functional performance and environmentally responsive characteristics, including:

1. Functionality
2. Energy Performance
3. Water Efficiency
4. Maintainability
5. System Cost
6. Indoor Environmental Quality
7. Local Environmental Impacts

B. Review design documents to verify that each commissioned system meets the Project Requirements.

C. Review construction documents to verify that commissioning is adequately specified, that each commissioned system can be commissioned and is likely to meet the Project Requirements.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. The contractor will make available standard testing equipment required to perform startup, initial checkout and functional performance testing as well as any special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents.

B. Data Logging equipment and software required to test equipment shall be provided by the CxA, but shall not become property of the Owner.

C. Instrumentation shall meet the following standards:

1. Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance.
2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.
3. Be maintained and in good repair and operational condition throughout the duration of use on this project.

D. Test Equipment Calibration Requirements: Contractors shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired after being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

PART 3 – EXECUTION

3.1 COMMISSIONING PROCESS

A. The following activities outline the commissioning tasks and the general order in which they occur. The CxA shall coordinate all activities.

1. Design Review and Documentation:

a. Basis of Design and Owner's Project Requirements Review
b. Design Document Review
c. Controls Coordination Review Meeting
d. Construction Document Review

2. Commissioning Scoping Meetings
3. Commissioning Plan
4. Submittal Review:
   a. General systems to be Commissioned
   b. Controls Submittal Review
5. Commissioning Controls Coordination Meeting
6. Start-Up / Pre-functional Checklists
7. Functional Performance Testing
8. Issues Log
9. Operations and Maintenance Training
10. Final Commissioning Report
11. Deferred and Seasonal Testing

3.2 DESIGN REVIEW AND DOCUMENTATION

A. Basis of Design and Owner's Project Requirements Review: Collect BOD and OPR documents from Owner and MEP Engineer. Review documents as they relate to functionality, energy performance, water efficiency, maintainability, system costs, indoor environmental quality, local environmental impacts, and any requirements specifically specified by the Owner in the OPR.

B. Design Document Review: Review design documents at two phases of design to verify that each commissioned system meets the Owner's requirements with special attention on integrated systems, building automation controls, and functional performance. Design review comments shall be submitted in writing to A/E and Owner. A/E will respond in writing to all comments prior to next document submission.

C. Controls Coordination Review Meeting: Comply with the following: <Edit for Project>

1. Schedule, coordinate, and facilitate a full day meeting during design phase between 50% CD and 95% CD submissions, or at a point in design where the building automation control design is at least 50% complete and includes system diagrams and sequences of operation.
2. Attendees shall include the design engineer, CM representative, University O&M representative, controls contractor, mechanical design assist contractor, and CxA.
3. The team shall review all sequences of operation to determine whether they are complete, accurate, and meet with university standards and operating practices. Special attention shall be paid to interactions between new systems and equipment and existing building and campus controls systems.

D. Construction Document Review: Review final construction documents to confirm that all design review comments have been resolved.

3.3 COMMISSIONING SCOPE MEETINGS

A. Commissioning Scope Meeting – Design Phase:

1. Schedule, coordinate, and facilitate a scope meeting during the design phase prior to the first design review.
2. Cx Team members who have been hired during the design phase shall be in attendance.
3. Review the Cx process with special attention on the design phase requirements.

B. Commissioning Scope Meeting – Construction Phase:

1. Schedule, coordinate, and facilitate a scoping meeting at the start of construction after the subcontractors have been selected.
2. All Cx Team members shall be in attendance.
3. Review the Cx process with special attention on the construction phase requirements.

3.4 COMMISSIONING PLAN

A. Develop a Commissioning (Cx) Plan to identify how commissioning activities will be integrated into general construction and trade activities. The Cx Plan shall identify how commissioning responsibilities are distributed. The intent of this plan is to raise questions and issues and resolve them with input from the entire Cx Team early in construction.

1. Identify who will be responsible for producing the various procedures, reports, and forms.
2. Determine what Cx activities will be scheduled and how they are incorporated into the project schedule.
3. Describe the testing and acceptance procedures.

3.5 SUBMITTAL REVIEW

A. Identify Submittals for Commissioning Review:

1. At start of Construction Phase, CM shall provide a complete submittal register to the CxA. The CxA shall identify which submittal packages should be reviewed for coordination with the commissioning scope. The University shall confirm and/or amend the list and return it to the CM. During submittal phase, submittals identified as Cx submittals shall be sent to the CxA and the Engineer of Record concurrently for review.

B. General Systems to be Commissioned:

1. Concurrently with the Engineer of Record, review the equipment and system submittals for the equipment to be commissioned to verify that the submitted equipment meets the requirements of the contract documents and the OPR. Focus on integration of equipment within the building systems.

C. Controls Submittal Review

1. Concurrently with the Engineer of Record, review the Automatic Temperature Control submittal to verify that the submitted design meets the requirements of the contract documents, the OPR, and the design intent for the operation of the building systems. After submittal review is complete, schedule the Commissioning Controls Coordination Meeting prior to manufacturer's resubmittal of ATC package. Only if the submittal is accepted with no comments noted by the A/E team, the Commissioning Controls Coordination Meeting may be skipped.

3.6 COMMISSIONING CONTROLS COORDINATION MEETING

A. Meeting Attendees:

1. CxA
2. Controls Contractor
3. Engineer of Record
4. Owner's Representatives
5. CM/GC
6. Architect

B. After the first controls submittal review is complete, schedule, coordinate and facilitate the Commissioning Controls Coordination Meeting.

C. Review all submittal review comments with the group and, as a group, determine the required resolution for each comment. Controls resubmittal shall be submitted within two (2) weeks of this meeting.

3.7 START-UP / PRE-FUNCTIONAL CHECKLISTS

A. Start-up/Pre-Functional Checklists: Coordinate start-up plans and documentation formats, including providing contractor with pre-functional checklists to be completed during the start-up process.

1. Manufacturer's start-up checklists and other technical documentation guidelines may be used as the basis for pre-functional checklists. CxA will coordinate with the Contractor to obtain manufacturer data as needed.

B. Start-up/Pre-Functional Checklists are used to verify that the systems are complete and operational before functional testing is scheduled.

3.8 FUNCTIONAL PERFORMANCE TESTING

A. Functional Performance Tests (FPT): Test procedures shall fully describe system configuration and steps required for each test; appropriately documented so that the test can be repeated with virtually identical results.

1. Test Methods: Functional performance testing and verification may be achieved using a combination of the following methods to test the complete sequence of operation. The CxA shall determine which method, or combination, is most appropriate:

    a. Direct manipulation of system inputs (i.e. applying heat or cold to sensors).
    b. Manipulation of system inputs with the building automation software (i.e. software override of sensor inputs)
    c. Direct observation of equipment readouts, gauges, and actuators.
    d. Trend logs of system inputs and outputs using the building automation system
    e. Short-term monitoring of system inputs and outputs using stand alone data loggers.

2. Setup: Setup each test procedure to be performed under conditions that simulate normal operating conditions as closely as possible. Where equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met, functional performance test procedures shall demonstrate the actual performance of safety shutoffs in a real or closely-simulated condition of failure.

3. Sampling: Multiple identical pieces of non-life-safety or non-critical equipment may be functionally tested using a sampling strategy. The sampling strategy shall be developed by the CxA. If, after three attempts at testing the specified sample percentage, failures are still present, then all remaining units shall be tested at the contractor's expense. Sampling may only be used as agreed upon in the Cx contract.

4. Trending: Identify conditions where trend data from the building automation system or data loggers can be used to verify sequence of operation performance. Include trend log requirements in FPT documentation.

B. Develop FPT procedures for equipment and systems identify specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Coordinate test procedures with the contractor for feasibility, safety, equipment, and warranty protection. Functional performance test forms shall include the following information at a minimum:

1. System and equipment or component name(s)
2. Equipment location and ID number
3. Date
4. Project name
5. Participants
6. Test Set-up instructions including special requirements and alarm limits.
7. Step-by-step test procedure

8. Acceptance criteria
9. Comments

C. Coordinate, observe, and record the results of the FPT's:

1. Coordinate retesting as necessary until correct performance is verified.
2. Verify the intended operation of individual components and system interactions under all design conditions and modes of operation.
3. Identify deficiencies during testing and include on FPT forms and the Issues Log
4. Confirm set-up of trend logs and collect data after the sample time period.

3.9 ISSUES LOG

A. Issues are items of non-compliance in materials, installation, or operation observed by the CxA.

B. The CxA shall notify responsible parties upon observation of deficiencies or issues of non-compliance. CxA shall recommend corrective actions as appropriate. Issues that are not immediately resolved shall be placed on the Issues Log.

C. The CxA shall update the Issues Log and submit it to the PM for distribution to all members of the Cx Team when changes are made.

D. Those identified as "Responsible" for a specific issue shall respond within three (3) days of receiving an updated Issues Log with the planned resolution.

1. "Responsible" indicates the party who is responsible for responding to the open issue, it does not imply responsibility for creating the issue. For example, if the issue relates to a temperature set-point, the Owner may be listed as the responsible party for providing the desired value.

2. Any member of the design and construction team may be identified to respond to Cx Issues. Team members are responsible for responding to design and construction questions raised during commissioning work.

3.10 OPERATIONS AND MAINTENANCE TRAINING

A. Reference 017900 "DEMONSTRATION AND TRAINING"

B. Verify and document training:

1. Training Verification:

a. Dates, Start and Finish Times, and Locations
b. Outline of the Training Agenda
c. Names and qualifications of presenters

d. Completed sign-in sheet from training sessions

C. Review O&M materials.

3.11 FINAL COMMISSIONING REPORT

A. Final Commissioning Report: Compile final commissioning report. Summarize all the tasks, findings, conclusions and recommendations from the Commissioning process. Include a "Lessons Learned" section.

3.12 DEFERRED AND SEASONAL TESTING

A. If a test cannot be completed due to building conditions, occupancy, weather, or seasonal conditions, the functional testing may be delayed upon the recommendation of the CxA and the approval of the Owner.

3.13 TEAM RESPONSIBILITIES

A. Owner's Responsibilities:

1. Provide the OPR documentation to the CxA and Contractors for use in developing the Cx Plan, testing plans, and checklists.

2. Provide the Basis of Design documents, prepared by the architect and approved by the Owner, for use in developing the Commissioning Plan; testing plans and checklists.

3. Assign operation and maintenance personnel and schedule them to participate in Commissioning Team activities including, but not limited to, the following:

a. Commissioning meetings.
b. Construction phase coordination meetings.
c. Piping and ductwork testing and flushing verification meetings.
d. Procedures meeting for testing, adjusting and balancing.
e. Testing and demonstration of systems, subsystems and equipment.
f. Training in operation and maintenance of systems, subsystems and equipment.
g. Final review and acceptance meetings.
h. Provide utility services required for the commissioning process.
i. Review and approve the commissioning plan.
j. Coordinate any seasonal or deferred testing.
k. Ensure that any seasonal, deferred testing and/or deficiency issues are addressed.

B. Architect / Engineer's Responsibilities:

1. Attend the Commissioning Scoping Meetings, Controls Coordination Meetings, and selected team meetings.

2. Perform submittal review, construction observation, as-built drawing preparation, and other items as contracted.

3. Provide the Basis of Design Document. The design engineers shall assist in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

4. Participate in the resolution of system deficiencies and issues identified during the commissioning, according to the contract documents.

5. Insure that the CxA's submittal comments are incorporated into the Design Professional's submittal comments prior to sending to CM for distribution.

6. Participate in resolution of design non-conformance and design deficiencies identified during the warranty-period commissioning process.

C. Construction Manager, Contractor, and Subcontractor Responsibilities:

1. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following brief overview:

   a. Facilitate the coordination of commissioning and incorporate commissioning activities into the overall project.
   b. Provide copies of all applicable submittals as required in the specifications including all changes.
   c. Provide detailed startup procedures.
   d. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, perform corrective actions.
   e. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
   f. Attend commissioning team meetings held on a scheduled basis.
   g. Make available a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA.
   h. Integrate and coordinate commissioning process activities with construction schedule.
   i. Review construction checklists provided by the CxA.
   j. Review commissioning process test procedures provided by the CxA.
   k. Complete commissioning process test procedures.

l. Submit training plan for approval, coordinate training and provide qualified instructors for training of Owner personnel.
m. Assist the CxA as necessary in the seasonal testing, deferred testing and deficiency resolution.
n. Ensure that subcontractors correct deficiencies and make necessary adjustments to submittals, O&M manuals and red-lined drawings for applicable issues identified during testing.
o. Provide as-built controls drawings and sequences of operation for all equipment.
p. Provide a written list of all user adjustable set-points and reset schedules with a brief discussion of the purpose of each and the range of reasonable adjustments with energy implications.

2. Equipment Supplier Responsibilities:

a. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
b. Assist in equipment testing per agreements with subcontractors.
c. Provide information requested by the CxA regarding equipment sequence of operation and testing procedures.

3. Commissioning Agent Responsibilities:

a. Roles and Responsibilities:

1) The CxA is not responsible for the design concept, the design criteria, compliance with codes, design or general construction scheduling, cost estimating or construction management.
2) The CxA may assist with problem solving and non-conformance items or deficiencies, but the CxA is not the Engineer of Record, and the commissioning process does not preclude the Engineer of Record of responsibilities for system evaluations, adequacy of systems to meet the OPR, capacities of systems, quality control checks, or any of the other elements and recommended final acceptance of systems to the Owner.
3) The primary role of the CxA is to coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultants with all necessary parties, frequently updated timelines and schedules and technical expertise.

b. Commissioning Plan:

1) The CxA shall develop a Commissioning Plan at the start of the project.
2) At the end of the Project, the CxA shall provide the Owner with the Final Commissioning Plan for the Owner's use.

c. Document Review:

1) Review the Owner's Project Requirements and Basis of Design developed by the design professionals.
2) Perform two (2) focused reviews of the drawings and specification during design phase. <Edit for Project>
3) Develop full commissioning specifications for all systems and equipment to be commissioned. The commissioning specifications will be subject to approval of the design team and included in the final construction specifications.
4) Review submittals applicable to systems being commissioned for compliance for commissioning needs, concurrent with the AE's reviews.

d. Cx Team Meetings:

1) Lead Cx Meetings during design and construction.

e. Coordination and Scheduling:

1) Coordinate and direct commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications, and consultations with all necessary parties.
2) Coordinate commissioning work with the CM to ensure that commissioning activities are being scheduled into the master project schedule.

f. Commissioning Progress:

1) Perform site visits, as necessary, to observe component and system installations.
2) Attend selected planning and jobsite meetings to obtain information on construction progress.
3) Review construction meeting minutes for revisions/substitutions relating to the commissioning process.

g. Pre-Functional Checks:

1) Verify proper installation of components, equipment, systems and assemblies.

h. Equipment and System Startup and Verification:

1) Review system startup reports and conduct selected site observation.
2) Perform TAB verification per contract requirements, and review the TAB report prior to functional testing.
3) Functional Performance Testing
4) With assistance from the Contractor, write Functional Performance Test procedures for all components, equipment or systems to be commissioned.
5) With the assistance of the Contractors, coordinate Functional Performance Testing. Witness and approve Functional Performance Testing performed by the Contractors.

i. With the assistance of the Contractors, coordinate retesting as necessary until satisfactory performance is achieved.
j. Witness seasonal or deferred Functional Performance Testing as necessary.

4. Issue/Deficiency Logs:

a. Prepare a formal, ongoing, online record of deficiencies, problems and concerns – and their resolution – raised by members of the Commissioning Team during the Commissioning Process.
b. Issues will be recorded in the Issues Log. The AE, CM/GC and Contractors will resolve all issues to the satisfaction of the Owner. Issues will be added by the CxA. Team members are required to respond to issues pertaining to their work. Team members are required to respond to issues added to the list within five (5) working days of issue of an update to the Issues Log.
c. When issues are resolved, they will be closed on the Issues Log by the CxA.

5. Operation and Maintenance Data:

a. The CxA shall review of the documentation submitted by the Contractor as required by the Specifications for completeness and accuracy. This commissioning review supplements, but does not replace, the Architect/Engineer's review.
b. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

6. Training:

a. The CM/GC and Contractors will provide all documentation and qualified training personnel for training.
b. The CxA will verify through the Contractor's plan and schedule, training agendas, and attendance documentation that proper training procedures were followed on all commissioned systems.
c. See specifications for training requirements.

7. Commissioning Final Report:

a. The CxA shall provide a final report following the completion of all Functional Performance Testing.

END OF SECTION 019100