PART 1 - GENERAL

1.01 Description

A. The purpose of the commissioning process is to provide the Owner / operator of the facility with a high level of assurance that the mechanical and electrical systems have been installed in the prescribed manner, and operate within the performance guidelines. The Commissioning Coordinator shall provide the Owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not to take away or reduce the responsibility of the system designers or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system installation, start-up, and aid in the orderly transfer of systems to beneficial use by the owner. The Commissioning Coordinator will be a member of the construction team, cooperating, and coordinating all commissioning activities with the contracting officer's representative, construction manager, contractors, sub-contractors, manufacturers, and equipment suppliers.

1.02 Scope

A. The functions and responsibility of the Commissioning Coordinator shall include:
1. Responsibility: The primary point of responsibility is to inform the General Contractor (Construction Manager) and the Owner on the status, integration, and performance of systems within the facility.
2. Information: The Commissioning Coordinator shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in the completion of the construction process. This shall include system completeness, performance, and adequacy to meet the intended performance standards of each system. Services include construction observation, spot testing, verification and functional performance testing, and providing performance and operating information to the responsible parties, i.e., contractors, and the Owner.
3. Quality Assurance: Assist the responsible parties to maintain a high quality level of installation and system performance.
4. Leadership / Training: Initiate and lead the involvement of the facility operations personnel in the commissioning process, set standards, and coordinate training of operating personnel on each system.
5. Observation of tests: Commissioning Coordinator shall coordinate and observe testing as required to ensure equipment and system performance meets the design intent.
6. Documentation of tests: Commissioning Coordinator shall document the results of the performance testing directly and/or ensure that the appropriate technicians document all testing. The Commissioning Coordinator shall provide standard forms to be used by all parties for consistency of approach and type of information to be recorded.

7. Resolution of disputes: The Commissioning Coordinator is to remain an independent party present on the project with specific knowledge of the project. Should disputes arise, the Commissioning Coordinator shall perform research to determine the scope and extent of the problem and educate the involved parties as to the nature and extent of the problem. This shall include technical and financial aspects of the dispute, including assistance to help identify who the responsible parties are to implement corrective action. The Owner shall preside over resolution of the problem.
8. Deficiencies: Provision of technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.
9. Acceptance: The Commissioning Coordinator shall determine and advise the Construction Manager and Owner of the date of acceptance for each component and system for start of the warranty period.
10. O&M Data: Provision of technical expertise to review operating and maintenance descriptions by system.

B. The Commissioning Coordinator is referred to as an independent contractor in this Division and shall work under a separate contract directly for the Owner.

C. The Commissioning Coordinator shall not be financially associated with any of the Division 2 through 16 contractors on this project to avoid potential conflicts of interest.

1.03 Systems To Be Commissioned

The following systems shall be commissioned:

I. Chilled water system(s)
II. Hot water system(s)
III. Air handling / distribution system
IV. Building automation system
V. Main electrical distribution
VI. Emergency/Back-up power systems
VII. Lighting controls
VIII. Photovoltaics (PV)

The following equipment shall be commissioned:

1. Motors
2. Variable frequency drives
3. Plumbing specialties
4. Sewage and sump pumps
5. Water distribution pumps
6. Compressed air equipment
7. Natural gas piping
8. Hydronic piping
9. HVAC pumps
10. Chemical water treatment
11. Hot water heat exchangers
12. Primary cooling heat exchangers
13. Air coils
14. Fan-coil units, including reheat coils

15. Finned-tube radiation
16. Unit heaters
17. Centrifugal fans
18. Axial fans
19. Power ventilators
20. Central-station air handling units
21. Direct/indirect evaporative cooling
22. Air filters
23. Metal ductwork
24. Duct accessories
25. Air outlets and inlets
26. Air terminals
27. Control systems equipment
28. Testing, adjusting, and balancing
29. Motor control centers
30. Lighting control equipment
31. PV equipment and conrols

1.04 Coordination

A. The Construction Manager shall be responsible for furnishing a copy of all construction documents, addenda, change orders, and appropriate approved submittals and shop drawings to the Commissioning Coordinator.

B. The Commissioning Coordinator shall coordinate directly with each contractor on the project specific to their responsibilities and contractual obligations. If the contractor is a subcontractor to another contractor, the Commissioning Coordinator shall disseminate written information to all responsible parties relative to the nature and extent of the communication.

C. The Commissioning Coordinator is primarily responsible to the Owner through the Construction Manager, and as such, shall regularly apprise the Construction Manager and the Owner of progress, pending problems and/or disputes, and shall provide regular status reports on progress with each system. Any potential change in the contractual and/or financial obligations of the owner (credits, change orders, schedule changes, etc.) shall be identified and quantified as soon as possible.

D. The Commissioning Coordinator shall coordinate the schedule of commissioning activities with the construction schedule. It is possible that some procedures will be completed before the entire mechanical or electrical system is completed.

1.05 Schedule

A. Commissioning of systems shall proceed per the criteria established in the specific sections that follow, with activities to be performed on a timely basis. The Commissioning Coordinator shall be available to respond promptly to avoid construction delays.

B. Start-up and testing of systems may proceed prior to final completion of systems to expedite progress. However, the Commissioning Coordinator shall not schedule

testing and checkout services that are the primary responsibility of the contractor / vendor in advance of their testing and checkout.

C. Problems observed shall be addressed immediately, responsible parties notified, and actions to correct deficiencies coordinated in a timely manner.

D. Contractor schedules and scheduling is the responsibility of the Construction Manager. The Commissioning Coordinator shall provide commissioning scheduling information to the Construction Manager for review and planning activities.

E. For pre-functional and functional performance tests, which occur in the acceptance procedures, the Commissioning Coordinator shall be available for up to two site visits to try and accomplish each test as part of the contract. Should additional work / site visits be required because systems are not ready or because they do not successfully pass test procedures after they have been indicated as ready, additional fees will be required. These additional fees shall be paid to the Commissioning Coordinator by the Owner and shall be reimbursed by the General Contractor.

1.06 Related Work Specified Elsewhere

A. Commissioning requires support from the contractors. The commissioning process does not relieve any contractors from their obligations to complete all portions of work in a satisfactory manner.

B. Refer to Division 15 and 16 contractor responsibilities relative to the commissioning process.

PART 2 - PRODUCTS

2.01 Test Equipment

A. All industry standard test equipment required for performing the specified tests shall be provided by the appropriate contractor and approved by the Commissioning Coordinator. Any proprietary vendor specific test equipment or software shall be provided by that vendor or manufacturer.

B. Any portable or hand-held setup / calibration devices required to initialize the control system shall be made available by the control vendor (at no cost) to the Commissioning Coordinator.

C. The instrumentation used in the commissioning process shall meet the following standards:

1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required.
2. Be calibrated at the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument
3. Be maintained in good repair and operating condition throughout the duration of use on this project.
4. Be immediately re-calibrated or repaired if dropped and/or damaged in any way during use on this project.

PART 3 - EXECUTION

3.01 Commissioning Plan And Schedule

A. The Commissioning Coordinator shall develop and submit a schedule for the commissioning process, which is integrated, with the construction schedule. Included shall be the required work by all team members (Commissioning Coordinator, contractors, and the Owner). Overlay with the construction schedule, and include time for test and balance, pre-functional performance testing, and functional performance testing.

3.02 Construction Observation

A. This is an additional and separate activity from that provided by the design team. Construction observation is required as part of the commissioning and coordination process to be provided by the Commissioning Coordinator.

3.03 Test And Balance

A. Air and water balance and equipment performance verification shall be accomplished by an independent test and balance firm. The Commissioning Coordinator shall spot check or observes a portion of this work to verify accuracy of results.

3.04 Pre-Functional and Functional Performance Test Procedures

A. Personnel experienced in the technical aspects of each system to be commissioned shall develop and document the commissioning procedure to be used. Include a performance checklist and performance test data sheets for each system based on actual system configuration. These procedures shall be reviewed by the Owner for technical depth, clarity of documentation and completeness. Special emphasis shall be placed on testing procedures that shall conclusively determine actual system performance and compliance with the design intent.

B. The majority of mechanical equipment requires safety devices to stop and/or prevent equipment operation unless minimum safety standards or conditions are met. These may include adequate oil pressure, proof-of-flow, non-freezing conditions, maximum static pressure, maximum head pressure, etc. The Commissioning Coordinator shall observe the actual performance of safety shutoffs in a real or closely simulated condition of failure.

C. Systems may include safety devices and components that control a variety of equipment operating as a system. Interlocks may be hard-wired or operate from software. The Commissioning Coordinator shall verify operation of these interlocks.

D. The Commissioning Coordinator shall determine the acceptance procedures for each system within Divisions 15 and 16 disciplines. The acceptance procedures shall incorporate the commissioning standards and successful testing results as referred to throughout Division 15 and 16 specifications.
1. In particular, the temperature control system shall have all I/O points individually verified for proper function, calibration, and operation. The Commissioning Coordinator shall review proposed testing procedures and report formats, and observe sufficient field testing to confirm that all I/O points have been properly tested.
2. All control sequence of operation strategies, alarm generation and reporting shall also be reviewed and proper operation verified by the Commissioning Coordinator.
3. The central work station graphics, point assignments, alarm messages, and logging functions shall be verified.

E. The appropriate contractor and vendor(s) shall be informed of what tests are to be performed and the expected results. Whereas some test results and interpretations may not become evident until the actual tests are performed, all parties shall have a reasonable understanding of the requirements. The commissioning plan shall address those requirements and be distributed to all parties involved with that particular system.

F. Acceptance procedures shall confirm the performance of systems to the extent of the design intent. When a system is accepted, the Owner shall be assured that the system is complete, works as intended, is correctly documented, and operator training has been performed.

3.05 Functional Performance Testing - Observation

A. The functional performance testing shall be done by the contractors and vendors. The Commissioning Coordinator shall witness and verify all of these tests.

B. Tests shall be completed comprehensively and to the extent necessary to enable the Commissioning Coordinator to assure the Owner that the systems do perform per the design intent.

3.06 Software Documentation Review

A. Review detailed software documentation for all DDC control systems. This includes review of vendor documentation, their programming approach, and the specific software routines applied to this project. Discrepancies in programming approaches and/or sequences shall be reported and coordinated in order to provide the Owner with the most appropriate, simple, and straightforward approach to software routines.

3.07 Operating And Maintenance (O&M) Manuals

A. The Commissioning Coordinator shall review the draft form of the O&M manuals provided by the Division 15 contractor and the Division 16 contractor. The review process shall verify that O&M instructions meet specifications and are included for all equipment furnished by the contractor, and that the instructions and wiring diagrams are specific (edited where necessary) to the actual equipment provided for this project.

Published literature shall be specifically oriented to the provided equipment indicating required operation and maintenance procedures, parts lists, assembly / disassembly diagrams, and related information.

The contractor shall incorporate the standard technical literature into system specific formats for this facility as designed and as actually installed. The resulting O&M information shall be system specific, concise, to the point, and tailored specifically to this facility. The Commissioning Coordinator shall review these documents as necessary for final corrections by the contractor.

B. The O&M manual review, and coordination efforts shall be completed prior to Owner training sessions, as these documents are to be utilized in the training sessions.

3.08 Training

Schedule and coordinate training sessions for the Owner's staff for each system. Training shall be in a classroom setting with the appropriate schematics, handouts, and visual / audio training aids on-site with equipment.

A. The Commissioning Coordinator shall host an overall training session with program overview and curriculum guidance.

B. The appropriate installing contractors shall provide training on all the major systems per specifications, including peculiarities specific to this project.

C. The equipment vendors shall provide training on the specifics of each major equipment item including philosophy, troubleshooting, and repair techniques.

D. The automatic control and fire alarm vendors shall provide training on the control system and fire alarm system per their specification section.

3.09 Record Drawings

A. The Commissioning Coordinator shall assist in the review of the as-built contract documents to verify incorporation of both design changes and as-built construction details with particular attention paid to commissioning-related items. The appropriate party shall correct discrepancies noted.

3.10 Exclusions

A. Responsibility for construction means and methods: The Commissioning Coordinator is not responsible for construction means, methods, job safety, or any construction management functions on the job site.

B. Hands-on work by the Commissioning Coordinator: The contractors shall provide all services requiring tools or the use of tools to start-up, test, adjust, or otherwise bring equipment and systems into a fully operational state. The Commissioning Coordinator shall coordinate and observe these procedures (and may make minor adjustments), but shall not perform construction or technician services other than verification of testing, adjusting, balancing, and control functions.

END OF SECTION