

**SECTION 01 91 01**

**CONTRACTOR-PROVIDED COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This Section 01 91 01 CONTRACTOR-PROVIDED COMMISSIONING REQUIREMENTS shall form basis of construction phase commissioning process and procedures. Contractor shall provide and pay for services of a 3<sup>rd</sup> Party Commissioning Agent. Contractor's Commissioning Agent shall add, modify, and refine commissioning procedures, as approved by Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.
- B. The CONTRACTOR shall submit credentials, qualifications and references of proposed 3<sup>rd</sup> Party Commissioning Agent(s) for review and approval by VA.
- B. Various sections of project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in Division 23 section of these specifications are intended to be provided in coordination with commissioning services and are not intended to duplicate services. Contractor shall coordinate work required by individual specification sections with commissioning services requirements specified herein.
- C. Where individual testing, adjusting, or related services are required in project specifications and not specifically required by this commissioning requirements specification, specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to VA to be indexed for future reference.
- D. Where training or educational services for VA are required and specified in other sections of specifications, including but not limited to Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 series sections of specification, these services are intended to be provided in addition to training and educational services specified herein.

E. Commissioning is a systematic process of verifying that building systems perform interactively according to construction documents and VA's operational needs. Commissioning process shall encompass and coordinate system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during construction phase is intended to achieve the following specific objectives according to contract documents:

1. Verify that applicable equipment and systems are installed in accordance with contract documents and according to manufacturer's recommendations.
2. Verify appropriate coordination is followed between various Divisions to insure a thorough and methodical process of rough-in, utility connection, setup, calibration and startup is followed on each new or modified system.
2. Verify and document proper integrated performance of equipment and systems.
3. Verify that Operations & Maintenance documentation is complete.
4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
5. Verify that VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
6. Document successful achievement of commissioning objectives listed above.

F. The commissioning process does not take away from or reduce responsibility of Contractor to provide a finished and fully functioning product.

## **1.2 CONTRACTUAL RELATIONSHIPS**

A. For this construction project, Department of Veterans Affairs contracts with a Contractor to provide construction services. Contracts are administered by VA Contracting Officer and Resident Engineer as designated representative of Contracting Officer. On this project, authority to modify contract in any way is strictly

limited to authority of Contracting Officer and Resident Engineer.

- B. In this structure, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer and Contractor. It is practice of VA to require that communications between other parties to contracts (Subcontractors and Vendors) be conducted through Resident Engineer and Contractor. It is also practice of VA that communications between other parties of project (Architect/Engineer) be conducted through Resident Engineer.
- C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to construction process. By its nature, a high level of communication and cooperation between Contractor's Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc) is essential to success of Commissioning effort.
- D. With these fundamental practices in mind, commissioning process described herein has been developed to recognize that, in execution of Commissioning Process, Contractor's Commissioning Agent must develop effective methods to communicate with every member of construction team involved in delivering commissioned systems while simultaneously respecting exclusive contract authority of Contracting Officer and Resident Engineer. Thus, procedures outlined in this specification must be executed within the following limitations:
  - 1. No communications (verbal or written) from Contractor's Commissioning Agent shall be deemed to constitute direction that modifies terms of any contract between Department of Veterans Affairs and Contractor.
  - 2. Commissioning Issues identified by Contractor's Commissioning Agent shall be delivered to Resident Engineer and copied to designated Commissioning Representatives for Contractor and subcontractors on Commissioning Team for information only in order to expedite communication process. These issues must be understood as professional opinion of Contractor's Commissioning Agent and as suggestions for resolution.

3. In event that any Commissioning Issues and suggested resolutions are deemed by Resident Engineer to require either an official interpretation of construction documents or require a modification of contract documents, Contracting Officer or Resident Engineer will issue an official directive to this effect.
4. All parties to Commissioning Process shall be individually responsible for alerting Resident Engineer of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with Contracting Officer or Resident Engineer, with appropriate technical guidance from Architect/Engineer.

### **1.3 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 23 08 01 CONTRACTOR-PROVIDED COMMISSIONING OF HVAC SYSTEMS.

### **1.4 SUMMARY**

- A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. The commissioning activities have been developed to support VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

### **1.5 DEFINITIONS**

- A. Architect: Includes Architect identified in Contract for Construction between Department of Veterans Affairs and Contractor, plus consultant/design professionals responsible for design of fire suppression, plumbing, HVAC, controls for HVAC systems, electrical, communications, electronic safety and security, as well as other related systems.
- B. CxA: Contractor's Commissioning Agent.
- C. Commissioning Plan: a document that is an overall plan that outlines commissioning process, commissioning team

responsibilities, schedule for commissioning activities, and commissioning documents.

- D. Commissioning Issue: a condition in installation or function of a component, piece of equipment or system that affects system operations, maintenance, and/or repair.
- E. Commissioning Observation: a condition in installation or function of a component, piece of equipment or system that may not be in compliance with Contract Documents, or may not be in compliance with manufacturer's installation instruction, or may not be in compliance with generally accepted industry standards.
- F. Systems Functional Performance Test: a test, or tests, of dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Systems Functional Performance Testing is dynamic testing of systems (rather than just components) under full operation (e.g., chiller pump is tested interactively with chiller functions to see if pump ramps up and down to maintain differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. systems are run through all control system's sequences of operation and components are verified to be responding as sequences state. Traditional air or water test and balancing (TAB) is not Systems Functional Performance Testing, in commissioning sense of word. TAB's primary work is setting up system flows and pressures as specified, while System Functional Performance Testing is verifying that system has already been set up properly and is functioning in accordance with Construction Documents. Contractor's Commissioning Agent develops Systems Functional Performance Test Procedures in a sequential written form, coordinates, witnesses, and documents actual testing. Systems Functional Performance Testing is performed by Contractor. Systems Functional Performance Tests are performed after startups, control systems are complete and operational, TAB functions and Pre-Functional Checklists are complete.
- G. System: A system is defined as entire set of components, equipment, and subsystems which must be coordinated to work

together during normal operation to produce results for which system is designed. For example, air conditioning supply air is only one component of an entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam supply, chilled water supply, refrigerant supply, hot water supply, controls and electrical service, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon coordination and proper operation of fuel supply, combustion air, controls, steam, feedwater supply, condensate return and other related components.

- H. Pre-Functional Checklist: a list of items provided by Contractor's Commissioning Agent to Contractor that require inspection and elementary component tests conducted to verify proper installation of equipment. Pre-Functional Checklists are primarily static inspections and procedures to prepare equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some Pre-Functional Checklist items entail simple testing of function of a component, a piece of equipment or system (such as measuring voltage imbalance on a three-phase pump motor of a chiller system). Term "Pre-Functional" refers to before Systems Functional Performance Testing. Pre-Functional Checklists augment and are combined with manufacturer's startup checklist and Contractor's Quality Control checklists.
- I. Seasonal Functional Performance Testing: a test or tests that are deferred until system will experience conditions closer to their design conditions.
- J. VA: Includes Contracting Officer, Resident Engineer, or other authorized representative of Department of Veterans Affairs.
- K. TAB: Testing, Adjusting, and Balancing.

#### **1.6 SYSTEMS TO BE COMMISSIONED**

- A. Commissioning of a system or systems specified for this project is part of construction process. Documentation and testing of these systems, as well as training of VA's Operation and

Maintenance personnel, is required in cooperation with VA and Contractor's Commissioning Agent.

B. The following systems shall be commissioned as part of this project:

1. HVAC (Division 23)

- a. Trending of Existing Air Handling Systems (AHU-30, AHU-31, and New and Existing Exhaust Systems serving the 3<sup>rd</sup> floor of the Acres Building: Fans, motors, Variable Speed Drives, air flows, temperature sensors, safeties such as fire alarm, smoke detectors or freezestats and damper end switches, controls).
- b. Trending of Existing Air Handling Systems (AHU-30, AHU-31, and New and Existing Exhaust Systems serving the 3<sup>rd</sup> floor of the Acres Building: Fans, motors, Variable Speed Drives, air flows, temperature sensors, safeties such as fire alarm, smoke detectors or freezestats and damper end switches, controls).
- c. Heating Hot Water Systems (New reheat water pumps and motors, controls, Variable Speed Drives, pipe differential pressure sensors).
- d. New and Existing Exhaust Fans serving the 3<sup>rd</sup> floor (Fans, motors, Variable Speed Drives, duct static pressure sensors, controls and safeties).
- e. Direct Digital Control System (BACnet or similar Local Area Network (LAN), Operator Work Station hardware and software, building controller hardware and software, terminal unit controller hardware and software, all sequences of operation, system accuracy and response time). Complete verification that dynamic readings of temperature, pressure, air flow, and water flow displayed on the existing Honeywell primary display and the Alerton front-end Secondary Display System (ECC) match the actual field readings at each device.
- f. New Exhaust Heat Recovery Systems extracting and rejecting heat to the general exhaust systems serving floors 3, 4 and 5 of the Acre Building in order to precondition the outdoor

air ventilation for central air handling units AHU-30 and AHU-31. Include verification that dynamic readings of temperatures, differential pressure, and air flows are accurately displayed on the existing Honeywell Front-end System as well as the Alerton Front-end Display.

- g. Laboratory Exhaust Systems (Fume hoods, Biosafety Cabinets, hood alarms, pressure controls, snorkels, system alarms, fans, motors, and Variable Speed Drives).
- h. Laboratory Ventilation Systems (Supply air terminal units and controls, pressure controls, offset flow tracking systems and alarms, fans, motors, and Variable Speed Drives).
- i. Wireless temperature monitors mounted in the walk-in coolers on the 3rd, 4th and 5th floors of Acre Building. Demonstrate "Checkpoint" software for display of temperature readings and historical graphs.
- j. Test and Balance:
  - a. Preconstruction air flows and pressure readings in ducts and systems listed under Section 23 0593.
  - b. Post-Construction air flows and pressure readings in ducts and systems listed under Section 23 0593.
  - c. Review of new duct connections at inlets to air valves, fume hoods and Bio-safety Cabinets.
  - d. Coordinate work of Test & Balance Subcontractor (Section 23 05 93) with DDC Controls Vendor (Section 23 09 23) for air flow at all terminal boxes, exhaust valves, air handling units, and exhaust fans as well as water flow at all heating and cooling coils and heat exchangers.
- k. Room Pressurization Controls for Animal Procedure and Tissue Culture Rooms (Pressure sensors, terminal units/air valves, controllers and alarms).
- l. Offset Flow-Tracking Equipment for Laboratories (Flow sensors, terminal units/air valves, controls and alarms).



- m. Fire alarm interlocks with air handling systems AHU-30 & AHU-31 and control of combination fire/smoke dampers from their duct-mounted smoke detectors.
  - n. HVAC Water Treatment Systems (Closed circuit systems - including shot feeders and final water analysis - including water analysis, flushing system, and introduction of corrosion inhibitors).
  - j. Cascading graphics for every new system display on the Alerton ECC front end and the existing Honeywell front-end with accurate dynamic data displayed at both PC's.
2. Fire Suppression (Division 21)
- a. Fire Protection System (Fire pump, jockey pump, fire pump automatic transfer switch/controller, Wet-pipe fire suppression, Dry-pipe fire suppression, Pre-action fire suppression, dry system air compressors and motors, and clean agent fire suppression).
3. Plumbing (Division 22)
- a. From Division 22, the new steam-fired Domestic Water Heaters, DW discharge temperature sensors, Domestic Water Booster Pumps, 6<sup>th</sup> floor domestic water pressure, New Fire Pump Status and standpipe pressure at highest point in the Acres Building.
  - b. Emergency Plumbing Fixtures (Showers, eye wash stations, water tempering valves, instruments and gages).

#### **1.7 COMMISSIONING TEAM**

A. Members Appointed by Contractor:

- 1. Contractor: designated person, company, or entity that plans, schedules and coordinates commissioning activities for construction team.
- 2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of entity he or she represents, explicitly organized to implement commissioning process through coordinated actions. Commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, suppliers, and specialists deemed

appropriate by Department of Veterans Affairs (VA) and Contractor's Commissioning Agent.

3. Contractor's Commissioning Agent: designated person, company, or entity that plans, schedules, and coordinates commissioning team to implement commissioning process. Contractor shall engage CxA.

B. Members Appointed by VA:

1. Representatives of facility user and operation and maintenance personnel.
2. Architect and engineering design professionals.

**1.8 VA'S COMMISSIONING RESPONSIBILITIES**

- A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, following:
1. Coordination meetings.
  2. Training in operation and maintenance of systems, subsystems, and equipment.
  3. Testing meetings.
  4. Witness and assist in Systems Functional Performance Testing.
  5. Demonstration of operation of systems, subsystems, and equipment.

**1.9 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES**

- A. The Contractor shall appoint an individual, company or firm to act as Contractor's Commissioning Agent.
1. The Contractor shall assign a Commissioning Manager to manage commissioning activities of Contractor, and subcontractors.
  2. Provide Construction Documents, prepared by Architect and approved by VA, to Contractor's Commissioning Agent and for use in managing commissioning process, developing commissioning plan, systems manuals, and reviewing operation and maintenance training plan.
- B. The Contractor shall ensure that commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with requirements of these specifications.

- C. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, following:
1. Participate in commissioning coordination meetings.
  2. Conduct operation and maintenance training sessions in accordance with approved training plans.
  3. Verify that Work is complete and systems are operational according to Contract Documents, including calibration of instrumentation and controls.
  4. Evaluate commissioning issues and commissioning observations identified in Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
  5. Review and comment on commissioning documentation.
  6. Participate in meetings to coordinate Systems Functional Performance Testing.
  7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Contractor's Commissioning Agent for incorporation into commissioning plan.
  8. Provide information to Contractor's Commissioning Agent for developing commissioning plan.
  9. Participate in training sessions for VA's operation and maintenance personnel.
  10. Provide technicians who are familiar with construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

**1.10 CONTRACTOR'S COMMISSIONING AGENT'S RESPONSIBILITIES**

- A. Organize and lead commissioning team.
- B. Prepare commissioning plan. See Paragraph 1.11-A of this specification Section for further information.
- C. Review and comment on selected submittals from Contractor for general conformance with Construction Documents. Review and

- comment on ability to test and operate system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to Construction Documents.
- D. At beginning of construction phase, conduct an initial construction phase coordination meeting for purpose of reviewing commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.
  - E. Convene commissioning team meetings for purpose of coordination, communication, and conflict resolution; discuss status of commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. Contractor's Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of commissioning meeting.
  - F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with Construction Documents.
  - G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.
  - H. Coordinate Systems Functional Performance Testing schedule with Contractor.
  - I. Witness selected systems startups.
  - J. Verify selected Pre-Functional Checklists completed and submitted by Contractor.
  - K. Witness and document Systems Functional Performance Testing.
  - L. Compile test data, inspection reports, and certificates and include them in systems manual and commissioning report.
  - M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.

- N. Review operation and maintenance training program developed by Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
- O. Prepare commissioning Field Observation Reports.
- P. Prepare Final Commissioning Report.
- R. Assemble final commissioning documentation, including Final Commissioning Report.

#### **1.11 COMMISSIONING DOCUMENTATION**

- A. Commissioning Plan: A document, prepared by Contractor's Commissioning Agent that outlines schedule, allocation of resources, and documentation requirements of commissioning process, and shall include, but is not limited, to following:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of relationship of these documents to other functions and a detailed description of submittals that are required to support commissioning processes. Submittal dates shall include latest date approved submittals must be received without adversely affecting commissioning plan.
  - 2. Description of organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  - 3. Identification of systems and equipment to be commissioned.
  - 4. Schedule of Commissioning Coordination meetings.
  - 5. Identification of items that must be completed before next operation can proceed.
  - 6. Description of responsibilities of commissioning team members.
  - 7. Description of observations to be made.
  - 8. Description of requirements for operation and maintenance training.
  - 9. Schedule for commissioning activities with dates coordinated with overall construction schedule.
- 10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.

11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  12. Preliminary Systems Functional Performance Test procedures.
- B. Systems Functional Performance Test Procedures: Contractor's Commissioning Agent shall develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures shall include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures shall be provided to VA and Architect/Engineer for review and comment. Systems Performance Test Procedure shall include test procedures for each mode of operation and provide space to indicate whether mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, following:
1. Name and identification code of tested system.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether record is for a first test or retest the following correction of a problem or issue.
  5. Dated signatures of person performing test and of witness, if applicable.
  6. Individuals present for test.
  7. Observations and Issues.
  8. Issue number, if any, generated as result of test.
- C. Pre-Functional Checklists: Contractor's Commissioning Agent shall prepare *Pre-Functional Checklists*. *Pre-Functional Checklists* shall be completed and signed by Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. Contractor's Commissioning Agent shall spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to Contractor for correction and resubmission.

- D. Test and Inspection Reports: Contractor's Commissioning Agent shall record test data, observations, and measurements on Systems Functional Performance Test Procedure. Report shall also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for application shall be included with data. Contractor's Commissioning Agent shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- E. Corrective Action Documents: Contractor's Commissioning Agent shall document corrective action taken for systems and equipment that fail tests. Documentation shall include any required modifications to systems and equipment and/or revisions to test procedures, if any. Contractor's Commissioning Agent shall witness and document retesting of systems and/or equipment requiring corrective action and document retest results.
- F. Commissioning Issues Log: Contractor's Commissioning Agent shall prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during Commissioning process. These observations and issues include, but are not limited to, those that are at variance with Contract Documents. Commissioning Issues Log shall identify and track issues as they are encountered, party responsible for resolution, progress toward resolution, and document how issue was resolved. Master Commissioning Issues Log shall also track status of unresolved issues.
1. Creating a Commissioning Issues Log Entry:
- a. Identify issue with unique numeric or alphanumeric identifier by which issue may be tracked.
  - b. Assign a descriptive title for issue.
  - c. Identify date and time of issue.
  - d. Identify test number of test being performed at time of observation, if applicable, for cross reference.
  - e. Identify system, subsystem, and equipment to which issue applies.
  - f. Identify location of system, subsystem, and equipment.

- g. Include information that may be helpful in diagnosing or evaluating issue.
  - h. Note recommended corrective action.
  - i. Identify commissioning team member responsible for corrective action.
  - j. Identify expected date of correction.
  - k. Identify person that identified issue.
- 2. Documenting Issue Resolution:
  - a. Log date correction is completed or issue is resolved.
  - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of issue, if any.
  - c. Identify changes to Contract Documents that may require action.
  - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
  - e. Identify person(s) who corrected or resolved issue.
  - f. Identify person(s) verifying issue resolution.
- G. Final Commissioning Report: Contractor's Commissioning Agent shall document results of commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. Commissioning Report shall indicate whether systems, subsystems, and equipment have been properly installed and are performing according to Contract Documents. This report will be used by Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of Contract Documents and those that do not meet requirements of Contract Documents. Commissioning report shall include, but is not limited to, following:
  - 1. Lists and explanations of substitutions; compromises; variances with Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by Contractor's Commissioning Agent.



2. Commissioning plan.
  3. Pre-Functional Checklists completed by Contractor, with annotation of Contractor's Commissioning Agent review and spot check.
  4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
  5. Commissioning Issues Log.
  6. Listing of deferred and off season test(s) not performed, including schedule for their completion.
- I. Systems Manual: Contractor's Commissioning Agent shall gather required information and compile Systems Manual. Systems Manual shall include, but is not limited to, following:
1. Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout Project.
  2. Reference to Final Commissioning Plan.
  3. Reference to Final Commissioning Report.
  4. Approved Operation and Maintenance Data as submitted by Contractor.

#### **1.12 SUBMITTALS**

- A. Commissioning Plan Submittal: Contractor's Commissioning Agent shall prepare a Commissioning Plan based on final Construction Documents. It shall contain preliminary information about the following commissioning activities:
1. The Commissioning Team: A list of commissioning team members by organization.
  2. Systems to be commissioned. A detailed list of systems to be commissioned for project. This list shall provide preliminary information on systems/equipment submittals to be reviewed by Contractor's Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by VA).
  3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.

4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of parties responsible for preparation, review, approval, and action on each document.
  5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, expected duration and predecessors for activity.
  6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on level of detailed information Contractor shall include on final submission.
  7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on level of testing rigor, and level of Contractor support required during performance of system's testing.
- B. Commissioning Plan Submittal: Based on Final Construction Documents and Contractor's project team, Contractor's Commissioning Agent shall prepare Final Commissioning Plan as described in this section. Contractor's Commissioning Agent shall submit three hard copies and three sets of electronic files of Final Commissioning Plan. Contractor's Commissioning Agent shall incorporate review comments into Final Commissioning Plan as directed by VA.
- C. Systems Functional Performance Test Procedure: Contractor's Commissioning Agent shall submit Systems Functional Performance Test Procedures to VA for review and comment. VA will return review comments to Contractor and Contractor's Commissioning Agent. Contractor's Commissioning Agent shall incorporate review comments into Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.
- D. Pre-Functional Checklists: Contractor's Commissioning Agent shall submit Pre-Functional Checklists to be completed by Contractor.

- E. Test and Inspection Reports: Contractor's Commissioning Agent shall submit test and inspection reports to VA with copies to Contractor and Architect/Engineer.
- F. Corrective Action Documents: Contractor's Commissioning Agent shall submit corrective action documents to VA Resident Engineer with copies to Contractor and Architect.
- G. Preliminary Commissioning Report Submittal: Contractor's Commissioning Agent shall submit three electronic copies of preliminary commissioning report. One electronic copy, with review comments, will be returned to Contractor's Commissioning Agent for preparation of final submittal.
- H. Final Commissioning Report Submittal: Contractor's Commissioning Agent shall submit four sets of electronically formatted information of final commissioning report to VA. Final submittal shall incorporate comments as directed by VA.
- I. Data for Commissioning:
  - 1. The Contractor's Commissioning Agent shall request in writing from Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of Commissioning Plan.
  - 2. The Contractor's Commissioning Agent shall request further documentation as is necessary for commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.
- J. Submit proof of compliance with Quality Assurance provisions related to Contractor's Commissioning Agent experience and qualifications.

#### **1.13 COMMISSIONING PROCESS**

- A. The Contractor's Commissioning Agent shall be responsible for overall management of commissioning process as well as coordinating scheduling of commissioning tasks with VA and Contractor. Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with Master Construction Schedule.

- B. Within 10 days of contract award, Contractor shall designate a specific individual as Commissioning Manager (CM) to manage and lead commissioning effort on behalf of Contractor. Commissioning Manager shall be single point of contact and communications for all commissioning related services by Contractor.
- C. Within 15 days of contract award, Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CR) to be responsible for commissioning related tasks. Contractor shall ensure designated Commissioning Representatives participate in commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

#### **1.14 QUALITY ASSURANCE**

- A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired the following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.
- C. Contractor's Commissioning Agent Qualifications:
  - 1. Acted as principal CX for at least four (4) projects over 50,000 sf; minimum two of which deal with existing buildings similar in nature to this Project.
  - 2. Experience in design, specification, or operation and troubleshooting of HVAC systems, energy management control systems, security systems, and Building Automation Management system.

3. A minimum of five (5) full years in this type of work is required
4. Knowledge of building operation and maintenance of O&M training.
5. Knowledge of test and balance of both air and water systems.
6. Experience in energy-efficient equipment design and control strategy optimization.
7. Direct experience in monitoring and analyzing system operation using direct digital controls, energy management control system trending, and stand-alone data logging equipment.
8. Excellent verbal and writing communication skills; highly organized and able to work with both management and trade contractors.
9. Experienced in writing commissioning specifications.
10. A bachelor's degree in Mechanical Engineering and P.E. certification; registered in State in which Project is located.
11. Certification by a nationally recognized authority, such as American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), AABC Commission Group (ACG) or Building Commissioning Association (BCA).

#### **1.15 COORDINATION**

- A. Management: Contractor's Commissioning Agent shall coordinate commissioning activities with VA. Contractor's Commissioning Agent shall submit commissioning documents and information to VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet objectives of contract documents.
- B. Scheduling: Contractor shall work with Contractor's Commissioning Agent and VA to incorporate commissioning activities into construction schedule. Contractor's Commissioning Agent shall provide sufficient information on commissioning activities to allow Contractor and VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite project and

commissioning process. Contractor shall update Master Construction as directed by VA.

- C. Initial Schedule of Commissioning Events: Contractor's Commissioning Agent shall provide initial schedule of primary commissioning events in Commissioning Plan and at commissioning coordination meetings. Commissioning Plan shall provide a format for this schedule. As construction progresses, more detailed schedules shall be developed by Contractor with information from Contractor's Commissioning Agent.
- D. Commissioning Coordinating Meetings: Contractor's Commissioning Agent shall conduct periodic Commissioning Coordination Meetings of commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- E. Pretesting Meetings: Contractor's Commissioning Agent shall conduct pretest meetings of commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.
- F. Systems Functional Performance Testing Coordination: Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. Contractor shall coordinate schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing shall be identified in detailed System Functional Performance Test Procedure prepared by Contractor's Commissioning Agent.
- B. Data logging equipment and software required to test equipment shall be provided by Contractor.

- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with tolerances specified in Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within past year to an accuracy of 0.5 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °F). Pressure sensors shall have an accuracy of + or - 2.0% of value range being measured (not full range of meter) and have been calibrated within last year. All equipment shall be calibrated according to manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

### **PART 3 - EXECUTION**

#### **3.1 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS**

- A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.
1. Pre-Functional Checklists are important to ensure that equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
    - a. The Pre-Functional Checklist shall identify trades responsible for completing checklist. Contractor shall ensure appropriate trades complete checklists.
    - b. The Contractor's Commissioning Agent shall review completed Pre-Functional Checklists and field-verify accuracy of completed checklist using sampling techniques.
  2. Startup and Initial Checkout Plan: Contractor shall develop detailed startup plans for all equipment. Primary role of Contractor in this process is to ensure that there is written documentation that each of manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in Startup Plan and in checklist forms.

- a. The Contractor shall develop full startup plan by combining (or adding to) checklists with manufacturer's detailed startup and checkout procedures from O&M manual data and field checkout sheets normally used by Contractor. Plan shall include checklists and procedures with specific boxes or lines for recording and documenting checking and inspections of each procedure and a summary statement with a signature block at end of plan.
- b. The full startup plan shall at a minimum consist of the following items:
  - 1) The Pre-Functional Checklists.
  - 2) The manufacturer's standard written startup procedures copied from installation manuals with check boxes by each procedure and a signature block added by hand at end.
  - 3) The manufacturer's normally used field checkout sheets.
    - a) The Contractor's Commissioning Agent shall submit full startup plan to VA for review. Final approval will be by VA.
    - b) The Contractor shall review and evaluate procedures and format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
  - a. All field installed temperature, relative humidity, CO<sub>2</sub> and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using methods described in Division 23 specifications.
  - b. All procedures used shall be fully documented on Pre-Functional Checklists or other suitable forms, clearly referencing procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup
  - a. Four weeks prior to equipment startup, Contractor shall schedule startup and checkout with VA and Contractor's Commissioning Agent. Performance of startup and checkout shall be directed and executed by Contractor.



- b. The Contractor's Commissioning Agent shall observe startup procedures for selected pieces of primary equipment.
- c. The Contractor shall execute startup and provide VA and Contractor's Commissioning Agent with a signed and dated copy of completed startup checklists, and contractor tests.
- d. Only individuals that have direct knowledge and witnessed that a line item task on Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

**3.2 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP**

- A. The Contractor shall clearly list any outstanding items of initial startup and Pre-Functional Checklist procedures that were not completed successfully, at bottom of procedures form or on an attached sheet. Procedures form and any outstanding deficiencies shall be provided to VA and Contractor's Commissioning Agent within two days of completion.
- C. The Contractor's Commissioning Agent shall review report and submit comments to VA. Contractor's Commissioning Agent shall work with Contractor to correct and verify deficiencies or uncompleted items. Contractor's Commissioning Agent shall involve VA and others as necessary. Contractor shall correct all areas that are noncompliant or incomplete in checklists in a timely manner, and shall notify VA and Contractor's Commissioning Agent as soon as outstanding items have been corrected. Contractor shall submit an updated startup report and a Statement of Correction on original noncompliance report. When satisfactorily completed, Contractor's Commissioning Agent shall recommend approval of checklists and startup of each system to VA.

----- End -----