

SECTION 01 91 13

COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The project will be pursuing Fundamental, Enhanced, Building Envelope and Monitoring Based Commissioning
- B. The role of the Commissioning Agent will be to coordinate and administer the commissioning process, as defined herein. The commissioning process will be implemented in accordance with the Massachusetts School Building Authority Standard Scope of Commissioning Services documents dated September 10, 2009. The project incorporates a Building Envelope commissioning process as well as requirements for mechanical, electrical, plumbing, and technology systems commissioning.
- C. The General Contractor and his subcontractors (mechanical, plumbing, electrical, technology, building envelope, and associated trade subcontractors) shall be the prime contractor responsible for the installation and placing in service of all mechanical, electrical, plumbing, technology, and building envelope equipment and systems in the building. The Owner's Project Manager and the General Contractor shall assist the Commissioning Agent in implementation of the commissioning plan and in maintaining the schedule of commissioning events. The commissioning process will not be a substitute for any work by the General Contractor, or any Sub-Contractor of the General Contractor, to install or place in service any equipment or system in the building.
- D. The Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, including all associated subcontractors and equipment manufacturers, shall be fully responsible for installation, start-up, testing, adjusting, and balancing, and verification and performance testing of all MEP, technology, and building envelope equipment and systems as required by the project specifications. The Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, including all associated subcontractors and equipment manufacturers, shall be an active participant in the commissioning process as specified herein, as required, and as directed by the Owner's Project Manager, the Commissioning Agent, and the General Contractor.
- E. The commissioning process shall be a team effort to ensure that all mechanical, electrical, plumbing, technology, and building envelope equipment and systems have been completely and properly installed and function together correctly to meet the design intent. The commissioning process shall also document system performance parameters for fine tuning of control sequences and operational procedures. The commissioning process shall coordinate system documentation and installation; equipment start-up; building automation system calibration; testing, adjusting, and balancing; and verification and performance testing.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary General Conditions and other Division 01 specification sections, apply to work of this Section.
- B. Divisions: 04 (Masonry), 07 (Thermal and Moisture Protection), 08 (Openings), 21 (Fire Protection), 22 (Plumbing), 23 (HVAC), 26 (Electrical), 27 (Communications), 28 (Electronic Safety and Security) and specification.
- C. Specification sections: 01 91 12 Building Enclosure Commissioning, 21 08 00 Fire Suppression Commissioning, 22 08 00 Plumbing Commissioning, 23 08 00 HVAC Commissioning, 26 08 00 Electrical Commissioning, 27 08 00 Communications Commissioning, 28 08 00 Electronic Safety & Security Commissioning.
- D. All related specification sections shall be used in conjunction with this section.

1.03 COMMISSIONING TEAM

- A. A representative of each of the following parties shall be designated as a member of the Commissioning Team:
 - 1. Owner or Owner's Representative.
 - 2. Commissioning Agent (CxA).

3. Owner's Project Manager.
4. General Contractor.
5. Mechanical (HVAC) Subcontractor.
6. Building Automation System (BAS) Subcontractor.
7. Testing, Adjusting and Balancing (TAB) Subcontractor.
8. Plumbing Contractor (if different than HVAC Subcontractor).
9. Fire Protection Subcontractor.
10. Electrical Subcontractor.
11. Building Envelope Contractors.
12. Other subcontractors and equipment manufacturers as required.

B. Each representative must attend scheduled meetings, in accordance with the Commissioning Agent's schedule.

1.04 SCOPE OF WORK

A. The work included in the commissioning process shall involve a complete and thorough evaluation of the operation and performance of all equipment and systems installed under this project. Equipment and systems that shall be evaluated include, but are not limited to, the following:

1. Mechanical systems:
 - a. Boilers
 - b. Piping
 - c. Pumps and drives
 - d. Air handler systems
 - e. Rooftop units
 - f. Heating and ventilating units
 - g. Terminal Units
 - h. Cabinet Unit Heaters
 - i. Fan Coil Units
 - j. Unit Heaters
 - k. Finned tube radiation
 - l. Convector
 - m. Exhaust fans
 - n. Split system air conditioning
 - o. Make-up Air units
 - p. Heat recovery systems
 - q. Automated temperature controls
 - r. Testing, adjusting and balancing spot check verification
2. Plumbing systems:
 - a. Natural Gas Systems
 - b. Backflow preventers
 - c. Water Heaters, re-circulating pumps, mixing valves and storage
 - d. Water closets and sinks
 - e. Laboratory Waste and Neutralization Tank
 - f. Safety shower/eyewash stations
3. Life Safety systems;
 - a. Security
 - b. Fire Suppression/Fire Alarm systems
 - c. Egress lighting
4. Electrical systems;
 - a. Electrical service and switchgear
 - b. Transformers
 - c. Motor control centers
 - d. Electrical distribution systems
 - e. Emergency and standby power systems

- f. Lighting controls & occupancy sensors
 - g. Low voltage systems
 - h. Grounding and bonding systems
5. Building Envelope Systems:
- a. Roofing systems, including parapet, skylights and openings
 - b. Exterior Walls
 - c. Windows, doors, grilles, sunscreens, louvers, and vents
 - d. Infrared scan of envelope and roof by Commissioning Agent
- B. Documentation required from the Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, as part of the commissioning process shall include as appropriate and applicable:
- 1. Equipment submittals and shop drawings for CxA review.
 - 2. Progress and status reports, including deficiencies noted.
 - 3. Manufacturers' suggested pre-functional checklists for CxA's use in developing pre-functional procedures.
 - 4. Start-up and testing documentation associated with systems being commissioned including but not limited to the following: duct leakage, pipe pressure, electrical testing, flushing / cleaning, etc.
 - 5. Performance (sign-off) of pre-functional checklists documentation. Including completed manufacturer start-up reports.
 - 6. Training agenda and material for CxA's review.
 - 7. Operation and maintenance (O&M) manuals.
- C. Pre-functional Checklists, Tests, and Startup:
- 1. Pre-functional checklists (PC) are important to ensure that the equipment and systems are hooked up and operational and that functional performance testing may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout by the Mechanical, Electrical, Plumbing, Technology, and Building Envelope Subcontractor. In general, the pre-functional testing for a given system must be successfully completed prior to formal functional performance testing or equipment or subsystems of the given system.
 - 2. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., oil levels OK, fan belt tension, labels affixed, gages in place, sensor calibration, etc.). However, some pre-functional checklist items entail simple 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 "pre-functional" refers to before functional testing. Pre-functional checklists augment and may be combined with the manufacturer's start-up checklist.
 - 3. Mechanical, Electrical, Plumbing, Technology, and Building Envelope Subcontractors typically already perform some, if not many, of the pre-functional checklist items the commissioning authority will recommend. This project requires that the procedures be documented in writing by the installing technician where detailed in the project specifications. The CxA does not witness most of the pre-functional check listing, except for testing of larger or more critical pieces of equipment and some spot-checking. It is noted that the checklists generated by the CxA do not take the place of manufacturer or Trade Contractor required checklists. The CxA, with assistance as required from the installing Mechanical, Electrical, Plumbing, Technology, and Building Envelope Subcontractor, will complete checklists that are generated by the CxA.
- D. Commissioning Tests: Detailed testing shall be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents and the design intent. All functional tests shall be witnessed by The Commissioning Agent. The following testing is required as part of the commissioning process:
- 1. Verification Functional Tests:
 - a. Verification tests shall be comprised of a full range of checks and tests to determine that all components, equipment, systems, and interfaces between systems operate in accordance with contract documents and the design intent. This shall include all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.
 - 2. Functional Performance Tests:

- a. Functional performance tests shall determine that the commissioned systems are operating in accordance with the Contract Documents and the design intent.

1.05 ROLES AND RESPONSIBILITIES

- A. All Commissioning Team members shall be involved in the commissioning process. Following is a description of the responsibilities of each party:
 - 1. Owner or Owner's Representative:
 - a. Assign maintenance personnel and schedule them to participate in meetings, training sessions, and inspections.
 - 2. Commissioning Agent:
 - a. Develop the commissioning plan.
 - b. Review submittals for major equipment being commissioned.
 - c. Coordinate and administer the commissioning effort, through organization of all meetings, commissioning tests, demonstrations, and assisting with training events, described in the Contract Documents and in the commissioning plan.
 - d. Verify and spot check that pre-functional checklists and initial start-up has been performed and documented by the responsible mechanical, Electrical Subcontractors and their subcontractors.
 - e. Observe equipment and system start-up and testing. Ensure the results are documented (including a summary of deficiencies), and manufacturer / HVAC Subcontractor start-up forms are incorporated in the O&M manuals.
 - f. Attend the training sessions.
 - g. Prepare detailed verification and functional performance testing procedure data sheets.
 - h. Conduct verification testing.
 - i. Conduct functional performance testing.
 - j. Re-test if performance deficiencies are found, corrected, and additional testing is requested. Only one retest will be performed. If the issue still remains after the re-test the additional cost to re-test will be incurred by the responsible HVAC Subcontractor. See section 3.3 below for further details.
 - k. Review O&M manuals.
 - l. Perform functional performance testing to accommodate seasonal tests and incorporate the results into the commissioning report.
 - m. Prepare the final commissioning report.
 - n. Assemble the final project documentation which shall include the Commissioning report.
 - o. Perform 10 month warranty walkthrough
 - 3. Project Manager:
 - a. Assist the Commissioning Agent in establishing the commissioning plan and in maintaining the schedule of commissioning events.
 - b. Attend all commissioning coordination meetings scheduled by the Commissioning Agent.
 - c. Keep the Commissioning Agent apprised of the schedule of work so that the Commissioning Agent can update the commissioning plan as the project progresses.
 - d. Direct General, Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, as required to satisfactorily complete the commissioning process.
 - 4. General Contractor:
 - a. Attend all commissioning coordination meetings scheduled by the Commissioning Agent.
 - b. Direct the Mechanical, Electrical, Plumbing, Technology, and Building Envelope Subcontractors, as required to satisfactorily complete the commissioning process.
 - c. Oversee the installation and placing in service of all building equipment and systems.

- d. Oversee the performance and documentation of the pre-functional checklists by mechanical, electrical, plumbing, technology, and building envelope contractors, and their subcontractors prior to the beginning of commissioning verification and functional testing of the equipment.
- e. Respond to issues noted in the Commissioning Agent field and summary reports.
- 5. Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors:
 - a. Include cost to complete commissioning requirements for mechanical systems in the contract price.
 - b. Attend commissioning coordination meetings at the discretion of the Commissioning Agent.
 - c. Arrange for various subcontractors and equipment manufacturers to attend commissioning coordination meetings scheduled by the Commissioning Agent, as indicated herein and as required.
 - d. Furnish or arrange for all labor, materials, and special tools and equipment required for execution of the commissioning process.
 - e. Include requirements for submittal data, O&M data, training, and commissioning in each purchase order or sub-contract written.
 - f. Ensure cooperation and participation of specialty subcontractors such as sheet-metal, piping, refrigeration, water treatment, BAS/ATC, TAB, etc.
 - g. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
 - h. Coordinate and provide pre-functional checklist documentation per Section 01 91 13 and the Commissioning Plan as developed by the Commissioning Agent.
 - i. Assist the Commissioning Agent in performing all verification and functional performance tests.
 - j. Respond to issues noted in the Commissioning Agent field and summary reports.
 - k. Prepare a preliminary schedule for mechanical system orientation and inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, etc., and task completion for use by the Commissioning Agent. Update schedule as appropriate throughout the construction period.
 - l. Gather O&M data on all equipment, and assemble in binders as required by the specifications. Submit to Commissioning Agent prior to the completion of construction. O & M manuals are to be issued to the project team within 60 days of the submittals being approved.
 - m. Notify the Project Manager a minimum of 10 working days prior to start-up of each specific piece of equipment and system start-up, so that observation and testing can occur.
 - n. Participate in, and schedule subcontractors and manufacturers to participate in all training sessions as set up by the Commissioning Agent.
- 6. Testing, Adjusting, and Balancing (TAB) Subcontractor:
 - a. Include cost for commissioning requirements in the contract price.
 - b. Attend initial commissioning coordination meeting scheduled by the Commissioning Agent, and other commissioning coordination meetings, as requested.
 - c. Submit the TAB procedures to the Commissioning Agent for review and acceptance.
 - d. Attend a TAB review meeting scheduled by the Commissioning Agent. Be prepared to discuss the procedures that shall be followed in testing, adjusting and balancing the HVAC system.
 - e. At the completion of the TAB work, and submittal of final TAB report, notify the HVAC Subcontractor and Project Manager.
 - f. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the Commissioning Agent for verification or diagnostic purposes.
- 7. Building Automation System (BAS) Subcontractor:
 - a. Include cost for commissioning requirements in the contract price.
 - b. Attend initial Commissioning coordination meeting scheduled by the Commissioning Agent, and other commissioning coordination meetings as requested.
 - c. Review design for controllability with respect to selected manufacturers equipment;

- 1) Verify proper hardware specification exists for functional performance required by specification and sequence of operation.
 - 2) Verify proper safeties and interlocks are included in design.
 - 3) Verify proper sizing of control valves and actuators based on design pressure drops. Verify control valve ability to control coil properly.
 - 4) Verify proper sizing of control dampers.
 - 5) Verify proper selection of sensor ranges.
 - 6) Clarify all questions of operation.
- d. Provide the following information to the Commissioning Agent:
- 1) Narrative description of each control sequence for each piece of equipment controlled.
 - 2) Diagrams showing all control points, sensor locations, point names, actuators, controllers, etc.
 - 3) A list of all control points, including analog inputs, analog outputs, digital inputs, and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each standalone control unit.
 - 4) Hardware operation and maintenance manuals.
 - 5) Integrate installation and programming schedule with construction and commissioning schedules.
 - 6) Provide thorough training to operating personnel on hardware operations and programming, and the application program for the system.
 - 7) Perform pre-functional checklist of controls on equipment requiring control pre-functional checks.
 - 8) Demonstrate system performance to Commissioning Agent including all modes of system operation (e.g., normal occupied, normal unoccupied, abnormal, emergency).
 - 9) Provide control system technician and instrumentation for use during all system verification and functional performance testing.
 - 10) Provide system modifications as required.
 - 11) Provide support and coordination with TAB Trade on all interfaces between the ATC and TAB scopes of work. Provide all devices, such as portable operator's terminals, for TAB use in completing TAB procedures.
 - 12) Additional trend logs may be required to facilitate the commissioning process.
8. Equipment Suppliers and Miscellaneous Subcontractors:
- a. Include cost for commissioning requirements in the contract price.
 - b. Attend initial Commissioning coordination meeting scheduled by the Commissioning Agent, and commissioning coordination meetings as requested.
 - c. Provide appropriate O&M manual section(s).
 - d. Participate in appropriate training sessions as scheduled by the Commissioning Agent.
 - e. Demonstrate performance of equipment as applicable.
- 1.06 DOCUMENTATION
- A. The Commissioning Agent shall oversee and maintain the development of commissioning documentation. The commissioning documentation shall be kept in three ring binders, and organized by system and sub-system where practical. All pages shall be numbered, and a table of contents page(s) shall be provided. The Commissioning documentation shall include, but not be limited to, the following:
1. A detailed description of the design intent for the project, listing operating parameters, control sequences, occupancy conditions, etc. (provided by the design engineer).
 2. A complete description of how the HVAC, electrical, plumbing, and fire protection systems are intended to operate (provided by the design engineer).
 3. Approved test and balance report for the building being commissioned.
 4. All verification and functional performance test checklists/results, organized by system and sub-system.

PART 2 - PRODUCTS

2.01 SPECIAL TOOLS AND/OR PROPRIETARY TEST EQUIPMENT

- A. Special tools, proprietary test equipment, and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed.

PART 3 - EXECUTION

3.01 GENERAL

- A. A pre-construction meeting of all Commissioning team members shall be held at a time and place designated by the Owner's Project Manager. The purpose shall be to familiarize all parties with the commissioning process, and to ensure that the responsibilities of each party are clearly understood.
 - 1. Two additional "kick-off" meetings will also be held prior to the commissioning functional testing. The second meeting will "kick-off" the pre-functional checklists, initial start-up, and scheduling. The third "kick-off" meeting will be held to discuss and schedule the functional testing, acceptance, training, and turnover.
 - 2. Additional meetings will be scheduled by the Commissioning Agent as needed to facilitate the commissioning process.
- B. The Mechanical, Electrical, Plumbing, Technology, and Building Envelope Subcontractors shall complete all phases of work so the systems can be started, tested, balanced, and commissioning procedures undertaken. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, and change orders.
- C. Commissioning procedures may begin prior to completion of a system and/or sub-systems, and shall be coordinated with the Commissioning Agent. Start of commissioning procedures before system completion does not relieve the Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, from completing those systems as per the contract requirements.

3.02 PARTICIPATION IN ACCEPTANCE PROCEDURES

- A. The Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, shall provide skilled technicians to support startup, testing, and debugging all systems within their respective specification sections and divisions. These same technicians shall be made available as necessary to assist the Commissioning Agent in executing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Agent and coordinated by the Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors,
- B. System performance problems and discrepancies may require additional technician time, Commissioning Agent time, reconstruction of systems, and/or replacement of system components. The additional technician time shall be made available for subsequent commissioning periods until the required system performance is obtained.

3.03 DEFICIENCY RESOLUTION

- A. In some systems, maladjustments, misapplied equipment, and deficient performance under varying loads will result in additional work being required to re-commission the systems. This work will be completed under the direction of the Project Manager, with input from the Commissioning Agent and Design Engineer. All Commissioning Team members will have input and the opportunity to discuss the work and resolve problems.
- B. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Project Manager indicating the nature of the problem and expected steps to be taken.
- C. The cost for the Trade contractors to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM/GC.

- D. For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CxA will direct the retesting of the equipment once at no “charge” to the CM/GC for their time. However, the CxA’s and owner’s time for a second retest will be charged to the CM/GC, who may choose to recover costs from the responsible contractor or subcontractor. Before retesting occurs, the CM/GC will inspect the deficiency and respond to the CxA that the issue has been addressed.
 - E. The time for the CxA and owner to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the CM/GC, who may choose to recover costs from the party responsible for misinformation or deficiency.
 - F. The Trade Contractors shall respond in writing to the CxA and owner at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
 - G. Any required retesting by any Trade contractor shall not be considered a justified reason for a claim of delay or for a time extension by the CM/GC, contractors or subcontractors.
- 3.04 SEASONAL COMMISSIONING
- A. Seasonal commissioning pertains to testing close to full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Initial commissioning shall be done as soon as contract work is completed, regardless of season.
 - B. Heating equipment shall be tested during heating season. Cooling equipment shall be tested during cooling season with a normal level of building occupancy. Each HVAC Subcontractor and supplier shall be responsible to participate in the initial and the alternate peak season tests of the systems as required in order to demonstrate performance.
- 3.05 OPERATING AND MAINTENANCE (O&M) TRAINING
- A. Training: Comprehensive training of Owner's maintenance personnel shall be performed by the Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, with assistance and input from the Commissioning Agent, and where appropriate, by subcontractors, and equipment manufacturers.
 - 1. Training shall be on-site and/or at other mutually agreed to places. Training shall begin prior to turnover of building to the Owner, and shall continue for a reasonable period of time after turnover.
 - 2. It is anticipated that training will be provided in multiple sessions as noted in the project specifications. The quantity of sessions will be clarified in various equipment/systems project specifications.
 - 3. The training shall include hands-on O & M instruction on the installed equipment and systems to be provided by the various MEP and Building Envelope Subcontractors or their representatives. The training shall emphasize operating instructions, and preventive maintenance as described in the operation and maintenance (O&M) manuals. The O & M manuals can be reviewed during the training sessions with the training representative in greater detail as desired by the Owner. The training period shall include an onsite inspection, explanation, and review of the systems encompassed by the commissioning process and is to be delivered by the Trade Subcontractors.
 - 4. Training requirements are partially specified in this specification section, and further specified in other specification sections.
 - B. The Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the Commissioning Agent and the Owner.
 - C. The Mechanical, Electrical, Plumbing, Technology, and Building Envelope Contractors, shall provide, well before substantial completion, a proposed agenda and schedule for training for approval by the Commissioning Agent and the Owner.
 - D. Training shall include:
 - 1. Use of the printed installation, operation, and maintenance instruction material included in the O&M Manuals.

2. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include review of start-up, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
3. Discuss relevant health and safety issues and concerns.
4. Discuss warranties and guarantees.
5. Cover common troubleshooting problems and solutions.
6. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
7. Discuss any peculiarities of equipment installation or operation.
8. Any classroom sessions provided may include the use of overhead projections, slides, video and audio taped material as required by specifications.

3.06 START-UP, PRE-FUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned, according to Section 1.4, Scope of Work. Some systems that are not comprised so much of actual dynamic machinery may have very simplified PCs and startup.
1. General:
 - a. Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
 2. Start-up and Initial Checkout Plan:
 - a. The CxA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start up plans as required for all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for pre-functional checklists and startup are identified in the commissioning scoping meeting and the commissioning plan.
 - b. Checklists generated by the CxA are provided to the applicable Trade contractor for informational purposes.
 - c. The Trade Contractor responsible for the purchase of the equipment develops the full start up plan by combining (or adding to) the CxA's checklists with the manufacturer's detailed start up and checkout procedures from the O&M manual and the normally used field checkout sheets.
 - 1) The full start up plan could consist of something as simple as:
 - a) The CxA's pre-functional checklists.
 - b) The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
 - c) The manufacturer's normally used field checkout sheets.
 - d. The Trade contractor submits the full startup plan to the CxA for review and approval as required in the project specifications.
 - e. The CxA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.

3.07 DOCUMENTATION, FUNCTIONAL PERFORMANCE TESTING

- A. Documentation: The CxA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Project Manager and to the Subs for informational purposes. The CxA will include the filled out forms in the final commissioning report.
- B. Non-Conformance:
1. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the Project Manager on a standard noncompliance form.

2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
4. As tests progress and a deficiency is identified, the CxA will discuss the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - 1) The CxA documents the deficiency and the Subcontractor's response and intentions and they go on to another test or sequence. Subsequently, the Sub corrects the deficiency, notifies the Project Manager and Commissioning Agent that the equipment is ready to be retested. The Commissioning Agent then retests the deficient system/component and documents the results.
 - 2) This process is repeated until the discrepancy is appropriately resolved. See section 3.3 above with regards to re-testing more than one time and potential cost overruns.
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented with the Sub's response and a copy given to the Project Manager.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
 - 3) The CxA documents the resolution process.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, and notifies the Project Manager and the Commissioning Agent. The Commissioning Agent reschedules the test and the test is repeated until satisfactory performance is achieved.
5. The Trade Contractors shall respond in writing to the Commissioning Agent and Project Manager at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements, proposals for their resolution, and current status of completion.
6. The Commissioning Agent retains the original discrepancy documentation until the end of the project.

END OF SECTION