

SECTION 21 0800 - COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. General

1. Work under this contract shall meet the requirements of Division 01, General Requirements, Conditions of Contract, and Supplementary Conditions. This specification covers commissioning of the fire suppression system for the entire structure.
2. All labor and materials shall be furnished to complete commissioning of the fire suppression systems specified herein.

B. Commissioning work shall be organized and structured to verify that all fire suppression system and equipment have been properly designed and installed and function together correctly to meet OPR (Owner Project Requirements) and BOD (Basis of Design). Commissioning shall be in accordance with NFPA 3, Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems, 2012 edition.

C. The Commissioning Authority (CxA) retained by Owner shall have responsibility for coordinating and directing the required steps of the commissioning process.

D. Fire suppression system installation, start-up, testing, preparation of O&M Manuals, training shall be the responsibility of the fire suppression contractors. Oversight of the observation, coordination, verification, and commissioning shall be the responsibility of the CxA. The CxA process does not relieve the fire suppression contractors of obligation to complete all portions of the work in a satisfactory manner and ensure systems are fully operational.

E. Refer to Division 01, Section 01 9113, for a full list of commissioning related definitions. A few critical definitions are included below:

1. *Commissioning*. A systematic process that provides documented confirmation that specific and interconnected fire and life safety systems function according to the intended design criteria set forth in the project documents and satisfy the owner's operational needs, including compliance requirements of any applicable laws, regulations, codes, and standards requiring fire and life safety systems.
2. *Commissioning Authority (CxA)*. The qualified person, company, or agency that plans, coordinates, and oversees the entire Cx process.
3. *Commissioning Plan*. The document prepared for each project, which identifies the processes and procedures necessary for a successful Cx process.
4. *Commissioning Record*. The complete set of commissioning documentation for the project, which is turned over to the owner at the end of the construction phase.
5. *Functional Testing*. Tests performed to verify compliance with manufacturers' specifications, applicable codes and standards, and the project BOD and OPR.

F. The purpose of the commissioning is to verify the design intent, develop the OPR and BOD, to verify that the OPR and BOD are verified through testing, and to provide training.

- G. The Commissioning Team shall be made up of representatives from the Owner, Design Team, General Contractor (GC), manufacturers, and construction trades. The trades represented on the Commissioning Team shall include, but not be limited to: Mechanical (including sheet metal and piping), Integrated Automation, Electrical, Plumbing, Fire Suppression and other specialty trades as necessary; fitting, controls, test and balance, and electrical. The lead person for each trade who will actually perform or supervise the work is to be designated as the representative to the Commissioning Team. Responsibility for various steps of the Commissioning Process shall be divided among the members of the Commissioning Team, as described in this section.

1.2 RELATED SECTIONS

- A. Division 01 Section 01 9113 - General Commissioning Requirements
- B. Division 22 Section 22 0800 – Commissioning of Plumbing Systems
- C. Division 23 Section 23 0800 – Commissioning of HVAC Systems
- D. Division 25 Section 25 0800 – Commissioning of Integrated Automation
- E. Division 26 Section 26 0800 – Commissioning of Electrical Systems
- F. Individual Division 01, 21, 22, 23, 25, and 26 sections contain requirements related to the Commissioning Process.

1.3 QUALITY ASSURANCE

- A. The following references should be used to develop and implement the commissioning program as appropriate:
 - 1. NFPA 3, Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems.
 - 2. ASHRAE Guideline 0, The Commissioning Process.

1.4 ROLES AND RESPONSIBILITIES

- A. Refer to Section 01 9113 for Commissioning Authority, Owner, Architect, and General Contractor roles and responsibilities.
- B. Refer to Section 22 0800 for plumbing contractor roles and responsibilities.
- C. Refer to Section 23 0800 for mechanical contractor roles and responsibilities.
- D. Refer to Section 25 0800 for integrated automation contractor roles and responsibilities.
- E. Refer to Section 26 0800 for electrical contractor roles and responsibilities.
- F. Design Team
 - 1. Provide the Owners Project Requirements (OPR).
 - 2. Provide documentation of initial design concepts and Design Intent based on Owner's program.
 - 3. Provide fire suppression system design parameters and obtain approval of Owner.

4. Prepare contract documents incorporating Commissioning Specification requirements and description of the electrical systems.
5. The Design Team shall specify and verify adequate maintenance accessibility for each piece of equipment in shop drawings and the actual installation.
6. Periodic inspections as part of the Design Team's contract with the Architect and/or Owner.
7. Review and approve submittals.
8. Participate in commissioning meetings.
9. Review Pre-functional Checklists and Functional Performance Test procedures submitted by the Commissioning Authority.
10. Prepare punch lists.
11. Review as-built records as required by contract documents. Issue a report noting deficiencies requiring correction to the Commissioning Authority.
12. Review and comment on final commissioning report.

G. Fire Suppression Contractor

1. Include cost to complete commissioning requirements for fire suppression systems in the contract price.
2. Include requirements for submittal data, O&M data, and training in each purchase order or sub contract written.
3. Ensure cooperation and participation of all subcontractors.
4. The building fire suppression systems shall be installed, tested, commissioned, and maintained in accordance with commissioning process of NFPA 3, *Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems*.
5. Ensure participation of major equipment manufacturers in appropriate training and testing activities.
6. Attend Construction Phase coordination meeting scheduled by the Commissioning Authority.
7. Conduct fire suppression system orientation and inspection when equipment is set.
8. Respond to (in writing) and address items documented in the Contractor Commissioning Issues Log.
9. Notify the GC a minimum of two weeks in advance of system start-up and testing, so CxA may be on site to witness.
10. Submit copies of all test results to the CxA.
11. Complete Pre-Functional Checklists for all equipment.
 - a. If no other system is agreed upon by Commissioning Team, Fire Suppression Contractor shall be responsible for completion of Pre-Functional Checklists for all equipment for which it issued a purchase order.
 - b. Fire Suppression Contractor shall coordinate completion of Pre-Functional Checklists with all other contractors that have made connections to equipment for which it issued a purchase order.
 - c. Remedy any deficiencies identified in Pre-Functional Checklists and notify CxA in writing that deficiencies have been addressed.
12. Assist the Commissioning Authority in all Pre-Functional Checklist verifications, Functional Performance Tests, and Integrated Systems testing.
13. Prepare preliminary schedule for fire suppression system orientation and inspections, O&M manual submission, training sessions, pipe system testing, flushing and cleaning, equipment start up, and task completion for use by the GC and Commissioning Authority. Update schedule as appropriate throughout the construction period.
14. Develop an individual system test plan, including acceptance and integrated testing.
15. Conduct Integrated System testing. Demonstrate the performance of the systems, including integration.

16. Keep drawings updated as changes in the field are made, and review with the GC and Commissioning Authority.
17. Gather O&M data on all equipment, and assemble in binders as required by the Commissioning Specification. Submit to GC for review prior to the completion of construction. Submit in digital media/electronic format (flash drive, CD, DVD).
18. Submit training syllabus for approval to Commissioning Authority.
19. Participate in, and schedule vendors and Contractors to participate in the training sessions as set up by the GC. Provide site-specific training information on digital media/electronic format (flash drive, CD, DVD). If training is videotaped, provide on digital media/electronic format (flash drive, CD, DVD).
20. Provide written notification to the General Contractor and Commissioning Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-systems are functioning as required.
 - a. Fire Alarm Notification Panel
 - b. Remote Fire Alarm Notification Panel
 - c. Smoke Control Systems
 - d. Automatic Sprinkler Systems
 - e. Standpipe and Hose Systems
 - f. Water Spray Fixed Systems
 - g. Water Mist Systems
 - h. Foam Systems
 - i. Water Tanks
 - j. Private Fire Service Mains
 - k. Chemical Fire Protections Systems
 - l. Explosion Prevention Systems
 - m. Smoke Detectors
 - n. Carbon Monoxide Detectors
 - o. Duct Mounted Smoke Detectors
 - p. Wet-Pipe Sprinkler System
 - q. Dry-Pipe Sprinkler System
 - r. Fire Pump
 - s. Jockey Pump
 - t. Control valves, fittings, fire stops, and any other materials or equipment required in the system.
21. Provide a complete set of as-built records to the GC. Hard Copy and Electronic Format (Flash Drive, CD, DVD, etc....) are required.

H. Equipment Manufacturers and Miscellaneous Contractors

1. Include cost for commissioning requirements in the contract price.
2. Provide submittals, and appropriate O&M manual section(s).
3. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
4. Participate in training sessions as scheduled by the GC.
5. Demonstrate performance of equipment as applicable.

1.5 SCOPE OF WORK

A. Commissioning work of Division 21 shall include, but not be limited to:

1. Testing and start-up of the equipment.
2. Completion of Pre-Functional Checklists.

3. Cooperation with the Commissioning Authority.
 4. Providing qualified personnel for participation in commissioning tests.
 5. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the Commissioning Process.
 6. Providing operation and maintenance manuals and as-built drawings to the Commissioning Authority for verification.
 7. Providing training and demonstrations for the systems specified in this Division.
- B. The work included in the Commissioning Process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:
- a. Fire Alarm Notification Panel
 - b. Remote Fire Alarm Notification Panel
 - c. Smoke Control Systems
 - d. Stair pressurization systems
 - e. Smoke proof enclosure ventilation systems
 - f. Fire suppression system controllers
 - g. Automatic Sprinkler Systems
 - h. Standpipe and Hose Systems
 - i. Water Spray Fixed Systems
 - j. Water Mist Systems
 - k. Foam Systems
 - l. Water Tanks
 - m. Private Fire Service Mains
 - n. Chemical Fire Protections Systems
 - o. Explosion Prevention Systems
 - p. Smoke Detectors
 - q. Carbon Monoxide Detectors
 - r. Duct Mounted Smoke Detectors
 - s. Wet-Pipe Sprinkler System
 - t. Dry-Pipe Sprinkler System
 - u. Fire Pump
 - v. Jockey Pump
 - w. Meter and Gauges
 - x. Control valves, fittings, fire stops, and any other materials or equipment required in the system.
- C. Timely and accurate documentation is essential for the Commissioning Process to be effective. Documentation required as part of the Commissioning Process shall include but not be limited to:
1. Commissioning Process Reports, which may include the following:
 - a. Commissioning Field Reports
 - b. Design Team Issues Log
 - c. Contractor Commissioning Issues Log
 - d. Meeting Minutes
 2. Pre-start, and start-up procedures
 3. Pre-Functional Checklists
 4. Functional Performance Tests
 5. Integrated System Testing
 6. Training agenda and materials
 7. As-built records

8. Final commissioning report
9. Operation and maintenance (O&M) manuals

D. Detailed testing may be performed on all installed equipment and systems to ensure that operation and performance conform to contract documents. All tests shall be witnessed by the Commissioning Authority. The following testing is required as part of the Commissioning process:

1. Pre-Functional Checklists (PFC) are 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. Verification is completed by the Division 21, 22, 23, 25, and 26 contractors and documented using Pre-Functional Checklists.
2. Functional Performance Tests (FPT) shall determine if the fire suppression system is operating in accordance with the design intent. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions.
3. Integrated System Testing shall verify the interconnections between the life safety and fire suppression systems function properly.

E. Comprehensive training of O&M personnel shall be performed by the Fire Suppression Contractor, and where appropriate, by other sub-contractors, and vendors prior to turnover of building to the owner. The training shall include classroom instruction, along with hands-on instruction on the installed equipment and systems. Training shall be recorded on digital media.

F. Submission of a digital copy of site-specific software for fire suppression and life safety systems that is current with the installed system.

1.6 DOCUMENTATION

A. The Commissioning Authority shall oversee and maintain the development of the document process. The GC shall facilitate project documentation through the web-based commissioning software. The commissioning documentation shall include, but not be limited to, the following:

1. Commissioning Plan
2. Commissioning Schedule
3. Document Request Log
4. Commissioning RFIs
5. Commissioning Field Reports on the WCxS
6. Design Team Issues Log on the WCxS
7. Contractor Commissioning Issues Log on the WCxS
8. Pre-Functional Checklists on the WCxS
9. Inspection Test Reports
10. Functional Testing
11. Integrated System Testing

B. See 01 9113 for additional information on the commissioning documentation.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. The appropriate Contractor(s) shall furnish all special tools and equipment required for testing during the commissioning process. A list of all tools and equipment to be used during commissioning shall be submitted to the Commissioning Authority for approval. All the test equipment to be utilized shall be calibrated as per National Fire Protection Agency (NFPA) and written manufacturer recommendations. The owner shall furnish necessary utilities for the Commissioning Process.

2.2 TEST EQUIPMENT – PROPRIETARY

- A. 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. Proprietary test equipment (and software) shall become the property of the owner upon completion of the Commissioning Process.

PART 3 - EXECUTION

3.1 GENERAL

- A. A pre-construction meeting of all Commissioning Team members shall be held at a time and place designated by the owner. The purpose shall be to familiarize all parties with the Commissioning Process, and to ensure that the responsibilities of each party are clearly understood.
- B. The Contractor 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 including pipe, fittings, pipe supports, valves, and controls as indicated on the contract documents, and implementing all corrective actions, clarifications, and change orders.
- C. A Commissioning Plan shall be developed by the Commissioning Authority. The Contractor shall assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation. If contractor-initiated system changes have been made that alter the Commissioning Process, the Commissioning Authority shall notify the Owner.
- D. Acceptance procedures are normally intended to begin prior to completion of a system and/or sub-systems, and shall be coordinated by fire suppression contractor. Start of acceptance procedures before system completion does not relieve the contractor from completing those systems as per the schedule.

3.2 PARTICIPATION IN COMMISSIONING

- A. The Contractor shall provide skilled technicians to start-up and debug all systems within Division 21. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program. Work schedules, time required for testing, etc., shall be requested by the Commissioning Authority and coordinated by the contractor. Contractor shall ensure that the qualified technician(s) are available and present during the agreed upon

schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

- B. System performance problems and discrepancies may require additional technician time, CxA 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.
- C. The CxA reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians shall include expert knowledge relative to the specific equipment involved and a willingness to work with the CxA. Contractor shall provide adequate documentation and tools to start up and test the equipment, system, and/or sub-system.

3.3 DEFICIENCY RESOLUTION

- A. In some systems, maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the Owner, with input from the contractor, equipment manufacturer, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Owner shall make final determination over any additional required work to achieve performance.
- B. Corrective work shall be completed in a timely fashion to permit the completion of the Commissioning Process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the Commissioning Process, the Commissioning Authority shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.
- C. The Owner's contract with the Commissioning Authority includes one (1) Functional Performance Tests and one (1) retest for each piece of equipment or system included in the commissioning scope. Commissioning Authority time and expenses required for retests beyond two, if required, due to incomplete installation or otherwise, will be paid by the Owner and reimbursed by the contractor.
- D. The Owner's contract with the Commissioning Authority includes one (1) Integrated System Testing and one (1) retest included in the commissioning scope. Commissioning Authority time and expenses required beyond one (1) retest, if required, due to incomplete installation or otherwise, will be paid by the Owner and reimbursed by the contractor.

3.4 ADDITIONAL COMMISSIONING

- A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The contractor(s), manufacturers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their contractual obligations.

3.5 CONSTRUCTION PHASE OBSERVATION

A. Scope of Construction Phase Observation

1. The Commissioning Authority will conduct periodic observations during the Construction Phase to monitor progress and compliance with the design intent and contract documents. It is the responsibility of the contractor to address the issues noted on the Issues Log and notify Commissioning Authority of completion.
2. Commissioning Authority observations will coincide with Design Team observations and are not intended to take the place of this work.

B. Documentation and Reporting

1. Issues identified by the Commissioning Authority during Construction Phase will be documented on the Contractor Commissioning Issues Log and distributed to Commissioning Team members.
2. Progress during the Construction Phase will also be documented by the Commissioning Authority using Commissioning Process Reports.

3.6 ACCEPTANCE PROCEDURES

A. Pre-functional Checklists

1. Scope of Pre-functional Checklists

- a. Tests and verifications included in the Pre-functional Checklists shall determine if all components, equipment, systems, and interfaces between systems are installed and are ready to operate in accordance with contract documents.

2. Documentation and Reporting Requirements

- a. Pre-Functional Checklists shall be provided for each component, piece of equipment, system, and sub-system, including all interfaces, interlocks, etc. Each item to be tested shall have a different entry line with space provided for comments. The checklists will include spaces for each party to sign off on.
- b. The checklist shall equipment characteristics and the installation status of the component or system.
- c. The commissioning authority shall review and approve the completed checklist before scheduling functional performance testing.
- d. Completed checklists shall be submitted to the Commissioning Authority for acceptance and inclusion in the commissioning report.

3. Acceptance of Pre-Functional Checklists

- a. The Commissioning Authority will select, at random, 10 percent of the checklists for verification.
- b. If 10 percent or more of the checklists are found to be inaccurate for each system or equipment type, all of the checklists for that system or equipment type will be rejected. Complete, accurate checklists will need to be resubmitted.

B. Functional Testing

1. Scope of Functional Testing

- a. Individual system functional operation and acceptance as required in applicable NFPA standards or AHJ installation standards tests.

2. Submittals

- a. Detailed procedures for each series of tests will be developed by the Commissioning Authority for review and acceptance by the GC and Owner. The procedures shall include samples of the data sheets that will be part of the reports.

3. Functional Test Procedures

- a. Shall verify the intended operation of components and systems as required by manufacturer installation, codes, standards, and project specifications.

4. Documentation and Reporting Requirements

- a. All measured data, data sheets, and a comprehensive summary, describing the operation of the fire suppression system at the time of testing shall be submitted to the Commissioning Authority.
- b. A preliminary functional test report shall be prepared by the Commissioning Authority and submitted to the Design Team for review. Any identified deficiencies need to be evaluated by the Design Team and General Contractor to determine if they are part of the contractor's or sub-contractor's contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s), and the specific Functional Performance Test repeated.
- c. If it is determined that the fire suppression system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the Owner must decide whether any required modifications needed to bring the performance of the fire suppression system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the owner shall determine if a portion or all required Functional Performance Tests should be repeated, and a revised report submitted.

C. Integrated System Testing

1. Scope of Integrated System Testing

- a. Verification of completeness and integrity of building construction
- b. Integrated System Testing should demonstrate that the final integrated system installation complies with the specific design objectives for the project and applicable codes and standards.
- c. Integrated System Testing should verify the interconnections between fire suppression and life safety systems function properly.
- d. Written documentation of the testing is required.
- e. Switch connections to fire alarms should be tested in accordance with NFPA 72, National Fire Alarm and Signaling Code.
- f. Control circuits requiring electrical power shall be tested for presence of operating voltage.

- g. Loss of power to monitored circuits should be tested to confirm signal receipt at one of the following:
 - 1) A constantly attended location at the premises
 - 2) A monitoring station as described in NFPA 731, Standard for Installation of Electronic Premises Security Systems, Chapter 9
 - 3) A supervising station as described in NFPA 72, National Fire Alarm and Signaling Code.

- h. Integrated testing of data sharing systems should document the following:
 - 1) Completion of acceptance testing for each component system
 - 2) Verification of data transfer between component systems
 - 3) Test of visual and audible signal upon loss of communication
 - 4) Test of degrade mode for each component system
 - 5) Proper function of integrated data sharing systems

- i. The following is a list of subsystems that will be interconnected in the integrated system for the project:
 - 1) Fire alarm system
 - 2) Emergency communication systems
 - 3) Building automation management system
 - 4) Means of egress systems and components
 - 5) Heating, ventilating, and air conditioning (HVAC) system
 - 6) Gas detection system
 - 7) Normal, emergency, and standby power systems
 - 8) Automatic sprinkler systems
 - 9) Fixed fire suppression and control systems
 - 10) Automatic operating doors and closures
 - 11) Smoke control and management systems
 - 12) Explosion prevention and control systems
 - 13) Elevator and pedestrian movement systems
 - 14) Security systems
 - 15) Commercial cooking operations

- 2. Submittals
 - a. Detailed procedures for each series of tests will be developed by the Commissioning Authority for review and acceptance by the GC and Owner. The procedures shall include samples of the data sheets that will be part of the reports.

- 3. Integrated System Test Procedures
 - a. The Commissioning Authority shall witness the Integrated System Test.
 - 1) Set the system equipment (i.e. water heater, pumps, ejectors, etc.) into the operating mode to be tested (i.e. normal shut-down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
 - 2) If during a test an operating deficiency is observed, appropriate comments will be added to the Test Procedure form and the Issues Log.

- b. If deficiencies are identified during Integrated System Testing, the General Contractor will be notified and action taken to remedy the deficiency. The final Integrated System Testing Procedure forms will be reviewed by the Commissioning Authority to determine if testing is complete and the system is functioning in accordance with the contract documents.
4. Documentation and Reporting Requirements
 - a. All measured data, data sheets, and a comprehensive summary, describing the operation of the plumbing system at the time of testing shall be submitted to the Commissioning Authority.
 - b. A preliminary Integrated System Test report shall be prepared by the Commissioning Authority and submitted to the Design Team for review. Any identified deficiencies need to be evaluated by the Design Team and General Contractor to determine if they are part of the contractor's or sub-contractor's contractual obligations. Construction deficiencies shall be corrected by the responsible contractor(s), and the specific Functional Performance Test repeated.
 - c. If it is determined that the fire suppression system is constructed in accordance with the contract documents, and the performance deficiencies are not part of the contract documents, the Owner must decide whether any required modifications needed to bring the performance of the Fire suppression system up to the finalized design intent shall be implemented, or if the test shall be accepted as submitted. If corrective work is performed, the owner shall determine if a portion or all required Functional Performance Tests should be repeated, and a revised report submitted.

3.7 SYSTEMS MANUAL:

- A. The Systems Manual shall be submitted in paper AND/OR electronic format and shall contain the following major sections:
 1. System Descriptions:
 - a. Title sheet including the complete name and address of the project and the complete name and address of the installing contractor (including telephone number for emergency service)
 - b. Complete table of contents
 - c. System design intent documentation
 - d. Complete list of equipment
 - e. List of equipment suppliers and/or manufacturers
 - f. Operation and maintenance instructions for major components
 - g. Inspection and test reports
 - h. Recommend spare parts
 - i. Riser diagrams or schematic drawings
 - j. "As-built" drawings and calculations
 - k. Fire Alarm System Record of Completion.
 - l. Point to Point Wiring Diagrams
 - m. Individual Device Interconnection Drawings
 - n. Copy of Original Equipment Submittals
 - o. Manufacturer's Proper Testing and Maintenance Requirements
 - p. Warranty
 - q. Other special requirements of the installation specification or installation such as valve tags and charts, hydraulic data nameplate information (for sprinkler systems)

3.8 SYSTEMS TRAINING:

- A. Submit Training Syllabus to Commissioning Authority for approval. Training syllabus shall be submitted a minimum of fourteen (14) business days prior to intended training date(s). Training shall not occur until training syllabus has been approved and all Commissioning Authority comments have been addressed and agreed by the Commissioning Authority. Any training sessions occurring not complying with above statements will not be consider complying with training requirements.
- B. Record site-specific training sessions on digital media/electronic format (flash drive, CD, DVD). Training sessions recorded shall be clearly audible, properly camera framed, and camera supported (tripod). Training session's not audible, inconsistent and distracting camera movement or other issues will have to be redone at contractor cost. Commissioning Authority has final approval of the quality of recorded digital media. Generic training videotapes can be submitted as supplementary and supporting education materials but cannot be submitted as the required primary site-specific training session.
- C. The Fire Suppression Contractor, and appropriate sub-contractors, shall provide comprehensive systems instruction on building systems prior to delivery. The instruction shall include classroom instruction delivered by competent instructors based upon the contents of the Systems Manual. Emphasis shall be placed upon overall systems diagrams and descriptions, and how system components interact. The classroom instruction shall also include detailed equipment instruction by qualified manufacturer's representatives for which operating instructions are provided. The manufacturer's representative training shall emphasize operating instructions and preventive maintenance as described in the Systems Manual. At a minimum, the training sessions shall cover the following items:
1. Types of installed systems
 2. Theory of operation
 - a. Design intent
 - b. Emergency conditions and procedures
 - c. Comfort conditions
 - d. Energy efficiency
 - e. Other issues important to facility operation
 3. System operations
 4. Use of control system
 - a. Sequence of operation
 - b. Problem indicators
 - c. Diagnostics
 - d. Corrective actions
 5. Service, maintenance, diagnostics and repair
 6. Use of reports and logs
 7. Troubleshooting, investigation of malfunctions, and determining reasons for the problem
- D. Each classroom training period shall be followed by an inspection, explanation, and demonstration of the system by the instructors. The applicable equipment shall be demonstrated including system startup and shutdown, with the exception of sprinkler systems.
- E. The contractor shall be responsible for organizing, arranging, and delivering this instruction in an efficient and effective manner on a schedule agreeable to the Owner.

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FOR: _____

ISSUED: 03/29/2017

- F. The contractor shall provide, at or before substantial completion, a proposed agenda and schedule of the above training for approval by the Commissioning Authority and the Owner.

END OF SECTION