SECTION 019100

GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 220800 Commissioning of Plumbing

B. Section 230800 Commissioning of HVAC

C. Section 260800 Commissioning of Electrical

D. Section 280800 Commissioning of Electronic Safety and Security

1.2 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned. For the remainder of commissioning requirements refer to the specific technical specifications.

B. The commissioning activities have been developed to support Owner and CA Energy Code, CalGreen, requirements.

1.3 SYSTEMS TO BE COMMISSIONED

A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's Operation and Maintenance personnel, is required in cooperation with the Owner and the Commissioning Agent.

B. The following systems will be commissioned as part of this project. For details on commissioning of equipment and sub-elements refer to the appropriate technical sections.

SYSTEMS TO BE COMMISSIONED	
Division 07 – Envelope	
Glazing	Space Pressurization
Whole Building Air Tightness Test	Hose Nozzle Test
Roof Flood Test	
Division 22 – Plumbing	
Domestic Hot Water System	Cold Water Emergency Supply Tank
Division 23 – HVAC	
Make-Up Air Unit	Packaged Rooftop Unit
Exhaust Fans	Air-Cooled Condenser
Terminal Units	
Division 26 - Electrical	
Photovoltaic System / Solar Ready Features	Electrical Distribution
Transformer	Emergency Generator
Switchboards	Automatic Transfer Switch
Panelboards	Circuit Breakers
Normal Power Outlets	Emergency Power Outlets

SYSTEMS TO BE COMMISSIONED	
Lighting Controls	
System Integration	
Public Address	Security
Nurse Call	Phone
Access Control	

1.4 REFERENCES

A. California Code of Regulations:
   1. Title 24, Part 11, 2022, California Green Building Standards Code, Section 5.4.10.2 Commissioning
   2. Title 24, Part 6, 2022, Building Energy Efficiency Standards, Section 10-103 and Section 120.8-Building Commissioning

1.5 DEFINITIONS

A. **Back Check:** A back check is a verification that an agreed-upon solution to a commissioning issue has been adequately addressed in a commissioning review.

B. **Basis of Design (BOD):** The Engineer's Basis of Design is comprised of two components: the Design Criteria and the Design Narrative, these documents record the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines.

C. **Commissioning Agent (CxA):** The qualified Commissioning Professional who administers the Cx process by managing the Cx team and overseeing the Commissioning Process. Where CxA is used in this specification it means the Commissioning Agent, members of his staff or appointed members of the commissioning team.

D. **Design Review:** The commissioning design review is a collaborative review of the design professional's design documents for items pertaining to the following: owner's project requirements; basis of design; operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems' sequence of operations including building automation system features; commissioning specifications and the ability to functionally test the systems.

E. **Commissioning Issue:** A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components.

F. **Contractor's Commissioning Coordinator (CxC):** A qualified individual appointed by the Contractor to manage the commissioning process on behalf of the Contractor.

G. **Commissioning Plan:** A document prepared and maintained by the CxA that outlines the commissioning process, commissioning scope and defines responsibilities, processes, schedules, and the documentation requirements of the Commissioning Process.

H. **Commissioning Report:** The final commissioning document which presents the commissioning process results for the project. Cx reports include an executive summary, the commissioning plan, issue log, correspondence, and all appropriate check sheets and test forms.

I. **Commissioning Representative (CxR):** An individual appointed by a sub- contractor to manage the commissioning process on behalf of the sub- contractor

J. **Construction Phase Commissioning:** All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

K. **Data Logging:** The monitoring and recording of temperature, flow, current, status, pressure, etc. of equipment using data recorders. Recorders may be temporary or permanent.

L. **Deferred System Test:** Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing during the normal acceptance testing period.

M. **Deficiency:** See “Commissioning Issue”.

N. **Design Intent:** The overall term that includes the OPR, the BOD and the Construction Documents. It is a detailed explanation of the ideas, concepts, and criteria for the foundation of the project design. The design intent documents are utilized to provide a written record of these ideas, concepts and criteria.

O. **Design Narrative:** A written description of the proposed design solutions that satisfy the requirements of the OPR.

P. **Design Phase Commissioning:** All commissioning tasks executed during the design phase of the project.

Q. **Functional Performance Test (FPT):** A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

R. **Installation Verification:** Observations that confirm the system or component has been installed in accordance with the contract documents and to industry-accepted best practices.

S. **Issues Log:** A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

T. **Owner’s Project Requirements (OPR):** A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

U. **System Verification Checklist (SVC):** A form generated by the CxA and executed by the contractor to verify that Commissioned Systems and Components are onsite, correctly installed, Started Up, calibrated, functional and ready for Functional Performance Testing and FPT Demonstration.

V. **System Verification:** A verification or test that is done before functional testing. SVC include installation verification and system and component start up tests.

W. **Site Observation Visit:** On-site observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

X. **Special System Inspections:** Inspections required by a local code authority prior to occupancy and are not a part of the commissioning process.

Y. **Start Up Tests:** Tests that validate the component or system is ready for automatic operation in accordance with the manufactures requirements.

Z. **Systems Manual:** A system-focused composite document that includes all information required for the owner's operators to operate the systems.

AA. **Training Plan:** A written document that details, in outline form the expectations of the operator training. Training agendas should include instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

BB. **Trending:** Monitoring over a period of time with the building automation system.

1.6 DESCRIPTION OF COMMISSIONING

A. This Section 019100 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.

B. Commissioning is a systematic process of verifying that the building systems perform as required by the Construction Documents and the Owner's operational needs. The commissioning process shall encompass and coordinate the system documentation, system verification, equipment startup, control system calibration & startup, testing and balancing, functional performance testing and training. Commissioning during the construction and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:
   1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.
   2. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
   3. Test, Verify and document proper dynamic functional performance of equipment and systems.
   4. Verify that Operations & Maintenance documentation is complete.
   5. Verify that the Owner'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 the successful achievement of the commissioning objectives listed above.

C. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in other technical sections of these specifications are intended to be provided in addition to and coordinated with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

D. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the Owner and the Commissioning Agent to be indexed for future reference.

E. Training or educational services for Owner are required and specified in other sections of the specifications, including but not limited to Division 7, Division 8, Division 22, Division 23, Division 26, and Division 28 series sections of the specification. The CxA will verify assist with coordination of these training, verify that the proposed content meets Owner needs and project requirements, and verify that the required training products are produced and provided.

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

1.7 COMMISSIONING PROCESS

A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating the scheduling of commissioning tasks with the Owner and the Contractor.

B. The Contractor shall be responsible for executing commissioning tasks as required by this specification.

C. The Contractor shall incorporate Commissioning tasks within the Master Construction Schedule.

D. Within 30 days of contract award, the Contractor shall designate a specific individual as the Contractor's Commissioning Coordinator (CxC) to manage and lead the commissioning effort on behalf of the Contractor. The CxC shall be the single point of contact and communications for all commissioning related services by the Contractor.

E. Within 45 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CxR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

F. Unless otherwise noted in the trade specific commissioning specification sections, the general commissioning process is as follows.

G. The following activities are a summary of the required Commissioning Process.

COMMISSIONING PROCESS		
ACTIVITY	Responsible Party	Description
COMMISSIONING PLAN	CxA	The document that specifies the project specific commissioning process, commissioning scope commissioning team responsibilities, schedules, and documentation requirements of the Commissioning Process.
SUBMITTAL REVIEW	CxA	Contractor Provides Submittals to the CxA concurrently with the Design Professionals. CxA reviews and provides comments.
SYSTEM VERIFICATION CHECKLISTS (SVC)	Authored by CxA Completed by Contractor	SVC forms are generated by the CxA and executed by the contractor to verify that Commissioned Systems are installed, started up, functional and ready for FPT.
START-UP VERIFICATION	Installing Contractor	CxA to verify that the startup activities specified in the contract documents have been executed and deficiencies corrected. Contractor to provide startup forms & reports to CxA for review & comment.

T-24 ACCEPTANCE TESTING VERIFICATION	Contractor	Contractor to provide completed CA Energy Code Certificates of Installation (NRCC-CI) and Certificates of Acceptance (NRCC-CA) form to CxA for review and comment. Design Professional to document which forms are required. Contractor to conduct testing and complete forms.
FUNCTIONAL PERFORMANCE TEST (FPT)	Authored by CxA Executed by Contractor	CxA to author FPT forms. Contractor to conduct physical testing of 100% of commissioned systems following the written protocol and provide the results to the CxA. Contractor to correct any issues or deficiencies.
FUNCTIONAL PERFORMANCE TEST (FPT) DEMONSTRATION	Directed by CxA Executed by Contractor	Contractor to demonstrate operation of a sample of commissioned systems in the presence of the CxA. CxA to direct the demonstration in accordance with the FPT forms. CxA to document demonstration results on the FPT forms.
TREND REVIEW	Trend Collection and Plotting by Contractor Review by CxA	CxA to review commissioned system operation over time by reviewing data logged by the building automation system. Contractor to provide data for CxA review.
SYSTEMS MANUAL	Supporting Docs by Contractor Manual by CxA	Compilation and writing of the Systems manual by CxA. Contractor to provided specified supporting documents
AS BUILT DRAWING VERIFICATION	As Built Drawings by Contractor Verification by CxA	Contractor Provides As Built drawings to the CxA concurrently with the Design Professionals. CxA reviews and provides comments.
TRAINING VERIFICATION	Training by Contractor Verification by CxA	Contractor to provide records of training conducted to CxA for their verification.
COMMISSIONING REPORTING	CxA	Reports on Cx activity and results prepared by the CxA
SEASONAL/DEFERRED TESTING	Directed by CxA Executed by Contractor	Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing will be rescheduled to occur at a more appropriate time during the warranty period. Scheduling/Coordination by the CxA. Contractor to support testing requirements per FPT requirements.

1.8 COMMISSIONING TEAM

A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Owner and Commissioning Agent.

B. Members Appointed by Contractor:
   1. Contractor' Commissioning Coordinator (CxC): Within 30 days of contract award, the Contractor shall designate a specific individual as the Contractor's Commissioning Coordinator (CxC) to manage and lead the commissioning effort on behalf of the Contractor. The CxC shall be the single point of contact and communications for all commissioning related services by the Contractor. The CxC shall meet the Quality Assurance reequipments as specified elsewhere in this section. .
   2. Contractor's Commissioning Representative(s) (CxR): Within 45 days of contract award, the contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CxR) to be responsible for commissioning related tasks. The CxRs shall meet the Quality Assurace reequipments as specified elsewhere in this section. The contractor shall ensure the designated CxRs participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all CxRs shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

C. Members Appointed by Owner:
   1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process.
   2. User: Representatives of the facility user and operation and maintenance personnel.
   3. Operation and Maintenance Personnel – representatives of the facility Operations and Maintenance staff.
   4. A/E: Representative of the Architect and engineering design professionals.

1.9 RESPONSIBILITIES

A. General: The commissioning Team and all others involved in the commissioning process shall follow the Cx Plan, attend the commissioning meetings, and execute building commissioning as specified by the Contract Documents and directed by the CxA.

B. Owner's Commissioning Responsibilities
   1. Appoint an individual, company or firm to act as the Commissioning Agent.
   2. Assign O&M Personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
      a. Coordination meetings.
      b. Training in operation and maintenance of systems, subsystems, and equipment.
      c. Testing meetings.
      d. Witness and assist in Systems Functional Performance Testing.
      e. Demonstration of operation of systems, subsystems, and equipment.
   3. Provide the Construction Documents, prepared by Architect and approved by Owner, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

C. Contractor's Responsibilities
   1. The Contractor shall assign a Commissioning Coordinator to manage commissioning activities of the Contractor, and subcontractors.

2. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.
3. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities
4. The Contractor shall incorporate Commissioning tasks, within the Master Construction Schedule to coordinate and facilitate the commissioning work performed by the Trade Subcontractors.
5. Notify the CxA of field Commissioning Activity so that the CxA may observe. Unless specified otherwise a minimum of 3 working days notification shall be provided
6. Review & Comment then accept and execute the Cx Plan prepared by the CxA.
7. Using the SVC, Startup, and FPT forms, document and certify the commissioned systems are installed, started, and functionally tested and operational.
8. Ensure completion of the California Title 24, Part 6, Certificate of Acceptance forms
9. Implement corrective action for issues identified on the Cx Log. Collaborate with Trade Subcontractors and to recommend and implement corrective actions. Assure resolution of all Cx issues.
10. Prepare then execute the Training Plan for training of Owner's operating personnel and building users.
11. Provide documentation required to complete the Commissioning Reports and Systems Manuals
12. Provide for Post Occupancy and Seasonal Testing as required by this section.

D. Commissioning Agent's Responsibilities
   1. Organize and lead the commissioning team
   2. Prepare the Commissioning Plan.
   3. Manage the Cx Process: The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating & scheduling of commissioning tasks with the Owner and the Contractor.
   4. Submittal Review: Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.
   5. Schedule & Conduct Commissioning Meetings
      a. Kickoff Meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for the Commissioning Process
      b. Additional Commissioning Meetings: Schedule and conduct additional meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute meeting minutes.
   6. Commissioning Observations: Observe construction and report progress, observations, and issues related to the Commissioned Systems..
   7. System Verification Checklists:
      a. Prepare project-specific System Verification Checklists and distribute to Cx Team.
      b. Verify satisfactory completion of selected SVC by Contractor.
   8. Start Up: Witness selected systems startups.
   9. Functional Performance Test:
      a. Prepare Project-specific FPT scripts and distribute to Cx Team.
      b. Coordinate systems Functional Performance Testing schedule with the Contractor.
      c. Witness and document Functional Performance Testing Demonstration.
   10. Commissioning Report: Assemble the commissioning documents and prepare the Commissioning Report

11. Test and Balance- Verify satisfactory completion of the TAB activity.
12. O&M Verification: Review and comment on operation and maintenance (O&M) documentation and for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 010000 GENERAL REQUIREMENTS.
13. Training Verification: Review training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.
14. Prepare, maintain, and distribute the Cx Issues Log.
15. Schedule and direct Seasonal or Deferred Testing.
16. Assemble the final commissioning documentation, including the Final Commissioning Report and any necessary addendums to the Final Commissioning Report.

1.10 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

A. Commissioning Coordinator (CxC) Assignment and Qualifications. The contractor shall submit the qualifications and resume for proposed person to be assigned as the project CxC, with responsibilities and minimum experience outlined in the Quality Assurance section.

B. Commissioning Representative (CxR) Assignment and Qualifications. The contractor shall submit the qualifications and resume for proposed persons to be assigned as the project CxRs, with responsibilities and minimum experience outlined in the Quality Assurance section.

C. Submittal Review:
   1. The CxA shall provide a list of submittals relevant to the Cx Process to the contractor.
   2. The contractor shall provide the indicated submittals to the CxA for review concurrently with the Design Professionals
   3. The CxA shall review selected submittals and provide review comments.

D. Look-Ahead Commissioning Schedule:
   1. Submit look-ahead schedule(s) per the “Schedule” requirements of this section.

E. Training Plan:
   1. The contractor shall submit a comprehensive Training Plan.
   2. Full requirements for the Training Plan are specified elsewhere in this section.
   3. Specific item-by-item Training requirements are specified by others. (e.g. Owner and/or Engineer of Record). The CxA shall verify specified training occurs.

F. Training Verification: After training has been completed the Contractor shall submit the following information to the Owner and the Commissioning Agent:
   1. Training Agenda: For each training module submit the agenda that was used during the training session.
   2. Attendance Record: For each training module, submit list of participants and length of instruction time.
   3. Training Recording: For Training Modules which require videography (see Technical Specifications) provide the final edited video to the CxA for review.

G. O&M Manuals:
   1. Prepare O&M manuals according to the contract documents,
   2. Include the Final As-Built Control Drawings
   3. Submit O&M manuals to CxA for review prior to O&M personnel training.
   4. Provide O&M Manuals to the CxA for inclusion in the Systems Manual

H. System Verification Checklists
   1. The Commissioning Agent will prepare and submit System Verification Checklists based on the Systems to be Commissioned.
   2. The contractor shall complete the SVCs and submit completed forms to the CxA.

I. Startup Plan
   1. The Contractor shall submit the Startup Plan as specified in Part 3 of this section.

J. Functional Performance Test Procedure:
   1. The Commissioning Agent will prepare and submit Functional Performance Test Procedures. The Contractor shall execute FPT and submit completed forms to the CxA.
   2. The contractor shall complete the FPTs and submit completed forms to the CxA.

K. Trend Review
   1. The Contractor shall submit graphical representations of the trended DDC points that show each system operating properly These graphical reports shall be submitted to the Owner and Commissioning Agent for review and analysis.
   2. Graphical Plotting – The contractor shall provide graphical plots with the trend points (series) plotted simultaneously on the graph with each series in distinct color. Plot shall be provided with dual y-axis when appropriate. The plots will further require title, axis naming, series named and legend.

L. As Built Drawing Review:
   1. The CxA shall provide a list of as built drawings relevant to the Cx Process to the contractor.
   2. The contractor shall provide the indicated as built drawings to the CxA for review concurrently with the Design Professionals
   3. The CxA shall review selected As built drawings and provide review comments.

M. Systems Manual:
   1. The contractor shall provide the following information to the CxA for use in the Systems Manual. The final System Manual shall be complied and submitted by the CxA:
      a. As-built drawings for commissioned systems
      b. As-built control drawings (by CxC)
      c. As-Built Sequences of Operation (by CxC)
      d. Table of Original Setpoints (by CxC)
      e. Table of Original Programmed Time Schedules (by CxC)
         1) Recommended schedule of maintenance requirements and frequency per manufacturer's recommendations (by CxC)
      f. Recommended schedule for calibrating sensors and actuators (byCxC)
      g. Equipment O&M (by CxC)
      h. Equipment Preventative Maintenance Schedules (by CxC)
      i. Confirmation of Training (by CxC)
   2. The CxA shall prepare the final systems manual and submit to the Owner. Min requirements of the Systems Manual are defined in Part 3 of this section.

N. Test and Field Observation Reports: The Commissioning Agent will submit test and Field Observation reports to the Owner with copies to the Contractor and the Architect/Engineer.

O. Commissioning Issues Log: The Commissioning Agent will submit the Commissioning Issues Log to the Owner with copies to the Contractor and Architect.

P. Commissioning Report:
   1. Preliminary Cx report: The CxA will prepare and submit the preliminary commissioning report. The report, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.
   2. Final Commissioning Report: The Commissioning Agent will prepare and submit the final commissioning report to the Owner. The final submittal will incorporate correction, additions, or alterations based on comments received.

1.11 SCHEDULE

A. Construction schedules and scheduling is the responsibility of the Contractor. The CxA shall provide commissioning scheduling information to the Contractor for review and planning activities. CxA-developed commissioning activities are to be integrated into the construction schedule by the Contractor.

B. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the to schedule commissioning activities.

C. Schedule the start date and duration for the following commissioning activities:
   1. Submittals
   2. Preliminary operation and maintenance manual submittals
   3. System Verification Checklist
   4. Startup
   5. Functional Performance Tests
   6. Functional Performance Test demonstrations

D. Schedule shall include a line item for each activity specific to the equipment or systems involved.

E. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short-interval schedule submittals.

F. Two-Week Look-Ahead Commissioning Schedule:
   1. Two weeks prior to the beginning of SVC, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning process.
   2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
   3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.

1.12 QUALIFICATIONS (QUALITY ASSURANCE)

A. Contractor’s Commissioning Coordinator: The CxC shall have at least 5 years experience, or experience on at least 5 separate similar project, in performing the roles described in this section. The Contractor shall submit the CxC’s qualifications for review and approval prior to commencement of the Work.

B. O&M Training Instructor Qualifications: Factory authorized service representatives shall provide O&M training. They shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

C. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.13 COORDINATION

A. Management: The Commissioning Agent will coordinate the commissioning activities with the Owner and Contractor. The Commissioning Agent will submit commissioning documents and information to the Owner. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

B. Scheduling: The Contractor shall work with the Commissioning Agent and the Owner to incorporate the commissioning activities into the construction schedule.
   1. Initial Schedule of Commissioning Events: The Commissioning Agent has provided the initial schedule of primary commissioning events in the Preliminary Commissioning Plan included as an appendix to this section. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.

C. Access for Verification and Testing: The Contractor shall coordinate construction activity with commissioning verification and testing activities to avoid necessity of removing and replacing construction to accomplish Cx.

1.14 COMMISSIONING DOCUMENTATION

A. Commissioning Plan
   1. Commissioning Plan: After the Commissioning Kickoff Meeting, based on information provided to date, the Commissioning Agent will prepare the Commissioning Plan which shall contain the following information:
      a. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions
      b. A detailed list of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
      c. Description of the 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.
      d. The Commissioning Team: A list of commissioning team members by organization.
      e. Systems to be Commissioned. A detailed list of systems to be commissioned for the project.
      f. A list of System Verification Checklists that are to be used;
      g. A list of systems to undergo Functional Performance Testing, including information on testing sample size.
      h. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
      i. Commissioning Documents: A list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
      j. Commissioning Activities Schedule: Identification of Commissioning Activities, , the expected duration and predecessors for the activity.
      k. Schedule of Commissioning Coordination meetings.
      l. Description of requirements for Operation and Maintenance training.
      m. Schedule for commissioning activities with dates coordinated with overall construction schedule.
      n. System Verification Checklists
      o. Functional Performance Test procedures.

B. Training Plan. The contractor shall submit a comprehensive Training Plan. Specific Training requirements per item are specified in the Technical sections. Full requirements for the Training Plan are specified elsewhere in this section.

C. System Verification Checklists: The Commissioning Agent will prepare System Verification Checklists. System Verification Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will verify System Verification Checklists for accuracy and readiness for testing. Inaccurate or incomplete System Verification Checklists shall be returned to the Contractor for correction and resubmission.

D. Functional Performance Test (FPT): The Commissioning Agent will develop Functional Performance Test Forms for each system to be commissioned, including interfaces or interlocks with other systems. The FPT forms will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required.
   1. Each System Functional Performance Test form, shall include, but not be limited to, the following:
      a. Name and identification code of tested system.
      b. Test number.
      c. Time and date of test.
      d. Indication of whether the record is for a first test or retest following correction of a problem or issue.
      e. Dated signatures of the person performing test and of the witness, if applicable.
      f. Individuals present for test.
      g. Observations and Issues.
      h. Issue number, if any, generated as the result of test.
   2. Preliminary Functional Performance Test Procedures - Preliminary Functional Performance Test Procedures, developed by the CxA based on the Construction Documents, will be provided to the Owner, Architect/Engineer, and Contractor for review and comment.
   3. Final Functional Performance Test Procedures. The CxA will revise the Preliminary FPT procedures based on comments received and issue the Final FPT Procedures to be used during the FPT and FPT Demonstration.

E. Test and Field Observation Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent will compile reports and certificates and include them in systems manual and commissioning report.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain a Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved.
   1. Commissioning Issues Log Items will contain:
      a. A unique numeric or alphanumeric identifier by which the issue may be tracked.
      b. A descriptive title for the issue.
      c. Identify date and time of the issue.
      d. System, subsystem, and equipment to which the issue applies.
      e. Location of system, subsystem, and equipment.
      f. May include information that may be helpful in diagnosing or evaluating the issue.
      g. Recommended corrective action., if any.
      h. Commissioning team member responsible for corrective action.
      i. Person that identified the issue.
   2. Documenting Issue Resolution:
      a. Log date correction is completed or the issue is resolved.
      b. Describe corrective action or resolution taken.
      c. Identify changes to the 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 the issue.
      f. Identify person(s) verifying the issue resolution.

G. Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used

by the Owner 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 Owner occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
3. System Verification Checklists completed by the Contractor, with annotation of the 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 the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report after the Warranty Period Cx Meeting. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:

1. Documentation of deferred and off-season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.
5. Identification of potential Warranty Claims to be corrected by the Contractor.

I. Systems Manual: The Commissioning Agent will compile and submit the Systems Manual. The contractor shall provided information to be complied as directed below. The Systems Manual will include, but is not limited to, the following:

Section	Responsible Party
OPR	Design Team & Owner
Design narrative and BOD	Design Team
Single-line drawings and schematics for major systems	Contract Documents
As-built control drawings	Contractor
As-Built Sequences of Operation	Contractor
Table of Original Setpoints	Contractor
Table of Original Programmed Time Schedules	Contractor
Recommendations for recommissioning frequency by equipment type	Cx Agent
Blank FPT forms for future use	Cx Agent
Recommended schedule of maintenance requirements and frequency per manufacturer's recommendations	Contractor
Recommended schedule for calibrating sensors and actuators	Contractor
Equipment O&M	Contractor
Equipment Preventative Maintenance Schedules	Contractor
Confirmation of Training	Contractor
Ongoing System Optimization Procedures	Cx Agent
Recommended standard trend logs	Cx Agent

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 will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.

B. Data logging equipment and software specified by the construction documents shall be provided by the Contractor.

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

PART 3 - EXECUTION

3.1 SCHEDULING AND COORDINATION

A. The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the Owner regarding the completion schedule for the System Verification Checklists

B. The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the Owner regarding the completion of all equipment and systems.

C. The Commissioning Agent will schedule Functional Performance Test Demonstrations with the Contractor and Owner. The Commissioning Agent will witness and document the Functional Performance Test Demonstrations The Contractor shall execute the tests in accordance with the Functional Performance Test Procedure

3.2 MEETINGS

A. Cx Kick-off Meeting: Within 30 days from the planning meeting, the Contractor and prime subcontractors of commissioned equipment and the contractors of all major control systems (e.g., BAS, lighting), and balancing subcontractors will attend a commissioning kick-off meeting planned and conducted by the CxA. This meeting is conducted by the CxA and will cover the overall scope and process of the commissioning for this project, management and reporting protocols, project schedule., roles and communication and documentation protocols.

B. Cx Meetings: Cx Meetings will be scheduled by the CxA. Cx Meetings shall be attended by the Contractor and appropriate subcontractors to deal with operation clarifications, deficiencies, Cx schedules, Cx Issues, verification and testing. Contractor shall attend meeting of the following frequency and duration:
   1. From 30 days prior to setting ductwork or mechanical equipment until the startup of the first piece of major mechanical equipment: 1-hour meetings every 6 weeks.
   2. From the startup of the first piece of major mechanical equipment until the beginning of functional testing of mechanical equipment: 1-hour meetings every two weeks.

3. From the beginning of functional testing of mechanical equipment until all mechanical equipment has had the first round of testing conducted: 1-hour meetings once a week.
4. From the end of the first round of testing until all deficiencies are corrected: 1-hour meetings once a week or as set by the owner.
5. If the number of deficiencies is abnormal or coordination or cooperation is insufficient, additional meetings or meeting durations shall be required.

C. Temporary or Early Startup of Equipment Meeting. When equipment will be used in a temporary mode prior to operating the equipment permanently, a meeting shall be held that discusses the issues surrounding indoor environmental quality, moisture intrusion, building pressurization, duct and equipment cleanliness, checkout of safeties and fire alarm and protection, maintaining hydronic water quality, etc.

D. Controls Integration Meeting: Prior to issuance of Final FPT Procedures, the CxA will conduct a controls integration meeting to discuss and clarify Sequence of Operations, resolve interactions between systems, control authorities between packaged controls and the building automation system, fire/life safety, security, lighting controls, and point naming convention.
1. Required attendance is
   a. the Mechanical and Electrical engineers of record,
   b. CxC,
   c. BAS Contractor and their program authors
   d. Lighting Controls Contractor and their programming engineers
   e. Communications Contractor
   f. Electronic, Safety and Security Contractor
2. The Owner may attend at their discretion.

3.3 SUBMITTAL REVIEW

A. The following procedures shall apply to all equipment and systems to be commissioned
1. The CxA shall provide a list of submittals relevant to the Cx Process to the contractor.
2. The contractor shall provide the indicated submittals to the CxA for review concurrently with the Design Professionals
3. The CxA shall review selected submittals and provide review comments. CxA review comments shall he handled as specified in Div 1 for the design professionals.

3.4 SYSTEM VERIFICATION CHECKLIST

A. The following procedures shall apply to all equipment and systems to be commissioned.
1. System Verification Checklists will be prepared by the CxA and executed by the Contractor.
2. The contractor shall complete one SVC for each system to be commissioned. No sampling strategies are used.
3. The System Verification Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
4. The Commissioning Agent will review completed System Verification Checklists and field-verify the accuracy of the completed checklist using sampling techniques.

3.5 START-UP VERIFICATION

A. The System Verification Checklists shall be completed as a prerequisite to startup activity.

B. Startup Plan: The Contractor shall develop detailed Startup Plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
1. The Startup Plan shall at a minimum consist of the following items:

a. The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block at the end.
b. The manufacturer's normally used field checkout sheets.
c. Any additional standard procedures used by the installing contractor,

2. The Contractor will submit the Startup Plan to the Owner and CxA for review. Final approval will be by the CxA

C. Sensor and Actuator Calibration
1. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
2. All procedures used shall be fully documented on the Startup forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

D. Execution of Equipment Startup
1. 7 days prior to equipment startup, the Contractor shall schedule startup and checkout with the Owner and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
2. The Commissioning Agent will observe the startup procedures for selected pieces of equipment.
3. The Contractor shall execute startup and provide the Owner and Commissioning Agent with a signed and dated copy of the executed Startup Plan, and all contractor completed checklists, tests & reports.

E. Control System Startup - The Contractor shall provide the following information regarding Control System Startup. Any documentation that is modified after submission shall be recorded and resubmitted to the Commissioning Agent.
1. Point-to-Point checkout documentation.
2. Sensor field calibration documentation and loop tuning documentation that may be required per Div 25

3.6 TEST AND BALANCE

A. TAB Report: Contractor to provide CxA with final TAB report which must have mechanical engineer of record (MEOR) stamp.

3.7 T-24 ACCEPTANCE TESTING

A. The contractor shall submit the completed T-24 acceptance tests to the Cx for review and comment.

B. The completion of the Title 24 Certificate of Acceptance forms is the contractor’s responsibility, not the CxA responsibility.

C. complete the Title 24 acceptance testing and forms are a prerequisite for FPT Demonstration.

3.8 FUNCTIONAL PERFORMANCE TEST

A. This paragraph applies to Functional Performance Testing of systems where referenced in Technical Specification Divisions.

B. The contractor shall operate each system as specified in the FPT Scripts through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. System response shall be documented in the FPT scripts.

C. The CxA will provide FPT test scripts to for project use.

D. The contractor shall execute the FPT scripts and document the results on 100% percent of commissioned equipment.

E. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.

F. Test results that are not within the acceptance criteria shall be corrected and tests re-conducted.

G. On successful completion of a test, sign the completed test procedure and data form and submit to the CxA. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Functional Performance Testing shall be complete prior to FPT Demonstration.

3.9 FUNCTIONAL PERFORMANCE TEST DEMONSTRATION

A. The contractor shall demonstrate a sample of the FPT to the CxA.

B. Notify CxA at least 10 days in advance of each test demonstration.

C. Functional Performance Testing shall be complete prior to FPT Demonstration

D. During the FPT Demonstration The contractor shall execute the test steps as directed by the CxA and the CxA shall record the results on the FPT forms.

E. Sampling: Perform test demonstrations on a sample of equipment after Functional Performance Testing submittals are approved. The sampling rate for test demonstrations shall be:
   1. TBD Envelope Commissioning
   2. 100% Of Air Handling Units
   3. 25% Terminal Boxes
   4. 25% Exhaust Fans
   5. 100% Domestic Hot Water System
   6. 100% Electrical Distribution
   7. TBD Lighting
   8. TBD System Integration Verification

F. Provide full access to CxA to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of CxA at the time of the test to authenticate the reported results.

G. The GC & Trade Subcontractors shall provide all industry standard test equipment, special tools, ladder/lifts, two-way radios and equipment required for performing the specified tests

H. The system specific commissioning specifications (listed in Paragraph 1.2) and/or the Cx Plan will define any required seasonal or deferred testing.

I. The GC & Trade Subcontractors shall provide staff with extensive project specific experience who are capable of executing the testing protocols described in the FPT scripts.

3.10 TREND REVIEW

A. The Contractor shall trend points of the system at intervals specified in the final FPT Scripts.

B. The trend review period shall extend 14 days and shall cover two weekend/non-operational periods.

C. The Contractor shall provide graphical trending through the DDC control system for systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing.
   1. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady stated conditions. These graphical reports shall be submitted to the Owner and Commissioning Agent for review and analysis.
   2. Graphical Plotting – The contractor shall provide graphical plots with trend points (series) plotted simultaneously on the graph with each series in distinct color. Plot shall be provided with dual y-axis when appropriate. The plots will further require title, axis naming, series named and legend.
      a. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
      b. A Graphical Plot for each control loop shall be provided. The plot shall contain the setpoints, actuator, and feedback sensor data representing a complete closed loop control.
      c. Single Point data is not acceptable for trending.
      d. RAW or CSV data is not acceptable for trending. The contractor shall graphically plot the data as specified.

D. Trend reports are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent.

E. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the Owner.

F. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Owner, prior to the execution of Systems Functional Performance Testing.

3.11 SYSTEMS MANUAL

A. The Systems Manual shall be written by the CxA.

B. The contractor shall provide material for the Systems Manual as specified in the submittals section of this specification.

C. The SYSTEMS MANUAL shall document the operational aspects of the building and be delivered to the Owner. The SYSTEMS MANUAL shall include the following;
   1. Site information, including a facility description, history, and current requirements
   2. Site Contact Information
   3. Instructions for basic operations and maintenance, including
      a. General Site Operating Procedures
      b. Emergency Operations Procedures
      c. Basic Trouble Shooting
      d. Recommended Maintenance Requirements
      e. Site Events Log
   4. Description of major systems (Mechanical, Electrical, Plumbing, Renewable Energy) including:
      a. Mechanical Systems Type(s)
      b. Electrical Distribution
      c. Normal Power System
      d. Essential Power System
      e. Domestic Water Heating System Type and location(s)
      f. Renewable Energy System

3.12 AS BUILT DRAWING VERIFICATION

A. The CxA shall provide a list of as built drawings relevant to the Cx Process to the contractor.

B. The contractor shall provide the indicated as built drawings to the CxA for review concurrently with the Design Professionals

C. The CxA shall review selected As built drawings and provide review comments.

3.13 TRAINING VERIFICATION

A. Training Preparation Meeting: Before operation and maintenance training, the Commissioning Agent will convene a training preparation meeting to include Owner's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of Owner's Operations and Maintenance personnel.

B. The Contractor shall provide training and demonstration as required by Division 07, Division 22, Division 23, Division 26, and Division 28 sections. These referenced sections will define training requirements including videography (if any), format, duration, etc.

C. The CxA shall review the training plan.

D. Training Plan – The contractors shall submit a Training Plan for review by the CxA. The Training Plan shall include, but is not limited to, the following:
   1. A list and schedule of all Training Sessions. A Training Session shall consist of one or more Training Modules.
   2. For each Training Session submit:
      a. An Agenda indicating which Training Modules will be covered.
      b. Recommended Attendees
      c. Instructor Names, Company Name, and Qualifications
      d. Location and Duration
   3. Training Modules: Develop a learning objective and teaching agenda for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include the following:
      a. List of installed systems, subsystems, and equipment to be trained.
      b. Outline of Training Topics
      c. System, and equipment descriptions.
      d. Equipment function.
      e. Operations: including startup, shutdown, break-in, and normal.
      f. Limiting conditions.
      g. Emergency Procedures
      h. Project Record Documents including as-builts and naming conventions
      i. Regular Maintenance and Cleaning Procedures
      j. Review of Spare Parts/Attic Stock Provided
      k. Warranties and Bonds
      l. Maintenance Service Agreements & similar continuing commitments

E. Training Verification Submittals: After training has been completed the Contractor shall submit the following information to the Owner and the Commissioning Agent:
   1. Training Agenda: For each training module submit the agenda that was used during the training session.
   2. Attendance Record: For each training module, submit list of participants and length of instruction time.
   3. Training Recording: For Training Modules which require videography (see Technical Specifications) provide the final edited video to the CxA for review.

F. Training Coordination:
   1. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
   2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
   3. Coordinate content of training modules with content of approved O&M manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the Owner.

3.14 DEFFERED AND SEASONAL TESTING

A. Unforeseen Deferred Testing: If any tests cannot be completed due to the building structure, required occupancy or other conditions, execution of the Testing may be delayed upon approval of the Owner. The deferred tests shall be conducted in the same manner as the seasonal tests as soon as possible.

B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The Owner will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent.

3.15 COMMISSIONING ISSUES, BACK-CHECKS AND RE-TESTS

A. Commissioning Issues and their associated recommended corrections are the professional opinion of the Commissioning Agent. No communication from the Commissioning Agent can modify the terms of the contract between the Owner and Contractor.
   1. If the Commissioning Issue is work required by the Contract Documents it shall be corrected promptly.
   2. If Commissioning Issues require an interpretation or modification of the construction documents the Contractor shall issue on RFI or other official request for a Construction Change.

B. The responsible party shall correct the issue and inform the CxC and CxA of the resolution and completion date. The CxA will record completion on the Cx Log after a successful witnessed re-test, field review, back-check, or other verification obtained through appropriate documentation or photographs, or acceptance by the Design Professional or Owner.

C. The CxA will witness one (1) re-test or will perform one (1) field back-check or verification of any Cx issue.

D. Cost of Retesting – The contractor will be responsible for charges relating to Retesting or back-checking beyond the allowance. The Owner reserves the right to back-charge the GC for any additional fees from the CxA.

3.16 COMMISSIONING ACCEPTANCE, CLOSEOUT, AND REPORTING

A. Acceptance
   1. Completion of the main commissioning activities (system verification checks, functional performance tests, FPT Demonstration and Training) shall be accomplished as a prerequisite for Cx Acceptance. Completion of any re-testing shall be completed prior to final acceptance of commissioning.
   2. No outstanding issues shall exist for life and occupational safety related systems.
   3. The TAB report has been reviewed and accepted by the Design Professional

4. Documentation for LEED shall have been submitted.
5. All GC and Trade Subcontractor commissioning documentation to the CxA for use in the final Systems Manual and Cx Report,
6. Draft O&M manuals and facility maintenance system data submitted and a schedule approved for the final manual submittal.
7. Draft As Built drawings of commissioned systems submitted and a schedule approved for the final As Built drawings submittal.
8. Completed Training of owner personnel according to the training plan with a schedule for the outstanding training submitted to and approved by the Project Manager.
9. The Owner will review Cx Progress and indicate whether they accept completion of the project construction phase commissioning or if not, the requirements for acceptance.
10. Upon Owner acceptance, any remaining open Cx issues will be transferred to the warranty phase Cx Log for tracking resolution and completion as part of the warranty phase commissioning.

B. Upon completion of all commissioning activities, the CxA will prepare and submit to the Owner the Cx Report detailing all completed commissioning activities and documentation.

END OF SECTION