

DOCUMENT 00903 – ADDENDUM NUMBER THREE

DATE: November 21, 2023

PROJECT: **MARTIN LUTHER KING JR. RECREATION CENTER**
705 14th Court East – Panama City, Florida 32401

FROM: CCR Architecture & Interiors
2920 First Avenue South - Birmingham, Alabama 35233

TO: Prospective Bidder

This addendum forms a part of the Contract Documents and modifies the original Construction Documents Dated May 18, 2023, as noted below.

CLARIFICATIONS:

1. **(Bid Form) Allowance: Commissioning of Outdoor Statue/Sculpture** – The 'Allowance: Commissioning of Outdoor Statue/Sculpture' line on the Bid Form should be **'Allowance: Third Party MEP Commissioning' instead and Bidders shall include a \$30,000 allowance amount for this item.** Also, refer to attached Revised Spec Section 019113, Subsection 1.2B Management, Addendum #3 dated 11/20/23, changing the Commissioning Cx Provider to be hired by the General Contractor instead of being contracted by the (Owner) City of Panama City, Florida.
2. **Relocated wood shed where? Offsite?** – Delete relocating the existing wood shed from the scope of work and Contract Sum.
3. **Gas valve to be removed but what about the gas line?** – The proposed gas line is to be abandoned in place or removed. Whichever method is to TECO's preference as the owner of the gas distribution system. TECO is extending the current service to the proposed gas connection on the west side of the proposed building.
4. **Existing OH lines and power poles to be removed by FPL ... if FPL wants to charge for this work, will the City pay this expense? Also ... Will they remove the Comcast lines also?** - FPL typically charges for relocation of their power poles. Relocation of the Comcast lines would need to be coordinated with Comcast.
5. **What is the purpose of the "Consult an arborist" comment.?** Significant impacts to the existing grade are proposed around the trees with the label "Consult an arborist." We recommend an arborist be consulted during construction to ensure construction activities do not impact the existing trees and it can be kept as a feature in the proposed site since we will be encroaching within the tree's root zone with earthwork activities.
6. **What is the intention related to the drop off on the north side of the ASAP building? Resurface or remove and replace?** Sawcut the existing pavement and connect the proposed asphalt at the edge of the asphalt at the drop off lane. The project was designed to match grades at the ASAP drop off lanes and the proposed driveway for MLK Jr. Rec Center.

7. **Should the FDOT connection permit drawings be included as a contract document?** No FDOT permits are required as all modifications are to existing driveways or roads intersections.
- Which Belgard typical section should be used that is shown on C-13 or should the pavers be constructed in accordance with detail 3 on L2-2?** The Belgard section on sheet L2-2 should be used as the construction detail. The details on Sheet C-13 shall be removed.
8. **Should the dumpster enclosure be constructed in accordance with the details shown on C-12 or A000?** The detail on C-12 is the appropriate detail for the dumpster foundation and size. A000 should be referenced for all exterior finishes, gate selection, and bollard layout.
9. **Along Palo Alto Avenue ... there is a note "Install 3-sided treated wood wall around inlet". This could be constructed very cheaply and poorly and comply with this narrative ... Suggest a detail be provided.** Contractor to provide vendor submittal prior to construction for engineer and City review. This can be updated on the civil plan set.
10. **Just west of the end of the Sheetpile wall there is a note "Handrail be others" ... does this mean someone besides the general contractor?** The handrail design and selection will be completed by the AMEPS consultant not civil consultant.
11. **Can a roof plan be provided?** Refer to Sheets A101 and A101-ALT for the Roof Plan.
12. **Rain leaders & Downspouts** - Refer to the internal rain leaders and downspouts on the plans.
13. **Subcontractor inquiry: Work to be awarded in ONE contract** – The project will be awarded as one total General Contract to a General Contractor. Yes, General Contractors are allowed to use Subcontractors on the project, as subcontracts between the General Contractor and Subcontractor(s).
14. **Alternate Air Barrier Coating Product** – Yes, W.R. Meadows AIR-SHIELD TMP Liquid Membrane Thin Film Permeable Air Barrier is an acceptable product for air barrier coatings in addition to Sto Gold Coat.
15. **CAD File Release Form** – For bidders requesting CAD base files, please fill out the attached CCR Architecture CAD Release Form and email the completed form to Roman Gary/CCR at roman@ccrarchitecture.com.
16. **Foodservice Equipment Item #19** – In Spec Section 114000, **delete Equipment Cutsheet Item #19 Gas Range. This item is not a part of the project. Equipment Item #1 is the Gas Range for the Food Concession room.**
17. **RFI Deadline** – The last day to submit Bid RFI questions is **Thursday – December 14, 2023 by 10:00 am central time.**

END OF DOCUMENT 00903

Attachments:

- **CCR Architecture CAD File Release Form**
- **Revised Spec Section 019113 General Commissioning Requirements, Addendum #3 dated 11/20/23.**



CCR ARCHITECTURE & INTERIORS

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In acceptance or utilization of these file(s), the Recipient agrees to the following terms and conditions:

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2. Recipient agrees to indemnify, defend and hold harmless CCR Architecture & Interiors, its officers, agents and employees from and against any and all claims, suits, losses, damages or costs, including reasonable attorney/s fees, arising from or by reason of Recipient's use or possession with respect to any of the files(s) furnished by CCR Architecture & Interiors pursuant to this agreement, and such indemnification shall survive acceptance of said files by Recipient.
3. Recipient agrees to accept the electronic files in the format provided. CCR Architecture & Interiors recommends that the files be used in the format provided.
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5. Since revisions or additions to these electronic files may occur at any time, the Recipient agrees to indemnify, defend and hold harmless CCR Architecture & Interiors, its officers, agents, and employees from and against any and all claims, suits, losses, damages, or costs, including reasonable attorney's fees, arising from the use of outdated files, and such indemnification shall survive acceptance of said files by Recipient.
6. All parties agree that the electronic files are the intellectual property of the Architect and Engineers of Record and that the limited use license granted along with these files is limited to the tasks necessary to complete this specific project. Once this project is substantially complete, this limited use license is cancelled.
7. Recipient agrees to accept all of the same terms and convey these same requirements and limitations when sharing these digital files for the purpose of completing this project.
8. These terms and conditions constitute the complete and final agreement of the parties hereto.

RECIPIENT ACCEPTS THE AFOREMENTIONED TERMS AND CONDITIONS.

Project Name: _____

Company: _____

By: _____
(signature) (date)

Title: _____

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commissioning. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. Ideally, this is achieved by beginning in the design phase and documenting design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

Commissioning activities during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

- 1) Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - 2) Verify and document proper functional performance of equipment and systems.
 - 3) Verify on-going proper performance persistence of systems under changing conditions throughout the first year of operation.
- B. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to respectively design, provide, and install a finished and fully functioning product.
- C. Abbreviations. The following are common abbreviations used in the *Specifications* and in the *Commissioning Plan*. Definitions are found in Section 1.6.

| | | | |
|----------|---|-------|--------------------------------|
| A/E- | Architect and design engineers (Sub to the General Contractor) | FT- | Functional performance test |
| CA- | Commissioning authority | MC- | Mechanical contractor |
| CC- | Controls contractor | PC- | Prefunctional checklist |
| Cx- | Commissioning | PM- | Project manager (of the Owner) |
| Cx Plan- | Commissioning Plan document | Subs- | Subcontractors to GC |
| GC- | General Contractor | TAB- | Test and balance contractor |
| EC- | Electrical contractor | | |

1.2 COORDINATION

- A. Commissioning Team. The members of the commissioning team consist of the Commissioning Authority (CA), the owner's Project Manager (PM), the Mechanical Engineer (ME), the designated representative of the General Contractor (GC), the architect and design engineers (particularly the mechanical engineer and the

electrical engineer), the Mechanical Contractor (MC), the Plumbing Contractor (PC), the Electrical Contractor (EC), the TAB services provider (TAB), the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment which is part of a system identified to be commissioned. If known, other members of the Owner's building or plant operations / maintenance staff may also a member of the commissioning team.

- B. Management. For this project, the Construction Phase CA is hired by the General Contractor per the Allowance issued by the Owner's Architect according to the contract specifications and bid form. The CA will still report directly to the Owner while copying the General Contractor, the Architect / Engineer, and the remainder of the Commissioning Team members with all project correspondence. The CA directs and coordinates the commissioning activities. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. The CA's responsibilities are the same regardless of who hired the CA.

1. Commissioning Services Provider: The Construction Phase CA services will be provided by Building Energy Sciences, LLC. (BES) of Pensacola, Florida.
2. Contact information is:
Building Energy Sciences, LLC
PO Box 16167
Pensacola, Florida 32507
Andy Heitman, CxA
andyheitman@buildingenergysciences.com
(850) 390 – 4117

- C. Scheduling. The CA will work with the General Contractor according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the General Contractor for scheduling commissioning activities. The General Contractor will integrate all milestone commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

The CA will provide the initial schedule (or possibly just sequence) of primary commissioning events at the commissioning scoping meeting. As construction progresses more detailed schedules are developed by the CA.

1.3 COMMISSIONING PROCESS

- A. Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will complete the plan which is then considered the "final" construction phase commissioning plan, though it will continue to evolve and expand as the project progresses. The *Specifications* will take precedence over the *Commissioning Plan*.
- B. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

Construction / Acceptance Period

1. Commissioning during construction begins with a kickoff meeting conducted by the CA where the commissioning process is reviewed with the commissioning

- team members.
2. Additional meetings, if required throughout construction, will be scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 3. Equipment documentation is submitted to the CA during normal submittals for use in developing and finalizing project-specific Cx documentation.
 4. The CA reviews the commissioned equipment submittals for compliance with contract requirements as well as for aspects related to commissioning and owner maintenance.
 5. The CA develops prefunctional checklists to be completed for systems and equipment to be commissioned during the equipment startup and check-out process. These checklists are intended to augment, not replace, the manufacturer's standard start-up / checkout documentation. These checklists are developed and completed using the on-line Cx Plus commissioning platform provided by BES Plus Tech.
 6. The CA and the Subs work together to execute and document the prefunctional checklists and perform startup and initial checkout. In general the CA will complete the installation checks portion of the prefunctional checklists while the CA and the Subs will complete the equipment start-up / checkout portions. The CA documents that the checklists and startup were completed according to the approved plans.
 7. The CA develops specific equipment and system functional performance test procedures. These tests are developed and completed using the on-line Cx Plus commissioning platform provided by BES Plus Tech.
 8. The Controls Contractor sets up trending of system points and automated delivery of the trend reports as directed by CA. This data, if available prior to manual functional testing, is utilized to judge the readiness of systems to be tested.
 9. The CA with the assistance of the TAB Contractor completes the Test, Adjust, Balance Verification (TAB-V) process. This must be successfully completed prior to beginning functional testing for each specific system.
 10. The manual functional test procedures are executed by the Subs, under the direction of, and documented by the CA.
 11. Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.
 12. Commissioning is substantially completed before Final Completion is granted to GC. This requires the issuance of a Final Construction Phase Cx Issues Log with all items resolved.

Warranty Period

1. For the duration of the Warranty Period the CA monitors the performance of the commissioned systems using the cloud-based Cx-PMOR system (BES Plus Tech Performance Plus) if contracted with the Owner to provide this service. Any items identified by this monitoring shall be resolved through the Contract Warranty Process.

1.4 RELATED WORK

- A. Specific commissioning requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section.

| | | |
|--------|---------------|---|
| 230800 | Mechanical Cx | Describes the Cx responsibilities of the mechanical, controls and TAB contractors and the prefunctional testing and startup responsibilities of each. |
| 260500 | Electrical Cx | Describes the Cx responsibilities of the electrical contractor. |

1.5 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. It is noted that the services for the Project Manager, Architect, HVAC mechanical and electrical designers/engineers, and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services as they are contracted separately with the Owner. Their responsibilities are listed here to clarify the commissioning process.

B. All Parties

1. Attend Pre-commissioning Meeting and normal construction period Commissioning Meetings, as deemed necessary by the CA, PM, and General Contractor to effectively participate in the Cx Process.
2. Each company / organization identified as being a member of the Cx Team shall designate an employee who is involved and familiar with the project to be the point-of-contact (POC) for the Cx process.
3. The identified POC shall regularly review the on-line Issue Log at the BES Plus Tech website project portal and the report documents which are emailed to the Cx Team.
4. The POC shall respond to any and all issues assigned to the company / organization that they are representing in the Cx Process within five (5) working days of the date the issue is added to the Log. Failure by a construction team member to effectively participate in the Cx Process, as judged by the Owner, can be considered cause for holding a construction progress payment.

C. Architect

Construction and Acceptance Phase

1. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as specifically contracted to the Owner.
2. Provide any design narrative documentation requested by the CA.
3. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.
4. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

Warranty Period

1. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

D. Mechanical and Electrical Designers / Engineers (of the A/E)

Construction and Acceptance Phase

1. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
2. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
3. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
4. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
5. Provide a presentation at one of the training sessions for the Owner's personnel.

Warranty Period

1. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during warranty-period.

E. Commissioning Authority (CA)

The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and his Subs. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. At the direction and discretion of the CA, the Contractors will provide tools or the use of tools to start, check-out and functionally test equipment and systems.

Construction and Acceptance Phase

1. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
2. Coordinate the commissioning work and, with the General Contractor, ensure that commissioning activities are being scheduled into the master schedule.
3. Plan and conduct a pre-commissioning meeting (Cx Kickoff Meeting) and participate in construction coordination and Owner-Contractor meetings as required to support the Cx Process.
4. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
5. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
6. Review normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the General Contractor reviews.

7. Write and distribute prefunctional tests and checklists.
8. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions / substitutions relating to the commissioning process. Assist in resolving any discrepancies.
9. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures. At the discretion of the CA this testing may be witnessed by an alternate party (e.g. PM, TAB, General Contractor) as approved by the CA, documentation shall be provided to the CA that the testing was completed satisfactorily and according to specifications.
10. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures. At the discretion of the CA this testing may be witnessed by an alternate party (e.g. PM, TAB, General Contractor) as approved by the CA, documentation shall be provided to the CA that the testing was completed satisfactorily and according to specifications.
11. Document equipment installation meets contract requirements by completion of the installation checks portion of the prefunctional checklists. Work together with Subs to complete the equipment start-up and check-out portion of the checklists. Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
12. Approve systems startup by reviewing start-up reports and by selected site observation.
13. Review TAB execution plan, discuss concerns and comments with TAB.
14. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
15. Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.
16. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
17. Analyze functional performance trend logs and monitoring data to verify performance.
18. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
19. Maintain a master deficiency and resolution log (aka 'Issues Log') and a separate testing record. Provide the General Contractor with written progress reports and test results with recommended actions.
20. Provide a final commissioning report (as described in this section).

Warranty Period

1. Configure and maintain the cloud-based Cx-PMOR performance monitoring system throughout the Warranty Period to identify performance and operational issues. Issues shall be documented using On-Going Issues Log and shall be corrected by way of the Contract Warranty Process.

2. Verify completion and effectiveness of required deficiency corrections for issues discovered during Warranty Period.

F. General Contractor (GC)

Construction and Acceptance Phase

1. Facilitate the coordination of the commissioning work by the CA, and ensure that commissioning activities are being scheduled into the master schedule.
2. Include the cost of providing commissioning assistance to the CA as described in the drawings and this and other related specification sections in the total contract price. *(do NOT include the cost of the Commissioning Authority as they are under contract to the Owner)*
5. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
6. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
7. Review commissioning progress and deficiency reports.
8. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
9. Assist the Owner PM and the CA in coordinating the training of owner personnel.
10. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
11. Coordinate the training of owner personnel in accordance to Contract Documents.
12. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

Warranty Period

1. Ensure that Subs complete deficiency corrections for issues discovered during Warranty Period.

G. Owner's Project Manager (PM)

Construction and Acceptance Phase

1. Manage the contract of the CA, A/E, and the General Contractor.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan—Construction Phase*.
3. Provide final approval for the completion of the commissioning work.

Warranty Period

1. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

H. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

2. Assist in equipment testing per agreements with Subs and as required by individual equipment specification sections.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.
4. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.
6. Provide Owner Training activities per individual equipment specification sections to include trainer personnel meeting specification qualification and experience requirements. Training provided shall meet or exceed the time duration as specified in the equipment specification sections unless specifically authorized in writing by the Owner PM that less training is acceptable.

1.6 DEFINITIONS

Acceptance Phase - phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

Basis of Design (BOD)- The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included. The document records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Commissioning Authority (CA) - an independent agent, not otherwise associated with the General Contractor or his Subs. The CA directs and coordinates the day-to-day commissioning activities. Regardless of to whom the CA is contracted, the CA shall report directly to the Owner's Project Manager (PM).

Commissioning Plan - an overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).

Control system - the central building energy management control system.

Cx-PMOR – see PMOR.

Datalogging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

General Contractor - the contractor providing general construction services and oversight of trade subcontractors as well as providing professionals who comprise the design team such as the HVAC mechanical designer/engineer and the electrical designer/engineer.

Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.

Factory Testing - testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.

Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Non-Compliance - see Deficiency.

Non-Conformance - see Deficiency.

Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

Owner-Contracted Tests - tests paid for by the Owner outside the General Contractor's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

Owner's Project Requirements (OPR) - A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

Performance Monitoring, Optimization, and Reporting (PMOR) - cloud based SaaS (Software as a Service) which provides automated building operating data acquisition, analysis, archival, and reporting by utilizing data provided from the building automation system to continually analyze and improve the overall

performance of the building and its underlying mechanical and electrical systems.

Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order to minimize the total construction time.

Prefunctional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

Project Manager (PM) - the contracting and managing authority for the owner over the design and/or construction of the project, a staff position.

Sampling - functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Section 019113, Part 3.6, F for details.

Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

Specifications - the construction specifications of the Contract Documents.

Startup - the initial starting or activating of dynamic equipment, including executing prefunctional checklists.

Subs - the subcontractors to the General Contractor who provide and install building components and systems.

Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures.

Trending - monitoring using the building control system.

Vendor - supplier of equipment.

Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.7 SYSTEMS TO BE COMMISSIONED

A. The following systems or equipment will be commissioned in this project.

1. HVAC Systems:
 - a. Packaged Rooftop Units (Dx Cooling, Gas Heating)
 - b. Rooftop Dedicated Outside Air System
 - c. DOAS Variable Air Volume Terminal Units with Electric Reheat
 - d. Mini-Split DX Air Conditioning Units
 - e. Air Distribution System Ductwork
 - f. Exhaust Air Systems and equipment
 - g. Kitchen Hood Make-up Air Unit
 - h. Testing, Adjusting, Balancing
 - i. HVAC Control System components
(a.k.a. Building Automation System)
2. Domestic Hot Water Systems
 - a. Domestic Water Heater(s)
 - b. Recirculation Pump
 - c. Thermostatic Mixing Valve
3. Electrical Systems:
 - a. Power Distribution related to HVAC equipment
 - b. Lighting Control Systems

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios, when required, shall be provided by the Division Contractor.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site, for the CA to use during functional testing, seasonal testing, and deferred testing. The equipment, tools, and instruments will be returned to the vendor / Subs after successful conclusion of the commissioning effort.
- 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 shall apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Humidity sensors shall have a certified calibration within the past 6 months and a resolution of +/- 1%. 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. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Pre-Commissioning Meeting. The CA will schedule, plan and conduct a pre-commissioning meeting with the entire commissioning team in attendance. This is also known as the Commissioning Kickoff Meeting.
- B. Miscellaneous Meetings. Meetings regarding the Commissioning Process that may be required throughout the construction period will be scheduled as agenda items at the General Contractor's regularly scheduled construction coordination meetings or Owner-Contractor meetings. An exception to this policy would be extraordinary meetings which are deemed necessary by the CA and the General Contractor with necessary parties attending in order to resolve outstanding deficiencies toward the end of the construction period.

3.2 REPORTING

- A. The CA will provide regular reports to the Owner's PM with copy to the General Contractor, depending on the management structure, with increasing frequency as construction and commissioning progresses.
- B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc. delivered via group email.
- C. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.
- D. Prior to project final completion the CA will provide to the PM a Final Construction Phase Commissioning Deficiencies Log with all identified construction phase commissioning issues resolved.

3.3 SUBMITTALS

- A. The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. This request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, and control drawings (e.g. typical formal construction submittals).
- B. These submittals to the CA do not constitute compliance for O&M manual documentation and review of the equipment submittals is not for contract compliance. The O&M manuals are the responsibility of the Contractor, though the CA will review and utilize this documentation for purposes of facilitating the Commissioning process. Review of the equipment submittals for contract compliance is the responsibility of the A/E.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned, according to Section 1.7, Systems to be Commissioned. Some systems that are not comprised so much of actual dynamic machinery and thus may have very simplified PCs and startup.
- B. General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
- C. Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms. Parties responsible for executing functional performance tests are identified in the testing requirements outlined in the *Commissioning Plan – Construction Phase*.
1. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.
 2. These checklists and tests are provided by the CA to the Contractor. The CA will complete the installation checks portion of the checklists while the Subs will assist the CA in completing the equipment start-up and check-out portions. Most forms will have more than one trade responsible for its execution.
 3. The CA may utilize some or all of a manufacturer's start-up documentation.
- D. Sensor and Actuator Calibration.
All field-installed temperature, relative humidity, CO, CO₂ and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner and CA before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.
- All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

Sensor Calibration Methods

All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.

Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building

automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

Tolerances, Standard Applications

| <u>Sensor</u> | <u>Required Tolerance (+/-)</u> | <u>Sensor</u> | <u>Required Tolerance (+/-)</u> |
|---|---|-----------------------------------|---|
| Cooling coil, chilled and condenser water temps | 0.4F | Flow rates, water | 4% of design |
| AHU wet bulb or dew point | 2.0F | Relative humidity | 4% of design |
| Hot water coil and boiler water temp | 1.5F | Combustion flue temps | 5.0F |
| Outside air, space air, duct air temps | 0.4F | Oxygen or CO ₂ monitor | 0.1 % pts |
| Watthour, voltage & amperage | 1% of design | CO monitor | 0.01 % pts |
| Pressures, air, water and gas | 3% of design | Natural gas and oil flow rate | 1% of design |
| Flow rates, air | 10% of design | Steam flow rate | 3% of design |
| | | Barometric pressure | 0.1 in. of Hg |

The above stated tolerances shall be considered the most stringent required. Based on field conditions and the relative affect of a sensor to the operation of the system(s) the CA may choose to relax the above tolerances at his discretion subject to approval of the PM.

Valve and Damper Stroke Setup and Check BAS Readout. For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator.

E. Execution of Prefunctional Checklists and Startup.

1. Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the General Contractor who will notify the CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the CA with the assistance of the Sub or vendor as required. The CA will primarily complete the installation checks portion of the checklists while the Subs will assist with the equipment start-up and check-out portion.
2. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
3. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

F. Deficiencies, Non-Conformance and Approval in Checklists and Startup.

1. The CA shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully as notes within

the checklist on the commissioning website or as a deficiency in the on-line issue log.

2. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the A/E, PM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner and shall notify the CA as soon as outstanding items have been corrected and submit a response to the deficiency in the on-line issue log and request a recheck or retest of the item. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the PM.

3.5 TEST, ADJUST, BALANCE (TAB) VERIFICATION (TAB-V)

- A. TAB Agency shall provide labor and instruments to complete TAB Verification process with the Commissioning Agent. TAB Verification (TAB-V) shall be conducted to verify the contents of the Engineer-of-Record reviewed TAB Report. The verification shall include the following sampling rates and strategies:
 1. Supply Air Flow: a sample 25% of the total supply air outlets / terminal unit calibrations shall be tested, acceptable tolerance shall be +/- 10% between the measured airflow and the design airflow / DDC indicated airflow. If more than 25% of the sample requires correction at the time of testing then another 10% of the total quantity of supply air outlets shall be tested.
 2. Exhaust Air Balance: ALL exhaust air devices and equipment on the project shall be verified to have airflows balanced to +0% / -10% of the design airflow.
 3. Outside Air Flow: ALL outside air flow balancing shall be verified and calibrated by the TAB Agency (with assistance of Controls Contractor) to be within +10% / -0% between the measured total airflow and the airflow indicated by the DDC system.
- B. The TAB Agency may be responsible to pay for the additional trip(s) required of the Cx Professional to test additional outlets due to test failures on a time and material basis.

3.6 PERFORMANCE MONITORING, OPTIMIZATION & REPORTING (PMOR)

- A. Objectives and Scope.
 1. This project will utilize a cloud-based SaaS (Software as a Service) commissioning, performance monitoring, optimization, and reporting (PMOR) system which is provided under the CA contracted scope of work. The system shall be utilized during three distinctive phases of the project: construction, acceptance, and warranty phase.
- B. Construction Phase - System Readiness:

1. The PMOR system will be utilized prior to Functional Performance Testing in order to gauge the readiness of the systems to be tested.
2. At least 10 days prior to the scheduled start of functional testing the BAS shall have delivered two weeks of operating data to the PMOR system. If the building automation system communication capabilities are not complete sufficiently to enable the BAS to email trend reports then the Controls Contractor shall manually generate two weeks trend data to a report. This manual report shall be the SAME EXACT REPORT FORMAT as was prior approved and will be used for the permanent reporting (specified elsewhere herein). This manual report shall either be emailed to the CA or shall be emailed to the project's specific PMOR email account.
3. Following receipt of two weeks of operating data (either automatically or manual) the CA shall review the data utilizing the PMOR system to assess the readiness of the specific system to begin on-site functional testing.
4. The CA shall notify the project team of the any deficiencies identified by the trend data analysis that would need to be addressed prior to beginning functional testing.

C. Acceptance Phase – Post Functional Test Monitoring:

1. The PMOR system shall be utilized following on-site Functional Testing to assess dynamic operation stability and to ensure the systems operate properly under varying load conditions and occupancy modes. This is a limited length testing and is intended to be conducted for a short period (approximately two weeks) prior the completion of the formal functional testing.
2. Any deficiencies identified during this monitoring period shall be added to the project Commissioning Issue Log to be addressed by the Contractor as construction deficiencies. Some deficiencies identified by this monitoring may required supplemental on-site functional testing to be performed at the cost of the Contractor.

D. Warranty Phase – Monitoring:

1. The PMOR system will be utilized during the first year following substantial completion to monitor the performance of the building and the individual systems.
2. Any operational deficiency identified by the system will be documented using the system's online Issue Log and the deficiency will be resolved through the contract's Project Warranty process.
3. At eleven months following substantial completion the CA shall provide a comprehensive review of the system operation using the PMOR system to analyze the data provided from the BAS. An updated Warranty Phase Issue Log shall be generated and the Contractor shall resolve all issues determined by the team to be subject to Warranty requirements.
4. At the Owner's option, and additional cost, the services of the CA and the PMOR system may be utilized after the expiration of the Warranty Phase as an On-Going Commissioning process.

3.7 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.

- B. The general list of equipment to be commissioned is found in Section 019113, Part 1.4.
- C. The parties responsible to execute each test are listed with each test in the functional test forms as published by the CA on the commissioning website.
- D. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in the *Commissioning Plan – Construction Phase*.

- E. Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test, shall provide limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the PM or General Contractor for review, if requested.

The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.

The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

The test procedure forms developed by the CA may include (but not be limited to) the following information:

1. System and equipment or component name(s)
2. Equipment location and ID number
3. Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
4. Date
5. Project name
6. Participating parties
7. A copy of the specific sequence of operations or other specified parameters being verified

8. Formulas used in any calculations
9. Required pre-test field measurements
10. Instructions for setting up the test.
11. Special cautions, alarm limits, etc.
12. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
13. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
14. A section for comments
15. Signatures and date block for the CA

F. Test Methods.

1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers (if stand-alone dataloggers are required then they will be provided and installed by the CA). The CA will determine which method is most appropriate for tests that do not have a method specified.
2. Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
3. Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate set point to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
5. Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.
6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.
7. Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test

according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

8. Sampling. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. The specific recommended sampling rates are specified in the *Commissioning Plan – Construction Phase*. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

A common sampling strategy referenced in the *Specifications* as the “xx% Sampling—yy% Failure Rule” is defined by the following example.

xx = the percent of the group of identical equipment to be included in each sample.

yy = the percent of the sample that if failing, will require another sample to be tested.

The example below describes a 20% Sampling—10% Failure Rule.

- a. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
 - b. If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
 - c. If 10% of the units in the second sample fail, test all remaining units in the whole group.
 - d. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.
- G. Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the General Contractor and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

- H. Test Equipment. Refer to Section 019113, Part 2 for test equipment requirements.

- I. Problem Solving. The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the General Contractor and his Subs.

3.8 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose by the CA on the commissioning website. Once published, these forms are available for review by all members of the commissioning team on the website.
- C. Non-Conformance.
 1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted in the online issue log and reported to the Cx Team Members via electronic notification or periodic reports generated from the website.
 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form as well as the online commissioning issue log.
 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner PM.
 4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
 - 1) The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CA documents the deficiency in the on-line commissioning issue log and assigns to the Sub for correction. Once the Sub has corrected the deficiency they will notify the CxP in the issue log of the resolution and that the item is ready to be retested.
 - 2) The CA reschedules the test and the test is repeated.
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - 1) The deficiency shall be documented on the on-line commissioning log with the Sub's response regarding the deficiency. The deficiency is assigned to the party to whom the CA believes responsible for resolution or whose input is required to proceed to resolution.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the Architect and his Consultants. Final acceptance authority is with the CA and the Owner Project Manager.
 - 3) The CA documents the resolution process using the online issue log.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency. Once the responsible party has corrected the deficiency they will notify the CA in the issue log of the resolution and that the item is ready to be retested.

5. Cost of Retesting.
 - a. At the discretion of the CA, A/E, and the Owner, the cost for the Sub to retest a functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
 - b. For a deficiency identified, not related to any start-up or initial checkout fault, the following shall apply: The CA and PM will direct the retesting of the equipment once at no "charge" to the GC for their time. However, the CA's time for a second retest will be charged to the GC, who may choose to recover costs from the responsible Sub.
 - c. The time for the CA to direct any retesting required because a specific start-up or checkout item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the GC, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.
 6. The Contractor shall respond using the commissioning website concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution. Comments shall be provided at least five (5) days after deficiency is noted or prior to a scheduled commissioning meeting whichever occurs first.
 8. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.
- C. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the Owner PM, if necessary.

3.9 OPERATION AND MAINTENANCE MANUALS / FINAL COMMISSIONING REPORT

A. O&M Manuals.

1. The specific content and format requirements for the project O&M manuals shall be per General Contractors contract requirements with Owner and General Contractor standard format for such. Special requirements for the controls contractor and TAB contractor are found in their respective specification sections.
2. CA Review and Approval. For this project the CA will not be involved in review and approval of the O&M manuals.
3. Final Commissioning Report Details. The final commissioning report shall include the following:
 - a. Final Construction Phase Commissioning Deficiency Report
 - b. Completed Prefunctional Checklist forms
 - c. Completed TAB Verification forms
 - d. Completed Functional Performance Test forms

4. Other documentation will be retained by the CA.

3.10 TRAINING OF OWNER PERSONNEL

- A. The GC shall coordinate with the Owner for desired training sequencing and scheduling and shall provide the approved schedule of training to the Owner and CA for review and approval. The Mechanical Contractor, Controls Contractor, Electrical Contractor, and Equipment Suppliers shall complete all training activities and documentation as directed by the GC, the approved schedule, and the specific equipment specification sections.

3.11 WRITTEN WORK PRODUCTS

- A. The commissioning process generates a number of written work products described in various parts of the *Specifications*. The *Commissioning Plan—Construction Phase*, lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

| <u>Product</u> | <u>Developed By</u> |
|--|-----------------------------|
| 1. Final commissioning plan | CA |
| 2. Cx Meeting minutes | CA |
| 3. Commissioning schedules | CA with General Contractor |
| 4. Equipment documentation submittals | Subs |
| 5. Sequence clarifications | Subs and General Contractor |
| 6. Prefunctional checklists | CA |
| 7. Final TAB report | TAB |
| 8. Issues Log (deficiencies) | CA |
| 10. Functional test forms | CA |
| 11. O&M manuals | Subs |
| 12. Overall training plan | GC |
| 13. Specific training agendas | Subs / GC |
| 14. Final commissioning deficiencies log | CA |

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