

SECTION 01 91 13

COMMISSIONING

This document is intended to note the Owners Design Requirements (ODR) for the titled specification section. Design professional to review and integrate ODR into the project's technical specifications. This ODR document should not be viewed as a standalone technical specification.

PART 1 - GENERAL COMMISSIONING REQUIREMENTS

◆ GENERAL

◆ RELATED DOCUMENTS

- Drawings and general provisions of the Contract. These requirements shall be in addition to applicable Division 01, 22, 23, and 26 Sections.
 - Division 22 Section "Basic Plumbing Requirements" for commissioning process activities for plumbing equipment, sub-systems, and systems.
 - Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVACR equipment, sub-systems, and systems.
 - Division 26 Section "Commissioning Electrical Systems" for commissioning process activities for electrical equipment, sub-systems, and systems.

◆ SUMMARY

- This section defines the commissioning process requirements that apply to the implementation of commissioning without regard to Division of work or to specific equipment, sub-systems, and systems.
- Commissioning is the process of ensuring that building system operate as intended through their life-cycle, as defined in this document and illustrated by the Contract Documents.

◆ ABBREVIATIONS & DEFINITIONS

- A/E: Architect, Architect/Engineer, Engineer.
- BMS: Building Management System
- Commissioning (Cx): A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all commissioned equipment and systems are planned, designed, installed, tested, operated and maintained (as appropriate to the commissioning scope) to meet the Owner's Project Requirements.
- Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- Commissioning Team: The individuals who through coordinated actions are responsible for implementing commissioning.
- CxA: Commissioning Authority, or their designated representative.
- Deficiency: A condition in the installation or function of a piece of equipment or system that is not in compliance with the Contract Documents and has not been corrected prior to the submission of the final commissioning report.
- Equipment, Sub-systems, and Systems: Where these terms are used together or separately, they shall mean "as-built" equipment, sub-systems, and systems.
- General Contractor (GC): The entity holding the prime construction contract and responsible for coordinating the work of all Sub-Contractors that are governed by the prime contract.
- FPT: Functional Performance Test.
- HVACR: Heating, Ventilating, Air Conditioning and Refrigeration.
- Non-Conformance: A deficiency that is accepted by the Owner as complete and acceptable or that has not been corrected prior to the submission of the final commissioning report.
- O & M: Operations and maintenance.
- Ongoing Commissioning Plan: A document that outlines the process, tasks, timeline, and

SECTION 01 91 13

COMMISSIONING

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documentation process for the ongoing commissioning process.

- PFC: Pre-Functional Checklist.
- Systems Manual: A systems-focused composite document that includes the operation and maintenance manual and additional information of use to the Owner during the post-occupancy phase.
- Test, Adjust & Balance (TAB): This term describes the actual performance related to HVACR systems of the Sub contracted for this purpose.
- ◆ commissioning team
 - This section outlines the commissioning process to be followed and the responsibilities of the Commissioning Team during the construction, acceptance, and post-occupancy project phases.
 - A multi-disciplinary team executes the commissioning process. The commissioning responsibilities of non-contractor team members during the construction, acceptance, and post-occupancy phases of the project are provided here for information, and to provide some context for the overall process. The composition of the commissioning team is fluid and changes throughout the project phases.
 - Team Members Appointed by Owner: CxA, Design Professional and Facility Operations Personnel.
 - Team Members Appointed by Contractor(s): GC, Representatives of the following Sub-Contractors and Suppliers, deemed appropriate by the CxA.
 - Division 22 Sub-Contractors appropriate to the scope of commissioning
 - Division 23 Sub-Contractors appropriate to the scope of commissioning
 - Division 26 Sub-Contractors appropriate to the scope of commissioning
 - Division 28 Sub-Contractors appropriate to the scope of commissioning
- ◆ owner's responsibilities
 - Provide the approved documentation, prepared by A/E, to the CxA and GC for use in developing the commissioning plan, systems manual, and operation and maintenance training plan, if not included as part of this Section.
 - Facilitate and support the commissioning process and give final approval of the commissioning work.
- ◆ Architect/engineer responsibilities
 - Attend selected commissioning team meetings.
 - Provide any sequence of operation documentation requested by the CxA. The designers shall assist 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.
 - Coordinate resolution to deficiencies identified during commissioning according to the contract documents.
 - Review and comment on FPT plans to confirm that test procedures meet the intended operation of the systems.
 - Furnish a copy of architectural supplemental instructions (ASI) and A/E field reports to the CxA.
- ◆ General Contractor's RESPONSIBILITIES

SECTION 01 91 13

COMMISSIONING

This document is intended to note the Owners Design Requirements (ODR) for the titled specification section. Design professional to review and integrate ODR into the project's technical specifications. This ODR document should not be viewed as a standalone technical specification.

- Provide representation with the means and authority to coordinate the implementation of the commissioning process as detailed elsewhere in the Contract Documents and supporting documents developed by the CxA.
 - Coordinate the commissioning process with Sub-Contractor(s).
 - Integrate commissioning process milestones in the construction schedule.
 - Attend, with responsible Sub-Contractor(s), commissioning progress meetings and cooperate with CxA for resolution of issues related to commissioning.
 - Furnish a copy of all requests for information (RFI), construction change notification (CCN), and other construction team generated documentation related to commissioning to the CxA.
 - Furnish a copy of Owner-Architect-Contractor (OAC) meeting minutes to the CxA.
 - Notify the CxA when equipment, sub-systems and systems are ready for PFCs.
 - Notify the CxA when equipment, sub-systems and systems are ready for FPTs. To ensure equipment and systems are ready for FPTs on the scheduled testing date, the GC shall complete the FPT Readiness Checklist included at the end of this section.
 - Authorize sub-contractors to make technicians available and/or coordinate with the manufacturer's authorized technicians to startup equipment and systems, and to simulate conditions for the purpose of completing FPTs.
 - Review commissioning reports and other commissioning team generated documentation.
 - Provide equipment operational and maintenance and related information requested by the CxA for final commissioning documentation.
- ◆ COMMISSIONING AUTHORITY'S RESPONSIBILITIES
- The CxA is not responsible for design concept, design criteria, compliance with codes, general construction scheduling, or construction means and methods. The CxA may assist with problem-solving and deficiency resolution, but the final responsibilities lie with the A/E and GC.
 - The primary roles of the CxA are to develop, coordinate and execute testing plans, observe and document performance and verify-that systems are functioning in accordance with this document and as illustrated in the Contract Documents and Manufacture's requirements.
 - Provide a Commissioning Plan that details the commissioning process recommended by the CxA.
 - Review design documentation from a CxA perspective to ensure accurate tests can be written with given sequence of operations.
 - Review construction-related submittals for compliance with equipment to be commissioned.
 - Provide and execute PFC & FPT Plans.
 - Plan and conduct a commissioning kick-off meeting with the Owner and GC to establish the purpose and proposed process for commissioning, and to establish individual roles and responsibilities.
 - Document the progress of construction through collecting completed commissioning documentation, attending construction meetings, and leading commissioning related meetings.
 - Provide reports on commissioning progress.
 - Witness the initial startup and checkout activities of a sample of the commissioned equipment. Review checkout and start-up procedures and reports completed by the installing

SECTION 01 91 13

COMMISSIONING

This document is intended to note the Owners Design Requirements (ODR) for the titled specification section. Design professional to review and integrate ODR into the project's technical specifications. This ODR document should not be viewed as a standalone technical specification.

Sub-Contractors or manufacturers' authorized technicians responsible for start-up.

- Verify that testing, adjusting, and balancing of Work is completed as required by the Contract Documents and perform limited verification of testing, adjusting, and balancing report data with the assistance of the TAB Agency personnel and testing equipment.
- Review the operations and maintenance manuals for completeness and warranty requirements for all commissioned equipment.
- Review as-built drawings relative to commissioned equipment and systems for accuracy of the installed conditions.
- Verify training of Owner's operating and maintenance personnel was completed.
- Review Systems Manual (provided by GC).
- Recommend acceptance of the commissioned equipment and systems to the Owner.
- Provide a final commissioning report that summarizes the work completed and demonstrates compliance with this document and the contract documents.
- Produce a Current Facilities Requirement document.
- Plan and conduct a meeting with the Owner and GC to close-out the commissioning process.

◆ COMMISSIONING DOCUMENTATION

- The GC shall provide the following information to the CxA for inclusion in the final commissioning report:
 - Copies of completed Plan and Documentation Requirements for Start-up and Initial Checkout.
 - Copies of completed Commissioning Corrective Action Reports.

◆ SUBMITTALS

- The requirements found in this Section shall be in addition to those listed elsewhere in Division 01 or in subsequent specification sections.
- The CxA will have access to submittals via ProCore. The CxA's review shall be limited to the equipment being commissioned with the commissioning review focused on confirming compliance with this document and the contract documents. The CxA will provide commissioning review comments to the Owner. The GC shall provide final approved copies of the submittals to the CxA for development of project FPTs.
 - The CxA will only review the initial submittal for equipment being commissioned. All re-submittals shall be provided to the CxA, it shall be at the CxA's discretion to review any additional re-submittals.
- The GC shall provide final approved copies of the submittals to the CxA for development of project specific commissioning documentation.
- The GC shall provide the CxA with manufacturer's installation instructions and start-up procedures, and initial operation and preventative maintenance data including troubleshooting instructions within 30 days of each submittal acceptance for use during the commissioning process.
 - The GC shall provide the CxA with Sub(s) blank normally used field checkout documents applicable to the project within 30 days of equipment startup for use during the commissioning process.

PART 2 - PRODUCTS

◆ Test equipment

SECTION 01 91 13

COMMISSIONING

This document is intended to note the Owners Design Requirements (ODR) for the titled specification section. Design professional to review and integrate ODR into the project's technical specifications. This ODR document should not be viewed as a standalone technical specification.

- All testing equipment, by GC or subcontractor, shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified elsewhere in the Contract Documents.
- Include special tools and instruments (only available from equipment manufacturer, specific to a piece of equipment) required for testing equipment in the base bid price to the GC.
- Contractors shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test equipment immediately after equipment has been repaired resulting from being dropped or damaged. Affix calibration tags to test equipment. Furnish calibration records to the CxA upon request.
- GC and Subcontractor should include in the work plan the equipment that will be utilized and provide any certificates of calibration for this equipment as needed.

PART 3 - EXECUTION

- ◆ commissioning process overview
 - The following narrative provides a brief overview of the typical commissioning tasks during the construction, acceptance, and post-occupancy phases and the general order in which they occur.
 - Construction-related submittals for all commissioned equipment are provided to the CxA during the normal submittal process.
 - The CxA develops specific equipment PFCs.
 - Early during construction the CxA conducts a kick-off meeting and presents the commissioning process for the project. Additional meetings with the commissioning team will occur throughout the project.
 - The CxA executes and documents the PFCs. The CxA reports on the PFC process including managing an issues report.
 - PFCs are completed before start-up and functional testing.
 - The GC and responsible Sub-Contractors shall document equipment start-up and initial checkout with assistance from manufacturer's technicians. The CxA may request copies of the manufacturer's or contractor's field start-up reports.
 - The CxA develops specific FPT plans for review by the A/E, GC and responsible Sub-Contractors.
 - The GC and responsible Sub-Contractors complete installation and checkout of all building control systems.
 - Testing, adjusting and balancing of completed HVACR systems is completed.
 - The CxA coordinates and executes FPTs with the assistance of responsible Sub-contractors. The CxA reports on the testing process including all observed deficiencies.
 - Testing of other commissioned systems not requiring formal functional testing is completed.
 - The CxA verifies training as required by the Contract Documents is completed.
 - The CxA may review close-out documentation and schedule deferred testing.
 - The CxA submits a final commissioning report.
- ◆ coordination
 - The GC shall prepare the overall construction schedule in sufficient detail for the CxA to

SECTION 01 91 13

COMMISSIONING

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identify construction milestones important to completing the commissioning process. The CA shall update the schedule as required by other Division 01 specifications and integrate all commissioning activities into the schedule. The GC shall include the CxA on the distribution of revised schedules.

- Sub-Contractors shall provide sufficient notice to the GC regarding their completion schedule for PFCs and start-up of all equipment and systems. Sub-Contractors shall transmit completed checklists and start-up documentation to the CxA without delay.
- The CxA will finalize scheduling of functional tests through the GC and responsible Sub-Contractors only upon completion of all checklists and start-up activities related to the equipment or systems and receipt of a completed FPT Readiness Checklist from the GC.
- Individual Sub-Contractor's shall be responsible for notifying the GC if commissioning activities involving a CxA site visit require rescheduling due to insufficient system completion. A Sub-Contractor's failure to notify the GC or the GC's failure to notify the CxA five (5) business days in advance of a scheduled CxA site visit shall result in the CxA back-charging the GC for all reasonable travel expenses and lost time.
 - At the direction of the CxA, the GC and responsible Sub-Contractors shall participate in a meeting prior to Functional Testing. The meeting shall be used to verify that all commissioned systems are properly installed and functional, and are ready for functional testing. Any known problems that may impact or prevent functional testing shall be discussed during the meeting. Based on the outcome of the meeting a date to commence functional testing will be determined.

◆ GENERAL TESTING REQUIREMENTS

- The CxA will prepare detailed testing plans, procedures, and checklists for systems, subsystems, and equipment described in the Commissioning Plan.
- The CxA shall perform PFCs on equipment and systems described in the Commissioning Plan.
- The responsible Sub-Contractors shall have trained technicians available to assist in the execution FPTs and/or coordinate with equipment manufacturers to make available authorized technicians for the same purpose.
- The CxA will coordinate and execute FPTs.
- The CxA shall sign off when the PFC forms are complete to provide notice that the equipment is ready for start-up followed by functional testing.
- Tests shall be performed using design conditions whenever possible.
- Simulated conditions may need to be imposed when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- The CxA may direct that set points be altered when simulating conditions is not practical.
- The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- If tests cannot be completed because of a deficiency outside the scope of the commissioned system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- If the Commissioning Plan indicates specific seasonal testing, complete appropriate initial

SECTION 01 91 13

COMMISSIONING

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performance tests and documentation and schedule seasonal tests.

- The CxA and the GC shall sign off when the Functional Performance Testing checklist forms are complete to provide notice that the equipment is ready to be turned over to the Owner.
- ◆ pre-functional checkout and start-up
 - Scope
 - The following procedures apply to all equipment to be commissioned for this division.
 - Purpose
 - The purpose of the pre-functional checklists is to ensure that the commissioned equipment is properly installed and ready for start-up and initial operation. Each piece of commissioned equipment shall receive complete pre-functional checkout by the CxA. The pre-functional checklist for a given piece of equipment must be successfully completed and approved prior to start-up and functional testing.
 - The primary role of the CxA is to ensure that there is written documentation and that each of the equipment manufacturer's recommended start-up procedures have been completed. The Sub-Contractor responsible for scheduling start-up shall ensure legible start-up documentation is submitted to the CxA through the GC.
 - Execution
 - The GC and Subcontractors shall perform a preliminary pre-functional checklist prior to the CxA completing the pre-functional checklists with the GC and Subcontractors during construction.
 - Documentation, Deficiencies and Approval of Tests
 - The Sub-Contractors shall clearly document any outstanding items from the pre-functional checkout and initial startup that were not completed successfully. The completed documentation shall be submitted, through the GC, to the CxA within five (5) business days of test completion.
 - The CxA will review the startup reports for completeness. The CxA will work with the Sub-Contractors to correct deficiencies or incomplete items involving the GC and others as necessary. The Sub-Contractors shall correct deficiencies or incomplete items in a timely manner, notifying the GC and CxA as soon as the outstanding items have been corrected. The Sub-Contractors shall submit corrected start-up reports.
- ◆ functional performance testing
 - Scope
 - The following procedures apply to all commissioning functional performance testing for all divisions.
 - Purpose
 - The objective of functional performance testing is to demonstrate that each commissioned system is operating according to the documented design intent and Contract Documents.
 - Execution
 - Each commissioned system shall be tested through its approved sequence of operation including all specified modes of operation.
 - Before test procedures are written, the CxA will be provided all requested documentation including the most currently approved controls submittals and any device parameters that could impact testing. The CxA will develop specific test procedures and forms to verify

SECTION 01 91 13

COMMISSIONING

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and document proper system operation. The GC shall authorize the required Sub-Contractors and equipment manufacturers to provide assistance in developing the test procedures if requested by the CxA.

- The CxA will submit the test procedures to the Sub-Contractors and equipment manufacturers for review for feasibility, safety, equipment and warranty protection. The CxA will also submit the test procedures to the A/E for confirmation that the functionality matches the design intent. All review comments shall be submitted to the CxA and if necessary the CxA will revise the test procedures per the submitted review comments prior to scheduling functional testing.
 - The time required for the CxA to coordinate and execute any retesting due to a Sub-Contractor's failure to disclose during this review that test procedures are not feasible within the context of the control system installed, shall be back-charged on an hourly basis to the GC. Any required retesting shall not be considered justification for a claim of delay or request for time extension by the GC.
- All training documentation, test reports, O&Ms, and submittals shall be at the jobsite before functional testing commences.
- The Sub-Contractors shall have trained technicians available to assist in the execution of the functional testing and/or coordinate with equipment manufacturers to make authorized technicians available. The CxA will coordinate and execute the testing and document the testing results.
 - The related commissioning specification sections include sample functional performance tests to inform the GC and Sub-Contractor(s) of the rigor required to complete these documents during acceptance
- Documentation, Deficiencies and Approval of Tests
 - The CxA will document the results of the functional performance tests using the specific procedural forms developed for that purpose.
 - All deficiencies shall be noted and reported to the GC by the CxA within five (5) business days of test completion. The CxA may recommend corrective actions to deficiencies found, however the burden of responsibility to clear any deficiency is with the GC and the Owner.
 - Corrections of minor deficiencies identified may be made during testing at the discretion of the CxA. In such cases the deficiency and resolution shall be documented in the functional test plan.
 - As testing progresses and deficiencies are identified, the CxA will discuss the deficiencies with the responsible Sub-Contractor(s).
 - When there is no dispute regarding the deficiency and the Sub-Contractor(s) accepts responsibility to perform the approved corrective action:
 - The CxA documents the deficiency and the Sub-Contractor(s) response and the testing proceeds. At the discretion of the CxA retesting of the corrected deficiency is rescheduled and the test is repeated.
 - If there is a dispute about a deficiency, regarding whether a deficiency exists or who is responsible for corrections:

SECTION 01 91 13

COMMISSIONING

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- The CxA documents the deficiency and the Sub-Contractor(s) response and reports to the GC within five (5) business days.
 - Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner. The CxA documents the resolution process.
 - The appropriate party performs the approved corrective actions. The CxA reschedules the test and testing is repeated until the deficiency is cleared.
 - Any deficiencies accepted by the Owner as found, or not corrected prior to submission of the final commissioning report, shall be marked as a non-conforming item for the purpose of the final report.
 - The time required for the CxA to coordinate and execute any retesting due to a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, shall be back-charged on an hourly basis to the GC. Any required retesting shall not be considered justification for a claim of delay or request for time extension by the GC.
 - The CxA notes each accepted functional test on the test plan. Formal approval of the completed functional performance test is contingent on the final review by the CxA and the Owner. The CxA recommends acceptance of each completed test to the Commissioning Team.
- ◆ deferred and seasonal testing
 - If any pre-functional check or functional performance test cannot be completed due an unforeseen condition not within control of the GC, execution of the pre-functional check or functional test shall be deferred based on the recommendation of the CxA and approval of the Owner. The affected testing shall be completed as soon as practical.
 - During the warranty period tests purposely delayed until weather conditions are closer to the system's design conditions shall be completed as part of this contract. The CxA will coordinate this activity. Tests shall be executed and documented by the CxA with deficiencies corrected by the appropriate Sub-Contractor(s), with the Owner's operations staff witnessing. Any final adjustments to the O&M manuals and/or as-built drawings due to the testing shall be made by the GC.
 - ◆ training of owner personnel
 - The GC shall be responsible for coordination and scheduling of training, and ultimately for ensuring that training is completed in accordance to the Contract Documents.
 - ◆ systems manual
 - The CxA will coordinate the development of a Systems Manual with the GC. The Systems Manual shall expand upon the more traditional operating and maintenance documentation to include information gathered during the commissioning process. The Systems Manual shall also serve as a training tool to inform those not involved in the design and construction phases of the project. The Systems Manual should align with the operation and maintenance documentation required by the Contract Documents.
 - The GC shall provide the following information to the CxA.
 - As-built control schematics of each commissioned system.
 - As-built control sequences including final setpoints and including lists of all control points.
 - Final parameters of all peripheral equipment (e.g. final parameters resident in a variable

SECTION 01 91 13

COMMISSIONING

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frequency drive).

- Recommended schedule of maintenance requirements and frequency, troubleshooting guidelines, and emergency procedures.
 - Valve lists for the various piping systems.
 - Equipment performance curves and tables the same as furnished with submittal data.
 - Control diagrams of factory wired equipment.
 - Temperature control system product data and shop drawings.
 - Warranties and guarantees that extend more than 1 year from the date of Substantial Completion.
- ◆ cURRENT FACILITY REQUIREMENTS And operations & maintenance plan
- The CxA will facilitate and produce the Current Facility Requirements and Operations & Maintenance Plan documents for use in the operation of the building. The CFR and O&M Plan contains all the information required to effectively and efficiently operate the building. This document takes into consideration not only the original design intent, but also changes through construction process and modifications for occupant comfort. The CFR and O&M Plan sets benchmarks for operation of the building going forward.
 - The GC shall provide the following information to the CxA.
 - Final Sequence of Operations.
 - Final occupancy schedules.
 - Final HVACR equipment setpoints.
 - Final light level settings.
 - Any changes to setpoints or schedules necessary for seasonal operation.
 - Minimum outdoor airflow rates and corresponding TAB set damper positions.

SECTION 01 91 13

COMMISSIONING

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FPT READINESS CHECKLIST

System to be Tested _____

System Installation is complete (primary units, terminal units, insulation, etc)

Y _____ N _____ N/A _____

Completed Factory Test Reports

Y _____ N _____ N/A _____

Manufacturer approved start-up is complete and all documents submitted to CxA

Y _____ N _____ N/A _____

System Test & Balance complete and report submitted to CxA.

Y _____ N _____ N/A _____

All equipment is operating normally under automatic control.

Y _____ N _____ N/A _____

EBI graphics complete.

Y _____ N _____ N/A _____

Control point to point by Honeywell is complete, points are updating on graphics.

Y _____ N _____ N/A _____

Controls programming, specified alarms and trend logs complete & verified.

Y _____ N _____ N/A _____

All previously identified pre-functional issues have been resolved

Y _____ N _____ N/A _____

All DDC control shop drawing and product submittals are Code 1 GC, Sub-contractors and manufactures can be available during testing.

Y _____ N _____ N/A _____

Ladders, lifts & other equipment necessary to access equipment will be available.

Y _____ N _____ N/A _____

Other work in the facility is scheduled to allow for un-interrupted functional testing.

Y _____ N _____ N/A _____