This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs. In particular, this master does not address building envelope commissioning, which may be desired as part of LEED certification.

Use this section for projects requiring the Contractor to provide a formal commissioning management plan and schedule, with a dedicated commissioning manager(s) to oversee the Contractor’s work. This section calls for a Commissioning Authority (CxA) to represent the Port. This role can be filled by the Port’s on-call CxA, a separately contracted CxA, or by Port staff.

SECTION 019100 - GENERAL COMMISSIONING REQUIREMENTS

1. GENERAL
	* + 1. DESCRIPTION
				1. This section describes requirements for commissioning. Commissioning (Cx) is a process used to ensure that equipment and systems are properly installed, that they deliver the required performance, and that the Port has the necessary documentation and training to properly operate and maintain them.
			2. KEY ROLES AND RESPONSIBILITIES
				1. The Contractor shall assign a commissioning manager or commissioning managers (CxM(s)), with the necessary knowledge, skills, tools, resources, and authority to ensure that all the Contractor’s responsibilities are performed to the Port’s satisfaction.
				2. The Contractor’s responsibilities for Cx include, but are not limited to:

Ensuring that all commissioned elements of the project are:

Correctly installed, started up, and fully tested to demonstrate their functionality and performance in all modes.

Fully documented to support ongoing operation and maintenance.

Training of designated Port staff regarding operation and maintenance of all commissioned elements of the project in accordance with the contract documents, applicable manufacturer’s requirements and recommendations, applicable codes and standards, and direction given by the Port.

Fill in blank below as appropriate.

* + - * 1. The Cx process will be overseen by a Commissioning Authority (CxA). The CxA may be a Port staff member, or a contracted agent or company. The Contractor’s duties are the same regardless of who performs the CxA role. Should the Contractor choose to subcontract the duties of the CxM, it shall not be to the CxA provided by the Port. The CxA for this project is \_\_\_\_\_\_\_\_\_\_\_\_\_\_.
				2. The CxA’s responsibilities include, but are not limited to, the following:

Preparing the commissioning process plan (Cx plan) to address the following:

Overview of the Cx requirements for the project.

Roles and responsibilities for all team members.

Description of the expected communication channels.

Detailed descriptions of all Cx activities.

Guidelines and templates for the development of installation checklists, startup procedures, and functional test plans.

A list of all commissioned elements, subsystems, systems, and interfaces between systems.

Planning and conducting a commissioning kick-off meeting with the CxM(s) and key Contractor and subcontractor representatives to familiarize the construction team with the contents of the Cx plan and the Contractor’s commissioning management plan.

Reviewing the Cx submittals and all RFIs and other submittals relating to the commissioned elements of the project.

Observing the progress of construction and all Cx activities, and reporting status to the Port.

Witnessing completion of selected installation checklists and startup procedures, and witnessing completion of all functional test plans, including any deferred functional test plan.

Providing and managing an online log to track all deficiencies from identification through resolution.

Verifying that all closeout procedures are followed in accordance with the contract.

Verifying that all warranty work is properly completed prior to expiration of the warranties.

Preparing a systems manual (if required).

Preparing a final commissioning report.

* + - 1. APPLICABLE CODES AND STANDARDS
				1. Refer to Section 011100, Summary of Work, for a list of applicable codes.
				2. The following industry standards for the commissioning process shall apply to the Work of this contract:

ANSI/ASHRAE/IES Standard 202-2018 Commissioning Process for Buildings and Systems

Edit list as appropriate.

* + - * 1. The following Port standards include requirements applicable to the work. These standards are available at <https://www.portofportland.com/Business/MasterSpecs>.

HVAC Standards for IT Rooms

Fire Alarm Device Schedule

Fire Alarm Device System Standard Design Guidelines

Panel Template

LCR Panel Template

* + - 1. COMMISSIONED ELEMENTS
				1. A commissioned element may consist of a single piece of equipment, multiple pieces of equipment, a portion of a system, a whole system, or a combination of equipment and systems depending on the context. For the purposes of the installation checklist, a commissioned element is typically a single piece of equipment. For the purposes of startup procedures, a commissioned element may include a single piece of equipment, a grouping of equipment, a portion of a system, or a complete system. For the purposes of a functional test plan, a commissioned element typically consists of a portion of a system or an entire system. A commissioned element may also consist of the interface between two systems or pieces of equipment provided under different divisions or sections of the specifications. The Contractor shall list the specific equipment being addressed in each installation checklist, startup procedure, and functional test plan.
				2. All equipment, systems, and interfaces between various equipment and systems specified in the following sections shall be commissioned in accordance with this section:

Edit list as appropriate. Ensure that all included sections refer to this section for commissioning and do not include conflicting requirements.

Division 08 – Openings:

Section 083325, High Speed Roll Up Doors

Division 10 – Specialties:

Section 101900, Integrated Technology Structures

Division 12 – Furnishings:

Section 122400, Window Shades

Division 21 – Fire Suppression:

Section 212000, Fire Suppression Systems

Section 211120, Fire Suppression Pumps

Section 212200, Fire Detection/Inergen Suppression System

Division 22 – Plumbing:

Section 221120, Plumbing Pumps

Section 223000, Plumbing Equipment

Section 224000, Plumbing Fixtures

Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC): All equipment and systems.

Division 26 – Electrical: All equipment and systems.

Division 28 – Electronic Safety and Security:

Section 281300, Security Access Control System

Section 282300, Video Surveillance System

Section 284600, Fire Detection and Alarm System

Division 32 – Exterior Improvements:

Section 323114, Automatic Gate Operator and Control

Division 33 – Utilities:

Section 330900, Tenant Metering System

Section 331233, Water Utility Meters

Section 335133, Natural Gas Utility Meters

Section 337173, Electric Utility Meters

Edit list as appropriate. Some excluded sections may still require commissioning or testing activities by the contractor or subcontractor.

* + - * 1. Equipment and systems specified in the following sections are not subject to the requirements of this section:

Division 10 – Specialties

Section 101463, Baggage Information Display System

Division 11 – Equipment:

Section 118129, Facility Fall Protection

Division 14 – Conveying Equipment:

Section 142100, Traction Elevators

Section 142400, Hydraulic Elevators

Section 143100, Escalators

Section 143200, Moving Walkways

Division 22 – Plumbing

Section 221319, Liquid Grease Collection System

Section 221320, Vacuum Grease Removal System

Division 27 – Communications

Division 28 – Electronic Safety and Security: Transportation Security Administration (TSA), airline, or other tenant-owned security access control systems and video surveillance systems.

Division 34 – Transportation

Section 347716, Baggage Handling System

Edit durations in paragraphs below as appropriate.

* + - 1. SUBMITTALS
				1. CxM(s) Qualifications:

Within \_\_\_\_ weeks following issuance of the Notice to Proceed, submit the CxM(s) resume(s) including the following information for approval:

Name.

Current title and brief job description.

History of employment and relevant work experience.

Relevant education, professional licensing, certification, technical training, professional affiliations, and similar credentials.

Three recent project references including reference names, titles, and phone numbers.

A list of the divisions or sections of the specifications, systems, or equipment that the CxM will be responsible for.

A list of other roles the CxM will, or may fill on this project. For example, superintendent, or project engineer.

* + - * 1. Contractor’s Commissioning Management Plan:

Within\_\_\_\_ weeks following approval of the CxM(s) qualifications, submit a commissioning management plan for approval.

The commissioning management plan shall include, but not be limited to, the following:

Commissioning team contact information, including for key Contractor, subcontractor, and supplier representatives.

Commissioning management process overview including a discussion of how the CxM(s) will interface with the Contractor’s other staff and subcontractor staff to ensure that commissioning activities are properly incorporated in the contract schedule, monthly update reports, and progress meeting schedules, and that all prerequisite work is complete prior to starting any specific commissioning activity.

Summary of the Contractor’s commissioning scope, including a list of the commissioned elements (all equipment and systems) and all Cx tasks.

Commissioning team task matrix, identifying the roles and responsibilities of each team member.

* + - * 1. Commissioning Schedule:

Include all specified commissioning activities in the contract schedule, the monthly update reports, and progress meeting schedules. See Section 013200, Construction Progress Documentation.

For each commissioned element, include the following information in the schedules:

Equipment tag(s), system name(s), or description as part of the task ID.

Milestone dates for the following tasks and activities:

Submittal of proposed and completed installation checklists.

Submittal of proposed and completed startup procedures.

Submittal of proposed and completed functional test plans.

Submittal of operation and maintenance manuals, redline drawings, training plans, and training videos (see Section 013300, Submittal Procedures).

Start and end dates for the following tasks and activities:

Performance of all installation checklists, startup procedures, functional testing, and deferred functional testing, by commissioned element.

Performance of Port staff operation and maintenance training.

* + - * 1. Installation Checklists:

Submit proposed installation checklists for each commissioned element no less than \_\_\_\_ weeks prior to completion of installation. Submit completed installation checklists no more than \_\_\_\_ weeks following completion of the checklist.

The installation checklists may be developed using a template provided by the manufacturer, by the CxA, or by the Contractor or subcontractor.

The installation checklists shall incorporate all installation requirements and recommendations as described by the following sources at a minimum:

Manufacturer’s literature.

The contract documents.

Applicable codes and standards.

The proposed installation checklists shall be comprehensive in nature and shall list general information and installation requirements to be verified including, but not limited to:

General information for the commissioned element such as the name or tag, the manufacturer, model, and serial number, the location and area(s) served, and the name of the installing Contractor and subcontractor.

The items to be inspected and verified including, but not limited to:

The presence of any damage.

The removal of any packaging or protective materials not intended to be permanently affixed.

The location, position, or orientation in accordance with the contract documents.

The presence or level of any lubricants, coolants, or other required fluids.

The presence and condition of any required filters.

The attachment, support, bracing, tightening of screws or bolts, and other mechanical or structural requirements.

The proper torquing of electrical connections.

The absence of wire whiskers or other improper electrical terminations.

The attachment and connection of any guards, barriers, disconnect switches, emergency stop switches, or other physical safety features or controls.

The available access for service, maintenance, repair, and replacement.

The correct attachment of external services or utilities such as supply and return piping and electrical conduit or wiring.

The certification or listing label from an authority such as Underwriters Laboratory (UL) or Intertek (ETL).

The physical labeling and tagging, including wire tags and QR code sticker (see Section 017000, Execution Requirements).

Completed installation checklists shall include the following:

The date and time when the checklist was completed.

The name and signature (or initials) of the individual responsible for completing the checklist.

A list of all deficiencies identified.

A list of any deficiencies that were remedied.

A list of any deficiencies to be entered into the online deficiency log.

* + - * 1. Startup Procedures:

Submit proposed startup procedures for each commissioned element no less than \_\_\_\_ weeks prior to energization or activation. Submit completed startup procedures no more than \_\_\_\_ weeks following completion of the procedure.

The startup procedures may be developed using a template provided by the manufacturer, by the CxA, or by the Contractor or subcontractor.

The startup procedures shall incorporate all startup requirements and recommendations as described by the following sources at a minimum:

Manufacturer’s literature.

The contract documents.

Applicable codes and standards.

The proposed startup procedures shall be comprehensive in nature and shall list general information and steps to be followed including, but not limited to:

General information for the commissioned element such as the name or tag, the manufacturer, model, and serial number, the location and area(s) served, the installing Contractor and subcontractor, the names and signatures of the individuals documenting and approving the procedure, and the date.

The startup procedures and step-by-step activities to be followed including, but not limited to:

Application of power.

Operational activation.

Verification of direction of rotation.

Verification of all safety features and functions.

Point-to-point verification, adjustment, and field calibration of sensors, instruments, and controls.

At the Port’s request, the startup procedure may include a requirement to operate the commissioned element for a period of time to verify its reliability.

Startup procedures shall not be performed on any commissioned element until its completed installation checklist has been approved and all deficiencies have been corrected.

Completed startup procedures shall document the following:

Date and time when the startup procedure was completed.

Name and signature (or initials) of the individual responsible for completing the startup procedure.

A list of all deficiencies identified.

A list of any deficiencies that were remedied during the startup.

A list of any deficiencies to be entered into the online deficiency log.

* + - * 1. Functional Test Plans and Deferred Functional Test Plans:

Submit proposed functional test plans for each commissioned element no less than \_\_\_\_ weeks prior to testing. Submit completed functional test plans no more than \_\_\_\_ weeks following completion of the test plan.

Submit deferred functional test plans for commissioned elements no less than \_\_\_\_ weeks prior to testing. All deferred functional testing shall be completed no later than \_\_\_\_ weeks prior to completion of the warranty period for said commissioned element. Submit completed deferred functional test plans no later than \_\_\_\_ weeks following completion of the deferred functional test plan.

For commissioned elements that include many identical pieces of equipment, a random statistical sampling strategy may be proposed. Sampling may not be applied to life safety-related equipment or systems, such as fire suppression, fire alarm, CCTV, access control, or emergency power and lighting.

The functional test plans may be developed using a template provided by the manufacturer, by the CxA, or by the Contractor or subcontractor.

The functional test plans shall incorporate and verify all functional and performance requirements as described by the following sources at a minimum:

Manufacturer’s literature.

The contract documents.

Applicable codes and standards.

The proposed functional test plans shall be comprehensive in nature and shall list general information and all test procedures to be followed including, but not limited to:

General information for the commissioned element such as the equipment or system name(s) or tag(s), the manufacturer, model, and serial number(s), the location and area(s) served, the installing Contractor and subcontractor, and the names of the CxM(s) and subcontractor personnel who are responsible for executing the test plan.

A list of any prerequisites such as approval of shutdown notifications or other Port-required notifications for impacts to airport operations.

A complete description of the test procedures, step-by-step activities, and the expected results to validate all functional and performance requirements including, but not limited to:

Automatically controlled sequences of operation (e.g., temperature controls and fire alarm notification and evacuation).

Manual operating controls (e.g., generator manual start/stop switch and motor starter H-O-A switch).

Factory-furnished controls (e.g., computer room air conditioning unit temperature controller and fuel storage tank leak detection system).

Speed of operation (e.g., high-speed rollup doors and motorized window shades).

Efficiency of operation (e.g., plumbing fixture water consumption and boiler combustion efficiency).

Capacities (e.g., chiller tonnage and UPS backup ampere-hours).

At the Port’s request, the functional test plan may include a requirement to operate the commissioned element for a period of time to verify its reliability.

Functional testing shall not be performed on any commissioned element until its completed startup procedure has been approved and all deficiencies have been corrected.

Completed functional test plans shall document the following:

Date and time when the test was conducted.

Weather or other relevant conditions present during the test.

Name and signature (or initials) of the individual responsible for documenting the test results.

A list of all deficiencies or unexpected results identified.

A list of any deficiencies that were remedied during the test.

A list of any deficiencies to be entered into the online deficiency log.

Delete the following paragraph if Section 284600 is not included in the project manual.

The fire alarm system has unique requirements for functional testing. Refer to Section 284600, Fire Detection and Alarm.

* + - * 1. Related Submittals

Refer to Section 013300, Submittal Procedures, for requirements for the following Cx-related materials:

Operation and maintenance manuals.

Redline (as-constructed) drawings.

Training plans.

Training videos.

* + - 1. QUALITY ASSURANCE
				1. The CxA shall have the authority to witness all scheduled Cx activities performed by the Contractor including, but not limited to, completion of installation checklists, startup procedures, functional test plans, deferred functional test plans, and Port staff training. Coordinate with the CxA to enable them to witness all activities as requested by the CxA.
1. PRODUCTS
	* + 1. EQUIPMENT
				1. All software, equipment, tools, instruments, ladders, lifts, and other such equipment (including any special test equipment only available from the vendor) required to perform the specified commissioning activities shall be provided by the Contractor.
				2. All instruments and data logging equipment used shall be of sufficient quality and accuracy to measure variables within the tolerances included in the technical specifications. The accuracy of all test instruments shall be stated as a percentage of the expected value to be measured, not as a percentage of the full range or span of the instrument. If not otherwise specified, the following minimum requirements shall apply:

Temperature sensors and thermometers shall have an accuracy of ± 1.0%.

Pressure and flow sensors shall have an accuracy of ± 3.0%.

AC voltage meters shall have an accuracy of ± 0.7%.

AC current meters shall have an accuracy of ± 1.0%.

Light meters shall have an accuracy of ± 3.0%.

* + - * 1. Calibrate all equipment according to the manufacturer’s recommended intervals and whenever dropped, damaged, or when the test results are in question.
				2. Dated calibration tags shall be affixed to the instrument, or certificates shall be made available upon request of the CxA, the Port, or its representative.
1. EXECUTION
	* + 1. MEETINGS
				1. Commissioning Kick-Off Meeting: No later than \_\_\_\_ weeks following approval of the Contractor’s commissioning management plan, the CxA will conduct a commissioning kick-off meeting with the Contractor’s entire commissioning team in attendance. This includes, at a minimum, the CxM(s), the superintendent(s), project engineer(s), and representatives of all subcontractors with responsibilities for commissioning activities. The Contractor shall coordinate the meeting date, time, and location with the CxA to allow for participation of its team. One week prior to this meeting, the CxA will distribute the commissioning process plan, the approved Contractor’s commissioning management plan, and the approved contract schedule to all participants for their reference. The meeting agenda shall familiarize the participants with these documents. The CxA will distribute meeting minutes to all parties attending the meeting.
				2. Ongoing Commissioning Meetings: Once commissioning activities begin, regular commissioning meetings shall be conducted by the Contractor. The meetings shall include the Contractor’s commissioning team, the CxA, and Port staff. These meeting may become part of the general construction meeting agenda if approved by the Port. The meetings shall address scheduling of Cx activities and coordination between the involved trades and the CxA, status and resolution of identified deficiencies, lessons learned from Cx activities previously performed, and potential Cx process improvements. The Contractor shall distribute meeting minutes to all parties.
			2. ONLINE DEFICIENCY LOG
				1. The CxA will provide a software tool to log all deficiencies identified throughout the Cx process including execution of the installation checklists, startup procedures, functional tests, and any deferred functional tests. The CxA will authorize access to the log for Port staff and members of the Contractor’s commissioning team, as requested by the Contractor.
				2. The Contractor shall create entries in the log that fully describe all deficiencies identified during completion of the installation checklists and startup procedures. The CxA will create entries in the log that fully describe all deficiencies identified during completion of functional test plans and any deferred functional test plans. Deficiencies that are remedied to the satisfaction of the CxA during the procedure (i.e., completion of installation checklist, startup procedure, or functional test plan) shall be included in the submittal of the completed document, but not entered into the online deficiency log. All log entries shall include a plan to remedy the deficiency including the assignment of responsibilities and completion date(s).
				3. The CxA will have the authority to edit all entries made by the Contractor, including the description of the deficiency, the plan for resolution, and the completion date(s). The CxA will notify the Contractor when edits are made. The Contractor may appeal any edits to the Port and the Port’s determination shall be final.
			3. INSTALLATION CHECKLISTS AND STARTUP PROCEDURES
				1. Completed installation checklists and startup procedures shall be approved by the CxM(s) prior to submission.
				2. Completed installation checklists and startup procedures showing deficiencies to be remedied shall be returned as “Revise and Resubmit.” Following correction of all deficiencies, resubmit the completed checklist and startup procedure with the initials of the CxM(s) verifying that the deficiencies have been corrected.
				3. The completed installation checklist submittal shall be approved before proceeding to startup.
				4. The completed startup procedure shall be approved before proceeding to functional testing.
			4. FUNCTIONAL TEST PLANS
				1. Functional test plans shall be executed by the Contractor and witnessed by the CxA. Testing generally shall proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface, interlock, integration, or other responses requiring coordination between systems shall be tested.
				2. Completed functional test plans showing deficiencies to be remedied shall be returned as “Revise and Resubmit.” Following correction of all deficiencies, resubmit the completed functional test plan with the initials of the CxM(s) verifying that the deficiencies have been corrected.
				3. At the Port’s sole discretion, the Contractor may be required to re-perform completed functional test plans with deficiencies either partially or in their entirety.
				4. The completed functional test plan shall be approved prior to placing the commissioned element into service and commencing its warranty period.
			5. DEFERRED FUNCTIONAL TESTING
				1. Deferred functional testing includes any functional testing activity that occurs following placement of a commissioned element into service.
				2. Deferred functional testing may be required by the Port due to any of the following conditions:

Where additional occupancy, load, or other changes in usage are required to fully test the commissioned element.

Where weather conditions impact the performance of a commissioned element, requiring additional “off-season” testing.

Where construction phasing, interim conditions, partial completion, or temporary occupancy, followed by subsequent modifications or completion of work, alters the commissioned element.

* + - * 1. Deferred functional testing may be requested by the Contractor when it is unable to complete testing prior to placing a commissioned element into service. The request shall be submitted as a written clarification and shall include the Contractor’s detailed plan to support the commissioned element until it is functionally tested and accepted by the Port. The request shall also address the schedule for executing the deferred functional test plan, including any provisions necessary for post-occupancy testing to mitigate the impact on the Port and its tenant’s operations. The Port will not approve any request to defer functional testing for commissioned elements that impact life safety or security such as the fire suppression and fire alarm systems, the CCTV and access control systems, or the emergency power and lighting systems.
				2. Completed deferred functional test plans showing deficiencies to be remedied shall be returned as “Revise and Resubmit.” Following correction of all deficiencies, resubmit the completed deferred functional test plan with the initials of the CxM(s) verifying that the deficiencies have been corrected.
				3. At the Port’s sole discretion, the Contractor may be required to re-perform completed deferred functional test plans with deficiencies either partially or in their entirety.
				4. The completed deferred functional test plan shall be approved prior to placing the commissioned element into service and commencing its warranty.
			1. CLOSEOUT PROCEDURES
				1. Refer to Section 013300, Submittal Procedures, and Section 017700, Closeout Procedures, for requirements.
				2. The CxM(s) shall ensure that training plans are submitted and approved prior to scheduling maintenance instruction and training for any commissioned element.
				3. Authorization to proceed with training will not be granted until the following criteria are met:

Completed functional test plans for the applicable commissioned elements are accepted.

Final, draft, or interim operation and maintenance manuals for applicable commissioned elements are complete and accepted.

* + - * 1. The CxM(s) shall ensure that training videos are submitted and approved following any training session.
			1. WARRANTY
				1. The CxA will conduct a warranty review meeting with the Port prior to the expiration of any warranty. The purpose of the meeting is to ensure that any deficiencies with the commissioned elements have been properly reported to the Contractor and resolved to the Port’s satisfaction. Any deficiencies that remain unresolved will be reported to the CxM(s) or the Contractor’s designated warranty representative.
				2. The CxM(s) or the Contractor’s designated warranty representative shall respond to any deficiencies reported by the Port prior to the expiration of any warranty. The response shall detail the Contractor’s plan and commitment to resolve the deficiency regardless of the expiration of the warranty, or it shall lay out the Contractor’s position and reason(s) to determine that there is no warranty obligation.
			2. FINAL COMMISSIONING REPORT
				1. The CxA will be responsible for preparing a report at the conclusion of the warranty and any deferred functional testing. The CxM(s) or the Contractor’s designated representative shall have the opportunity to review the draft report and provide comments and suggestions prior to finalization of the report by the CxA.

END OF SECTION 019100