ICC 1000

APPLICATION OF THE COMMISSIONING PROCESS

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By

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ICC Headquarters:

500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001-2070

District Offices:

Birmingham, AL • Chicago, IL • Los Angeles, CA

Telephone: 1-888-422-7233 (ICC-SAFE)

www.iccsafe.org

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CHAPTER 1: INTRODUCTION

Section 101
General

101.1 Purpose and scope.

Purpose: This standard provides a set of requirements that will address the current practices relating to the application of the overall commissioning process described in relevant commissioning process standards. This includes procedures for the commissioning process application and acceptance criteria for adoption by commissioning providers, users and local jurisdictions to facilitate implementation and enforcement of commissioning provisions established in building codes.

Scope: This standard establishes minimum requirements for the application of the process of commissioning buildings and systems, and criteria for code officials (AHJ), owners, and agencies to implement the commissioning process. This standard establishes a process that is applicable to buildings in the public or private sectors.

Section 201
Acronyms

201.1 The following acronyms are used throughout the guideline.

BAS Building automation systems
BOD Basis of design
CxA Commissioning agency
EPA Environmental Protection Agency
FPT Functional performance test
HVAC Heating, ventilating and air conditioning
LEED Leadership in Energy and Environmental Design
O&M Operations and maintenance
OPR Owner's project requirements

Section 202
General Definitions

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***Acceptance*:** A formal action, taken by a person with appropriate authority (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.

***Basis of Design (BOD)*:** A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements 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.

***Checklists*:** Project and element-specific checklists that are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements are being achieved. Checklists are used for general evaluation, testing, training, and other design and construction requirements.

***Commissioning*: (Cx):** See Commissioning Process.

Commissioning agency (CxA) An established and recognized agent or agency regularly engaged in conducting tests and furnishing commissioning services. The agency may consist of one or multiple individuals having various expertises. The Commissioning Agency can be a third-party commissioning provider or the owner's in-house staff member.

***Commissioning Authority (CxA)*:** An entity identified by the Owner who leads, plans, schedules, and coordinates the commissioning team to implement the Commissioning Process.

***Commissioning Plan (Cx Plan)*:** A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

***Commissioning Process*:** A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

***Commissioning Process Activities*:** Components of the Commissioning Process.

***Commissioning Progress Report*:** A written document that details activities completed as part of the Commissioning Process and significant findings from those activities, and is continuously updated during the course of a project.

***Commissioning Team*:** The individuals and agencies, who through coordinated actions, are responsible for implementing the Commissioning Process.

Commissioning Testing: The evaluation and documentation of the equipment and assemblies: delivery and condition; installation; proper function according to the manufacturer's specifications, and project documentation to meet the criteria in the Owner's Project Requirements.

***Construction Checklist*:** A form used by the commissioning team to verify that appropriate materials and components are on-site, ready for installation, correctly installed, functional, and in compliance with the Owner's Project Requirements. Also see **Checklists**.

***Construction Documents*:** This includes a wide range of documents, which will vary from project to project, and with the Owner's needs and regulations, laws, and jurisdictional requirements. Construction documents usually include the project manual (specifications), plans (drawings), and General Terms and Conditions of the contract.

***Contract Documents*:** This includes a wide range of documents, which will vary from project to project and with the Owner's needs, regulations, laws, and jurisdictional requirements. Contract Documents frequently include price agreements, construction management process, sub-contractor agreements or requirements, requirements and procedures for submittals, changes, and other construction requirements, timeline for completion, and the Construction Documents.

***Coordination Drawings*:** Drawings showing the work of all trades to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances.

Design Checklist: A form developed by the commissioning team to verify that elements of the design are in compliance with the Owner's Project Requirements. Also see **Checklists**.

Design Review– PEER: An independent and objective technical review of the design of the Project or a part thereof, conducted at specified stages of design completion by one or more qualified professionals, for the purpose of enhancing the quality of the design.

Design Review – Constructability: The review of effective and timely integration of construction knowledge into the conceptual planning, design, construction and field operation of a project to achieve project objectives efficiently and accurately at the most cost effective levels to reduce or prevent errors, delays and cost overruns.

Design Review – Code or Regulatory: A review of a document conducted by staff or designated entity of an Authority Having Jurisdiction to determine whether the content of the document complies with regulations, codes, or other standards administered by the Jurisdiction.

Design Review – Commissioning: A review of the design documents to determine compliance with the Owner's Project Requirements, including coordination between systems and assemblies being commissioned, features and access for testing, commissioning and maintenance, and other reviews required by the OPR and commissioning plan.

***Evaluation*:** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems and their performance are confirmed with respect to the criteria required in the Owner's Project Requirements.

Existing Building Commissioning Process: A quality-focused process for attaining the Current Facility Requirements of an existing facility and its systems and assemblies being commissioned. The process focuses on planning, investigating, implementing, verifying, and documenting that the facility and/or its systems and assemblies are operated and maintained to meet the Current Facility Requirements, with a program to maintain the enhancements for the remaining life of the facility.

***Commissioning Report*:** A document that records the activities and results of the Commissioning Process and is developed from the Commissioning Plan with all of its attached appendices.

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

O&M manuals. Documents that provide information necessary for the operation and maintenance of installed equipment and systems.

***On-Going Commissioning Process (OCx)*:** A continuation of the Commissioning Process well into Occupancy and Operations to continually improve the operation and performance of a facility to meet current and evolving Current Facility Requirements or Owner's Project Requirements. On-Going Commissioning Process activities occur throughout the life of the facility; some of these will be close to continuous in implementation, and others will be either scheduled or un-scheduled as needed.

Owner. The individual or entity holding title to the property on which the building is constructed.

***Owner's Project Requirements (OPR)*:** A written document that details the requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term Project Intent or Design Intent is used by some owners for their Commissioning Process Owner's Project Requirements.)

Owner's representative. An individual or entity assigned by the owner to act and sign on the owner's behalf.

Performance Test (PT): Performance Testing is the process of verifying that a material, product, assembly, or system meets defined performance criteria. The methods and conditions under which performance is verified are described in one or more test protocols.

Process equipment. Energy-using equipment and components that are not used for HVAC, electrical, plumbing and irrigation operations. Such devices include, but are not limited to, heat transfer, water purifying, air cleaning, air vacuum and air compressing.

***Re-Commissioning*:** (See Existing Building Commissioning.) An application of the Commissioning Process requirements to a project that has been delivered using the Commissioning Process.

Retro-Commissioning: (See Existing Building Commissioning.) The Commissioning Process applied to an existing facility that was not previously commissioned.

Sequence of operation. A written description of the intended performance and operation of each control element and feature of the equipment and systems.

***Systems Manual*:** A system-focused composite document that includes the design and construction documentation, facility guide and operation manual, maintenance information, training information, commissioning process records, and additional information of use to the Owner during occupancy and operations.

***Test Procedure*:** A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems to verify compliance with the Owner's Project Requirements.

***Training Plan*:** A written document that details the expectations, schedule, duration and deliverables of Commissioning Process activities related to training of project operating and maintenance personnel, users, and occupants.

Section 301

The Commissioning Process301.1 The ***Commissioning Process*** is defined as a quality-focused process for enhancing the delivery of a new and existing building project. The overall process focuses upon verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements (OPR).

301.2 The commissioning process has a series of actions and schedules for proper completion. Each action has specific deliverables. These define the building and commissioning requirements, and the documentation of the performance results and training for the systems, and assemblies commissioned. The actions in the commissioning process shall be: :

a. The owner initiates the Commissioning Process and retains the commissioning authority at the beginning of the project. The roles and responsibilities of the project and commissioning teams are determined. Procedures and contracts are prepared and executed.

b. Next the project requirements are determined and documented, including not only the site and building scope and use but also the performance, training, commissioning and documentation requirements. The deliverable for this action is the Owner's Project Requirements (OPR) document which is the guiding instruction for the project, which is updated throughout the project.

c. At this time the initial Commissioning Plan is developed showing the commissioning scope, roles

and responsibilities, communication procedures, and design and construction requirements for providing and integrating commissioning into the project. This Commissioning Plan is updated throughout the project with checklists, functional, and performance testing protocols and procedures, schedules and documentation details.

d. The design team then determines and documents the design approach to meet the Owner's Project Requirements. The commissioning authority reviews this Basis of Design (BOD) for conformance to the OPR.

e. During the design phase, the contractor commissioning requirements are determined for each commissioned system, and commissioning specifications are included in the construction documents package.

f. In the design phase, the commissioning authority reviews the design documents for conformance to the OPR, and provides the design review report.

g. Early in the project construction, the commissioning team reviews the materials and equipment submittals for conformance to the OPR and construction documents. This submittal review and report provides familiarity with the building systems for development of testing and commissioning requirements.

h. As the project is constructed, the commissioning team observes and verifies the installation and witnesses the equipment start up and testing. At system completion, functional testing, and performance testing is conducted and documented in checklists, logs and reports to verify performance compliance with the OPR and design documents.

i. One of the main functions and benefits of commissioning process is the identification and resolution of project issues, in both the design and construction phases, using the Issues and Resolution Log and project team collaboration. The design team and contractors shall provide responses to the issues.

j. During design and construction the project documents are assembled into the systems manual that provides the details and history of the design and construction of the building, and information needed to properly operate the building. The systems manual is used in the training of the operations and facility staff and occupants, and is updated throughout the life of the building.

k. To operate the building in accordance with the OPR and design capabilities, the building operations, maintenance, and facility staff must be trained on the installed and commissioned equipment and systems. The training plans and records are retained and updated for use in later training. The commissioning authority witnesses this training for effectiveness and conformance to the OPR and project documents.

l. Commissioning logs and interim reports are collected throughout the project and distributed as required by the commissioning plan. At the completion of the project, the commissioning report is assembled and provided to the owner and others as required by the OPR, project documents, and local jurisdiction requirements.

301.3 Commissioning Process Scope: The commissioning scope will depend upon how the project will be designed, built, and operated. Commissioning will be performed based on the extent of commissioning effort defined and procured by the owner. The outline in 301.2 describes the

commissioning process and can be supplemented by companion technical documents and guidelines to describe the specific technical details to properly implement the commissioning process relative to a specific facility, system, or assembly.

301.4 Commissioning Process Management: The commissioning process is applicable on many levels. It can be applied to one or a number of systems and assemblies in the project as defined in the owner's project requirements and commissioning plan. If more than one system and more than one person or entity is involved in the commissioning process, there must be a designated manager of the entire commissioning process to coordinate the process and the documentation. That person is called the Commissioning Provider and he/she must be certified for that responsibility. Those entities responsible for specific technical areas or systems that may require technical certification or licenses shall be called Commissioning Specialists. These commissioning specialists shall report to or be under the direction of the Commissioning Provider for process accomplishment and documentation assembly. Where a commissioning process completion approval is required by the code or code official, a qualified individual or agency shall be retained by the owner and approved by the code official as the commissioning provider for that project.

Section 302
Owner's Project Requirements

302.1 Owner's (or owner representative's) project requirements (OPR).

The Owner's Project Requirements are a written document that details the requirements of a project and the expectations of how it will be used and operated. This includes project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, documentation, and supporting information. (The term Project Intent or Design Intent is used by some owners for their Commissioning Process Owner's Project Requirements.)

301.2 Contents of the OPR shall include:

a. Facility objectives, size, location, user requirements, and owner directives including space usage, occupancy, operation and project schedules, codes, and indoor environment requirements, including temperature, humidity, and ventilation..
b. Commissioning process scope and requirements, including logs, reviews and reports and listing of equipment, systems and assemblies requiring commissioning with Installation evaluation and testing requirements.
c. Equipment, systems and assemblies requirements, expectations, and warranty provisions including maintainability, access, and operational performance requirements.
d. Environmental, sustainability, and efficiency goals and benchmarks.
e. Project documentation requirements and formats including; Basis of Design, Commissioning Plans and reports and the Systems Manual.
f. Training requirements for owner's operation and maintenance personnel and occupants.

301.3 Compliance method. Compliance is demonstrated by the owner or owner's representative developing and/or approving the OPR document, including requirements identified in the adopted code and standards requirements of the local jurisdiction

301.4 Enforcement. At his or her discretion, the code official shall confirm demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved OPR document; and

2. Receipt of a form (see the CF-1 form) signed by the owner or owner's representative, and commissioning provider attesting that the OPR has been completed and approved by the owner.

Section 303
Commissioning Plan

303.1 Commissioning plan. The commissioning plan **is** a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process. The commissioning plan establishes the commissioning process guideline for the project and the commissioning team's level of effort by identifying the required commissioning activities to ensure that the OPR and the BOD are met.

303.2 The Commissioning Plan is usually provided in two phases, The Preliminary Commissioning Plan, which is completed before issuance of the construction permit, contains the general requirements for commissioning as shown in 303.3. During construction, the Final Commissioning Plan, which is completed before the start of commissioning testing, is developed based on the update of the Preliminary Commissioning Plan with the addition of the construction checklists, schedules, procedures and performance requirements for the actual equipment and systems being installed as shown in 303.4

303.3 Prior to permit issuance, a **Preliminary Commissioning Plan** based on the the OPR and applicable codes shall be completed to document how the project will be commissioned. Contents of the Preliminary Commissioning Plan shall comply with code requirements and include:

a. Overview of the commissioning process and goals developed specifically for each phase of the project, from design through occupancy and operations.

b. General roles and responsibilities for the Commissioning Team throughout the project. The responsibilities shall delineate the duties of the commissioning providers, commissioning specialists, inspectors, contractors, suppliers, and other agencies. The details and specific assignments will be updated in the Final Commissioning Plan

c. Documentation of general communication channels including the distribution of the Commissioning Plan and documentation during the design and construction processes. This includes the development and utilization of the Issues and Resolution Logs and a preliminary listing of required reports including format, reviews and approvals.

d. Project construction design documentation review and submittal evaluation procedures and reports in accordance with the OPR.

e. General description of commissioning process activities, and a preliminary schedule of activities.

f. The list of operations, systems and assemblies that will be commissioned and/or inspected. Performance criteria shall be included when available and where not shown on the construction documents.

g. Preliminary format for Commissioning checklists and testing forms, and Commissioning Progress Reports that will be used during the project to communicate and track commissioning information.

h. Guidelines and formats that will be used to develop the Systems Manual, Training Plans, and Final Commissioning Report.

i. The framework for procedures to follow whenever Commissioning Process evaluation results do not meet the OPR or the construction document requirements.

303.4 **Final Commissioning Plan**: Before the start of commissioning testing, the Final Commissioning Plan shall update the Preliminary Commissioning Plan and include the following information:

a. Update the overview of the Commissioning Process and goals developed specifically for each phase of the project if changes are necessary.

b. Update the roles and responsibilities for the Commissioning Team. The responsibilities shall delineate the detailed duties of the commissioning providers, specialists, inspectors, contractors, suppliers, and other agencies.

c. Update the documentation and communication channels including the distribution of the Commissioning Plan during the construction process with specific assignments.

d. Update and expand the detailed description of Commissioning Process activities, the schedule of activities and the list of operations, systems and assemblies that will be commissioned or inspected. Evaluation procedures, and performance criteria shall be included for all commissioned systems and assemblies..

e. Update the requirments and assign responsibilities for the Systems Manual and Training Plans.

f. Update the listings and formats for Commissioning Process evaluation checklists, testing forms, issues and resolution log, and Commissioning Progress Reports. .

g. After final equipment selection and approval, and before installation, detailed testing procedures and checklists for installation observation, functional testing and performance testing for all commissioned systems and assemblies shall be developed and included in the Final Commissioning Plan. Conditions under which the testing will be performed shall be included where relevant. Verification of sequences of operation shall be included

h. Update the procedures to follow whenever Commissioning Process evaluation does not meet the OPR or construction document requirements.

i. Provide a general description of Commissioning Process activities that will occur during Occupancy and Operations.

303.5 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific commissioning plan that includes the elements listed in 303.3 prior to issuance of permit and compliance with updates and elements listed in 303.4 before testing.

304.6 Enforcement. At his or her discretion, the code official confirms demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved commissioning plans; and
2. Receipt of a form (see the Commissioning Plan Sample Compliance form CF-2) signed by the owner or owner's representative, and commissioning provider, attesting that the commissioning plans has been completed.

Basis of Design

304.1 Basis of Design (BOD). The Basis of Design is a document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements 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.

The BoD shall be completed at the start of the design phase of the building project, and updated as necessary during the design and construction phases.

304.2 The BOD document shall include compliance with local code requirements and the following

a. Description in detail of the design team's technical approach to each of the Owner's requirements.

b. Provide a platform for the review of the design and changes as the project progresses.

c. Coordination of applicable technical and code requirements as well as the commissioning requiremenmts.

d. Design criteria and design assumptions are in agreement with the OPR.

e. Requirements for sustainable design and other certifications when required.

f. Requirements that systems, assemblies, and equipment be located and installed to be commissionable and maintainable, and that training be provided to operations and maintenance staff.

304.3 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific commissioning Basis of Design. that includes the elements listed in 304.2.
302.10 Enforcement. At his or her discretion, the code official shall confirm demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved BOD document; and
2. Receipt of a form (see the BOD form CF-3) signed by the architect, engineer or designer of record, and the commissioning provider attesting that the BOD has been completed and meets the requirements of the OPR.

Section 305
Commissioning Measures Shown in the Construction Documents

305.1 Commissioning requirements. For construction projects, commissioning shall be included in the design and construction processes and documents to identify commissioning requirements included in the adopted code, and standards, in the OPR and the Commissionig Plan.

305.2 The project commissioning requirements shall include:

a Commissioning specifications developed for all systems and assemblies being commissioned, and included in the construction documents.

b. Roles and responsibilities, communications requirements, issue resolution, meetings and schedules.

c. Documention development, application and control requirements including commissioning checklists and system manual production and utilization.

d. Applicable Commissioning Process specifications and requirements that shall be included in all contracts with contractors, sub-contractors, suppliers, service providers, and manufacturers for systems and assemblies being commissioned.

e. Requirements for contractors, sub-contractors suppliers, service providers, and manufacturers to provide the required documentation as defined in the contract documents and commissioning plan.

305.3 Compliance method. Compliance is achieved by including commissioning requirements in the project specifications and documents as shown in 305.2.:

305.4 Enforcement. At his discretion, the code official confirms demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved commissioning specifications; and
2. Receipt of a form (see the Sample Commissioning Measures in Construction Documents form CF-4) signed by the owner or owner's representative, or designer of record, and commissioning provider attesting that the owner-approved commissioning specifications are included in the construction documents.

Section 306
Commissioning Review of Design Documents

306.1 Commissioning Design Reviews. The Commissioning Provider shall perform a review of the commissioned systems and assemblies in the design documents to evaluate compliance with the OPR. Design review shall be completed prior to the issuing of construction documents for systems being commissioned.

306.2 The commissioning design documents review shall include:

306.2.1 A design review - commissioning report with comments, questions, and observations to the Owner and design teams for compliance with the Owner's Project Requirements. This

design review-commissioning shall not be considered a Design Review- PEER or Design Review-Code or Regulatory document

306.3 The design team, owner, and/or other responsible party shall respond to the Commissioning provider document review report with necessary answers and document modifications for the project.

306.4 A copy of the document review report(s) and response shall be included in the final Commissioning Report.

306.5 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific commissioning review report that includes the elements listed in 306.2 through 306.4

306.4 Enforcement. At his or her discretion, the code official confirms demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved commissioning review reports; and
2. Receipt of a form (see the Sample Compliance form CF-5) signed by the owner or owner's representative, and commissioning provider, attesting that the commissioning review has been completed.

Section 307
Commissioning Review of Construction Submittals

307.1 Commissioning Submittal Reviews: For construction projects requiring contractor or supplier submittals, a submittal documents review for commissioned systems and assemblies shall be performed to evaluate compliance with the OPR and commissioning plan. The commissioning submittal review does not replace the designer of record submittal review.

307.2 The commissioning design documents review shall include:

306.2.1 A review the construction submittals for commissioned systems concurrently with the designers. The reviews shall be provided to the designer of record or as required in the OPR and commissioning plan. The Commissioning Provider shall identify construction submittals for review to be provided by the Contractor for the systems being commissioned.

307.3 The designer shall consider the Commissioning Provider's comments and provide direction to the Contractor in accordance with the designer's best professional judgment with a copy to the Commissioning Provider.

307.4 The submittal review report shall include a listing of the submittals reviewed, the date reviewed and a summary of the submitted equipment/materials properties and/or procedures that appear not to meet the OPR.

307.5 A copy of the submittal document review report(s) and response shall be included in the Final Commissioning Report.

307.6 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific commissioning review report that includes the elements listed in 307.2 through 307.5

306.4 Enforcement. At his or her discretion, the code official confirms demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved commissioning review reports; and
2. Receipt of a form (see the Sample Compliance form CF- 6) signed by the owner or owner's representative, and commissioning provider, attesting that the commissioning review has been completed.

Sectoion 308

Commissioning Issue and Resolution Logs

308.1 Issues and Resolution Log is a formal and ongoing record of problems or concerns and their resolutions that have been raised by members of the Commissioning Team during the course of the Commissioning Process. The Commissioning Provider and Commissioning Team shall develop a formal Issues and Resolutions Log with supporting documentation.

308.2 The contects of the Issue and Resolution Logs shall include:

a. All open and continuing items, with status and responsible person or organization for resolution.

b. Procedures to maintained the log throughout the project until all issues are resolved or accepted by the Owner.

c. Procedures to distribute the logs to the Commissioning Team at intervals prescribed in the Commissioning Plan.

308.3 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific Issue Logs that includes the elements listed in 308.2

308.4 Enforcement. At his or her discretion, the code official confirms demonstrated compliance by:

1. Receipt of a copy of the approved commissioning Logs; and
2. Receipt of a form (see the Sample Compliance form CF-7) signed by the owner or owner's representative, and commissioning provider, attesting that the issues have been addressed.

Section 309
Commissioning Testing

309.1 Commissioning Testing is the evaluation and documentation of the equipment and assemblies: delivery and condition; installation; proper function according to the manufacturer's specifications, and

project documentation to meet the criteria in the Owner's Project Requirements and construction documents..

309.2 Commissioning Testing Requirements

309.2.1 The systems and assemblies identified in the OPR and Commissioning Plan shall be confirmed to comply with the OPR and with the construction documents.

309.2.2 Checklists and test procedures with necessary report forms shall be developed before equipment or assembly installation. All checklists and test reports shall be included in the Final Commissioning Report.

a. Project-specific construction checklists and commissioning testing procedures shall be established for review by the Owner and appropriate team members.

b. The test procedures shall list the entities responsible for executing each of the tests.

c. Whenever a test data result is required for a specific system or assembly, there shall be an item in the associated Construction Checklist for the test data to be submitted to the Commissioning Provider.

309.2.3 There shall be a uniform and effective process for documentation of testing to provide Commissioning testing of and interaction between commissioned equipment, systems, and assemblies. Commissioning team shall refer to applicable Commissioning technical resources tailored to their specific projects.

309.2.4 Evaluation of the systems and assemblies by the Commissioning team shall include the following:

a. Vital information on the equipment or materials being supplied. Information shall detail what equipment/material was specified and submitted. What was actually delivered on the site shall be documented and verified.

b. The condition of the equipment at the time it is delivered at the site and prior to its installation.

c. Proper installation of the systems and assemblies. Evaluation shall focus on the physical installation of the systems and assemblies, on their ability to meet the contract documents requirements, and on accessibility for commissioning, testing, and maintenance operations.

d. Testing procedures, conditions and successful Commissioning testing results of systems and assemblies.

309.3 Completed test reports including checklists and test procedures shall be submitted to the project team for review and the Commissioning Provider for evaluation and inclusion in the Commissioning Report.

309.4 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific Commissioning Testing Report that includes the elements listed in 309.2.

309.5 Enforcement. At his or her discretion, the code official confirms demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved commissioning testing report; and
2. Receipt of a form (see the Sample Compliance forms CF-8) signed by the owner or owner's representative, and commissioning Provider attesting that the testing has been completed.

Section 310
Project Documentation and Systems Manual

310.1 Systems Manual: The Systems Manual is a system-focused composite document that includes the design and construction documentation, facility guide and operation manual, maintenance information, training information, commissioning process records, and additional information of use to the Owner during occupancy and operations. Documentation of the operational aspects of the building needed to understand, operate, and maintain the buildings systems and assemblies shall be completed within the systems manual, which shall be delivered to the building owner or representative and facilities operator. The systems manual shall include the documentation identified in the adopted code and standards .

310.2 Contents: The Systems Manual shall include:

a. Owners project requirements or current facility requirements and basis of design available for the project.
b. Construction record documents including; record plans, specifications and approved submittals.
c. Facility, systems and assemblies information including:
    c.1 Manufacturer's operation and maintenance data for installed equipment systems and assemblies including wiring diagrams and schematics.
    c.2 Warranties and certificate of occupancy.
    c.3 Contractor, supplier, or service agency listing and contact information
d. A facility operations guide, including an operating plan, building and equipment operating schedules, setpoints and ranges, sequences of operation, system and equipment limitations and emergency procedures.
e. Where training is provided, training plans, materials and records shall be provided.
f. A final commissioning report in accordance with Section 312.

310.3 To the extent available the information in 310.2 a through d shall be completed and made available for the training process in section 311.

310.4 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific Systems Manual that includes the elements listed in 3010.2.

310.5 Enforcement. At his or her discretion, the code official confirms demonstrated compliance at plan intake by:

1. Receipt of a copy of the approved Systems Manual and
2. Receipt of a form (see the Sample Compliance formsCF-9) signed by the owner or owner's representative, and Commissioning Provider attesting that the Systems Manual has been completed.

Section 311.
Training

311.1 The training of the operating and maintenance staff of the facility shall be required in the contract documents and include the development and application of a training plan. The Training Plan is a written document that details the expectations, schedule, duration and deliverables of Commissioning Process activities related to training of project operating and maintenance personnel, users, and occupants.

311.2 The contents of the training plan ahall include:

a. Outline of instructional topics related to the systems, subsystems, equipment, and assemblies. These topics shall address the design, construction, operation, and maintenance of commissioned systems, assemblies, and equipment. A review and utilization of the Systems Manual shall be included in the training process.

b. Learning objectives and training delivery methods, locations and duration for each instructional topic in conformance to the OPR and commissioninmg Plan..

c. Training materials and instructor requirements to be employed during the instructional process.

d. Training report, records and recording requirements.

311.3 Archival of instruction, delivery of instruction, and training materials shall be provided as specified in the Contract Documents and per the OPR. A copy of the Training Plan, training materials, and records shall be included in the final Systems Manual.

311.4 Compliance method. Compliance with code is demonstrated by the preparation of a project-specific TrainingPlan and Report that includes the elements listed in 311.2.

311.5 Enforcement. At his or her discretion, the code official confirms demonstrated compliance during enforcement by:

9.1. Receipt of a copy of the written training program and completed attendance forms; and

9.2. Receipt of a form signed by the owner or owner's representative, and commissioning provider attesting that the training program and delivery of training has been completed (see the sample form CF-10).

Section 312
Commissioning Report

3012.1 Commissioning report

The Commissioning Report is a document that records the activities and results of the Commissioning Process and is developed from the requirements in the OPR and Commissioning Plan

312.2 The contents of the commissioning report shall include:

a. Documentation of the commissioning activities included in the commissioning plan required by adopted codes and the OPR including delayed testing.
b . A copy of the final commissioning plan, including functional test, and performance test procedures used during the commissioning process and measurable criteria for test acceptance.
c A copy of the final Owner's Project Requirements, Basis of Design, and design and submittal reviews as required by the Commissioning Plans. As an alternate the copies of the OPR and BOD may be omitted from the commissioning report if included in the Systems Manual.
d. The results of all evaluations, start-up data, functional tests, and performance tests, and reports by suppliers, contractors, inspectors, and commissioning specialists and providers.
e. Reports demonstrating compliance with the requirements of the OPR and design documents. -
f. Issue logs and disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
g. A resolution plan approved by the owner or the owner's representative identifying the deferred tests and issues that are unresolved or incomplete and any required conditions for completion.

312.3 . Compliance method. The components of the commissioning report include requirements identified in 312.2 and the adopted code or standards

312.4. Enforcement. At his or her discretion, the code official confirms demonstrated compliance by:

3.1. Receipt of a copy of the commissioning report; and

3.2. Receipt of a form signed by the owner or owner's representative attesting that the commissioning report has been completed (see the sample form CF-11).

SECTION 401
Commissioning Provider and Specialist Qualifications

401.1 Performance: As required by code, commissioning of one or more of the required systems shall be completed by qualified and approved personnel or agencies.

401.2 Approved agencies and personnel: Approved agencies and personnel performing code required commissioning of any part of the systems as listed in code requirements shall be certified by an organization accredited to the criteria set forth in the most recent edition of ISO/IEC 17024. Documentation shall be submitted to the code official verifying certification of commissioning personnel.

Informative Appendix A : COMMISSIONING PROCESS COMPLIANCE TEMPLATES AND FORMS

Owner's Project Requirements

401.1 Template. These templates are a guide for collecting the information associated with the Commissioning Process activities. The information should be developed by the project team in collaboration with the owner.

OWNER'S PROJECT REQUIREMENTS SAMPLE COMPLIANCE FORM
CF -1

Project Name:_____

Project Address: _____Permit Number: _____

Item#	OPR ITEMS	PAGE NUMBER IN OPR DOCUMENT
	Project Program	
a	objectives, size, location, user requirements, and owner directives including space usage, occupancy, operation and project schedules and codes, Indoor environment requirements, including temperature, humidity, and ventilation..	
	Commissioning Process	
b	f. Commissioning process scope and requirements, including logs, reviews and reports and listing of equipment, systems and assemblies requiring commissioning with Installation evaluation and testing requirements.	
	Systems and Assemblies	
c	nt, systems and assemblies requirements, expectations, and warranty provisions including maintainability, access, and operational performance requirements.	
	Other	
	Environmental Quality and Efficiency Requirements	
d	nental, sustainability, and efficiency goals and benchmarks.	
	Documentation	

e	Project documentation requirements and formats including; Basis of Design, Commissioning Plans and reports and Systems Manual.	
Building Occupant and O&M Personnel Training		
f	Training requirements for owner's operation and maintenance personnel and occupants.	

(continued)

Commissioning Agency Information		
	Name of Commissioning Agency:	
	Address of Agency:	
	Contact person(s) Name(s):	
	Signature	

Owner/Owner's Representative Acknowledgement

Owner's project requirements (OPR). The expectations and requirements of the building appropriate to its phase shall be documented before the design phase of the project begins. The OPR includes the elements listed in this form and have been approved by the owner or owner's representative.

Name: _____

Owner Owner's Representative

Company Name (if applicable): _____

Signature: _____ Date: _____

COMMISSIONING PLAN SAMPLE COMPLIANCE FORM
CF-2 Preliminary

Project Name:_____

Project Address:_____Permit Number: _____

ITEM #	PRELIMINARY COMMISSIONING PLAN ITEMS	PAGE NUMBER IN COMMISSIONING PLAN DOCUMENT
	General Project Information	
a	Overview of the commissioning process and goals dev specifically for each phase of the project, from design t occupancy and operations.	
	Roles and Responsibilities	
b	General roles and responsibilities for the Commissioning Team throughout the project. The responsibilities shall delineate the duties of the commissioning providers, commissioning specialists, inspectors, contractors, suppliers, and other agencies. The details and specific assignments will be updated in the Final Commissioning Plan	
	Communication Channels	
c	Documentation of general communication channels including the distribution of the Commissioning Plan and documentation during the design and construction processes. This includes the development and utilization of the Issues and Resolution Logs and a preliminary listing of required reports including format, reviews and approvals	
	Documentation and Submittal Review	
d	Project construction design documentation review and submittal evaluation procedures and reports in accordance with the OPR.	
	Commissioning Process Activities	
e	General description of commissioning process activities, and a preliminary schedule of activities.	
	Commissioned Syatems and Asemblies	
f	The list of operations, systems and assemblies that will be commissioned and/or inspected. Performance criteria shall be included when available and where not shown on the construction documents.	
	Checklists, Forms, Logs and Reports	

g	Preliminary format for Commissioning checklists and testing forms, and Commissioning Progress Reports that will be used during the project to communicate and track commissioning information.	
	Systems Manual, Training Plans and Final Commissioning Report	
h.	Guidelines and formats that will be used to develop the Systems Manual, Training Plans, and Final Commissioning Report.	
	Resolution Process	
i	The framework for procedures to follow whenever Commissioning Process evaluation results do not meet the OPR or the construction document requirements.	

Commissioning Agency Acknowledgement

I have reviewed the Preliminary Commissioning Plan and verified that it meets the owner's project requirements:

Name: _____
Company Name (ifapplicable): _____
Agency's Signature: _____
Date

Owner/Owner's Representative Acknowledgement

The commissioning plan includes the items listed in this form and have been approved by the owner or owner's representative.

Name: _____ Owner Owner's Representative

Company Name _____

Signature: _____ Date: _____

FINAL COMMISSIONING PLAN SAMPLE COMPLIANCE
FORM CF-2 Final

Project Name:_____

Project Address:_____Permit Number: _____

ITEM #	FINAL COMMISSIONING PLAN ITEMS	PAGE NUMBER IN COMMISSIONING PLAN DOCUMENT
	General Project Information	
a	Update the overview of the Commissioning Process and developed specifically for each phase of the project if changes are necessary.	
	Roles and Responsibilities	
b	Update the roles and responsibilities for the Commissioning Team. The responsibilities shall delineate the detailed duties of the commissioning providers, specialists, inspectors, contractors, suppliers, and other agencies.	
	Communication Channels	
c	Update the documentation and communication channels including the distribution of the Commissioning Plan during the construction process with specific assignments.	
	Documentation and Submittal Review	
d	Update and expand the detailed description of Commissioning Process activities, the schedule of activities and the list of operations, systems and assemblies that will be commissioned or inspected. Evaluation procedures, and performance criteria shall be included for all commissioned systems and assemblies..	
	Systems Manual and Training Plans	
e	Update the requirements and assign responsibilities for the Systems Manual and Training Plans.	
	Checklists, Forms, Logs and Reports Formats	
f	Update the listings and formats for Commissioning Process evaluation checklists, testing forms, issues and resolution log, and Commissioning Progress Reports.	

	Construction Testing Checklists, Forms, Logs and Reports	
g	After final equipment selection and approval, and before installation, detailed testing procedures and checklists for installation observation, functional testing and performance testing for all commissioned systems and assemblies shall be developed and included in the Final Commissioning Plan. Conditions under which the testing will be performed shall be included where relevant. Verification of sequences of operation shall be included	
	Resolution Process	
h.	Update the procedures to follow whenever Commissioning Process evaluation does not meet the OPR or construxction document requirements.	
	Occupancy and Operation	
i	j. Provide a general description of Commissioning Process activities that will occur during Occupancy and Operations.	

Commissioning Agency Acknowledgement

I have reviewed the Final Commissioning Plan and verified that it meets the Owner's Project Requirements:

Name: _____

Company Name (ifapplicable): _____

Agency's Signature: _____

Date

Owner/Owner's Representative Acknowledgement

The commissioning plan includes the items listed in this form and have been approved by the owner or owner's representative.

Name: Owner Owner's Representative

Company Name _____

Signature: _____ Date: _____

Basis of Design

.

requirements. b. Additional criteria include CRI and CCT.

BASIS OF DESIGN SAMPLE COMPLIANCE FORM
CF- 3

Project Name:_____

Project Address: _____Permit Number: ____

ITEM #	BOD ITEMS	PAGE NUMBER IN BOD DOCUMENT
	Technical Approach	
a	Description in detail of the design team's technical approach to each of the Owner's requirements	
	Review	
b	Provide a platform for the review of the design and changes as the project progresses.	
	Codes and Commissioning	
c	Coordination of applicable technical and code requirements as well as the commissioning requiremenmts.	
	Assumptions	
d	Design criteria and design assumptions are in agreement with the OPR.	
	Sustainability and Related Criteria	
e	Requirements for sustainable design and other certifications when required.	
	Maintenance and Training	
f	Requirements that systems, assemblies, and equipment be located and installed to be commissionable and maintainable, and that training be provided to operations and maintenance staff	

(continued)

Commissioning Agency Acknowledgement

I have reviewed the basis of design and verified that it meets the owner's project requirements:

Name: _____

Company Name (ifapplicable):

Agency's Signature: _____ Date: _____

Owner/Owner's Representative Acknowledgement

The Basi of Design includes the items listed in this form and have been approved by the owner or owner's representative.

Name: _____ Owner Owner's Representive

Company Name (if applicable): _____ _____

\Signature: _____Date_____

COMMISSIONING MEASURES IN CONSTRUCTION DOCUMENTS CF-4

Project Name:_____

Project Address: _____Permit Number: _____

ITEM #	SPECIFICATION ITEMS	PAGE NUMBER IN COMMISSIONING PLAN DOCUMENT
	General Project Specification Information	
a	Commissioning specifications developed for all systems and assemblies being commissioned, and included in the construction documents.	
	Commissioning Roles and Responsibilities	
b	Roles and responsibilities, communications requirements, issue resolution, meetings and schedules	
	Systems To Be Commissioned and Documentation Process	
c	Documention development, application and control requirements including commissioning checklists and system manual production and utilization.	
	Commissioning Team Contract Requirements	
d	Applicable Commissioning Process specifications and requirements that shall be included in all contracts with contractors, sub-contractors, suppliers, service providers, and manufacturers for systems and assemblies being commissioned.	
	Contractor Provided Documentastion	
e	Requirements for contractors, sub-contractors suppliers, service providers, and manufacturers to provide the required documentation as defined in the contract documents and commissioning plan.	

Commissioning Agency Acknowledgement

I have reviewed the specifications and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____ Date: _____

Owner/Owner's Representative Acknowledgement

The specifications include the items listed in this form and have been approved by the owner or owner's representative.

Name: _____

Owner Owner's Representative

Company Name (if applicable): _____

Signature: _____ Date: _____

Commissioning Review of Design Documents
CF-5

Project Name:_____

Project Address: _____Permit Number: _____

ITEM #	COMMISSIONING DESIGN DOCUMENTS REVIEW ITEMS	PAGE NUMBER IN COMMISSIONING REVIEW DOCUMENT
	General Project Information	
	The Commissioning provider shall provide a design review - commissioning report with comments, questions, and observations to the Owner and design teams for compliance with the Owner's Project Requirements. This design review-commissioning shall not be considered a Design Review- PEER or Design Review-Code or Regulatory document	
	Design Review Response	
	The design team, owner, and/or other responsible party shall respond to the Commissioning provider document review report with necessary answers and document modifications for the project.	
	Documentation	
	A copy of the document review report(s) and response shall be included in the final Commissioning Report	

Commissioning Agency Acknowledgement

I have reviewed the design documents and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____Date: _____

Owner/Owner's Representative Acknowledgement

The design documents include the items listed in this form and have been approved by the owner or owner's representative.

Name: _____

Owner Owner's Representative_____

Company Name _____

Signature: _____Date: _____

Commissioning Review of Submittal Documents
CF-6

Project Name:_____

Project Address: _____Permit Number: _____

ITEM #	COMMISSIONING SUBMITTAL REVIEW ITEMS	PAGE NUMBER IN COMMISSIONING REVIEW DOCUMENT
	General Project Submittal Information	
	Commissioning Provider shall identify construction submittals to be provided by the Contractor for the systems being commissioned. The Commissioning Provider shall review the construction submittals concurrently with the designers and provide comments to the designer.	
	Submittal Review Response	
	The designer shall consider the Commissioning Provider's comments and provide direction to the Contractor in accordance with the designer's best professional judgment with a copy to the CxA.	
	Systems To Be Commissioned and Documentation Process	
	The submittal review report shall include a listing of the submittals reviewed, the date reviewed and a summary of the submitted equipment/materials properties that appear not to meet the OPR.	

Commissioning Agency Acknowledgement

I have reviewed the submittals and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____ Date: _____

Owner/Owner's Representative Acknowledgement

The submittals include the items listed in this form and have been approved by the owner or owner's representative.

Name: _____

Owner Owner's Representative

Company Name _____

Signature: _____Date: _____

Commissioning Issue and Resolution Logs

CF-7

Project Name:_____

Project Address: _____Permit Number: _____

ITEM #	COMMISSIONING ISSUES AND RESOLUTION LOG ITEMS	PAGE NUMBER IN COMMISSIONING ISSUE LOG DOCUMENT
	General Project Information	
a	All open and continuing items, with status and responsible person or organization for resolution	
	Updating Procedures	
b	Procedurres to maintained the log throughout the project until all issues are resolved or accepted by the Owner.	
	Distribution	
c	Procedures to distribute the logs to the Cx Team at intervals prescribed in the Cx Plan.	

Commissioning Agency Acknowledgement

I have reviewed the issue logs and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____Date: _____

Owner/Owner's Representative Acknowledgement

The issue logs include the items listed in this form and have been approved by the owner or owner's representative.

Name: _____

Owner Owner's Representative

Company Name _____

Signature: _____Date: _____

Commissioning Testing

CF-8

Project Name:_____

Project Address: _____Permit Number: _____

ITEM #	COMMISSIONING TESTING ITEMS	PAGE NUMBER IN COMMISSIONING DOCUMENT
	General Project Information	
a.	The systems and assemblies identified in the OPR and Commissioning Plan shall be confirmed to comply with the contract documents.	
	Checklists and Procedures	
b.	Checklists and test procedures with necessary report forms shall be developed before equipment or assembly installation. All completed checklists and test reports shall be included in the Final Commissioning Report.	
	Project-specific Construction Checklists and Commissioning testing procedures shall be established for review by Owner and appropriate team members.	
	The test procedures shall list the entities responsible for executing each of the tests.	
	Whenever a test data result is required for a specific system or assembly, there shall be an item in the associated Construction Checklist for the test data to be submitted to the Commissioning Provider.	
	Testing Process	
c	There shall be a uniform and effective process for documentation of testing to provide Commissioning testing of and interaction between commissioned equipment, systems, and assemblies. Commissioning team shall refer to applicable Commissioning technical resources tailored to their specific projects.	

d	Vital information on the equipment or materials supplied. Information shall detail what equipment/material was specified and submitted. What was actually delivered on the site shall be documented and verified.	
	The condition of the equipment at the time it is delivered at the site and prior to its installation.	
	Proper installation of the systems and assemblies. Evaluation shall focus on the physical installation of the systems and assemblies, on their ability to meet the contract documents requirements, and on accessibility for Commissioning, testing, and maintenance operations.	
	Testing procedures, conditions and successful Commissioning testing results of systems and assemblies.	
	Completed test reports including checklists and test procedures shall be submitted to the project team for review and the Commissioning Provider for evaluation and inclusion in the Commissioning Report.	

Commissioning Agency Acknowledgement

I have reviewed the testing and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____Date: _____

Owner/Owner's Representative Acknowledgement

The testing documentation includes the items listed in this form and have been approved by the owner or owner's representative.

Name: _____

Owner Owner's Representative

Company Name _____

Signature: _____Date: _____

Equipment and Assemblies Tested

REPORT#[a]	SYSTEM/EQUIPMENT TESTED	PAGE/TAB NUMBER IN COMMISSIONING REPORT

DOCUMENTATION AND SYSTEMS MANUAL FORM
CF9

Project Name:_____

Project Address: _____ Permit Number: _____

ITEM #	SYSTEM MANUAL ITEMS	PAGE NUMBER IN SYSTEMS MANUAL DOCUMENTS
	Project Requirements	
a	Owners project requirements or current facility requirements and basis of design available for the project	
	Construction Documents	
b	Construction record documents including; record plans, specifications and approved submittals.	
	Systems and Assemblies Information	
c	Facility, systems and assemblies information including: c.1 Manufacturer's operation and maintenance data for installed equipment systems and assemblies including wiring diagrams and schematics. c.2 Warranties and certificate of occupancy. c.3 Contractor, supplier, or service agency listing and contact information	
	Operations Information	
d	A facility operations guide, including an operating plan, building and equipment operating schedules, setpoints and ranges, sequences of operation, system and equipment limitations and emergency procedures.	

Training	
e Where training is provided, training plans, materials and records shall be provided.	
Commissioning Report	
A final commissioning report in accordance with Section 312.f	.
Other	
	Other resources and

Commissioning Agency Acknowledgement

I have reviewed the Systems Manual and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____Date: _____

Owner/Owner's Representative Acknowledgement

The Systems Manual documentation includes the items listed in this form and have been approved by the owner or owner's representative.

Name: Owner Owner's Representative

Company Name _____
Signature: _____Date: __

Project Name:_____

Project Address: Permit Number:

Commissioning Agency Acknowledgement

I have reviewed the issue logs and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency'Signature: _____Date: _____

/Owner's Representative Acknowledgement

The issue logs include the items listed in this form and have been approved by the owner or owner's representative.

Name: _____ Owner

Owner's Representative

Company Name _____ Signature:

_____Date: _____

ITEM #	TRAINING ITEMS	PAGE NUMBER IN TRAINING PLAN DOCUMENT
	General Training Information	
a	Outline of instructional topics related to the systems, subsystems, equipment, and assemblies. These topics shall address the design, construction, operation, and maintenance of commissioned systems, assemblies, and equipment. A review and utilization of the Systems Manual shall be included	
	Objectives and Methods	
b	Learning objectives and training delivery methods, locations and duration for each instructional topic in conformance to the OPR and commissioninmg Plan..	
	Materials and Records	
c	Training materials and instructor requirements to be employed during the instructional process. Training report, records and recording requirements	

COMMISSIONING REPORT SAMPLE COMPLIANCE FORM
CF11

Project Name:_____

Project Address: _____Permit Number: ____

ITEM #	COMMISSIONING REPORT ITEMS	PAGE NUMBER IN COMMISSIONING REPORT DOCUMENT
	Commissioning Scope	
a	Documentation of the commissioning activities included in the commissioning plan required by adopted codes and the OPR including delayed testing.	
	Commissioning Plan	
b	A copy of the final commissioning plan, including functional and performance test procedures used during the commissioning process and measurable criteria for test acceptance	
	Design Documents and Reviews	
c	A copy of the final owner's project requirements, basis of design, and design and submittal reviews as required by the commissioning plan. As an alternate the copies of the OPR and BOD may be omitted from the commissioning report if included in the Systems Manual..	
	System Evaluations	
d	The results of all evaluations, start-up data, functional and performance tests, and reports by suppliers, contractors, inspectors, and commissioning providers.	
	Reports	
e	. Reports demonstrating compliance with the requirements of the OPR and design documents. -	
	Issues and Resolutions	
f	Issue logs and disposition of all deficiencies found during testing, including details of corrective measures used or proposed.	
	Open Items	
g	A resolution plan approved by the owner or the owner's representative identifying the deferred tests and issues that are unresolved or incomplete and any required conditions for completion.	

Commissioning Agency Acknowledgement

I have reviewed the commissioning report and verified that it meets the owner's project requirements:

Name: _____

CompanyName _____

Agency' Signature: _____ Date: _____

Owner/Owner's Representative Acknowledgement

The commissioning report includes the items listed in this form and have been approved by the owner or owner's representative.

ame: _____

Owner Owner's Representative

Company Name _____

Signature: _____ Date: _____

Informative Appendix B: Commonly Commissioned Systems

B.1 As required by code, commissioning of one or more of the following systems can be included;.

1. Heating, Ventilation and Air Conditioning (HVAC) systems
2. Lighting systems
3. Plumbing systems
4. Energy systems
5. Irrigation systems
6. Indoor environmental quality
7. Building enclosure systems
8. Fire protections systems
9. Fire alarm systems
10. Vertical conveyance systems
11. Site development and land use
12. Construction and demolition waste management

Other systems requiring commissioning may be added by the owner.

B.2 The following criteria can be used for the systems information when developing the Owner's Project Reqiuirements, and Basis of Design:

B.2.1 Site development and land use. These can include:

1. Natural resources and base line conditions of building site:
    1.1. Identify invasive vegetation.
    1.2. Determine location of any protection areas and to what extent the native soils and hydrological conditions have been disturbed on site.
    1.3. Applicable codes.
2. Landscape irrigation systems:
    2.1. A narrative description of the system shall be provided, including type, performance and water usage.
    2.2. The reason for the system selection shall be described, including why the chosen system is better than the alternatives. Issues such as performance, efficiency, reliability, flexibility, expandability, cost, owner preference and simplicity shall be addressed.
    2.3. Sequence of operation, including operating schedules and set points shall be listed.
    2.4. How the system meets the OPR shall be described.
    2.5. Applicable codes shall be listed.

B.2.2 Vegetation and soil protection and restoration. A vegetation and soil protection plan may be provided in accordance with the following:

1. Existing vegetation location on a building site that is to be preserved and protected.
2. Portions of the building site to be designated vegetation and soil protection areas (VSPAs) during the construction process.
3. Methods to be used to maintain the protection of the designated VSPAs.

4. Temporary locations. Temporary locations for the stockpiling of topsoil that could be potentially damaged by construction activities or equipment shall be identified.
5. Placement of soil. Soil placement or replacement to establish or restore the ability of the soil to support vegetation shall be identified.

6. Topsoils. The design team shall ensure that topsoils or soil blends imported to a building site to serve as topsoil are not mined from greenfield sites or farmlands.
7. Absorption and percolation. A narrative identifying all proposed absorption systems and percolation tests to be performed on the building site shall be provided.
8. Applicable codes. All applicable codes shall be listed on the vegetation and soil protection plan.

B.2.3 Storm water management and erosion control.

1. A narrative description of the system and how the increase in runoff from the resulting development will be addressed shall be provided.
2. The reason for the best management practice (BMPs) selection, including why the chosen BMPs are better than the alternatives; and issues, such as site conditions, performance, efficiency, reliability, flexibility, simplicity, expand- ability, cost and owner preference, shall be described.
3. How the system meets the OPR shall be described.
4. Applicable codes shall be listed for storm water management and erosion control.

B.2.4 Land-clearing debris and soil reuse.

1. A plan that will recycle or salvage 75 percent of the land-clearing debris and excavated soils shall be developed.
2. Materials to be diverted from disposal through recycling or reuse shall be identified.
3. The amount of materials to be diverted (by weight or volume) and the location as to where they will be diverted shall be specified.
4. The removal and disposal of invasive plant species shall be addressed.
5. The method, amount and location of disposal and treatment of contaminated soils shall be provided.
6. Applicable codes shall be listed for land-clearing debris and soil reuse.

B.2.5 Site exterior lighting.

1. A narrative description of the system, including type of fixtures, lamps, ballasts and controls shall be provided.
2. The reason for system selection, including why the chosen system is better than the alternatives; and issues, such as visual comfort, performance, efficiency, reliability, cost, flexibility, owner preference, color rendering, integration with daylighting and ease of control, shall be described.
3. Design criteria for each type of space shall be provided:
3.1. Applicable codes, guidelines, regulations and other references used.
3.2. Illumination design targets [footcandle (lux)] and lighting calculation assumptions.
4. Lighting design targets shall be provided, including uplight rating, glare rating and backlight rating.

B.2.6 How the system meets the OPR materials requirements.

Building materials criteria. Recognized performance and quality criteria for the selection of building materials shall be described. Criteria might address, for example, durability; water, vapor and air movement control; energy performance; local availability; availability of repair and replacement materials; ease of maintenance.

B.2.7 Energy.

Energy metering, monitoring and reporting.

1. All energy-load types to be metered shall be identified.
2. All energy types that are applicable to the building shall be identified.

3. A narrative of the energy data acquisition and management system to be selected shall be provided.
4. Sequence of operation, including operating schedules, set points and stage capacity shall be defined.
5. How the system meets the OPR shall be described.
6. Applicable codes for energy metering, monitoring and reporting shall be listed.

B.2.8 Mechanical systems completion.

1. The means for system balancing, duct testing and O&M systems manual shall be provided.
2. A narrative description of HVAC system, including system type, location, con- trol type, efficiency features, outdoor air ventilation strategy, indoor air quality features, environmental benefits and other special features shall be provided.
3. Reasons for the system selection, including why the chosen system is better than the alternatives; and issues, such as comfort, performance, efficiency, reliability, flexibility, simplicity, cost, owner preference, site constraints, climate, maintenance and acoustics shall be described.
4. Design criteria shall be provided, including the following:
4.1. Load calculation method/software.
4.2. Summer outdoor design conditions (_____°F dry bulb and ____°F wet bulb).
4.3. Winter outdoor design conditions (__°F dry bulb and ____°F wet bulb).
4.4. Indoor design conditions (___°F dry bulb cooling, _____percent RH cooling. _____°F dry bulb heating, _____ percent RH heating).
4.5. Applicable codes, guidelines, regulations and other references used.
4.6. Load calculation assumptions.
5. Sequence of operations, including operating schedules and set points shall be defined. This may refer to plans or specifications if the sequence is indicated within the permit documents.
6. How the system meets the OPR shall be described.
7. Applicable codes regarding mechanical systems completion shall be listed.

B.2.9 Renewable energy systems. A narrative description of the system, including type, performance, control type, energy savings and payback period shall be provided.
1. The reason for the system selection, including why the chosen system is better than the alternatives; and issues, such as performance, efficiency, reliability, flexibility, simplicity, expandability, cost, payback period, utility company incentives, and owner preference, shall be described.
2. Sequence of operation, including operating schedules, set points and energy storage capacity shall be described.
3. How the system meets the OPR shall be described.
4. Applicable codes regarding renewable energy systems shall be listed.

B.2.10 Lighting. A narrative description of the lighting system, including type of fixtures, lamps, ballasts and controls shall be provided.

System selection. The reason for the system selection, including why the chosen system is better than the alternatives; and issues, such as visual comfort, performance, efficiency, reliability, cost, flexibility, owner preference, color rendering, integration with daylighting and ease of control, shall be described.

Design criteria. Design criteria for each type of space shall be pro- vided, including the following:

1. Applicable codes, guidelines, regulations and other references used.

2. Illumination design targets [footcandle (lux)] and lighting calculation assumptions.

3. Lighting power testing. Lighting power design targets for each type of space shall be provided.

4. IECC lighting power allowance and lighting power design target (watts/ft²).

5. Lighting control strategies. Lighting control strategies for each type of space including sequence of operation, operating schedules and lighting level set-points shall be described. How the system meets the OPR shall be described.

B.2.11 Water.

B.2.11.1 Water reuse systems. A narrative description of the system, including type, performance, capacity and reuse purpose shall be provided.

1. The reason for the system selection, including why the chosen system is better than the alternatives; and issues, such as site constraints, climatic conditions, performance, efficiency, reliability, flexibility, expandability, cost, owner preference and simplicity, shall be described.
2. Sequence of operation, including operating schedules and set points shall be defined.
3. How the system meets the OPR shall be described.
4. Applicable codes regarding water reuse systems shall be listed.

B.2.12 Indoor environmental quality.

1 Sound reduction barriers. A narrative of proposed sound reduction barriers used to dampen noise from mechanical and emergency generator equipment located outside of buildings shall be provided.

2 HVAC background noise. A narrative for how HVAC background noise will be addressed shall be provided.

3 Applicable codes. Applicable codes regarding indoor environmental quality shall be listed

B.2.13 Optional systems. For each additional system selected:

1. A narrative of system(s) to be commissioned shall be provided.
2. The reason for the system selection, including why the chosen system is better than the alternatives; and issues, such as site constraints, climatic conditions, performance, efficiency, reliability, flexibility, expandability, cost, owner preference and simplicity shall be described.
3. Sequence of operation, including operating schedules and set points shall be defined.
4. How systems meet the OPR shall be defined.
5. Applicable codes regarding optional systems shall be listed.

ORMATIVE APPENDIX C: REQUIRED TECHNICAL SKILLS AND MINIMUM TECHNICAL ALIFICATIONS

Site Development and Land Use

Landscape irrigation systems. Landscaping irrigation systems require the knowledge of:

1. Local (municipal) regulations pertaining to landscape irrigation.
2. Landscape irrigation design principles.
3. Landscape irrigation components.
4. Regional vegetation pertaining to minimal water requirements for sustainable growth.
5. Both potable and nonpotable water sources.
6. Basic plumbing systems.
7. Landscape design and systems.

Outdoor fountains and water features. Outdoor fountains and water features require the knowledge of:

1. Local (municipal) regulations pertaining to outdoor fountains and water features.
2. Fountain and water feature design principles.
3. Fountain and water feature components.
4. Fountain and water feature materials.
5. Nonpotable water sources.
6. Codes and standards pertaining to erosion control.
7. Principles and practice of controlling sediment, erosion and other storm water pollutants.
8. Hydrology, water quality, air quality, habitat conservation and site grading.

Movement of water. Any movement of water requires the knowledge of:

1. On-site rainfall management as it pertains to volume, duration and discharge.
2. Hydrologic soil groups.
3. Pollutants, including, but not limited to, sediments, organic compounds, nutrients, metals, bacteria, viruses, oils and grease.
4. Ground water contamination.
5. Drainage system elements, including, but not limited to, infiltration, retention and detention basins, and biofilters.
6. Drainage system design techniques, including, but not limited to, two-stage design, basin-side slopes, forebay, low-flow channels, vegetation, maintenance access, multiple use and aesthetics.

Topography and site grading. In determining topography and site grading, knowledge of the following is necessary:

1. Principles and practice of site grading; and cut and fill regulations and calculation.

2. Hydrology, water quality, air quality, habitat conservation and site grading.

3. Flood plain development. Principles of soil mechanics in the investigation, evaluation and design of civil works involving the use of earth materials.

Construction waste management. Construction waste management requires knowledge of:

1. Local or regional regulations pertaining to construction waste management.
2. Recycling and salvaging construction materials.
3. Materials cost pertaining to their adaptive reuse.
4. Hazardous construction and demolition wastes.

Heat island mitigation. Heat island mitigation requires the knowledge of:

1. Local, regional and municipal codes and standards pertaining to heat island mitigation.
2. Energy consumption trends, air pollutant emissions, greenhouse gases, water quality and human health and comfort.
3. Use of trees and vegetation as they pertain to heat island mitigation.
4. Practices and principles involved in green roof and cool roof design and construction.
5. Practices and principles involved in pervious and cool pavement design and construction.

Outdoor and site lighting. Knowledge of the following is required for outdoor and site lighting:

1. Local, regional and municipal codes and standards pertaining to outdoor and site lighting.
2. White light sources and the benefits thereof.
3. Photometrics.
4. Principles and practices of site lighting, up lighting, lighting trespass, glare and dark-sky friendliness.

EPA's 1995 Brownfield Program. Established to limit the liability to potential developers; knowledge of the following is necessary:

1. Expansion or redevelopment of sites, which have been abandoned, idled or underused, that have been complicated by real or perceived environmental contamination, structure obsolescence, lack of access to capital and overall neighborhood opposition to the redevelopment of the site.
2. Local zoning ordinances.
3. Soil science.

Evaluating the CxA. The following is a list of qualifications that the code official may use in evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. Third-party certification acceptable to the AHJ.
2. State licensure or reciprocity may not be a manufacturer of components; and it may not be the installer.
3. Prior experience within the landscape irrigation industry.
4. Water feature engineer.

5. Civil engineer.
6. National Pollutant Discharge Elimination System Level 1A Certification.
7. Civil engineer experienced and knowledgeable in the practice of soil engineering (soils engineer).
8. Professional Certification: International Waste Manager – Technical status or equal.
9. Building Commissioning Certifications with experience requirements.

Materials (Architectural Building Assembly)

Materials (architecural building assembly). A knowledge of the following is necessary:

1. IgCC 105.4.
2. The *International Building Code*® (IBC®).
3. Building assemblies, architectural detailing and structural system calculations.
4. Energy codes, ASHRAE 90.1.
5. Material safety data sheets (MSDS) and other product verification.
6. Egress requirements.

Qualifications. The following is a list of qualifications that the code official may use when evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. Licensed architect.
2. Professional engineer.
3. ICC certified inspector.
4. ICC certified CALGreen inspector.
5. Licensed contractor (third party).

Energy

Management and monitoring systems. In the approval and enforcement of management and monitoring systems, knowledge of the following is required:

1. Energy policy.
2. Assessing the potential value of improved energy management.
3. Securing sufficient resources to implement strategic energy management.
4. Assuring accountability and commitment from core parts of the organization.
5. Identifying opportunities for improvement and ensuing implementation (including staff training).
6. Measuring, tracking, evaluating and communicating results.
7. Technical standards.
8. Indoor air quality.
9. Energy audits.

9.1. Inspection, survey and analysis of energy flows for energy conservation.

9.2. Types of energy audits.

9.2.1. Benchmarking.

9.2.2. Walk-through or preliminary audit.

9.2.3. General audit.

9.2.4. Investment-grade audit.

10. Procurement.
11. Financing.
12. Codes and standards.
13. Energy accounting and economics.
14. Instrumentation.
15. Alternative finance.
16. Building automation and control systems.
17. Electrical systems.
18. Energy procurement.
19. Green buildings, LEED and Energy Star.
20. Lighting systems.

Qualifications. The following is a list of qualifications that the code official may use in evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. Professional engineer.
2. An independent third-party commissioning certification program.

HVAC Systems

HVAC systems. Knowledge and consideration of the following are required when evaluating HVAC systems:

1. Design and construction phase commissioning process.
2. Construction communication protocol.
3. Facility requirements.
4. Sustainability and energy requirements.
5. Facility design and construction requirements.
6. Design conditions (climatic conditions, room conditions, temperature humidity levels, and pressure requirements, etc.).
7. Design methods, techniques and software applications.
8. National, state and local building codes, standards and guidelines.
9. Schematic, design development, construction phase documents.
10. Design of mechanical, electrical and plumbing systems.
11. Electrical—Power distribution, motor control centers, power monitoring, etc.
12. Building automation systems, diagrams, points and sequences.

13. Specification formats.

14. Construction phase commissioning processes.

15. Commissioned systems and equipment.

16. Construction submittals.

17. Installation requirements of mechanical, electrical and plumbing (MEP) equipment and systems.

18. O&M requirements.

19. Equipment manufacturer's start-up procedures.

20. Mechanical/electrical equipment and system operation.

21. BAS control diagrams, points, sequences and configuration.

22. TAB process and procedures.

23. O&M documentation.

24. System manual components.

25. Delivery of training.

    25.1. Record test data and results.

    25.2. Develop trending and analyze trend reports.

    25.3. Facilitate the FPT process.

Qualifications. The following is a list of qualifications that the code official may use in evaluating the CxA. The code official may consider one or more of the qualifica- tions in this list:

1. Professional engineer.

2. An independent third-party commissioning certification program.

Lighting

Lighting systems. Knowledge of the following is required for the evaluation oflighting systems:

1. Skills and abilities to verify that the systems listed are designed, installed and operate as intended.

2. IEEE standards.

3. NFPA 70.

4. Arc flash safety requirements.

5. Lockout tag-out procedures and medium-voltage power distribution equipment and controls.

6. Motors, starters and VFDs.

7. Generator systems and their associated subsystems [battery charging and starting; lubrication; fuel; ignition; cooling; prime-mover engine (Diesel/turbine); reduction gear; exciter; and generator] of UPS systems and their associated subsystems (backup generator; input/output switch gear; battery and charging).

8. Underwriters Laboratories (UL) standards for lightning protection.

Qualifications. The following is a list of qualifications that the code official may use in evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. Professional engineer.
2. Third-party certification acceptable to the AHJ.

Water

Water systems. Knowledge, skills and abilities to verify that the systems listed are designed, installed and operate as intended is required.

Qualifications. The following is a list of qualifications that the code official may use when evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. Professional engineer.
2. Third-party certification acceptable to the AHJ.

Indoor Environmental Quality

507. found in Section 502, Materials (Architectural Building Assembly), Section 504, HVAC Systems, and Section 505, Lighting.

Vertical Conveyance Systems

Elevators. Knowledge of the following is required for the approval of elevators:

1. ASME A17.1.
2. ASME A17.2.
3. ASME A17.3.

Qualifications. The following is a list of qualifications that the code official may use when evaluating the CxA:

1. Qualified Elevator Inspector (QEI) certification.
2. Third-party license.

Escalators. Knowledge of the following is required for the approval of escalators:

1. ASME A17.1.
2. ASME A17.2.
3. ASME A17.3.
4. Speed measurements as related to escalators.

Qualifications. The following is a list of qualifications that the code official may use when evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. QEI certification.
2. State licensing, if applicable.

Construction and Demolition Waste Management

Construction and demolition waste management. Knowledge of the follow- ing is required for the evaluation of construction and demolition waste management systems:

1. Federal, state and local regulatory requirements for construction and demolition waste management (C&D WM).
2. Federal, state and local regulatory requirements for C&D hazardous materials WM.
3. Material recycling and salvaging process.
4. Materials cost pertaining to their adaptive use.
5. Federal, state and local requirements for health and safety awareness for C&D material handling and management jobsite process.
6. Project documents and scope of work associated with all materials cited for C&D WM.
7. Methods appropriate for project C&D WM bulk commingling, and diversion or source-site separation and diversion.
8. Project schedule and critical path of C&D WM within all scopes of project work.
9. Communication skills and knowledge of information management for project.

Qualifications. The following is a list of qualifications that the code official may use when evaluating the CxA. The code official may consider one or more of the qualifications in this list:

1. Approved and recognized training programs for Federal and State Occupational Health and Safety Administration (OSHA) Asbestos Abatement certifications and compliance.
2. Approved and recognized training programs for Federal and State OSHA Lead Abatement certifications and compliance.
3. Approved and recognized training programs for Federal and State OSHA 10 and OSHA 30 certifications.
4. Approved respiratory awareness compliant with OSHA 29 CFR, Part 1910.134.
5. Approved and recognized green construction training programs for construction and demolition waste management.

Systems Verification

Systems verification. The tables in Appendix D provide a visual list of equipment/ items/components that need to be tested/verified when installed or where applicable.

Site Development and Land Use

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Landscape Irrigation: • Landscape irrigation design • Static pressure verification • Point of connection • Backflow prevention • Flow meter • O&M manual	• Verify the availability of required static pressure. • Backflow. • O&M manual.
Irrigation Design and Systems: • Irrigation controllers with weather or moisture-based capabilities • Irrigation design • Sprinkler head layout at perimeter of building	• Check irrigation controllers for compliance with the plans and specifications. • Check for proper irrigation, proper water spray coverage, and appropriate overlap and spacing in accordance with the plans. • Check for correct sprinkler head emitters with appropriate head rotation to prevent over spraying onto building walls. • Verify sprinkler head per approved plans.
Outdoor Ornamental Fountains and Water Features: • System calibration • System performance • Testing of system or related components in-pool items • Testing of mechanical room • Erosion control systems	• For outdoor ornamental fountains and water features, verify the following per plans: □ Design of water feature or fountain. □ Available water source. □ Available electrical voltage. □ Electrical components. □ Mechanical components. □ Plumbing components. • Verify calibration of all components, including, but not limited to, pumps, filters, chemical controllers, motors, electrical panels, pipe installation, geo-membranes, surface materials. • Verify performance of leakage tests. • Verify performance of the system as a unit. • Verify performance of all modes of operation. • Verify test of in-pool items, including, but not limited to, nozzles, suction and inlet fittings, overflows and weirs, control valves, lights, junction boxes, cord seals, and level sensors. • Verify test of mechanical room, including, but not limited to, control panel terminations, lighting panel, disconnects and ground-fault device wiring to all equipment, valve tags and flow directional arrows, piping and pressure gauges.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Site drainage:	• Verify storm water pollution prevention plan (SWPPP), when required, is on site. • Verify drainage system is installed in accordance with site drainage plan. • Check, when required by the plans: □ Silt fencing. □ Construction drive. □ Erosion control blankets. □ Erosion control straw logs. • Observation and documentation that all BMP pertaining to erosion control were successfully utilized. • Observation and documentation during construction that all elements of the erosion control plan are in place such that the soil on the site is contained with no chance of run-off. • Verification that collected water after a rain event will move through the site in accordance with the site drainage plan. • Verification and documentation that the drainage system components meet or exceed those specified in the site drainage plan. • Verification and observation that the O&M and systems manual, as submitted, meet the criteria and needs of the end user.
Topography and Grading (cut/fill): • Grading plan • Soil analysis/compaction plan • Site safety plan • Tree removal/mitigation plan • Soil stabilization and erosion • Control plan • Re-vegetation plan, slope-control planting • Equipment utilization plan • Ground water and infiltration	• Verify that soils reports are complete and in accordance with local rules and regulations. • Verify site waste reduction plan is consistent with IgCC and/or local ordinance, including tree removal. • Verify vegetation meets the re-vegetation plan. • Ensure air quality plan is part of SWPPP or soil erosion control plan. • Check to ensure site safety plan is in place. • Verify that earth-moving equipment has been maintained and repaired in accordance with the O&M manual pertaining to each piece of equipment. • Verify that all elements of site erosion control are monitored daily for deficiencies or necessary repairs. • Verify that areas of fill are compacted to a level that meets or exceeds the soil compaction plan. • Verify that sufficient soil samples representing a true cross section of the cut and fill areas, and of the material to be used as fill, have been taken and tested under the supervision of a certified soils engineer. • Verification of all field and laboratory tests of the land to be covered with fill to confirm that the characteristics of the soil, including its expansive qualities, and bearing value of the land, consolidation potential, can support the proposed fill and structures. • Verify that laboratory analysis and related data support the proposals to replace, rework or blend, or to stabilize or modify with additives. • Periodic site inspections to verify that the previously disturbed areas are maintaining their slopes and compaction rates.
Land-clearing Debris and Soil Reuse: • Waste management communication plan • Waste inventory • Salvage • Disposal • Source-separated construction, demolition and land-clearing recycling • Waste management report	• Verify that the materials on the site are handled as outlined in the waste management plan. • Verify that the recyclables and salvage items are packaged for removal and transported as outlined in the waste management plan. • Verify that hazardous construction materials are handled as outlined in the construction waste management plan. • Verify that the waste management goals and the waste prevention goals met the requirements of the waste management plan. • Verify that the waste inventory reconciles with all disposal manifests or weight tickets. • Verification and documentation that the waste management report correctly reflects the outcome of the waste management plan.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Heat Island Mitigation: • Energy consumption • Air pollutant emissions • Greenhouse gases • Trees and vegetation	• Verify cool roof complies with thermal emittance, solar reflectance, or SRI values per the code. • Verify structural and vegetative elements of the green roof. • Verification of the water quality as it pertains to the mitigation techniques utilized in the original construction of the site. • Verify that the O&M manual meets the needs of the property owner. • Check and document the energy consumption savings as they pertain to the mitigation techniques used in the construction of the site. • Check and document the decreased air pollutant emissions and greenhouse gases produced and released as they pertain to the mitigation techniques utilized in the original construction of the site. • Verification and documentation of the water quality as it pertains to the mitigation techniques utilized in the original construction of the site.
Lighting: • Site lighting • Security lighting • Area lighting • Landscape lighting • Sports lighting	• Verify exterior lighting meets light pollution plan. • Check and document that all fixtures are in compliance with the definitions as defined by the IESNA. • Check peripheral vision enhancement. • Check and document that the smallest wattage lamp source available is used to meet the desired lighting levels. • Check and document that the ratios of illuminance and luminance values are in compliance with the IESNA's *9th Edition Handbook Recommended Standards*. • Verify that all fixtures installed have been either selected from the specified product group or submitted as approved alternatives, as approved by the governing body of the local area. • Check and document that primary entry lighting, exterior emergency egress lighting, service area lighting, surface parking, parking garage and roadways are in compliance with the final lighting commissioning plan. • Verification and documentation that the O&M manual meets the goals of the owner.
Brownfield Mitigation: • Baseline risk assessment • Corrective action plan • Remedial action plan • Remedial investigation/ feasibility study	• Verification and documentation that the baseline risk assessment clearly and correctly identified and evaluated the threat to human health and the environment. • Verification and documentation that the recommended cleanup criteria and alternatives for remediation are aligned with the extent of contamination on the site. • Observation, verification and documentation that the cleanup of the site is at a level determined to be health protective for its intended use.

Materials (Architectural Building Assembly)

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
• Foundations subsoil drainage system	• Verify compliance with approved plans, specifications and construction documents.
• Foundation dampproofing and waterproofing	
• Flashing at: exterior doors, skylights, wall flashing and drainage systems	
• Exterior wall coverings	
Optional systems (not in the IgCC):	
• Moisture envelopes	• Meet OPR, BOD, Cx specifications.
• Exterior below-grade walls	• Check for proper drainage system at exterior wall perimeter to keep water from entering the building.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
• External floor and soffits, slab-on-grade	• Check for thermal resistance or insulation when required. • Check the IECC, when applicable. • Slabs: Check drainage for moisture penetration.
• Exterior walls	• Check drawings for wall assembly requirements and any sound transmission class (STC) requirements in accordance with ASTM E 90 and ASTM E 413. • Check for compliance with Section 1403.2 of the 2009 *International Building Code* (IBC).
• Exterior glazed window fenestration: windows, glazed doors and skylights	Drawing reviews and contractor submittal reviews: • Check that fenestration products are labeled with a *U*-factor (see NFRC 100) and a solar heat gain coefficient (SHGC) (see NFRC 200), and certification for the air infiltration requirement of 0.3 cfm/ft^2 of the 2010 *California Energy Code* (CEC) or other approved standards. • Check for proper flashing and caulking at walls and roof assemblies. Glazed doors: • Check for proper flashing, and seals and gaskets; and proper pull force, if provided with a closer. • Check for proper door swing. • Check for STC requirements, if applicable.
• Site-built fenestration: curtain walls and store-front systems, and atrium roof systems	• Check for a label certificate issued by the National Fenestration Rating Council (NFRC) or a label certificate issued by the glazing fabricator that meets the default *U*-factor of the 2008 CEC and SHGC; or an NFRC component modeling approach (CMA) label certificate or another approved standard. • Check for proper door swing. • Check for STC requirements, if applicable.
• Field-fabricated fenestrations: fenestration made at the site, not preformed or cut	• Check for compliance with the default *U*-factor and the default SHGC in accordance with the tables of the 2008 CEC or another approved standard.
• Exterior doors	• Check for proper flashing installation at header, walls and floor. • Check for *U*-factor requirements for swinging and nonswinging doors. • Check for appropriate manufacturer's referenced standard [American Architectural Manufacturer's Association (AAMA); Canadian Standards Association (CSA); and Window and Door Manufacturer's Association (WDMA) or other approved standard] product data sheets.
• Sealants, control joints and flashing (stationary and moveable)	• Check for proper installation in accordance with the manufacturer's written instructions. • Check for proper flashing installation.
• Shading devices (stationary and moveable)	• Check for proper anchoring to building with proper flashing at wall connections. • At mechanical devices: check for proper installation and controls.
• Structural systems	• Check for proper anchoring in accordance with construction documents, including metal connectors and beam supports.
• Materials and finishes	• Check for compliance with allowed volatile organic compound limits and proper manufacturer's installation application. • Review product data sheets.

For SI: 1 cubic foot per minute per square foot = 0.00508 m^3/(s · m^2).

Other Project Requirements (not required by the IgCC)

• Structural systems	• Check for proper anchoring in accordance with the construction documents, including metal connectors and beam supports.
• Structural requirements for mechanical systems and renewable energy systems	• Prefunctional checklists, site observations and construction testing.

Management and Monitoring Systems

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
• Workstation graphic displays	Verify the following is consistent with the commissioning plan: • Systems design. • System specifications. • System submittals. • System installations. • System prestartup inspection checklist. • System functional performance testing. • Systems training. ☐ Device Point to Point checkout (Static Testing). ☐ Device Point to Point checkout (Dynamic Testing). ☐ Sensor calibration. ☐ Valve and damper stroke setup and check. ☐ Coil valve leak check. ☐ Isolation valve or system valve leak check.
• Public display systems	
• Central processing/monitoring hardware and software	
• Network communications/alarm functions	
• User interface with emergency medical services	
• Monitoring functions required for facility operations	
• Local control panels and individual monitoring points	
Integrated Automation Instrumentation for HVAC Systems: • Actuators and operators • Sensors and transmitters • Control valves • Control dampers • Flow meters	
Integrated Automation Instrumentation for Plumbing Systems: • Domestic water metering • Grey water metering • Fuel system (gas, oil) metering	
Integrated Automation Instrumentation and Terminal Devices for Electrical Systems: • Power meters • Kilowatt (kW) transducers • Current sensors • Battery monitors • Lighting relays • UPS monitors	
Integrated Automation of Renewable Energy Systems: • Solar photovoltaic • Wind generation • Geothermal	
• Building management systems	• Confirm installation complies with the contract documents
• Electrical systems	
• Lighting systems	
• Alternative power systems	
• On-site renewable energy	
• Whole-building energy analysis	• Confirm installation complies with the contract documents
• Controllability of lighting systems	
• Controllability of thermal systems	

HVAC Systems

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Instrumentation and Control for HVAC: • Actuators and operators • Sensors and transmitters • Control valves • Control dampers • Direct-digital control system	(tasks included on previous page)
Unitary HVAC Equipment: • Packaged terminal air conditioners • Room air conditioners • Self-contained air conditioners • Computer room air conditioners • Split-system air conditioners • Air-source unitary heat pumps • Water-source unitary heat pumps	• Verify air system balancing. • Verify hydronic system balancing. • Verify duct system testing. • Verify that mechanical system manuals and construction documents required by the O&M manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. □ Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside building or located where exposed to the exterior environment.
Humidity Control Equipment: • Humidifiers • Heated-pan humidifiers • Wetted-element humidifiers • Atomizing humidifiers • Direct-steam-injection humidifiers • Jacketed, steam humidifiers • Self-contained steam humidifiers • Portable humidifiers, mechanical dehumidification units • Outdoor, mechanical dehumidification units • Indoor, mechanical dehumidification units • Portable dehumidifiers • Desiccant dehumidification units	

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Convection Heating and Cooling Units: • Chilled beams • Air coils • Fan coil units • Unit ventilators • Induction units • Radiators convectors • Finned-tube radiation heaters • Unit heaters • Cabinet unit heaters • Propeller unit heaters • Wall and ceiling unit heaters • Water-to-water heat pumps	• Verify air system balancing. • Verify hydronic system balancing. • Verify mechanical system manuals construction documents required by the O&M and systems manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside of the building or located where exposed to the exterior environment.
Humidity Control Equipment: • Humidifiers • Heated-pan humidifiers • Wetted-element humidifiers • Atomizing humidifiers • Direct-steam-injection humidifiers • Jacketed, steam humidifiers • Self-contained steam humidifiers • Portable humidifiers • Mechanical dehumidification units • Outdoor, mechanical dehumidification units • Indoor, mechanical dehumidification units • Portable dehumidifiers • Desiccant dehumidification units	
Radiant Heating Units: • Radiant-heating electric cables • Radiant-heating electric mats • Radiant-heating hydronic piping • Radiant-heating electric panels • Gas-fired radiant heaters • Electric radiant heaters	

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Central Heating Equipment—Breechings, Chimneys and Stacks: • Draft control devices • Draft-induction fans • Vent dampers • Barometric dampers • Fabricated breechings and accessories • Fabricated stacks • Gas vents • Insulated sectional chimneys • Flue-gas filtration equipment • Gaseous filtration • Particulate filtration	• Verify air system balancing and a means for providing the system balancing. • Verify hydronic system balancing and a means for providing the system balancing. • Verify duct system testing. • Verify that mechanical system manuals and construction documents required by the O&M manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. □ Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside of the building or located where exposed to the exterior environment.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Fuel-fired Heaters: • Fuel-fired duct heaters • Oil-fired duct heaters • Gas-fired duct heaters • Gas-fired radiant heaters • Fuel-fired unit heaters • Oil-fired unit heaters • Gas-fired unit heaters	
Furnaces: • Electric-resistance furnaces • Fuel-fired furnaces • Gas-fired furnaces • Oil-fired furnaces	
Heat Exchangers for HVAC: • Steam-to-steam heat exchangers, steam-to-water heat exchangers • Liquid-to-liquid heat exchangers • Plate-type, liquid-to-liquid heat exchangers • Shell-type, liquid-to-liquid heat exchangers • Direct-geoexchange heat exchangers	• Verify air system balancing and a means for providing the system balancing. • Verify hydronic system balancing and a means for providing the system balancing. • Verify duct system testing. • Verify that mechanical system manuals and construction documents required by the O&M manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. □ Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside of the building or located where exposed to the exterior environment.
Heating Boiler Feedwater Equipment: • Boiler feedwater pumps • De-aerators	
Heating Boilers: • Electric boilers • Condensing boilers • Stainless-steel condensing boilers • Aluminum condensing boilers • Low-mass boilers • Pulse combustion boilers • Cast-iron boilers • Water-tube boilers • Finned water-tube boilers • Steel water-tube boilers • Copper water-tube boilers • Fire-tube boilers • Scotch marine boilers • Steel fire-tube boilers • Boiler blowdown systems	
Solar Energy Heating Equipment: • Heating solar collectors • Heating solar flat-plate collectors • Heating solar concentrating collectors • Heating solar vacuum-tube collectors • Packaged solar heating equipment	

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Central Cooling Equipment: • Refrigerant compressors • Centrifugal refrigerant compressors • Noncondensable, gas-purge equipment • Reciprocating refrigerant compressors • Scroll refrigerant compressors • Rotary-screw refrigerant compressors • Compressor and condenser units, packaged air/water-cooled refrigerant compressor and condenser units	• Verify air system balancing and a means for providing the system balancing. • Verify hydronic system balancing and a means for providing the system balancing. • Verify duct system testing. • Verify that mechanical system manuals and construction documents required by the O&M manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. □ Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside of the building or located where exposed to the exterior environment.
Cooling Towers: • Forced-draft cooling towers • Open-circuit, forced-draft cooling towers • Closed-circuit, forced-draft cooling towers • Natural-draft cooling towers • Liquid coolers	
Packaged Water Chillers: • Absorption water chillers • Direct-fired absorption water chillers • Indirect-fired absorption water chillers • Centrifugal water chillers • Air-cooled centrifugal water chillers • Water-cooled centrifugal water chillers reciprocating water chillers • Scroll water chillers • Rotary-screw water chillers	
Thermal Storage: • Chilled-water thermal storage • Ice thermal storage • Ice-slurry thermal storage	• Verify air system balancing and a means for providing the system balancing. • Verify hydronic system balancing and a means for providing the system balancing. • Verify duct system testing. • Verify that mechanical system manuals and construction documents required by the O&M manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. □ Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside of the building or located where exposed to the exterior environment.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Air Outlets and Inlets: • Diffusers, registers and grilles • HVAC gravity ventilators • HVAC gravity dome ventilators • HVAC gravity-louvered penthouse ventilators • HVAC gravity upblast ventilators	• Verify air system balancing. • Verify hydronic system balancing. • Verify duct system testing. • Verify that mechanical system manuals and construction documents required by the O&M manual are submitted. • Verify functional performance testing of HVAC equipment and associated controls and control systems. • Verify acceptance of HVAC systems and equipment/system verification report. • Verify that preparation and distribution of final HVAC system is complete and in accordance with the contract documents. • Confirm construction documents, required drawings, manuals, balancing reports and commissioning report are provided. □ Confirm they are provided to the owner. • Verify air-handling system access. • Verify air-handling system filters. • Verify temperature and humidity in occupied spaces. • Verify specific indoor air quality and pollutant control measures. • Verify listing, installation and venting of fireplaces and combustion appliances. • Verify that mechanical and emergency generator equipment is located outside of the building or located where exposed to the exterior environment.
Air Terminal Units: • Constant-air-volume units • VAV units	
Electronic Air Cleaners: • Washable electronic air cleaners • Self-contained electronic air cleaners	
Gas-phase Air Filtration: • Activated-carbon air filtration • Chemically impregnated adsorption air filtration • Catalytic-adsorption air filtration	
HVAC Air Cleaning Devices—Particulate Air Filtration: • Panel air filters • Renewable-media air filters • Washable air filters • Extended surface filters • High-efficiency particulate filtration	
HVAC Air Distribution: • Dampers • Volume-control dampers • Fire dampers • Smoke-control dampers • Backdraft dampers • Duct silencers • Turning vanes • Duct- access doors • HVAC fans • Axial HVAC fans • Centrifugal HVAC fans. • HVAC power ventilators • Air curtains	
Special Exhaust Systems: • Dust-collection systems • Sawdust collection systems • Engine exhaust systems • Positive-pressure engine exhaust systems • Mechanical engine exhaust systems	(Included in above tasks/comments) • Verify compliance with local codes
Ventilation Hoods: • Commercial kitchen hoods • Listed commercial kitchen hoods • Standard commercial kitchen hoods • Fume hoods	

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
HVAC Piping and Pumps; **Hydronic Piping and Pumps:** • Hydronic piping • Underground hydronic piping • Above-ground hydronic piping • Ground-loop heat-pump piping • Hydronic piping specialties • Hydronic pumps • In-line centrifugal hydronic pumps • Base-mounted, centrifugal hydronic pumps • Vertical-mounted, double-suction centrifugal hydronic pumps • Vertical-turbine hydronic pump, automatic	• Installed in compliance with contract documents. • Flushing and cleaning plan submitted and approved. • System properly flushed and cleaned and temporary piping removed. • Piping pressure tested according to contract document. • Isolation valves provided at all branches and main takeoffs as required by the contract documents. • Valves installed in the proper direction. • Valves that require a positive shutoff are verified to not leak when closed at normal operating pressure. • Valves tagged and valve schedule submitted and displayed per contract documents. • Temperature, pressure and flow gages and sensors installed. • Piping gages, BAS and associated panel temperature and pressure readouts match.
HVAC Water Treatment: • Water treatment for closed-loop hydronic systems • Water treatment for open hydronic systems • Water treatment for steam system feedwater	
Internal-combustion Engine Piping: • Internal-combustion engine remote-radiator coolant piping • Internal-combustion engine exhaust piping	
Refrigerant Piping: • Refrigerant piping valves • Refrigerant piping specialties • Refrigerant safety relief valve discharge piping • Refrigerants	
Steam and Condensate Piping and Pumps: • Steam and condensate pump units • Steam and condensate heating piping • Steam and condensate heating piping specialties • Steam condensate pumps • Electric-driven steam condensate pumps • Pressure-powered steam condensate pumps	

Lighting and Electrical

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Lighting and Electrical: • Automatic demand-reduction control system functionality • Plug load controls • Connection of appliances to switched receptacles • Verification of transformer nameplate efficiency • Lamps (lighting installations) • Ballasts (lighting installations)	• Devices installed per manufacturer's instructions and specifications.
• Lighting control systems (low voltage)	• Verify a representative sample of zones for sweep warning effectiveness, override capability and zone size. • Test accuracy of schedule, sweep warning system and sweep override switches.
• Automatic daylight harvesting	• Verify photosensors are properly placed and aimed. • Verify daylight control zones correspond to available daylight. • Calibrate dimming set points without the presence of daylighting. • Calibrate dimming gain in presence of daylighting. • Calibrate switching deadbands and set points. • Performance test a representative sample of daylight zones.
• Occupancy and vacancy sensors	• Calibrate sensitivity sensor and time delay adjustment. • Performance test a representative sample of control zones, including entry tests, hand-motion tests and perimeter tests.

Optional Items

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Medium-voltage: • Substations • Switches • Circuit breakers • Switchgear • Switchboards • Panel boards • Emergency systems	• Verify coordination study is complete, and that breaker and relay settings are set in accordance with the study. • Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist. • Test transformers. • Test protective devices. • Test control circuits, e.g., potential transformers and current transformers. • Test switchgear, e.g., electrical and mechanical operations. • Test circuit breakers. • Local operational tests. • Remote operational tests, if applicable. • Verify training of operating personnel for O&M of equipment.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Low-voltage: • Substations • Disconnects • Circuit breakers • Motor control centers • Panel boards • Emergency systems	• Verify coordination study is complete, and that breaker and relay settings are set in accordance with the study. • Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist. • Test transformers. • Test protective devices, e.g., potential transformers and current transformers. • Test control circuits. • Test switchgear, e.g., electrical and mechanical operations. • Test circuit breakers. • Local operational tests. • Remote operational tests, if applicable. • Verify training of operating personnel for O&M of equipment.
• Motors, motor starters and drives (VFD)	• Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist. • Verify motor and starter data match specification and each other. • Inspect the installation. • Take voltage and current reading; compare with nameplate and manufacturer's specifications. • Test for proper motor rotation; if VFD, verify proper motor rotation when in VFD bypass mode. • Local operational tests. • Remote operational tests, if applicable. • Verify training of operating personnel for O&M of equipment. • Monitor operations.
• Emergency generators and distribution systems	• Verify coordination study is complete, and that breaker and relay settings are set in accordance with the study. • Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist and factory commissioning plan. • Inspect the installation. • Follow factory commissioning plan. • Local operational tests. • Remote operational tests, if applicable. • Load and duration tests (increasing loads over increasing durations). • Verify training of operating personnel for O&M of equipment. • Monitor operation.
• UPS	• Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist and factory commissioning plan. • Inspect the installation. • Follow factory commissioning plans (transfer testing, to generator, to bypass, to maintenance bypass, etc.). • Verify training of operating personnel for O&M of equipment. • Monitor operation.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
• Grounding equipment and building grounding systems	• See IEEE 81. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Inspect the installation. • Verify training of operating personnel for O&M of equipment.
• Lightning protection equipment and systems	• Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Inspect the installation. • Ensure installer is listed by UL, and that a master label application is submitted to UL for the installation. • Ensure owner signs the master label application. • Ensure receipt of master label from the installer. • Place master label on the protected structure, as requested. • Take voltage and current reading; compare with nameplate and manufacturer's specifications. • Test for proper motor rotation; if VFD, verify proper motor rotation when in VFD bypass mode. • Verify training of operating personnel for O&M of equipment. • Monitor operation.

Other Electrical Systems (Communications—Including Telecom, Intercom, Public Address, Television, Video, etc.)

Optional items

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Medium-voltage: • Transformers • Substations • Switches • Circuit breakers • Switchgear • Switchboards • Panel boards • Emergency systems	• Verify coordination study is complete, and that breaker, fuse and relay settings are set in accordance with the study. • Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist. • Test transformers. • Test protective devices. • Test control circuits, e.g., potential transformers and current transformers. • Test switchgear, e.g., electrical and mechanical operation. • Test circuit breakers. • Local operational tests. • Remote operational tests, if applicable. • Test all mechanical connections using an infrared camera after initial energizing and after the system is loaded. • Verify training of operating personnel for O&M of equipment.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Low-voltage: • Transformers • Substations • Disconnects • Bus duct • Circuit breakers (air circuit breakers not molded case circuit breakers) • Motor control centers • Panel boards • Emergency systems	• Verify coordination study is complete, and that breaker, fuse and relay settings are set in accordance with the study. • Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist. • Test transformers. • Test protective devices, e.g., potential transformers and current transformers. • Test control circuits. • Test switchgear, e.g., electrical and mechanical operation. • Test circuit breakers. • Local operational tests. • Remote operational tests, if applicable. • Test all mechanical connections using an infrared camera after initial energizing and after the system is loaded. • Verify training of operating personnel for O&M of equipment.
• Motors, motor starters and drives (VFD)	• Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present, e.g., installer, factory representative, etc. • Review start-up checklist. • Verify motor and starter data match specification and each other. • Inspect the installation. • Take voltage and current reading, compare with nameplate and manufacturer's specifications. • Test for proper motor rotation; if VFD, verify proper motor rotation when in VFD bypass mode. • Local operational tests. • Remote operational tests, if applicable. • Verify training of operating personnel for O&M of equipment. • Monitor operation.
• Emergency generators and distribution systems	• Verify coordination study is complete, and that breaker, fuse and relay settings are set in accordance with the study. • Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist and factory commissioning plan. • Inspect the installation. • Follow factory commissioning plan. • Local operational tests. • Remote operational tests, if applicable. • Test all mechanical connections using an infrared camera after initial energizing and after the system is loaded. • Load and duration tests (increasing loads over increasing durations). • Verify training of operating personnel for O&M of equipment. • Monitor operation.
• UPS	• Witnessing of factory tests, as appropriate. • Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Review start-up checklist and factory commissioning plan. • Inspect the installation. • Follow factory commissioning plans (transfer testing to generator, to bypass, to maintenance bypass, etc.). • Test all mechanical connections using an infrared camera after initial energizing and after the system is loaded. • Verify training of operating personnel for O&M of equipment. • Monitor operation.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
• Grounding equipment and building grounding systems	• Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Inspect the installation. • Verify training of operating personnel for O&M of equipment.
• Lightning protection equipment and systems	• Ensure all necessary representatives are present (e.g., installer, factory representative, etc.). • Inspect the installation. • Ensure installer is listed by UL and that a master label application is submitted to UL for the installation. • Ensure building owner signs the master label application. • Ensure receipt of master label from the installer. • Place master label on the protected structure, as requested. • Take voltage and current reading, compare with nameplate and manufacturer's specifications. • Test for proper motor rotation; if VFD, verify proper motor rotation when in VFD bypass mode. • Verify training of operating personnel for O&M of equipment. • Monitor operation.

Water

Plumbing Systems (Water Distribution, Sanitary/Storm Water, Rainwater, Gray Water, etc.)

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Facility Water Distribution Piping: • Domestic water piping • Domestic water piping specialties • Domestic water pumps • Domestic water-packaged booster pumps	• Installed in compliance with contract document. • Flushing and cleaning plan submitted and approved. • Piping pressure tested according to contract document.
Facility potable-water-storage tanks	• Installed in compliance with contract document.
Facility Sanitary Sewerage: • Sanitary waste piping specialties • Sanitary drains • Fats, oils and grease disposal systems • Grease removal devices • Backwater valves • Air admittance valves • Sanitary waste interceptors and separators • Sanitary sewerage pumps • Wet pit-mounted, vertical sewerage pumps • Submersible sewerage pumps • Sewerage pump basins and pits • Facility septic tanks • Facility gray water tanks	• Installed in compliance with contract document. • Flushing and cleaning plan submitted and approved. • System properly flushed and cleaned and temporary piping removed. • Piping pressure tested according to contract document. • Valves installed in the proper direction. • Valves that require a positive shutoff are verified to not leak when closed at normal operating pressure. • Valves tagged and valve schedule submitted and displayed per contract documents.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Facility Storm Drainage: • Facility storm drainage piping • Sump pump discharge piping • Sump pumps • Submersible sump pumps • Sump-pump basins and pits • Packaged, pedestal drainage pump units • Packaged, submersible, drainage pump units • Rainwater storage tanks	• Installed in compliance with contract documents. • Flushing and cleaning plan submitted and approved. • System properly flushed and cleaned and temporary piping removed. • Piping pressure tested according to contract documents. • Valves installed in the proper direction. • Valves that require a positive shutoff are verified to not leak when closed at normal operating pressure. • Valves tagged and valve schedule submitted and displayed per contract documents. • Check electrical connections.
General service compressed-air systems	• Verify installation in compliance with contract document
Domestic Water Heat Exchangers: • Instantaneous domestic water heat exchangers • Heating fluid-in-coil, instantaneous domestic water heat exchangers • Domestic water-in-coil, instantaneous domestic water heat exchangers • Heating fluid, instantaneous domestic water heat exchangers • Circulating, domestic water heat exchangers • Circulating, compact domestic water heat exchangers • Circulating, storage domestic water heat exchangers • Noncirculating, domestic water heat exchangers • Noncirculating, storage domestic water heat exchangers • Domestic water brazed-plate heat exchangers • Domestic water frame-and-plate heat exchangers • Domestic water heat reclaimers	• Comply with manufacturer's recommended checkout and startup procedures. • Manufacturer's recommended spare parts are provided. • Equipment label permanently affixed. • Pumps in place and properly supported. • Pressure/temperature relief valves installed per contract documents. • Shaft seal is leak free. • Insulation installed per contract documents. • All electrical connections are tight. • Grounding installed and operational. • Safeties installed and operational. • Control system interlocks connected and functional. • Pump rotates in correct direction. • Temperature and pressure gages and sensors installed per contract documents.
Domestic Water Softeners; **Domestic Water Filtration Equipment;** **Electric Domestic Water Heaters:** • Instantaneous electric domestic water heaters • Flow-control, instantaneous electric domestic water heaters • Thermostat-control, instantaneous electric domestic water heaters • Electric domestic water heaters • Small-capacity electric domestic water heaters. • Residential, storage electric domestic water heaters • Collector-to-tank, solar-electric domestic water heaters • Collector-to-tank, heat-exchanger-coil, solar-electric domestic water heaters • Light-commercial electric domestic water heaters • Commercial domestic water electric booster heaters • Commercial domestic water electric booster heaters • Commercial storage electric domestic water heaters	• Comply with manufacturer's recommended checkout and startup procedures. • Manufacturer's recommended spare parts are provided. • Equipment label permanently affixed. • Pumps in place and properly supported. • Pressure/temperature relief valves installed per contract documents. • Shaft seal is leak free. • Insulation installed per contract documents. • All electrical connections are tight. • Grounding installed and operational. • Safeties installed and operational. • Control system interlocks connected and functional. • Pump rotates in correct direction. • Temperature and pressure gages and sensors installed per contract documents.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Fuel-fired Domestic Water Heaters: • Instantaneous, tankless, gas domestic water heaters • Residential gas domestic water heaters • Residential, atmospheric, gas domestic water heaters • Residential, direct-vent, gas domestic water heaters • Residential, power-vent, gas domestic water heaters • Commercial gas domestic water heaters • Commercial, atmospheric, gas domestic water heaters • Commercial, power-burner, gas domestic water heaters • Commercial, power-vent, gas domestic water heaters • Commercial, high-efficiency, gas domestic water heaters • Commercial, coil-type, finned-tube, gas domestic water heaters • Commercial, grid-type, finned-tube, gas domestic water heaters • Oil-fired domestic water heaters • Large-capacity, oil-fired domestic water heaters • Dual fuel-fired domestic water heaters	• Comply with manufacturer's recommended checkout and startup procedures. • Manufacturer's recommended spare parts are provided. • Equipment label permanently affixed. • Pumps in place and properly supported. • Pressure/temperature relief valves installed per contract documents. • Shaft seal is leak free • Insulation installed per contract documents. • All electrical and fuel connections are tight. • Grounding installed and operational. • Safeties installed and operational. • Control system interlocks connected and functional. • Pump rotates in correct direction. • Temperature and pressure gages and sensors installed per contract documents.
Commercial Plumbing Fixtures: • Commercial water closets, urinals and bidets • Commercial water closets • Commercial urinals • Commercial lavatories and sinks • Commercial lavatories • Commercial sinks • Commercial bathtubs • Commercial showers • Commercial disposers • Wash fountains • Commercial faucets, supplies and trim • Flushometers	• Installation is per manufacturer's instructions. • Pipe fittings complete and properly supported. • Faucet/flush handles secure and properly aligned. • Associated trim and accessories consistent with contract documents. • Joints between fixtures, walls and floors and counters sealed. • Insulation installed per contract documents. • Fixtures consistent with ADA. • Water pressure meets contract documents. • Hot water temperature meets contract documents. • Automatic flush valves and sensors verified for proper operation and sensitivity adjustment.
Emergency Plumbing Fixtures: • Emergency showers • Eyewash equipment • Self-contained eyewash equipment	• Installation is per manufacturer's instructions. • Water pressure meets contract documents. • Hot water temperature meets contract documents.
Drinking Fountains and Water Coolers: • Drinking fountains • Pressure water coolers • Water-station water coolers • Remote water coolers	• Installation is per manufacturer's instructions. • Water pressure meets contract documents. • Water temperature meets contract documents.

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
Fountain Plumbing Systems: • Fountain piping • Fountain pumps • Fountain water treatment equipment • Fountain equipment controls	• Comply with manufacturer's recommended checkout and startup procedures. • Manufacturer's recommended spare parts are provided. • Equipment label permanently affixed. • Pumps in place and properly supported. • Pressure / temperature relief valves installed per contract documents. • Shaft seal is leak free. • Insulation installed per contract documents. • All electrical connections are tight. • Grounding installed and operational. • Safeties installed and operational. • Control system interlocks connected and functional. • Pump rotates in correct direction.
Swimming Pool Plumbing Systems: • Swimming pool pumps • Swimming pool water treatment equipment • Swimming pool equipment controls	

Indoor Environmental Quality

IEQ Requires	TASKS/COMMENTS
• For IEQ requirements for individual systems see the following sections: □ See Table 603, Energy, and Table 604, HVAC Systems.	—
• Optional systems (not required by the IgCC). □ See Table 602, Materials (Architectural Building Assembly).	—

Construction and Demolition Waste Management

RELATED SYSTEMS, EQUIPMENT, ASSEMBLIES AND COMPONENTS	TASKS/COMMENTS
• C&D waste diversion goals • Integrated waste management plan within all scopes of project work • C&D WM project team coordinator • C&D WM field worker requirements • Project staging and coordination issues • Establish types of materials to be diverted, salvaged and or recycled • Identify known and potential hazardous materials on project • Material consumption during project development and design • Material consumption and waste during all project phases and scopes of work • Desired method of C&D WM • Verification documents and information management process reporting • C&D WM schedule of events within project critical path	• External verification documentation and reporting. • Internal information management process reporting and records. • Monitor and evaluate progress and coordinate adjustments, as necessary. • Coordinate progress and events; and communicate through proper documentation, meetings and other communications. • Verification that the integrated waste management plan on site is communicated and documented to a qualified and approved waste hauler. • Verification for the proper handling of hazardous C&D materials on site, and that they are transferred to an approved waste hauler for hazardous C&D materials removed from the project site. • Verification that project material consumption goals are being met. • Verification that recycled and salvaged material intended for project reuse, meets all material design requirements, codes, standards and project documents. • Verification of material cost savings and diversion goals, as they relate to recycled and salvaged materials. • Verification and amount of source site separation and diversion, for each material identified. • Verification and amount of bulk commingling and diversion, for all materials with an estimate for each type of material used on project. • Verification that workers are approved and meet all necessary federal, state and local regulatory requirements for handling hazardous materials. • Verification of project closeout; all documentation required for the project is complete, up-to-date, and reported as required by the AHJ and contract documents.