
USACE / NAVFAC / AFCEC / NASA

UFGS-01 91 00.15 (May 2023)

Change 1 - 08/23

Preparing Activity: NAVFAC

Superseding

UFGS-01 91 00.15 10 (May 2019)

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

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SECTION 01 91 00.15

BUILDING COMMISSIONING

05/23, CHG 1: 08/23

NOTE: This guide specification covers Building Commissioning requirements for design and construction of: new building; additions; existing building sustainment, restoration, and modernization.

Coordinate all Sections that reference commissioning with this section, including Sections 01 45 00 QUALITY CONTROL, 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL, 01 45 00 QUALITY CONTROL, 01 91 19 BUILDING ENCLOSURE COMMISSIONING, 23 08 00 COMMISSIONING OF MECHANICAL[AND PLUMBING] SYSTEMS, 22 33 30.00 10 SOLAR WATER HEATING EQUIPMENT, 26 08 00 APPARATUS INSPECTION AND TESTING, 26 31 00 SOLAR PHOTOVOLTAIC (PV) COMPONENTS, 26 51 00 INTERIOR LIGHTING, and 26 56 00 EXTERIOR LIGHTING.

Adhere to [UFC 1-300-02](#) Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a [Criteria Change Request \(CCR\)](#).

PART 1 GENERAL

NOTE: This section contains tailoring options for

KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, ARMY, NAVY, DESIGN-BUILD, DESIGN-BID-BUILD, and INTEGRATED SYSTEMS TESTING.

Select KTR HIRED COMMISSIONING PROVIDER tailoring for projects that require the Commissioning Provider to be provided by the Construction Contractor.

Select GOVT HIRED COMMISSIONING PROVIDER tailoring for Navy managed projects where the Commissioning Provider is retained under a separate contract with the Government.

ARMY tailoring applies to construction projects managed by the Army. Army managed projects will always have a KTR HIRED COMMISSIONING PROVIDER in accordance with Engineering Regulation 1110-345-723 TOTAL BUILDING COMMISSIONING PROCEDURES. Do NOT select GOVT HIRED COMMISSIONING PROVIDER tailoring for Army managed projects. Refer to Engineering Regulations for further information.

Army Engineering Regulation (ER) 1110-345-723 describes Army project commissioning leadership structure. In all cases, the construction contractor will be required to provide a Contractor's Commissioning Specialist (CxC), herein referred to as the Lead Commissioning Specialist, to perform the duties listed. For design-build projects, the CxC serves as the Commissioning Specialist for Design (CxD) as defined in ER 1110-345-723. The Army will utilize a Government Commissioning Specialist (CxG) as described in the ER. Regardless of whether the CxG is provided by Army personnel or third party contract, all communication and coordination with the CxG will be managed through the Contracting Officer via processes established in other specification sections such as Quality Control and Submittal Procedures.

NAVY tailoring applies to construction projects managed by the Navy.

Select DESIGN-BUILD tailoring for Design-Build project execution.

Select DESIGN-BID-BUILD tailoring for Design-Bid-Build project execution.

Select INTEGRATED SYSTEMS TESTING tailoring for buildings with central control systems and interactive operation among different systems. (Examples include mission critical facilities such as hospitals, laboratories, mission operations, or other essential (RCIV) and strategic asset (RCV) facilities.)

Coordinate this Section with the commissioning

requirements of ASHRAE Standard 90.1 as required by
UFC 1-200-02, "High Performance and Sustainable
Building Requirements" paragraph "Commissioning".

Building Commissioning is a systematic, quality-focused process for enhancing the delivery of a project that focuses on verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the project requirements. The purpose is to reduce the cost and performance risks associated with delivering facilities projects, and to increase value to owners, occupants, and users.

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

- | | |
|------------------|---|
| ASHRAE 90.1 - IP | (2019) Energy Standard for Buildings Except Low-Rise Residential Buildings |
| ASHRAE 180 | (2012) Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems |
| ASHRAE 202 | (2018) Commissioning Process for Buildings and Systems |

ASSOCIATED AIR BALANCE COUNCIL (AABC)

- | | |
|-----------------------------|--------------------------------|
| ACG Commissioning Guideline | (2005) Commissioning Guideline |
|-----------------------------|--------------------------------|

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB S1110 (2019) Whole Building Technical Commissioning of New Construction; 2nd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 014 (2013) HVAC Systems Commissioning Manual, 2nd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 25-345-1 (2019) Commissioning -- Systems Manual

1.2 DEFINITIONS

Commissioning Process (Cx) - a quality-focused process for enhancing the delivery of a project. Refer to ASHRAE 202 for a comprehensive description of the commissioning process.

NOTE: The following paragraph contains tailoring for ARMY, NAVY, and GOVT-HIRED COMMISSIONING PROVIDER.

Commissioning Provider Lead Commissioning Specialist (Cx) - The entity hired by the Government, who leads, plans, and coordinates the Commissioning Team. The terms Commissioning Provider, Commissioning Firm, Lead Commissioning Specialist, Commissioning Specialist, and Commissioning Authority (CA or CxA) when used by sustainable Third Party Certification (TPC) programs, are interchangeable.

Commissioning Authority - The Government retains the authority for oversight and assurance of the entire commissioning process, and final approval of all commissioning deliverables.

NOTE: The following paragraph is tailored for NAVY. For Navy managed projects, refer to NAVFAC Instruction 3960.1 "Technical Oversight and Acceptance Testing of Critical Systems" for information on Acceptance Testing Representatives' roles and responsibilities.

Government Acceptance Testing Representatives - Government Acceptance Testing Representatives perform the inherently Governmental function of technical oversight and quality assurance for critical systems, and is distinctly separate from the commissioning process. Government Acceptance Testing Representatives witness final testing of critical systems and report systems' acceptance to the COR. Submittals to be surveilled and approved by Government Acceptance Testing Representatives are identified in Section 01 33 00 SUBMITTAL PROCEDURES 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES. Testing required to be witnessed by Government Acceptance Testing Representatives are identified in system level sections.

NOTE: The Owner's Project Requirements (OPR) document may be included as deemed appropriate by the project team or as required by some Third Party Certification (TPC) systems (such as LEED and Green Globes). The preliminary design deliverables and preliminary design authority (PDA) documentation (1391, Basis of Design, UFCs, etc.) constitute the Owner's Project Requirements (OPR) and may be used in lieu of a stand-alone OPR. If used, the OPR is referenced by the CxC during design review when the specification is tailored for KTR HIRED COMMISSIONING PROVIDER.

NOTE: The Owner's Project Requirements (OPR) document may be included as deemed appropriate by the project team or as required by some Third Party Certification (TPC) systems (such as LEED and Green Globes). When not otherwise required for TPC, inclusion of the OPR for CxC review may be beneficial for ensuring large or complex projects conform to the Owner's needs. This may be unnecessary for more typical construction projects. If used, the OPR is referenced by the CxC during design review and during submittal review, inspections, and testing.

NOTE: If used, insert the OPR as Appendix A to the specification section. Include a statement on the OPR cover stating that the document is provided for commissioning review purposes only and is not a contract requirement. Retain the bracketed references to Owner's Project Requirements (OPR) throughout the specification when one is included. Delete the bracketed OPR references when the OPR is not included.

[Owner's Project Requirements (OPR) - document that details the stakeholders' requirements for the project and the expectations for how it will be used and operated. The OPR is provided for commissioning review purposes only and is not a contract requirement.

]1.3 COMMUNICATION WITH THE GOVERNMENT COMMISSIONING PROVIDER

NOTE: The following paragraph contains tailoring for ARMY, NAVY, KTR HIRED COMMISSIONING PROVIDER, and GOVT HIRED COMMISSIONING PROVIDER

The Lead Commissioning Specialist (CxC) must submit all plans, schedules, reports, and documentation directly to the Contracting Officer's Representative concurrent with submission to the CQC System QC Manager.

The Lead Commissioning Specialist must have direct communication with the Contracting Officer's Representative regarding all elements of the commissioning process; however, the Government has no direct contract authority with the Lead Commissioning Specialist.

The CQC System Manager QC Manager must communicate directly with the CxC and Contracting Officer's Representative regarding all elements of the commissioning process; however, the CxC has no direct contract authority. Coordinate with the Contracting Officer's Representative for all commissioning activities required by the Commissioning Provider. Inform the Contracting Officer's Representative when systems are ready for commissioning activities, and allow access to the construction site and system(s) to be tested.

1.4 COMMUNICATION WITH GOVERNMENT ACCEPTANCE TESTING REPRESENTATIVES

The QC Manager must communicate directly with the Government Acceptance Testing Representatives and Contracting Officer's Representative regarding Government acceptance testing activities. Inform the Contracting Officer's Representative when systems are ready for testing to be witnessed by Government Acceptance Testing Representatives, and allow access to the construction site and system(s) to be tested.

1.5 SYSTEMS TO BE COMMISSIONED

NOTE: The following systems are required to be commissioned per ASHRAE Standard 90.1 as required by UFC 1-200-02 paragraph "Commissioning." Select all systems that are part of the scope. Add other systems as required by the scope of the project or required by the applied sustainable third party certification program. Other systems may be appropriate for commissioning depending on scope and funding such as communications systems or specialty process systems. Per UFC 1-200-02, paragraph Outdoor Water, new, permanent, potable irrigations systems are not allowed. Only include the bracketed irrigation system line item for new, non-potable irrigation systems or existing irrigation systems that are part of the commissioning scope of work.

Include bracketed "Building envelope" for new buildings and renovation projects that include significant envelope scope. Coordinate with Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING.

Coordinate commissioning and quality control activities for the following systems, equipment, and associated controls. System-specific requirements are located in the associated specification sections. Commission the following systems, equipment, and associated controls in accordance with this section and the inspection, testing, and quality control requirements of their respective sections:

- [Heating, ventilating, air-conditioning, and refrigeration systems (mechanical and passive) and associated controls (HVAC)
-][Lighting systems: interior and exterior, automatic and manual daylighting controls, occupancy sensing devices, automatic shut-off controls, time switching, and other lighting control devices, and dimming systems
-][Service hot-water systems and controls

-] [Water pressure-booster systems
-] [Building Control Systems
-] [Utility Monitoring and Control Systems
-] [Metering and sub-metering
-] [Automatic Receptacle Control
-] [Building Envelope in accordance with Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING.
-] [_____]

1.6 RELATED SECTIONS

Refer to the following technical sections for additional commissioning requirements for respective systems:

- [Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING
-] [Section 23 08 00 COMMISSIONING OF MECHANICAL[AND PLUMBING] SYSTEMS
-] [Section 26 08 00 APPARATUS INSPECTION AND TESTING

]1.7 COMMISSIONING TEAM

NOTE: The following paragraph contains ARMY, NAVY, and DESIGN-BUILD tailoring.

Select the contractors and Government team members based on systems to be commissioned and the commissioning plan. **Include Government Acceptance Testing Representatives for all Navy-executed projects.**

The Commissioning team will include, but is not limited to the following team members.

Ensure all Design and Construction Activities for systems to be commissioned are coordinated with the appropriate commissioning team members.

- a. Commissioning Provider Lead Commissioning Specialist (CxC)
- b. Quality Control Manager (QCM) CQC System Manager
- c. Sub-Contractor Representatives for each trade responsible for construction/installation of systems to be commissioned
- d. Construction Manager (CM) Contractor's Project Manager
- e. Technical Commissioning Specialists for each system to be commissioned
- f. TAB Representative

- g. Equipment manufacturer representatives
- h. Government Contracting Officer
- i. Government Representatives
- j. Installation Maintenance Representative
- k. Facility End User
- l. Designer of Record (DOR)
- m. Government Acceptance Testing Representatives

[_____]

1.8 PROJECT SCHEDULE

NOTE: This paragraph contains tailoring options for ARMY and NAVY.

Edit milestones based on systems to be commissioned and the requirements of the contract documents.

Select bracketed items as applicable. Include additional schedule tasks as necessary. Final editing will require renumbering remaining items.

Include the following tasks in the project schedule required by Section 01 32 01.00 10 PROJECT SCHEDULE 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS). Ensure sufficient time is scheduled to complete each item. The order of items listed below is not intended to imply a specified sequence:

NOTE: The following two items are tailored for KTR HIRED COMMISSIONING PROVIDER and DESIGN-BUILD.

- a. Submission and approval of the Commissioning Firm Qualifications
- b. Submission and approval of the Design Phase Commissioning Plan

NOTE: The following items are tailored for KTR HIRED COMMISSIONING PROVIDER. Select the Design Review Report submittal if a design review will be conducted post-contract award. Commissioning design review report may be required by applicable Sustainability Third Party Certification guidelines.

- [c. Submission and approval of the Design Review Report
-] d. Submission and approval of the Interim and Final Construction Phase Commissioning Plans

- e. Commissioning Kickoff Meeting
- f. Regular Commissioning Coordination Meetings
- g. Installation of permanent utilities (gas, water, electric, steam)
- h. Building Enclosure Construction
- i. Submission and approval of the Completed Building Enclosure Inspection Checklists
- j. Manufacturer's Equipment Start-Up for each of the systems to be commissioned
- k. Submission and approval of the Completed Commissioning Observation Checklists
- l. Submission and approval of Certificate of Readiness for each system to be commissioned
- m. Commissioning Testing, including Functional Performance Testing, for each system to be commissioned

NOTE: The following item is tailored for INTEGRATED SYSTEMS TEST.

- n. Integrated Systems Tests
- o. Post-test deficiency correction for each system to be commissioned
- p. Re-Testing

NOTE: The following two items are tailored for ARMY.

- q. Submission and approval of the Maintenance and Service Life Plans
- r. Submission and approval of the Systems Manual
- s. Training for each of the systems to be commissioned

NOTE: The following item is tailored for KTR HIRED COMMISSIONING PROVIDER.

- t. Submission and approval of the Initial and Final Commissioning Reports
- u. Seasonal Testing

NOTE: The following item is tailored for NAVY.

- v. Final testing required to be witnessed by Government Acceptance

Testing Representatives, as identified in system level sections.

NOTE: Item w. Warranty Phase Site Visit bracketed text is tailored for KTR HIRED COMMISSIONING PROVIDER. Warranty phase site visit is recommended to document any deficiencies and verify systems function according to project requirements post-occupancy. Warranty phase site visit may be required by applicable Sustainability Third Party Certification guidelines.

- [w. Warranty Phase Site Visit
-] [x. Post-Construction Endurance Testing
-] y. Updated Commissioning report
- [z. [_____]
-] [1.9 PHASING

NOTE: Include this bracketed paragraph and provide instruction to contractor for projects with phases or multiple buildings to convey particular commissioning scheduling requirements beyond the Contractor's means and methods. Determine whether systems are to be commissioned as each phase or building is completed, or deferred until all phases or buildings are complete. Coordinate scheduling requirements with project manager.

[This project includes multiple [phases][and][buildings]. Commissioning activities for each project phase[and][building] must be scheduled separately and must correspond to each completion milestone in the master schedule.] [_____]

]1.10 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army managed projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the

approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

For Navy design-build projects, delete Section 01 33 00 SUBMITTAL PROCEDURES, and replace with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES and Section 01 33 10.05 20 DESIGN SUBMITTAL PROCEDURES. For Army managed projects, use Section 01 33 00 SUBMITTAL PROCEDURES for both design-build and design-bid-build projects.

Choose the first bracketed item for Navy, Air Force, and NASA managed projects, or choose the second bracketed item for Army managed projects.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-05 Design Data

NOTE: The following submittal is tailored for KTR HIRED COMMISSIONING PROVIDER and DESIGN-BUILD.

Design Phase Commissioning Plan; G[, [_____]]

SD-06 Test Reports

Completed Construction Observation Checklists; G[, [_____]]

NOTE: The following submittals are tailored for KTR HIRED COMMISSIONING PROVIDER. Select the Design Review Report submittal if a design review will be conducted post-contract award. Commissioning design review report may be required by applicable Sustainability Third Party Certification guidelines.

[Design Review Report; G[, [_____]]

] Interim Construction Phase Commissioning Plan; G[, [____]]
Final Construction Phase Commissioning Plan; G[, [____]]; S
Initial Commissioning Report; G[, [____]]
Issues Log; G[, [____]]

SD-07 Certificates

NOTE: The following submittal is tailored for KTR
HIRED COMMISSIONING PROVIDER.

Commissioning Firm; G[, [____]]

SD-10 Operation and Maintenance Data

NOTE: The following submittal is tailored for ARMY
and KTR HIRED COMMISSIONING PROVIDER.

Maintenance and Service Life Plan; G[, [____]]

Systems Manual; G[, [____]]

SD-11 Closeout Submittals

NOTE: The following submittals are tailored for KTR
HIRED COMMISSIONING PROVIDER. Retain the Updated
Final Commissioning Report submittal for projects
that require a Warranty Phase Site Visit.

Final Commissioning Report; G[, [____]]

Updated Final Commissioning Report; G[, [____]]

NOTE: Retain the following submittal for projects
that are required to track "S" submittals in the
Sustainability eNotebook, in accordance with Section
01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

[Final Commissioning Report (eNotebook); S

][Updated Final Commissioning Report (eNotebook); S

]1.11 COMMISSIONING FIRM

NOTE: The following paragraphs are tailored for KTR
HIRED COMMISSIONING PROVIDER. Verify the
certifications below cover the requirements of the

systems to be commissioned in the project. Add or delete certificates as appropriate.

Employ the services of a Commissioning Firm and all Commissioning Specialists required to perform work for this project. The Commissioning Firm must be a first-tier subcontractor that is financially and corporately independent from prime contractor and all other subcontractors and the Designer of Record and that is not participating in any other work on this Contract, including design, furnishing equipment, construction, or testing, adjusting, and balancing.

NOTE: Choose the bracketed option 60 days for large or complex projects or projects with long duration. Choose the bracketed option 30 days for small or non-complex projects, or projects with shorter duration.

- a. Submit the Commissioning Firm's and Commissioning Specialists' qualifications, including the name of the firm and each CxC and each certification, no later than [60][30] calendar days after contract award notice to proceed notice to proceed.
- b. If, for any reason, a specialist loses a certification during this period, immediately notify the Contracting Officer and submit another Commissioning Specialist for approval. An approved successor must validate all work performed for this project by the CxC who lost a certification.

1.11.1 Commissioning Specialists (CxC)

Assign Lead Commissioning Specialist and other appropriate Commissioning Specialists for the systems to be commissioned.

1.11.1.1 Lead Commissioning Specialist (CxC)

NOTE: Retain the bracketed certifications for CONUS and other locations where commissioning firms are likely to achieve this level of qualification. Delete the bracketed certification requirements in locations, such as other countries, where these certificates are not normally acquired.

Lead Commissioning Specialist (CxC) coordinates all aspects of the commissioning process. Duties include leading and overseeing the commissioning work and acting as the primary point of contact for the commissioning work. CxC may serve as a systems Specialist if all requirements for both designations are met. CxC must have a minimum of five years of commissioning experience, including two projects of similar size and complexity to this project.

[CxC must be certified in one of the following:

NEBB Building System Commissioning Professional (CxCP)

ACG Certified Commissioning Authority (CxA)
 ICB/TABB Certified Commissioning Supervisor
 BCA Certified Commissioning Professional (CCP)
 AEE Certified Building Commissioning Professional (CBCP)
 University of Wisconsin-Madison Qualified Commissioning Process
 Provider (QCxP)
 ASHRAE Building Commissioning Professional (BCxP).

]1.11.1.2 Commissioning Specialists

NOTE: Retain Commissioning Specialists based on the systems to be commissioned. Coordinate requirements with referenced UFGS Sections.

Choose bracketed phrases that are part of the project scope of work. Add any specialists necessary to execute the commissioning scope of this project.

Refer to the related technical commissioning specification section for additional qualifications for each Commissioning Specialist associated with each system. Include all Commissioning Specialist qualifications with the Commissioning Firm submittal:

- [a. Mechanical Commissioning Specialist: The technical work associated with mechanical systems to be commissioned must be performed by a Commissioning Specialist certified by NEBB, ACG, ICB/TABB, AEE, University of Wisconsin-Madison, ASHRAE, or BCA in the commissioning of HVAC systems with five years of experience in the commissioning of HVAC systems.

]

NOTE: Low complexity electrical systems, such as lighting control systems, may not necessitate the use of an electrical specialist. In such cases, the project team may allow the mechanical specialist to perform the electrical specialist role. Select the appropriate bracketed language. The contractor may then determine which type of specialist to use.

NOTE: More complex electrical systems may necessitate an electrical commissioning specialist. When the project includes specification Section 26 08 00 APPARATUS INSPECTION AND TESTING, the engineering technician performing the inspection and testing work described in that section may serve as the electrical commissioning specialist for commissioning. Select the appropriate bracketed language. Include bracketed option for utilizing Mechanical Commissioning Specialist to commission low complexity systems.

- [b. Electrical Commissioning Specialist: The technical work associated with electrical systems to be commissioned must be performed by an engineering technician with five years of experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.[The lead engineering technician specified in specification Section 26 08 00 APPARATUS INSPECTION AND TESTING may serve as the Electrical Commissioning Specialist.][The Mechanical Commissioning Specialist may be utilized to perform the technical work associated with electrical systems to be commissioned.]
-] c. Building Enclosure Commissioning Specialist: The technical work associated with the Building Envelope system must be performed by a Building Enclosure Commissioning Specialist that is a[registered architect or engineer, or building scientist, with five years of building enclosure design or construction experience][or a professional with training and Certification in Building Enclosure Commissioning from a third-party certification organization plus five years of commissioning experience]. The commissioning provider must have the necessary training, experience, and FPT equipment.

1.12 GOVERNMENT HIRED COMMISSIONING PROVIDER

NOTE: This paragraph is tailored for NAVY and GOVT HIRED COMMISSIONING PROVIDER when the Commissioning Provider is retained under a separate contract by the Government.

The Commissioning Provider (CxC) is employed by Government under separate contract. Incorporate key milestones of the Commissioning process into the Project Schedule identified in this Section.

1.13 COMMISSIONING STANDARD

NOTE: This paragraph is tailored for ARMY or KTR HIRED COMMISSIONING PROVIDER.

Comply with **ASHRAE 202** and the commissioning standards under which the Commissioning Firm and Specialists qualifications are approved, which may include **ACG Commissioning Guideline**, **NEBB S1110**, or **ANSI/SMACNA 014**. Comply with the requirements of the commissioning standard under which the Commissioning Firm and Specialists qualifications are approved. When the firm and specialists are certified by BCA, AEE, ASHRAE, or the University of Wisconsin-Madison, comply with the requirements of one of these acceptable standards: **ACG Commissioning Guideline**, **NEBB S1110**, **ANSI/SMACNA 014**, or **ASHRAE 202**. In a conflict, the most stringent requirements apply. In addition, comply with **ASHRAE 90.1 - IP** commissioning requirements for all systems. Refer to related technical commissioning specification sections for additional standards requirements.[Comply with applicable International Electrical Testing Association (NETA) testing standards for electrical systems.] The following requirements apply to all project commissioning and test standards:

- a. Implement all recommendations and suggested practices contained in the

Commissioning Standard and test standards.

- b. Use the Commissioning Standard for all aspects of Commissioning, including calibration of instruments.
- c. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, adhere to the manufacturer calibration recommendations.
- d. All quality assurance provisions of the Commissioning Standard such as performance guarantees are part of this contract.
- e. The Commissioning Specialists must develop commissioning procedures for any systems or system components not covered in the Commissioning Standard.
- f. Use any new requirements, recommendations, and procedures published or adopted by the body responsible for the applicable Commissioning Standards at the time of project award.
- g. If there is a conflict between the requirements of the contract documents and the commissioning standard used, the contract documents take precedent.

1.14 SUSTAINABILITY THIRD PARTY CERTIFICATION (TPC)

NOTE: Select this paragraph for projects applying sustainability Third Party Certification (TPC) requirements. Refer to UFC 1-200-02 to determine when SUSTAINABLE THIRD PARTY CERTIFICATION (TPC) is required. Coordinate with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. This paragraph is tailored for KTR HIRED COMMISSIONING PROVIDER.

The Commissioning Specialist must perform all commissioning activities, coordination, and submittals required by the sustainability Third Party Certification (TPC) program applied to this project, in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

NOTE: Choose this paragraph for projects applying sustainability third party certification LEED. Edit the bracketed phrases based on the credits (options and paths) in the project scope. For design-bid-build projects, ensure a Government team member or a third party contractor is qualified to act as the LEED Commissioning Authority, based on LEED requirements.

Include bracketed option "and Option 2: Envelope Commissioning" on LEED projects for new buildings or renovation projects with significant envelope scope.

[CxC must provide documentation or perform commissioning activities, coordination and submittals as required by Leadership in Energy and

Environmental Design (LEED) Fundamental Commissioning and Verification[
and Enhanced Commissioning [Option 1: Path 1 Enhanced Commissioning]
[Option 1: Path 2 Enhanced and Monitoring-Based Commissioning] [and Option
2: Envelope Commissioning]].

1.15 ISSUES LOG

The Commissioning Specialist develops and maintains an Issues Log for the systems to be commissioned. The issues log documents and tracks resolution of deficiencies identified during submittal reviews, inspection, and testing. At any point during construction, any commissioning team member finding deficiencies may communicate those deficiencies in writing to the Commissioning Specialist for inclusion into the Issues Log. For each issue, the Issues Log includes, but is not limited to, a unique reference number, description of the issue with contract requirement referenced, location of or equipment name/tags exhibiting the issue, the initials of the individual's name whom reported the issue, the date of first observation, the proposed resolution of the issue and date proposed, the date of any subsequent observations with applicable additional information, and the date of implementation of the final resolution of the issue as confirmed by the Commissioning Specialist and Contracting Officer. Issues must not be deleted from the issues log.

**NOTE: This paragraph contains tailoring options for
KTR HIRED COMMISSIONING PROVIDER, ARMY, NAVY,
DESIGN-BUILD, and DESIGN-BID-BUILD.**

CxC must submit the Issues Log monthly and within three working days from changes to the Issue Log. The CxC is responsible for distributing the Issues Log to the Commissioning Team. CQC System Manager must track construction deficiencies identified in the Issues Log using a quality management system in accordance with Section [01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM)] [01 45 00 QUALITY CONTROL]. The QC manager is responsible for notifying the CxC and Contracting Officer of outstanding deficiencies and tracking them to resolution in accordance with Section 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL 01 45 00 QUALITY CONTROL, "Quality Control Plan".

1.16 CERTIFICATE OF READINESS

**NOTE: This paragraph contains tailoring options for
ARMY and NAVY.**

**Choose the bracketed phrases required in the project
scope.**

Prior to scheduling Commissioning Tests for each system, the Quality Control Manager must issue a Certificate of Readiness for each system, certifying that inspections have been completed, open issues have been resolved, and the system is ready for Commissioning Tests. Refer to each related technical commissioning specification section for additional requirements.

Submit the Certificate of Readiness for each system [30] [_____] calendar days [20] [_____] working days prior to Commissioning Tests of that

system. Do not schedule Commissioning Tests for a system until the Certificate of Readiness is approved by the Government.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 DESIGN COMMISSIONING COORDINATION MEETING

NOTE: This paragraph is tailored for DESIGN-BUILD, and contains tailoring options for KTR HIRED COMMISSIONING PROVIDER and GOVT HIRED COMMISSIONING PROVIDER.

The design phase commissioning coordination meeting should occur prior to 50 percent design completion.

Conduct a design commissioning coordination meeting led by the CxC prior to the [35] [50] percent design submittal for systems to be commissioned. Discuss Participate in a design commissioning coordination meeting led by the CxC prior to the [35] [50] percent design submittal for system to be commissioned. The purpose of the meeting is to discuss the commissioning process, including project contract requirements, lines of communication, roles and responsibilities, schedules, and documentation requirements.

NOTE: This paragraph contains tailoring options for ARMY and NAVY. Choose bracketed option for command and maintenance activity representatives as applicable.

The Construction Manager, Contractor's Project Manager, Quality Control team, Designer of Record, and the Government Acceptance Testing Representatives and other Government team members must attend this meeting. Invite the User and[a Directorate of Public Works Representative][a Reserve Support Command Representative] [____][a Public Works Division Representative] [Base Civil Engineering Representative] [____] to attend this meeting. The meeting may be conducted by teleconferencing.

3.2 DESIGN PHASE COMMISSIONING PLAN

NOTE: This paragraph is tailored for DESIGN-BUILD and contains tailoring options for KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, and NAVY.

Submit the Design Phase Commissioning Plan no later than 14 calendar days after the Design Commissioning Coordination Meeting. Outline the commissioning process, commissioning team members and responsibilities, lines of communication, and documentation requirements for the design phase of the project in the Design Phase Commissioning Plan. Identify the

Commissioning Standards chosen for the project.

Provide a list of team members for systems to be commissioned with contact information, a list of tests as required by Section 01 33 00 SUBMITTAL PROCEDURES 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES, and project schedule as required by Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULE for inclusion in the Design Phase Commissioning Plan no later than 14 calendar days after the Design Commissioning Coordination Meeting.

[3.3 DESIGN REVIEW

NOTE: For Navy, the DESIGN REVIEW paragraph is a bracketed selection; select the DESIGN REVIEW paragraph if a design review is required after contract award. For Army, the DESIGN REVIEW paragraph is not bracketed. Commissioning design review report is required for Army managed projects and may be required by applicable Sustainability Third Party Certification guidelines. This paragraph contains tailoring options for ARMY, NAVY, KTR HIRED COMMISSIONING PROVIDER and GOVT HIRED COMMISSIONING PROVIDER. Choose bracketed language regarding the Owner's Project Requirements Document for projects that require one (refer to specifier note regarding OPR in paragraph DEFINITIONS for further information).

NOTE: When a KTR hired commissioning provider is used for a DESIGN-BID-BUILD project, the first opportunity for the CxC to review the project is early in construction. Leveraging the CxC's experience in review of the design to identify any remaining problems allows early correction, where correction is necessary. This can allow major problems to be addressed with minimal time and cost growth during construction. The Government, in coordination with designers, must review the Design Review Report to determine if any design changes are necessary. Changes to the construction contract are still at the sole discretion of the Contracting Officer.

The CxC and other Commissioning Specialists must review design documents. The design review must occur prior to [60] [_____] percent design completion. The design review must include verifying that the design for the systems to be commissioned are prepared in accordance with the contract documents.

Provide a Design Review Report identifying discrepancies or deficiencies that would prevent the systems to be commissioned from operating or performing effectively in accordance with the design requirements or being adequately safely maintained. Report must include individual list of each deficiency and corresponding corrective action necessary for proper system performance.[Identify any discrepancies between the design and the Owner's Project Requirements Document. The Owner's Project Requirements Document is provided for commissioning review purposes only and does not

form a part of the contract documents for this project.] **Submit the Design Review Report no later than [14] [____] calendar days after approval of the Commissioning Firm and Commissioning Specialists after completing the review of the design.** The Contracting Officer, Construction Manager, the Contractor's Project Manager, the CxC, and the Designers of Record for the associated systems must meet, discuss, and resolve any outstanding items contained in the report no later than 14 calendar days after submission of the report. The CxC must verify that their review comments have been adequately addressed in subsequent design submittals.

The CxC is responsible for reviewing the design and preparing a Design Review Report identifying discrepancies or deficiencies that would prevent the systems to be commissioned from operating or performing in accordance with the design requirements or being safely maintained.

The Contracting Officer, the CxC, and the Designers of Record for the associated systems must meet, discuss, and resolve any outstanding items contained in the report no later than 14 calendar days after submission of the report. The CxC will verify that their review comments have been adequately addressed in subsequent design submittals.

3.4 CONSTRUCTION SUBMITTAL REVIEWS

NOTE: This paragraph contains tailoring options for KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, and DESIGN-BUILD.

This paragraph contains tailoring for ARMY. Choose bracketed "and the Owner's Project Requirements" for projects that require one. Refer to specifier note regarding OPR in paragraph DEFINITIONS for further information.

Coordinate construction submittal document reviews for commissioned systems and assemblies with the CxC. The commissioning submittal review does not replace the designer of record (DOR) or Government submittal review, in accordance with Section 01 33 00 SUBMITTAL PROCEDURES 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES.

The CxC must identify construction submittals to be provided by the contractor for the commissioned systems. The CxC must evaluate construction submittals for compliance with the contract documents[and Owner's Project Requirements Document] prior to submission to the Government concurrent with DOR review. Include a copy of CxC comments with the construction submittals. The CxC is responsible for identifying construction submittals to be provided by the contractor for the commissioned systems. The CxC is responsible for evaluating construction submittals for compliance with the contract documents. The DOR must consider the CxC's comments, and the DOR provides direction to the contractor as necessary. Provide a copy of final DOR submittal reviews with comment responses to the CxC. Include a copy of the submittal document review transmittal and response in the Commissioning Report.

3.5 COMMISSIONING KICKOFF MEETING

NOTE: This paragraph contains tailoring options for KTR HIRED COMMISSIONING PROVIDER and GOVT HIRED COMMISSIONING PROVIDER.

Conduct a Commissioning Kickoff Meeting, led by the CxC, after approval of the Commissioning Firm and Commissioning Specialists, and no later than [60] [_____] days following construction notice to proceed. Discuss The CxC is responsible for conducting a Commissioning Kickoff Meeting no later than 60 days following construction notice to proceed to discuss the commissioning process including contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics as specified in this section.

NOTE: This paragraph contains tailoring options for ARMY and NAVY. Choose bracketed option for command and maintenance activity representatives as applicable.

The Construction Manager, Contractor's Project Manager, Quality Control team, Designer of Record, and the Government Acceptance Testing Representatives and other Government team members must attend this meeting. Invite the User and[a Directorate of Public Works Representative][a Reserve Readiness Division Representative] [_____] [a Public Works Division Representative] [Base Civil Engineering Representative] [_____] to attend this meeting.

3.6 REGULAR COMMISSIONING COORDINATION MEETINGS

NOTE: This paragraph contains tailoring options for ARMY, NAVY, KTR HIRED COMMISSIONING PROVIDER, and GOVT HIRED COMMISSIONING PROVIDER. Choose bracketed option for command and maintenance activity representatives as applicable.

The Quality Control team, Designer of Record, and the Government Acceptance Testing Representatives and other Government team members must attend this meeting. Sub-Contractor Representatives for each trade responsible for construction/installation of systems to be commissioned must attend this meeting as requested by the CxC. Invite the User and[a Directorate of Public Works Representative][a Reserve Readiness Division Representative][a Public Works Division Representative] [_____] [a Base Civil Engineering Representative] [_____] to attend this meeting.

CxC must conduct monthly commissioning coordination meetings when installation of commissioned systems begins. Provide status of commissioned systems, open issues log items, outstanding submittals, and upcoming commissioning activities. Conduct bi-weekly commissioning coordination meetings within 30 days of the scheduled date for commissioning testing.

Participate in monthly commissioning coordination meetings led by the CxC when installation of commissioned systems begins. Provide status of commissioned systems, open issues log items, outstanding submittals, and

upcoming commissioning activities. Participate in bi-weekly commissioning coordination meetings within 30 days of the scheduled date for commissioning testing.

3.7 CONSTRUCTION PHASE COMMISSIONING PLANS

NOTE: Portions of the following paragraphs contain tailoring options for KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, INTEGRATED SYSTEMS TEST, ARMY, and NAVY.

Include bracketed "and Template Building Enclosure Inspection Checklists" for new buildings or renovation projects with significant envelope scope.

Choose Sustainability eNotebook bracketed option as applicable. Refer to Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING.

The Interim Construction Phase Commissioning Plan identifies the commissioning and testing standards and outline the overall commissioning process, the commissioning schedule, the commissioning team members and responsibilities, lines of communication, documentation requirements for the construction phase of the project[, and Template Building Enclosure Inspection Checklists]. Submit the Interim Construction Phase Commissioning Plan, prepared by the CxC, 14 calendar days after the Construction Commissioning Coordination Meeting and 14 days prior to the start of construction of the building enclosure. Provide a list of team members for systems to be commissioned with contact information, a list of tests as required by Section 01 33 00 SUBMITTAL PROCEDURES 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES, and project schedule as required by Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULE for inclusion in the Interim Construction Phase Commissioning Plan no later than 14 calendar days after the Commissioning Coordination Meeting.

The Final Construction Phase Commissioning Plan includes the information provided in the Interim Construction Phase Commissioning Plan as well as commissioning construction observation checklists and test procedures such as Pre-Functional Checklists, Integrated Systems Test Checklists, and Functional Performance Test Checklists and other Commissioning Test Checklists for each building, for each system required to be commissioned, and for each component for inclusion in the Final Construction Phase Commissioning Plan. Refer to the related technical commissioning specification section for additional requirements for checklists. Submit the Final Construction Phase Commissioning Plan, prepared by the CxC, no later than [90] [_____] calendar days prior to the start of Commissioning Inspections.[Once approved, file the approved plan in the Sustainability eNotebook.] Provide updates to the list of team members for systems to be commissioned with contact information, a list of tests as required by Section 01 33 00 SUBMITTAL PROCEDURES, and project schedule as required by Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULE for inclusion in the Final Construction Phase Commissioning Plan within 14 calendar days of a written request from the CxC.

3.7.1 Construction Observation Checklists

**NOTE: This paragraph contains tailoring options for
KTR HIRED COMMISSIONING PROVIDER and GOVT HIRED
COMMISSIONING PROVIDER.**

Construction Observation Checklists must include items for physical inspection or testing that demonstrate that installation and start-up of equipment and systems is complete. Refer to paragraph COMMISSIONING INSPECTIONS. Construction observation checklists must be tailored to verify the specific installation requirements and details of the construction documents and manufacturer's instructions. Use the Construction Observation Checklists prepared by the CxC for physical inspection or testing to demonstrate that installation and start-up of equipment and systems is complete. Refer to paragraph COMMISSIONING INSPECTIONS.

3.7.2 Test Procedures and Checklists

**NOTE: This paragraph contains tailoring options for
KTR HIRED COMMISSIONING PROVIDER and GOVT HIRED
COMMISSIONING PROVIDER.**

Test procedures and checklists must include procedures that explain, step-by-step, the actions and expected results that will demonstrate that the systems perform in accordance with the contract. Refer to paragraph COMMISSIONING TESTS. Include the following sections and details appropriate to the systems being tested in the test procedures and checklists:

- a. Notable system features including information about controls to facilitate understanding of system operation
- b. Conclusions and recommendations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements. Recommendation must clearly indicate that the system should or should not be approved by the Government.
- c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions
- d. Attendees
- e. Identification of the equipment involved in the test
- f. Control system feature identification
- g. As-found condition of the system operation
- h. List of test items with step numbers along with the corresponding feature or operation, intended test procedure, expected system response, and pass/fail indication.
- i. Space for comments for each test item.

Use the test procedures and checklists prepared by the CxC that list, step-by-step, the actions and expected results that will demonstrate that the systems perform in accordance with the contract. Refer to paragraph

COMMISSIONING TESTS.

3.8 COMMISSIONING INSPECTIONS

NOTE: Choose bracketed "and the Owner's Project Requirements (OPR)" for projects that will include an Owner's Project Requirements (OPR) document. Refer to specifier note regarding OPR in paragraph DEFINITIONS for further information.

Complete inspections using Construction Observation Checklists for each individual item of equipment or system for each system required to be commissioned in accordance with the commissioning plan. Indicate commissioning team member inspection and validation of each checklist item by initials. Validation of each checklist item by each team member indicates that item conforms to the contract documents and design in their area of responsibility. Commissioning Specialist validation of each checklist item indicates that each item has been installed correctly and in accordance with contract documents[and the Owner's Project Requirements (OPR)]. Submit the initialed and Completed Construction Observation Checklists no later than 7 calendar days after completion of inspection of all checklists items for each system.

3.9 COMMISSIONING TESTS

NOTE: This paragraph contains tailoring for ARMY and NAVY. Choose bracketed "and the Owner's Project Requirements Document" for projects that will include an Owner's Project Requirements (OPR) document. Refer to specifier note regarding OPR in paragraph DEFINITIONS for further information.

Demonstrate that all systems, equipment, and components have been installed correctly and that the systems operate and perform, including interactive operation between systems, in accordance with contract documents[and the Owner's Project Requirements Document]. Perform tests as specified in related technical commissioning specifications. Provide all materials, services, and labor required to perform all commissioning tests.

Commissioning Specialist's duties include leading and documenting all tests for the systems to be commissioned with appropriate sub-contractors performing the Tests. The representatives listed in the paragraph COMMISSIONING TEAM must attend the tests with the exception of the Construction Manager Contractor's Project Manager.

3.9.1 Test Scheduling and Coordination

NOTE: The following paragraph contains tailoring for INTEGRATED SYSTEMS TEST.

Schedule Commissioning Tests for each system only after the Certificate of Readiness has been approved by the Government for the system. Correct all

deficiencies identified through any prior review, inspection, or test activity before the start of Commissioning tests.

Commissioning Tests and Integrated Systems Tests must be performed with the CxC present. Government reserves the right to witness all tests. Coordinate test schedule with Government representatives.

3.9.2 Testing Procedures

NOTE: Select bracketed language for electrical system testing. Mechanical and building enclosure testing requirements are included in related sections. Until an electrical commissioning specification section is available, detailed requirements for electrical system testing are not available. Testing will be as required in referenced standards, including ASHRAE Standard 90.1.

Commissioning tests include tests such as functional performance and integrated systems tests.[For electrical systems testing, include testing of sensor calibrations, control responses, safeties, interlocks, operating modes, capacity, lighting levels, and verification of all other electrical system contract performance requirements.] Perform test procedures in accordance with the commissioning standards specified. In addition, comply with the testing procedures specified in the sections listed in paragraph RELATED SECTIONS.

3.9.3 Sample Strategy

NOTE: This paragraph contains tailoring for DESIGN-BUILD AND DESIGN-BID-BUILD. For design-bid-build projects, sample strategy will be addressed by the related technical commissioning specification sections (such as Section 23 08 00 COMMISSIONING OF MECHANICAL[AND PLUMBING] SYSTEMS). Because of the need for Section 01 91 00.15 to stand-alone for some design-build solicitations, sample strategy will be specified in this paragraph for design-build projects.

NOTE: For design-build projects, select the percentage sample size for large groups of identical equipment as determined by the project delivery team. Higher percentages may be appropriate for critical systems or projects or for small numbers of equipment.

NOTE: Electrical systems sampling must be addressed in this specification. Add equipment/system types and sample size for each electrical item as appropriate.

Refer to the sections identified in paragraph RELATED SECTIONS for sample strategy. Perform commissioning tests for all systems and equipment to be commissioned using the sample strategy identified herein. Complete a Test

Checklist for each item of equipment or system to be tested. For sample sizes less than 100 percent for similar equipment, the Contracting Officer's Representative reserves the right to select the specific equipment or system to be tested.

[For electrical systems, test 100 percent of all equipment and systems except for the following. Test at the sample rate shown:

a. Lighting Controls [____]

b. [____]

c. [____]

] Test all central plant equipment, primary air handling units, and process cooling or heating equipment. Test all system-level equipment serving multiple zones. [Twenty-five][Fifty][____] percent sample testing is allowed for large groups of identical equipment with identical controllers serving single zones such as air terminal units, fan coil units, unitary equipment, and plumbing fixtures. Sample size may be no less than three units.

For electrical systems, test 100 percent of all equipment and systems except for the following[. Test at the sample rate shown]:

a. [____]

b. [____]

c. [____]

3.9.3.1 100 Percent Sample Procedures

Systems or equipment for which 100 percent sample size are tested fail if one or more of the test procedures results in discovery of a deficiency and the deficiency cannot be resolved within 5 minutes during the test.

Re-test to the extent necessary to confirm that the deficiencies have been corrected without negatively impacting the performance of the rest of the system.

3.9.3.2 Less than 100 Percent Sample Procedures

Randomly test each sample group of identical equipment. Sample size must be at least three units. If 10 percent of the units in the first sample fail the commissioning tests, test a second sample group, the same size as the first sample group. The second sample must not include any units from the first sample group.

If 10 percent of the units in the second sample fail, test all remaining units. If at any point frequent failures occur, the CxC may stop the testing and require the contractor to perform and document a checkout of the remaining equipment prior to continuing commissioning testing.

3.9.4 Aborted Tests and Re-Testing

Abort any test if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. Re-test after all deficiencies identified during the original test

have been corrected. Contracting Officer may withhold payment equivalent to lost time, re-testing, and aborted tests. These costs may include salary, travel costs, and per diem for Government team members.

3.10 TRAINING PLAN

NOTE: Coordinate requirements with Sections 01 91 19 BUILDING ENCLOSURE COMMISSIONING, 01 78 23 OPERATION AND MAINTENANCE DATA, and 01 45 00 QUALITY CONTROL 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL 01 45 00 QUALITY CONTROL, all of which address training plans.

This paragraph contains tailoring options for NAVY.

CxC must review the training plan for training associated with the equipment and systems to be commissioned, checking that each plan has the trainer name, trainer contract information, training schedule and location. Submit review at least 30 days prior to the first training event. Incorporate CxC review comments prior to submitting training plan in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW). Update and resubmit the training plan based on any corrective action taken.

[3.11 SYSTEMS MANUAL

NOTE: This paragraph is tailored for ARMY, NAVY, DESIGN-BUILD, KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, and INTEGRATED SYSTEMS TEST.

NOTE: A Systems Manual is required for Army managed projects in accordance with Engineering Regulations. A Systems Manual is required for projects applying LEED or Green Globes sustainability third party certification. Refer to Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Coordinate requirements with Section 01 78 23 OPERATION AND MAINTENANCE DATA and 01 45 00 QUALITY CONTROL 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL 01 45 00 QUALITY CONTROL, both of which address manuals.

The Systems Manual includes the Basis of Design, system single line diagrams, as-built sequences of operation and controls drawings, as-built control setpoints, recommended schedule for sensor and actuator calibration, recommended schedule of maintenance when not in the O&M manuals, recommended re-testing schedule with proposed testing forms, and full equipment warranty information for all commissioned systems. Incorporate CxC review comments prior to submitting Systems Manual in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW). Submit Systems Manual no later than 30 calendar days following completion of Functional Performance Tests and Integrated Systems Tests. Update and resubmit the system manual information based on any corrective action taken during the warranty

period.

**NOTE: This paragraph is tailored for ARMY and KTR
HIRED COMMISSIONING PROVIDER.**

Prepare and submit a Systems Manual, including a signed certification or letter from the Commissioning Specialists and the CxC stating that the Systems Manual is complete, clear, and accurate. The Systems Manual, for all commissioned systems, must conform to Appendix A SYSTEMS MANUAL ORGANIZATION AND CONTENT per ER 25-345-1, available at the USACE Publications website at the following location: <https://www.publications.usace.army.mil/USACE-Publications/Engineer-Regulations/>. Submit Systems Manual no later than 30 calendar days following completion of Functional Performance Tests and Integrated Systems Tests. Update and resubmit the Systems Manual based on any corrective action taken during the warranty period.

Ensure Systems Manual is coordinated with the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA and Quality Control requirements.

3.12 MAINTENANCE AND SERVICE LIFE PLAN

NOTE: This paragraph is tailored for ARMY. This paragraph contains tailoring for INTEGRATED SYSTEMS TEST. The Maintenance and Service Life Plans are required for Army and Army Reserve projects. Coordinate requirements with Sections 01 78 23 OPERATION AND MAINTENANCE DATA and 01 45 00 QUALITY CONTROL, both of which address maintenance requirements.

3.12.1 Maintenance Plan

Prepare and submit a Maintenance Plan for the project mechanical, electrical, plumbing, and fire protection systems. Prepare the HVAC and refrigeration sections of the Maintenance Plan in accordance with ASHRAE 180. Develop required inspection and maintenance tasks similar to Section 5 of ASHRAE 180 for the other commissioned systems and fire protection systems. Ensure Maintenance Plan is coordinated with the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Submit the Maintenance Plan no later than 30 calendar days following the completion of Functional Performance Tests and Integrated Systems Tests.

3.12.2 Service Life Plan

Prepare and submit a Service Life Plan for the building enclosure, structural systems, and site hardscape that includes the following for each assembly or component:

- a. A description of each including the materials or products.
- b. The estimated service life, in years.
- c. The estimated maintenance frequency and description of maintenance

tasks.

- d. The point of maintenance access for the components with estimated service life less than service life of the building.

Ensure Service Life Plan is coordinated with the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit the Service Life Plan no later than 30 calendar days following the completion of Functional Performance Tests and Integrated Systems Tests.

3.13 COMMISSIONING REPORT

NOTE: This paragraph contains tailoring options for ARMY, NAVY, KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, and INTEGRATED SYSTEMS TESTS.

Choose Sustainability eNotebook bracketed option as applicable. Refer to Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Choose bracketed "and the Owner's Project Requirements Document" for projects that require one. Refer to specifier note regarding OPR in paragraph DEFINITIONS for further information.

Include two bracketed "Building Enclosure Inspection Checklists" for new buildings or renovation projects with significant envelope scope.

NOTE: Include the bracketed option Air Leakage Test Reports and Diagnostic Test Reports for Army projects that include this report in Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING.

Submit an Initial Commissioning Report Final Commissioning Report no later than 14 calendar days following commissioning team validation of all Commissioning Tests, including Functional Performance Tests, and Integrated Systems Tests, with the exception of Seasonal Tests. Submit a Final Commissioning Report upon completion of training and trend log reviews. [File the approved Final Commissioning Report (eNotebook) in the Sustainability eNotebook.]Include the following information in the Final Commissioning Report:

- a. An executive summary describing the overall commissioning process, the results of the commissioning process, outstanding deficiencies and recommended resolutions, and seasonal testing that must be scheduled for a later date. Indicate, in the executive summary, whether the systems meet the requirements of the contract documents[and the Owner's Project Requirements Document].
- b. A list of deficiencies discovered during the commissioning process and the corrective actions taken in the report.
- c. Completed [Building Enclosure Inspection Checklists,]Pre-Functional Checklists and other Commissioning Observation Checklists, Commissioning Test Checklists such as Functional Performance Test Checklists and Integrated Systems Test Checklists,[, the Air Leakage

Test Reports and Diagnostic Test Reports,] the Final Construction Phase Commissioning Plan, the Issues Log, Training Attendance Rosters, the Design Review Reports, Submittal Review Report, and any other documents as specified by related technical commissioning specification sections.

The Commissioning Specialist is responsible for preparing a Commissioning Report following commissioning team validation of all Commissioning Tests, including Functional Performance Tests, and Integrated Systems Tests, with the exception of Seasonal Tests. [File the Commissioning Report in the Sustainability eNotebook.]Provide information including, but not limited to, outstanding deficiencies and recommended resolutions, seasonal testing that must be scheduled for a later date, Completed [Building Enclosure Inspection Checklists,] Pre-Functional Checklists and other Commissioning Observation Checklists, Training Attendance Rosters, PVT Report, and the approved TAB Report within 14 days of request.

[3.14 WARRANTY PHASE SITE VISIT

NOTE: Warranty phase site visit is recommended to document any deficiencies and verify systems function according to project requirements post-occupancy. Warranty phase site visit may be required by applicable Sustainability Third Party Certification guidelines.

Choose Sustainability eNotebook bracketed option as applicable. Refer to Section **01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING**. Choose bracketed "and the OPR" for projects that will include an Owner's Project Requirements (OPR) document. Refer to specifier note regarding OPR in paragraph DEFINITIONS for further information.

This paragraph contains tailoring options for ARMY, KTR HIRED COMMISSIONING PROVIDER and GOVT HIRED COMMISSIONING PROVIDER.

Choose bracketed "and the Owner's Project Requirements" for projects that require one. Refer to specifier note regarding OPR in paragraph DEFINITIONS for further information. Choose bracketed Post-Construction Endurance Test and Trend Log Report if included in the project from Section **23 08 00 COMMISSIONING OF MECHANICAL[AND PLUMBING] SYSTEMS**.

The Lead Commissioning Specialist must visit the building site concurrent with the 9 month warranty inspection to inspect building system equipment and review building operation with the building operating/maintenance staff, and identify any deficiency of the building systems to operate in accordance with the contract documents[and the Owner's Project Requirements Document]. The Commissioning Specialist must notify the Contracting Officer of any identified deficiencies and the proposed corrective action. Submit **Updated Final Commissioning Report** and Systems Manuals, documenting the results of the warranty phase inspection. Include other warranty or post-construction phase activities as specified

in related technical commissioning specification sections, such as Seasonal testing results[and Post-Construction Endurance Test and Trend Log Report].[File the approved [Updated Final Commissioning Report \(eNotebook\)](#) in the Sustainability eNotebook.]

Notify the Lead Commissioning Specialist at least 28 calendar days prior to visiting building site for the 9 month warranty inspection. Provide updates to any documentation included in the Commissioning Report based on the results of the warranty phase inspection. Provide all warranty phase documentation, such as Seasonal testing results to the Commissioning Specialist.[File the [Updated Final Commissioning Report \(eNotebook\)](#) in the Sustainability eNotebook.]

]

[APPENDIX A - OWNER'S PROJECT REQUIREMENTS DOCUMENT

NOTE: If an Owner's Project Requirements document (OPR) is to be included with the specification, attach it as Appendix A. Include a statement on the OPR cover stating that the document is provided for commissioning review purposes only and is not a contract requirement. Refer to paragraph DEFINITIONS for information regarding the OPR.

] -- End of Section --