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USACE / NAVFAC / AFCEC / NASA

UFGS-01 91 00.15 20 (February 2021)

Change 1 - 05/21

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Preparing Activity: NAVFAC

Superseding

UFGS-01 91 00.15 (February 2019)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2022

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## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2022

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SECTION 01 91 00.15 20

TOTAL BUILDING COMMISSIONING  
02/21, CHG 1: 05/21

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

Use this specification for Navy projects only. Choose only NAVY tailoring. ARMY tailoring is for future consolidation and not valid at this time. Coordinate all Sections that reference commissioning with this section, including Sections 01 45 00.00 10 QUALITY CONTROL, 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL, 01 45 00.00 20 QUALITY CONTROL, 23 08 00.00 20 COMMISSIONING OF MECHANICAL AND PLUMBING SYSTEMS, 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS, 22 33 30.00 10 SOLAR WATER HEATING EQUIPMENT, 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).

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NOTE: This section contains tailoring options for KTR HIRED COMMISSIONING PROVIDER, GOVT HIRED COMMISSIONING PROVIDER, ARMY, NAVY, DESIGN-BUILD, DESIGN-BID-BUILD, BUILDING ENVELOPE COMMISSIONING, 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 projects where the Commissioning Provider is retained under a separate contract with the Government.

Select ARMY tailoring for projects that will report the real property asset for Air Force or Army.

Select NAVY tailoring for projects that will report the real property asset for Navy or Marine Corps.

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

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

Select BUILDING ENVELOPE COMMISSIONING tailoring for projects that require building envelope commissioning, where more oversight is needed beyond the requirements of Sections 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM and 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS. (Examples include facilities with pressurization or humidity control requirements such as armories, electronic equipment facilities, hospitals, and laboratories.)

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 International Green Construction Code (IgCC), as required by UFC 1-200-02, "High Performance and Sustainable Building Requirements" paragraph "Commissioning."

\*\*\*\*\*

Total Building Commissioning (TBCx) 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 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 Commissioning Standard (2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

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

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

## 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 GOVT-HIRED COMMISSIONING PROVIDER.**  
\*\*\*\*\*

Commissioning Provider (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 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](#). Testing required to be witnessed by [Government Acceptance Testing Representatives](#) are identified in system level sections.

## 1.3 COMMUNICATION WITH THE [GOVERNMENT LEAD COMMISSIONING SPECIALIST](#)

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

The Lead Commissioning Specialist (Cx) 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 Govt-hired 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 International Green Construction Code (IgCC), 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. 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.

\*\*\*\*\*

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
- ][ Air-curtain systems
- ][ Lighting systems: automatic and manual daylighting controls, occupancy sensing devices, automatic shut-off controls, time switching, and other lighting control devices, and dimming systems
- ][ Domestic hot-water systems and controls

- ][ Water pumping and mixing systems over 4 kW 5 hp and purification systems
- ][ Irrigation system performance that uses more than 4000 L 1000 gal per day
- ][ Renewable energy systems and energy storage systems
- ][ Energy and building management and demand-control systems
- ] [\_\_\_\_\_]

\*\*\*\*\*  
 NOTE: The following item is tailored for BUILDING  
 ENVELOPE COMMISSIONING.  
 \*\*\*\*\*

Building Envelope: air tightness for the entire building envelope  
 (systems, components, and assemblies).

#### 1.6 COMMISSIONING TEAM

\*\*\*\*\*  
 NOTE: The following paragraph contains 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. Lead Commissioning Specialist (Cx/C)
- b. Quality Control Manager (QCM)
- c. Sub-Contractor Representatives for each trade responsible for  
 construction/installation of systems to be commissioned
- d. Construction Manager (CM)
- e. Designer of Record (DOR)
- f. Technical Commissioning Specialists for each system to be commissioned
- g. TAB Representative
- h. Equipment manufacturer representatives
- i. Government Contracting Officer



- j. Government Representatives
- k. Government Acceptance Testing Representatives
- l. Installation Maintenance Representative
- m. Facility End User
- n. [\_\_\_\_\_]

#### 1.7 PROJECT SCHEDULE

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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 Coordination Meeting
- f. Regular Commissioning Coordination Meetings
- g. Installation of permanent utilities (gas, water, electric)

\*\*\*\*\*  
NOTE: The following two list items are tailored for  
BUILDING ENVELOPE COMMISSIONING.  
\*\*\*\*\*

- h. Building Envelope Construction
- i. Submission and approval of the Completed Building Envelope Inspection Checklists
- j. Manufacturer's Equipment Start-Up for each of the systems to be commissioned
- k. Submission and approval of the Completed Pre-Functional Checklists
- l. Submission and approval of Certificate of Readiness for each system to be commissioned
- m. 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 item is tailored for ARMY.  
\*\*\*\*\*

- q. Maintenance and Service Life Plans
- r. Training for each of the systems to be commissioned

\*\*\*\*\*  
NOTE: The following item is tailored for KTR HIRED  
COMMISSIONING PROVIDER.  
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- s. Submission and approval of the Initial and Final Commissioning Reports
- t. Seasonal Testing

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NOTE: The following item is tailored for NAVY.  
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- u. Final testing required to be witnessed by Government Acceptance Testing Representatives, as identified in system level sections.

\*\*\*\*\*  
NOTE: The following items (v. and w.) are 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.

\*\*\*\*\*

[ v. Warranty Phase Site Visit

] w. Updated Commissioning report

[ x. [\_\_\_\_\_]

][1.8 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.] [\_\_\_\_\_]

]1.9 SUBMITTALS

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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 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 DB projects, delete 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.

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

#### 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

\*\*\*\*\*

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[, [\_\_\_\_]]  
Completed Pre-Functional Checklists; G[, [\_\_\_\_]]

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NOTE: The following submittal is tailored for BUILDING ENVELOPE COMMISSIONING.

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Completed Building Envelope Inspection Checklists; G[, [\_\_\_\_]]

#### SD-07 Certificates

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NOTE: The following submittal is tailored for KTR  
HIRED COMMISSIONING PROVIDER.  
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Commissioning Firm; G[, [\_\_\_\_]]

Certificate Of Readiness; G[, [\_\_\_\_]]

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

Maintenance and Service Life Plans; 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

#### ] 1.10 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 commissioning 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 contractor and all other subcontractors and

the Designer of Record.

\*\*\*\*\*

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 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. Validate all work performed for this project by the CxC who lost a certification by an approved successor.

#### 1.10.1 Commissioning Specialists (CxC)

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

##### 1.10.1.1 Lead Commissioning Specialist (CxC)

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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 qualified Systems Commissioning Administrator (SCA)

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).

#### 1.10.1.2 Commissioning Specialists

\*\*\*\*\*

**NOTE: This paragraph contains tailoring for  
BUILDING ENVELOPE COMMISSIONING. 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.**

\*\*\*\*\*

Commissioning Specialists with the following qualifications must perform the technical work associated with each system to be commissioned:

- 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.
- 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.

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**NOTE: The following item is tailored for BUILDING  
ENVELOPE COMMISSIONING.**

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- c. Building Envelope Commissioning Specialist: The technical work associated with the Building Envelope system must be performed by a [registered architect with five years of building envelope design or construction experience][ or a professional with training and certification as an Air Barrier Installer from the Air Barrier Association of America (ABAA) or other third party air barrier association.].

#### 1.10.2 Commissioning Standard

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 Commissioning Standard**, **ANSI/SMACNA 014**, or **ASHRAE 202**. Comply with applicable NETA testing standards for electrical systems.

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

#### 1.11 GOVERNMENT HIRED COMMISSIONING PROVIDER

\*\*\*\*\*  
NOTE: This paragraph is tailored for 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.

#### 1.12 SUSTAINABILITY THIRD PARTY CERTIFICATION (TPC)

\*\*\*\*\*  
NOTE: Select this paragraph for projects applying  
sustainability Third Party Certification (TPC)  
requirements. 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 is  
qualified to act as the LEED Commissioning  
Authority, based on LEED requirements.  
\*\*\*\*\*



[ 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]].

#### 1.13 ISSUES LOG

The Commissioning Specialist develops and maintain 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 QCS in accordance with Section [01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM)][01 45 00.00 10 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 00.00 20 QUALITY CONTROL, "Quality Control Plan".

#### 1.14 CERTIFICATE OF READINESS

\*\*\*\*\*  
**NOTE: This paragraph contains tailoring options for  
ARMY and BUILDING ENVELOPE COMMISSIONING.**

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

\*\*\*\*\*

Prior to scheduling Functional Performance Tests, the Quality Control Manager must issue a Certificate of Readiness for each system, certifying that pre-functional checks have been completed, open issues have been resolved, and the system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, equipment and system start-up reports; Performance Verification Test

Reports; completed Building Envelope Inspection Checklists; the Air Leakage Test Reports and Diagnostic Test Reports; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; Issues Log; and HVAC Controls Start-Up Reports to the extent applicable to the system. Sign and date the Certificate of Readiness, and include signatures and dates from the CxC; the Quality Control Representative; the Mechanical, Electrical, Controls, Building Envelope, and TAB subcontractor representatives.

Submit the Certificate of Readiness for each system 14 calendar days prior to Functional Performance Tests of that system. Do not schedule Functional Performance 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 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][\_\_\_\_] to attend this meeting. 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, ARMY, 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 Standard 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, and project schedule as required by Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULE 01 32 01.00 10 PROJECT 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: Select the Design Review paragraph if a  
design review is required after contract award.  
Commissioning design review report may be required  
by applicable Sustainability Third Party  
Certification guidelines. This paragraph contains  
tailoring options for KTR HIRED COMMISSIONING  
PROVIDER and GOVT HIRED COMMISSIONING PROVIDER.**

\*\*\*\*\*

The CxC and other Commissioning Specialists must review design documents. The design review must include verifying the Design Plans and Specifications 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 in accordance with the design requirements or being safely maintained. Report must include individual list of each deficiency and corresponding corrective action necessary for proper system performance. 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 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.

### 13.4 CONSTRUCTION SUBMITTAL REVIEWS

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

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.

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. 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 provide 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 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][\_\_\_\_] 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. Invite the User and[ a Directorate of Public Works Representative][ a Reserve Support Command Representative][\_\_\_\_][ a Public Works Division 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 functional performance 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 functional performance 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, BUILDING ENVELOPE COMMISSIONING, INTEGRATED SYSTEMS TEST, ARMY, and NAVY.**

**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 Envelope Inspection Checklists. Submit the Interim Construction Phase Commissioning Plan 14 calendar days after the Construction Commissioning Coordination Meeting and 14 days prior to the start of construction of the building envelope. 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, and project schedule as required by Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULE 01 32 01.00 10 PROJECT 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

the Pre-Functional Checklists, Integrated Systems Test Checklists, and Functional Performance 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. Submit the Final Construction Phase Commissioning Plan no later than 90 calendar days prior to the start of Pre-Functional Checks.[ 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 Section 01 32 01.00 10 PROJECT SCHEDULE for inclusion in the Final Construction Phase Commissioning Plan within 14 calendar days of a written request from the CxC.

### 3.7.1 Template Building Envelope Inspection Checklists

\*\*\*\*\*  
**NOTE: This paragraph is tailored for BUILDING  
ENVELOPE COMMISSIONING and contains tailoring  
options for KTR HIRED COMMISSIONING PROVIDER and  
GOVT HIRED COMMISSIONING PROVIDER.**  
\*\*\*\*\*

The Building Envelope Commissioning Specialist must develop the Template Building Envelope Inspection Checklists to verify the building materials and construction maintain the required air tightness of the building envelope system.

Use the Template Building Envelope Inspection Checklists prepared by the CxC to verify the building materials and construction maintain the required air tightness of the building envelope system.

### 3.7.2 Pre-Functional Checklists

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

The Pre-Functional 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 PRE-FUNCTIONAL CHECKS. Pre-functional checklists must be tailored to verify the specific installation requirements and details of the construction documents and manufacturer's instructions.

Use the Pre-Functional 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 PRE-FUNCTIONAL CHECKS.

### 3.7.3 Functional Performance Test Checklists

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

Functional Performance Test Checklists must include procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. Refer to paragraph FUNCTIONAL PERFORMANCE AND INTEGRATED SYSTEMS TESTS. Include the following sections and details appropriate to the systems being tested in the Functional Performance Test 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. Point-to-point observations including demonstrating system flow meters and sensors have been calibrated and are correctly displayed on the Operator work station
- h. Actuator operation observations demonstrating actuator responses to commands from the control system
- i. As-found condition of the system operation
- j. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.
- k. Space for comments for each test item.

Use the Functional Performance Test Checklists prepared by the CxC that list, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. Refer to paragraph FUNCTIONAL PERFORMANCE AND INTEGRATED SYSTEMS TESTS.

#### 3.7.4 Integrated Systems Test Checklists

\*\*\*\*\*  
This paragraph is tailored for INTEGRATED SYSTEMS  
TEST and contains tailoring options for KTR HIRED  
COMMISSIONING PROVIDER and GOVT HIRED COMMISSIONING  
PROVIDER.  
\*\*\*\*\*

Integrated Systems Test Checklists must include test procedures that explain, step-by-step, the actions and expected results that will demonstrate that the interactive operations between systems performs in accordance with the contract. Refer to paragraph FUNCTIONAL PERFORMANCE AND INTEGRATED SYSTEMS TESTS. Include the following sections in the

#### Integrated Systems Test Checklists:

- a. Notable features of the interconnected systems organized by discipline including information to facilitate understanding of system operation
- b. Conclusions and recommendations. Conclusions must clearly indicate if the systems do or do not perform in accordance with contract requirements. Recommendation must clearly indicate that the systems should or should not be approved by the Government
- c. Test conditions including date and beginning and ending time
- d. Identification of the equipment and systems involved in the test
- e. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.
- f. Space for comments for each test item.

Use the Integrated Systems Test Checklists prepared by the CxC that list, step-by-step, the actions and expected results that will demonstrate that the interactive operations between systems performs in accordance with the contract. Refer to paragraph FUNCTIONAL PERFORMANCE AND INTEGRATED SYSTEMS TESTS.

#### 3.7.5 Building Envelope Inspection and Testing

\*\*\*\*\*  
**NOTE: This paragraph is tailored for BUILDING  
ENVELOPE COMMISSIONING and contains tailoring  
options for KTR HIRED COMMISSIONING PROVIDER and  
GOVT HIRED COMMISSIONING PROVIDER.**  
\*\*\*\*\*

Document building envelope inspection by the commissioning team using the approved Template Building Envelope Inspection Checklists. Indicate commissioning team member inspection and validation of each Building Envelope Inspection Checklist item by initials at the time they are inspected and found to be in conformance with contract requirements. Inspect checklist items before they become hidden as construction progresses. Submit the initialed and [Completed Building Envelope Inspection Checklists](#) no later than 14 calendar days after completion of inspection of all checklist items.

The Building Envelope Commissioning Specialist must conduct at least two site visits to the site to observe construction of the building envelope in-progress, each time reviewing the in-progress checklists to ensure that the commissioning team is inspecting the building envelope as required.

The Building Envelope Commissioning Specialist must witness the building envelope pressure tests and diagnostic tests specified in Section [07 05 23](#) PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS; review the resulting reports; and provide recommendations for correction of any deficiencies or further testing.

Participate in periodic building envelope inspections with the commissioning specialist using the approved Template Building Envelope Inspection Checklists to observe and document construction of the building



envelope in-progress. Complete the checklists and indicate inspection and validation of each Building Envelope Inspection Checklist item by initials at the time they are inspected. Notify the Commissioning Specialist and Contracting Officer at least 21 calendar days before checklist items are concealed to ensure inspection items can be observed before construction progresses. Submit the initialed and Completed Building Envelope Inspection Checklists no later than 14 calendar days after completion of inspection of all checklist items.

Notify the Building Envelope Commissioning Specialist at least 21 calendar days prior to the building envelope pressure tests and diagnostic tests specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

### 3.8 PRE-FUNCTIONAL CHECKS

\*\*\*\*\*  
**NOTE: Choose bracketed "and the Owner's Project Requirements (OPR)" for projects that apply a third party certification program that requires one.**  
\*\*\*\*\*

Complete one Pre-Functional Checklist for each individual item of equipment or system for each system required to be commissioned including, but not limited to, ductwork, piping, equipment, fixtures (lighting and plumbing), and controls. Indicate commissioning team member inspection and validation of each Pre-Functional Checklist item by initials. Validation of each Pre-Functional Checklist item by each team member indicates that item conforms to the contract documents and validated design in their area of responsibility. Commissioning Specialist validation of each Pre-Functional 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 Pre-Functional Checklists no later than 7 calendar days after completion of inspection of all checklists items for each system. Include manufacturer start-up checklists associated with equipment with the submission of the Pre-Functional Checklists.

### 3.9 FUNCTIONAL PERFORMANCE AND INTEGRATED SYSTEMS TESTS

\*\*\*\*\*  
**NOTE: This paragraph contains tailoring for BUILDING ENVELOPE COMMISSIONING and INTEGRATED SYSTEMS TEST. Choose bracketed "and the OPR" for projects that apply a third party certification program that requires one.**  
\*\*\*\*\*

Demonstrate that all system components have been installed, that each control device and item of equipment operates, and that the systems operate and perform, including interactive operation between systems, in accordance with contract documents[ and the OPR]. Provide all materials, services, and labor required to perform the Pre-Functional Checks, Building Envelope Inspection, Integrated Systems Tests, and Functional Performance 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.

Perform Integrated Systems Tests only after the Functional Performance Tests for each associated system are completed with all deficiencies resolved and after the related Functional Performance Test Checklists have been signed by each commissioning team member.

### 3.9.1 Test Scheduling and Coordination

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

Conduct Initial Functional Performance Tests as soon as all contract work is completed, regardless of the season. Develop and implement means of artificial loading to demonstrate, to a reasonable level of confidence, the ability of the HVAC systems to handle peak seasonal loads. Schedule Functional Performance 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 Functional Performance Tests.

Functional Performance 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

Functional performance testing is conducted by simulating conditions at control devices to initiate a control system response. Over-writing control input values through the control system is not allowed unless approved by the Contracting Officer. Do not simulate conditions when damage to the system or building may result.

Follow the Functional Performance Test from the approved Final Construction Phase Commissioning Plan. Perform Functional Performance Tests for each item of equipment and each system required to be commissioned. Verify all sensor calibrations, control responses, safeties, interlocks, operating modes, sequences of operation, capacities, lighting levels, and all other performance requirements comply with contract, regardless of the specific items listed within the checklists provided. In general, testing must progress from equipment or components to subsystems to systems to interlocks and connections between systems. Commissioning Specialists are responsible for determining the order of components and systems to be tested. Indicate validation of each item of equipment and systems tested by signature of each commissioning team member for each test. The Quality Control Representative, Commissioning Specialists, and Contracting Officer's Representative, if present, must indicate validation after the equipment and systems are free of deficiencies.

### 3.9.3 Integrated Systems Tests

\*\*\*\*\*  
**NOTE: This paragraph is tailored for INTEGRATED  
SYSTEMS TEST.**  
\*\*\*\*\*

Follow the Integrated Systems Test Checklists from the approved Final Construction Phase Commissioning Plan. Integrated Systems Tests must be performed for the interactive operation between systems such as HVAC systems, fire protection systems, back-up electrical supply, energy generation systems, and other systems, and verify correct interactive operation, acceptable speed of response, and other contract requirements for both normal and failure modes. Examples of Integrated Systems Tests include the correct operation of HVAC systems during emergency system activation, correct operation of uninterruptible power supplies or energy generators and connected systems, or lighting system operation during power outage or emergency system activation.

#### 3.9.4 Sample Strategy

\*\*\*\*\*  
**NOTE: This paragraph contains tailoring for**  
**INTEGRATED SYSTEMS TEST.**  
\*\*\*\*\*

Perform Functional Performance Tests and Integrated Systems Tests for all systems and equipment to be commissioned using the sample strategy identified herein. Complete a Functional Performance 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 during testing. Perform Integrated Systems Tests for all systems and equipment having interactive operation. Complete an Integrated Systems Test Checklist for each item of equipment or system.

Test all central plant equipment, primary air handling units, and process cooling or heating equipment. Test all system-level equipment serving multiple zones. Twenty 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, lighting zones, and plumbing fixtures.

##### 3.9.4.1 100 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.

##### 3.9.4.2 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 functional performance 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, and testing becomes more troubleshooting than verification, the CxC may stop the testing and require the contractor to perform and document a checkout of the remaining units prior to continuing functional testing.

### 3.9.5 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 Section 01 78 23  
OPERATION AND MAINTENANCE DATA and 01 45 00.00 10  
QUALITY CONTROL 01 45 00.05 20 DESIGN AND  
CONSTRUCTION QUALITY CONTROL 01 45 00.00 20 QUALITY  
CONTROL, both 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 ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI). Update and resubmit the training plan based on any corrective action taken.

Document training attendance using training attendance rosters and submit completed attendance rosters no later than 7 calendar days following the completion of training for each system to be commissioned.

#### [3.10.1 Systems Manual

\*\*\*\*\*

**NOTE:** Select Systems Manual 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 00.00 10  
QUALITY CONTROL 01 45 00.05 20 DESIGN AND  
CONSTRUCTION QUALITY CONTROL 01 45 00.00 20 QUALITY  
CONTROL, both of which address manuals.

**This paragraph contains tailoring options for NAVY.**

\*\*\*\*\*

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 ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI). Update and resubmit the system manual information based on any corrective action taken during the warranty period.

\*\*\*\*\*

NOTE: This paragraph is tailored for ARMY. This paragraph contains tailoring options for KTR HIRED COMMISSIONING PROVIDER and GOVT 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 to 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.

Provide updates to Commissioning Provider for inclusion in the Systems Manual to identify 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.

### 3.10.2 Maintenance and Service Life Plans

\*\*\*\*\*

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 00.00 10 QUALITY CONTROL, both of which address maintenance requirements.

\*\*\*\*\*

#### 3.10.2.1 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 and Quality Control requirements.

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

### 3.10.2.2 Service Life Plan

Prepare and submit a Service Life Plan for the building envelope, 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 and Quality Control team requirements. Submit the Service Life Plan no later than 30 calendar days following the completion of Functional Performance Tests and Integrated Systems Tests.

### 3.11 COMMISSIONING REPORT

\*\*\*\*\*

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

**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 apply a  
third party certification program that requires one.**

\*\*\*\*\*

Submit an Initial Commissioning Report no later than 14 calendar days following commissioning team validates all 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 OPR].
- b. A list of deficiencies discovered during the commissioning process and the corrective actions taken in the report.
- c. Completed Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists, Integrated Systems Test Checklists, the Final Construction Phase Commissioning Plan, the Issues Log, Training Attendance Rosters, the Design Review Reports, Submittal Review Report, and the approved TAB Report.

The Commissioning Specialist is responsible for preparing a Commissioning Report following commissioning team validates all 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 Envelope Inspection Checklists, Pre-Functional Checklists, Training Attendance Rosters, PVT Report, and the approved TAB Report within 14 days of request.

### [3.12 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 apply a third party certification program that requires one.

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

\*\*\*\*\*

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 OPR]. 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 phase activities, such as Seasonal testing results.[ 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.]

] -- End of Section --