

Preparing Activity: NAVFAC

-----  
Superseding  
UFGS-01 78 23 (August 2015)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025

\*\*\*\*\*

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

05/23

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 MEETINGS
  - 1.3.1 [Post-Award Kickoff Meeting] [Pre-Construction Meeting]
  - 1.3.2 Operation and Maintenance Manual and Facility Data Workbook Coordination Meeting
  - 1.3.3 Submittal Coordination Meeting
  - 1.3.4 Facility Turnover Meeting
- 1.4 FACILITY DATA WORKBOOK
- 1.5 OPERATION AND MAINTENANCE MANUAL MEDIA
  - 1.5.1 CD or DVD Label and Disk Holder or Case
  - 1.5.2 O&M Manual Tabbed Hard Copy
- 1.6 O&M MANUAL CONTENT
  - 1.6.1 Part 1: Executive Summary
  - 1.6.2 Part 2: Facility Design and Construction
    - 1.6.2.1 General Facility and Systems Description
    - 1.6.2.2 Basis of Design
    - 1.6.2.3 Contract Documents, RFP, Amendments, and Modifications
    - 1.6.2.4 Room Inventory of Real Property and Finishes
  - 1.6.3 Part 3: Facilities, Systems, and Assemblies Information
    - 1.6.3.1 Organization
    - 1.6.3.2 Related Specifications
    - 1.6.3.3 Manufacturer's Operations and Maintenance Data
    - 1.6.3.4 Approved Submittals and Certificates
    - 1.6.3.5 Approved Coordination/Shop Drawings
  - 1.6.4 Sequence of Operation for Operating Equipment
    - 1.6.4.1 Safety Precautions and Hazards
    - 1.6.4.2 Operator Prestart
    - 1.6.4.3 Startup, Shutdown, and Post-Shutdown Procedures
    - 1.6.4.4 Normal Operations
    - 1.6.4.5 Emergency Operations
    - 1.6.4.6 Operator Service Requirements

- 1.6.4.7 Environmental Conditions
- 1.6.4.8 Operating Log
- 1.6.4.9 Additional Requirements for Equipment Control Systems
- 1.6.4.10 Testing Equipment Information and Performance Data
- 1.6.5 Routine Maintenance Requirements
  - 1.6.5.1 Preventive Maintenance Plan, Schedule, and Procedures
  - 1.6.5.2 Lubrication Data
- 1.6.6 Repair Procedures
  - 1.6.6.1 Troubleshooting Guides and Diagnostic Techniques
  - 1.6.6.2 Wiring Diagrams and Control Diagrams
  - 1.6.6.3 Removal and Replacement Instructions
  - 1.6.6.4 Repair Work-Hours
  - 1.6.6.5 Warranty Information
  - 1.6.6.6 Extended Warranty Information
  - 1.6.6.7 Record Drawings and Utility Systems
  - 1.6.6.8 Personnel Training Requirements
  - 1.6.6.9 Contractor / Supplier Listing and Contact Information
- 1.6.7 Part 4: Facility Operations
  - 1.6.7.1 Completed Facility Operating Plan
  - 1.6.7.2 Testing Equipment and Special Tool Information
  - 1.6.7.3 Testing and Performance Data
  - 1.6.7.4 Approved Field Test Reports and Manufacturer's Field Reports
  - 1.6.7.5 Maintenance Plans, Procedures, Checklists, Records, and Spare Parts Inventory
    - 1.6.7.5.1 Maintenance Schedules
    - 1.6.7.5.2 Ongoing Commissioning Operational and Maintenance Record Keeping
    - 1.6.7.5.3 Janitorial and Cleaning Plans and Procedures
- 1.6.7.6 Utility Record Drawings
  - 1.6.7.6.1 Utility Schematic Diagrams
  - 1.6.7.6.2 Enlarged Connection and Cutoff Plans
    - 1.6.7.6.2.1 Description of Utility Metering and Monitoring Systems
    - 1.6.7.6.2.2 Procedures for Tracking Utility Use and Reporting
    - 1.6.7.6.2.3 One-Line Diagrams and Meter Location of System
  - 1.6.7.6.3 Spare Parts and Supply Lists
- 1.6.8 Part 5: Training
- 1.6.9 Part 6: Cx Project Report and TAB Report
- 1.6.10 Part 7: Regulatory Requirements
- 1.6.11 Part 8: Permits
- 1.6.12 Part 9: Operations and Maintenance Manual Approval
- 1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES
  - 1.7.1 Package Quality
  - 1.7.2 Data Package 1
  - 1.7.3 Data Package 2
  - 1.7.4 Data Package 3
  - 1.7.5 Data Package 4
  - 1.7.6 Data Package 5
  - 1.7.7 Changes to Submittals

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.1 TRAINING
  - 3.1.1 Training Plan
  - 3.1.2 Training Content

- 3.1.3 Training Outline
- 3.1.4 Training Video Recording
- 3.1.5 Unresolved Questions from Attendees
- 3.1.6 Validation of Training Completion
- 3.1.7 Quality Control Coordination
- 3.2 SUBMITTAL SCHEDULING
  - 3.2.1 Operation and Maintenance Manual, Progress Submittal
  - 3.2.2 Operation and Maintenance Manual, Prefinal Submittal
  - 3.2.3 Operation and Maintenance Manual, Final Submittal
  - 3.2.4 Final Operation and Maintenance Manual Submittal Translation

-- End of Section Table of Contents --

\*\*\*\*\*  
USACE / NAVFAC / AFCEC UFGS-01 78 23 (May 2023)

Preparing Activity: NAVFAC

-----  
Superseding  
UFGS-01 78 23 (August 2015)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025

\*\*\*\*\*

### SECTION 01 78 23

#### OPERATION AND MAINTENANCE DATA 05/23

\*\*\*\*\*

**NOTE:** This guide specification covers the requirements for Operation and Maintenance (O&M) data packages, manuals and training.

In addition to this Section, use Section 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW) on projects at Marine Corps Installations and at Navy Installations, Joint Bases, Department of Defense (DoD) Agencies, or Field Activities where NAVFAC PW is the maintenance provider of the facility for:

1. New Construction Projects greater than or equal to \$1 Million.
2. Major Renovation projects greater than or equal to 50 percent of the Plant Replacement Value (PRV).

For other projects below the threshold, consult the Administering Public Works Facilities Management Division (FMD) to determine if Section 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW) is required.

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 \(CCR\)](#).

\*\*\*\*\*

\*\*\*\*\*

NOTE: This specification contains tailoring for  
NAVY, ARMY, COMMISSIONING AUTHORITY, NAVY  
DESIGN-BUILD, NAVFAC EURAFCENT, AND NAVFAC FE.

\*\*\*\*\*

PART 1 GENERAL

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 GUIDELINE 1.4 (2019) Preparing Systems Manuals for  
Facilities

ASTM INTERNATIONAL (ASTM)

ASTM E1971 (2024) Standard Guide for Stewardship for  
the Cleaning of Commercial and  
Institutional Buildings

ASTM E2166 (2016; R 2023) Standard Practice for  
Organizing and Managing Building Data

U.S. DEPARTMENT OF DEFENSE (DOD)

FC 1-300-09N (2024) Navy and Marine Corps Design

1.2 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 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 and Air Force 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.

\*\*\*\*\*

\*\*\*\*\*

NOTE: For Navy Design-Build 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.

\*\*\*\*\*

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. Submittals not having a "G" or "S" classification are 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:

\*\*\*\*\*

NOTE: In SD-10 Operation and Maintenance Data, use the bracketed item for Facility Data Workbook only if SECTION 01 78 24.00 10 FACILITY DATA REQUIREMENTS or SECTION 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW) are not used in the project. When one of these Sections is included, the Facility Data Workbook is included as a submittal in the Section used and will not be used in this Section.

\*\*\*\*\*

SD-10 Operation and Maintenance Data

- [ Facility Data Workbook; G, [\_\_\_\_\_] ]
- Training Plan; G, [\_\_\_\_\_] ]
- Training Outline; G, [\_\_\_\_\_] ]
- Training Content; G, [\_\_\_\_\_] ]
- Operation And Maintenance Manual, Progress Submittal; G, [\_\_\_\_\_] ]
- Operation And Maintenance Manual, Prefinal Submittal; G, [\_\_\_\_\_] ]
- Operation And Maintenance Manual, Final Submittal; G, [\_\_\_\_\_] ]

SD-11 Closeout Submittals

- Training Video Recording; G, [\_\_\_\_\_] ]
- Validation of Training Completion; G, [\_\_\_\_\_] ]
- Training Plan; G, [\_\_\_\_\_] ]
- Record Drawings And Utility Systems; G, [\_\_\_\_\_] ]

1.3 MEETINGS

To assure that Operation and Maintenance Manual and Facility Data Workbook requirements are being met through the duration of the project, organize the following meetings and discuss the subsequent topics:

1.3.1 [Post-Award Kickoff Meeting] [Pre-Construction Meeting]

\*\*\*\*\*  
**NOTE: Use Post-Award Kickoff Meeting for Design-Build Projects, or use Pre-Construction Meeting for Design-Bid-Build Projects.**  
 \*\*\*\*\*

At a minimum, discuss the following:

- a. The requirement for Operation and Maintenance Manuals and Facility Data deliverables under this contract including coordination meetings
- b. Processes and method of gathering Facility Data information during construction
- c. Primary roles and responsibilities associated with the development and delivery of the Operation and Maintenance Manuals and Facility Data deliverables, and
- d. Identify and agree upon a date and attendance list for the meetings described below:

1.3.2 Operation and Maintenance Manual and Facility Data Workbook Coordination Meeting

Facilitate a meeting after the [Pre-Construction Meeting] [Post-Award

Kickoff Meeting] prior to the submission of the Operation and Maintenance Manual Progress Submittal. Meeting attendance must include the Contractor's Operation and Maintenance Manual and Facility Data Workbook Preparer, [Designer of Record (DOR), ]Quality Control Manager, [the Commissioning Authority (CxA), ]the Government's Design Manager (DM), Contracting Officer's Representative, and Government's facility data reviewer. Include any Mechanical, Electrical, and Fire Protection Sub-Contractors.

The purpose of this meeting is to reach a mutual understanding of the scope of work concerning the contract requirements for Operation and Maintenance Manual and coordinate the efforts necessary by both the Government and Contractor to ensure an accurate collection, preparation and timely Government review of Operation and Maintenance Manual.

### 1.3.3 Submittal Coordination Meeting

Facilitate a meeting following submission and Government review of each design or progress submittal of the Operation and Maintenance Manual and Facility Data Workbook.

- a. Include personnel from the Coordination meeting and any additional personnel identified.
- b. The purpose of this meeting is to demonstrate ongoing compliance with the requirements identified in this specification. Discuss Government review comments and unresolved items preventing completion and Government approval of the Operation and Maintenance Manuals and Facility Data Workbook (FDW).
- c. The applicable deliverables, along with Government remarks associated with review of these submittals serve as the primary guide and agenda for this meeting.

### 1.3.4 Facility Turnover Meeting

Include Operation and Maintenance Manual in NAVFAC Red Zone (NRZ) facility turnover meetings as specified in Section 01 30 00, ADMINISTRATIVE REQUIREMENTS.

## 1.4 FACILITY DATA WORKBOOK

\*\*\*\*\*

**NOTE: In this paragraph, choose the first set of brackets if Section 01 78 24.00 10 FACILITY DATA REQUIREMENTS for Army projects or 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW) for Navy projects is in contract. Otherwise, choose the second bracketed sentence.**

\*\*\*\*\*

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program[ as outlined in [01 78 24.00 10 FACILITY DATA REQUIREMENTS][01 78 24.00 20 FACILITY DATA WORKBOOK (FDW)]]. [ As a minimum, provide Facility Data Workbook as a list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.]

1.5 OPERATION AND MAINTENANCE MANUAL MEDIA

Assemble Operation and Maintenance Manual into an electronically bookmarked file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete bookmarked operation and maintenance directory.

1.5.1 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

- a. Building Number
- b. Project Title
- c. Activity and Location
- d. Construction Contract Number
- e. Prepared For: (Contracting Agency)
- f. Prepared By: (Name, title, phone number and email address)
- g. Include the disk content on the disk label
- h. Date
- i. Virus scanning program used

[1.5.2 O&M Manual Tabbed Hard Copy

\*\*\*\*\*  
**NOTE: Use this paragraph only if a hard copy is required.**  
\*\*\*\*\*

Provide a hard copy of the O&M manual upon completion of the project. Provide tabs for each section and subsection for ease of navigation by the user.

]1.6 O&M MANUAL CONTENT

\*\*\*\*\*  
**NOTE: See Operation and Maintenance Manual template located at [www.wbdg.org/dod/ufgs/ufgs-01-78-23](http://www.wbdg.org/dod/ufgs/ufgs-01-78-23).**  
\*\*\*\*\*

Organize the bookmarked Operation and Maintenance Manual into the following Parts in accordance with **ASHRAE GUIDELINE 1.4**, and as modified and detailed below. Word template for O&M Manual is available at: [www.wbdg.org/dod/ufgs/ufgs-01-78-23](http://www.wbdg.org/dod/ufgs/ufgs-01-78-23).

1.6.1 Part 1: Executive Summary

Provide a summary of the information found in the O&M manual including the

purpose of the manual and a description of the manual's organization.

## 1.6.2 Part 2: Facility Design and Construction

### 1.6.2.1 General Facility and Systems Description

Provide an overview of the intent for design and use of the facility. Provide a PDF of the Record Drawings prepared in accordance with [ **FC 1-300-09N** and] **01 78 00** CLOSEOUT SUBMITTALS and bookmarked using the sheet title and sheet number. Include uncluttered **28 by 43 mm 11 by 17 inches** floor plans with room numbers, type or function of space, and overall facility dimensions on the floor plans. Do not include items such as construction instructions, references, or frame numbers.

Detail the overall dimensions of the facility, number of floors, foundation type, expected number of occupants, and facility Category Code list and generally describe all the facility systems and any special building features (for example, HVAC Controls, Sprinkler Systems, Cranes, Elevators, and Generators). Include photographs marked up and labeled to show key operating components and the overall facility appearance.

### 1.6.2.2 Basis of Design

Provide a copy of the contract Basis of Design.

### 1.6.2.3 Contract Documents, RFP, Amendments, and Modifications

Provide the contract construction documents complete, to include specifications, drawings, Request for Proposal, amendments, and modifications.

### 1.6.2.4 Room Inventory of Real Property and Finishes

\*\*\*\*\*  
**NOTE: This paragraph is intended to provide data on equipment and materials incorporated in the construction of the project that cannot readily be determined after completion of construction. The data is expected to be of value for future maintenance, alteration, and repair work.**  
\*\*\*\*\*

Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. Include, as applicable, the following information for each piece of equipment installed: description of item, all dimensions, location by room number, model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Real property includes, but is not limited to, floor coverings, wall surfaces, ceiling surfaces, windows, roofing, HVAC filters, plumbing fixtures, and lighting fixtures. Submit the final list [30] [\_\_\_\_\_] days after transfer of the completed facility.

Include spatial data defining actual net **square meters square footage** and data of each room. Also include the room finish schedule including room names and numbers. Include schedules in the construction drawings in the room inventory. Add a column to each schedule to record what was provided by the contractor during construction. Provide a PDF of room inventory.

Key the designations to the related area depicted on the contract drawings. List the following data:

| RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA |                       |  |                      |            |
|---|-----------------------|--|----------------------|------------|
| Description                                       | Specification Section | Manufacturer and Catalog, Model, and Serial Number | Composition and Size | Where Used |
| [_____]   |                       |  |                      |            |

### 1.6.3 Part 3: Facilities, Systems, and Assemblies Information

#### 1.6.3.1 Organization

Bookmark information in this section using the current version of [ASTM E2166](#) Unifomat II, UFGS numbers, and document type as outlined in the example below. Bookmark/tab each item to the third level for easy navigation of the manual.

Example as shown in Table below:

| PARTS AND SUBPART NUMBERING                                       |
|---|
| 3.1 B20 EXTERIOR CLOSURE (System)                                 |
| 3.1.1 B2030 EXTERIOR DOORS (Subsystem)                            |
| 3.1.1.1 B2030110 GLAZED DOORS (Component)                         |
| 3.1.1.1.1 Applicable specifications List in UFGS Format           |
| 3.1.1.1.2 Manufacturer's Operations and Maintenance Data          |
| 3.1.1.1.3 Approved Submittal                                      |
| 3.1.1.1.4 Coordination/Shop Drawings                              |
| 3.1.1.1.5 Sequence of Operation for Operating Equipment           |
| 3.1.1.1.6 Testing Equipment Information and Performance Data      |
| 3.1.1.1.7 Routine Maintenance Requirements                        |
| 3.1.1.1.8 Repair Procedures                                       |
| 3.1.1.1.9 Emergency Procedures & Locations of Applicable Controls |
| 3.1.1.1.10 Warranties   |
| 3.1.1.1.11 Record Drawings and Utility Systems                    |
| 3.1.1.1.12 Contractor / Supplies Listing and Contact Information  |

### 1.6.3.2 Related Specifications

Reference each specification related to the subsystem in this section, and locate the actual specification section in Part 2 of the O&M Manual. List specifications in table format as shown in the below example.

| UFGS Number | Specification Title | Page Spec Begins in Part 2 |
|-------------|---------------------|----------------------------|
|             |                     |                            |
|             |                     |                            |
|             |                     |                            |

### 1.6.3.3 Manufacturer's Operations and Maintenance Data

Provide a copy of all manufacturer specifications and cutsheets. Provide text-searchable, high-quality document files from the manufacturer's online or electronic documentation. Color documents are preferred. Provide documents specific to the product(s) installed under this Contract. Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Provide Uniformat II Level 3 identification for D20, D30, D40 installed equipment. When possible, do not submit document files containing multiple product catalogs from the same manufacturer, or product data from multiple manufacturers in the same files. Provide documents directly from the manufacturer whenever possible. Do not provide scanned copies of hardcopy documents. Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master part catalog.

### 1.6.3.4 Approved Submittals and Certificates

Provide a copy of all submittals documented with the required approval as applicable for each UFGS specification listed in the table outlined in applicable specifications. Include copies of SD-07 Certificates submittals documented with the required approval, SD-08 Manufacturer's Instructions submittals documented with the required approval, and SD-10 Operation and Maintenance Data submittals documents with the required approval.

### 1.6.3.5 Approved Coordination/Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some

portion of the work. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

#### 1.6.4 Sequence of Operation for Operating Equipment

Provide record one-line diagrams for each floor, delineating mechanical equipment location within the building. Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

##### 1.6.4.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard. Specify if any certifications or licenses are required to operate the equipment.

##### 1.6.4.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

##### 1.6.4.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

##### 1.6.4.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

##### 1.6.4.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

##### 1.6.4.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

##### 1.6.4.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.6.4.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.6.4.9 Additional Requirements for Equipment Control Systems

Provide Data Package 5 and the following for all control systems:

- a. Provide a narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Submit complete controls equipment schedules, full as-built sequence of operations, wiring and logic diagrams, Input/Output Tables, equipment schedules, copies of checkout tests and calibrations performed by the Contractor (not Cx tests), and all associates information.

\*\*\*\*\*

**NOTE: Include the following items c through f below, depending on the project scope.**

**Make sure these are consistent with Operation and Maintenance Manual.**

\*\*\*\*\*

- c. Full points list. Provide a listing of rooms with the following information for each room:
  - (1) Floor
  - (2) Room number
  - (3) Room name
  - (4) Air handler unit ID
  - (5) Reference drawing number
  - (6) Air terminal unit tag ID
  - (7) Heating or cooling valve tag ID
  - (8) Minimum cfm
  - (9) Maximum cfm
- d. Full print out of all schedules and set points after testing and acceptance of the system.
- e. Full as-built print out of software program.
- f. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

#### 1.6.4.10 Testing Equipment Information and Performance Data

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

#### 1.6.5 Routine Maintenance Requirements

##### 1.6.5.1 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including requirements by type of activity. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

- a. Define the anticipated time required to perform each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

##### 1.6.5.2 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities. Provide procedural instructions for Oil Sampling for all equipment.
- c. A Lubrication Schedule showing service interval frequency.

#### 1.6.6 Repair Procedures

Provide instructions and a list of tools required to repair or restore the

product or equipment to proper condition or operating standards. Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials. Specify if any certifications or licenses are required to repair the equipment.

#### 1.6.6.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

#### 1.6.6.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

#### 1.6.6.3 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required specialty tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

#### 1.6.6.4 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

#### 1.6.6.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Identify if replacement of a subassembly, attachment or accessory requires the entire assembly to be replaced. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.6.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

#### 1.6.6.7 Record Drawings and Utility Systems

The record drawings are the final compilation of actual conditions reflected in the as-built drawings. Provide record drawings as outlined in 01 78 00 CLOSEOUT SUBMITTALS.

Using Record Source Drawings, show and document details of the actual installation of the utility systems, annotate and highlight the Operation and Maintenance information. Provide the following drawings at a large enough scale to differentiate designated isolation units from surrounding valves and switches.

#### 1.6.6.8 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.6.6.9 Contractor / Supplier Listing and Contact Information

Provide a list that includes the name, address, telephone number, email and website of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

### 1.6.7 Part 4: Facility Operations

#### 1.6.7.1 Completed Facility Operating Plan

Provide a plan that documents that procedures for the operation of systems and assemblies in the facility. The systems that should be included in the Operating Plan include, but are not limited to:

- a. Electrical systems and equipment
- b. Mechanical systems and equipment
- c. Fire Protection systems and equipment
- d. Control Systems and equipment
- e. Architectural and Structural systems, fixtures, structures, and equipment
- f. Vertical transportation such as elevators and escalators

#### 1.6.7.2 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

#### 1.6.7.3 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting

and blank test forms. Provide final set points.

#### 1.6.7.4 Approved Field Test Reports and Manufacturer's Field Reports

Compile and provide approved Field Test Reports (SD-06) and Manufacturer's Field Reports (SD-09) submittals.

#### 1.6.7.5 Maintenance Plans, Procedures, Checklists, Records, and Spare Parts Inventory

##### 1.6.7.5.1 Maintenance Schedules

Include recommended maintenance schedules for systems and equipment.

##### 1.6.7.5.2 Ongoing Commissioning Operational and Maintenance Record Keeping

Include ongoing commissioning and optimization procedures and documentation to monitor and improve the performance of facility systems.

##### 1.6.7.5.3 Janitorial and Cleaning Plans and Procedures

Include a copy of facility cleaning and janitorial plan with procedures and intended chemicals and equipment.

Provide environmentally friendly cleaning recommendations in accordance with [ASTM E1971](#).

#### 1.6.7.6 Utility Record Drawings

##### 1.6.7.6.1 Utility Schematic Diagrams

Provide a one-line schematic diagram for each utility system such as power, water, wastewater, and gas/fuel. Schematic diagram must show from the point where the utility line is connected to the mainline up to the [1.5 meter 5 foot](#) connection point to the facility. Indicate location or area designation for route of transmission or distribution lines; locations of duct banks, manholes/handholes or poles; isolation units such as valves and switches; and utility facilities such as pump stations, lift stations, and substations.

##### 1.6.7.6.2 Enlarged Connection and Cutoff Plans

Provide enlarged floor plans and provide information between the [1.5 meter 5 foot](#) utilities connection point and where utilities connect to facility distribution. Enlarge floor plans/elevations of the rooms where the utility enters the building and indicate on these plans the locations of the main interiors and exterior connection and cutoff points for the utilities. Also enlarge floor plans/elevations of the rooms where equipment is located. Include enough information to enable someone unfamiliar with the facility to locate the connection and cutoff points. Indicate designations such as room number, panel number, circuit breaker, or valve number of each utility and equipment connection and cutoff point, and what that connection and cutoff point controls.

##### 1.6.7.6.2.1 Description of Utility Metering and Monitoring Systems

Provide in narrative format a description of the utility metering and monitoring systems. Include locations, function, and related systems.

1.6.7.6.2.2 Procedures for Tracking Utility Use and Reporting

Procedures for usage reporting and tracking in support of establishing and monitoring utility budgets and costs, and in developing annual energy reports.

1.6.7.6.2.3 One-Line Diagrams and Meter Location of System

Provide one-line diagrams and design drawings that highlight meter locations on the site.

1.6.7.6.3 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.6.8 Part 5: Training

Provide a copy of training plans used for each type of equipment along with training materials used, arranged in specification sequence. Provide a copy of training records, sign-in sheets, and agendas. Include training and documentation on the updating and continued use of the O&M Manual.

1.6.9 Part 6: Cx Project Report and TAB Report

Provide the final Cx Plan and complete Cx reports with evaluation and testing forms and records for each building system. Include relevant commissioned system assemblies test reports including installers checklists of assemblies. Provide all Cx Progress Reports, issues and resolutions logs with resolution or status of each item, and a list of any open items and seasonal or additional testing required.

1.6.10 Part 7: Regulatory Requirements

Provide information describing regulatory and policies compliance requirements or provide a reference to where it is stored.

1.6.11 Part 8: Permits

Provide information requiring frequently asked questions and associated answers or provide a reference to where it is stored.

1.6.12 Part 9: Operations and Maintenance Manual Approval

Provide a signed document stating that the project O&M Manual has been reviewed and confirming agreement with the approach it presents. Include contact information for the signer for coordination of any future changes.

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

\*\*\*\*\*  
**NOTE: The type of O&M data needed for any product, system, or piece of equipment depends upon the complexity of that item. If not, specify the appropriate Data Package number in the technical section using the Data Package Number from the choices 1 through 5 below.**

Data Package 1 is typically used for architectural items requiring simple but specific maintenance and replacement; for example, acoustical ceiling, floor tile or carpeting system.

Data Package 2 is used for an item that is less simple; for example, an item having a motor and some sequence of operation such as a refrigerated drinking fountain.

Data Package 3 is used for a complex piece of equipment, having a specific troubleshooting sequence, but one which does not require an operator on watch; for example, HVAC temperature controls.

Data Package 4 is used for an extremely complex piece of equipment, having an extensive sequence of operation, a complex troubleshooting sequence and one requiring frequent operator attention; at least for start-up and shut-down. Examples include small boilers and small diesel generator sets.

Data Package 5 is used for electrical equipment, components or systems on which, wiring and control diagrams are needed for operation, maintenance or repair. Examples are 400 Hz frequency converters, annunciator panels and cathodic protection systems.

\*\*\*\*\*

Provide the O&M data packages specified in individual technical sections. O&M Data Packages are one of the components of the O&M Manual. The information required in each type of data package follows:

#### 1.7.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

#### 1.7.2 Data Package 1

- a. Safety precautions and hazards
- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Warranty information
- e. Extended warranty information
- f. Contractor information
- g. Spare parts and supply list

#### 1.7.3 Data Package 2

- a. Safety precautions and hazards

- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan, schedule, and procedures
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Extended warranty information
- m. Contractor information

1.7.4 Data Package 3

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Operating log
- h. Lubrication data
- i. Preventive maintenance plan, schedule, and procedures
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques
- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions
- o. Spare parts and supply list
- p. Product submittal data

- q. O&M submittal data
- r. Parts identification
- s. Warranty information
- t. Extended warranty information
- u. Testing equipment and special tool information
- v. Testing and performance data
- w. Contractor information
- x. Field test reports

1.7.5 Data Package 4

- a. Safety precautions and hazards
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Operating log
- i. Lubrication data
- j. Preventive maintenance plan, schedule, and procedures
- k. Cleaning recommendations
- l. Troubleshooting guides and diagnostic techniques
- m. Wiring diagrams and control diagrams
- n. Repair procedures
- o. Removal and replacement instructions
- p. Spare parts and supply list
- q. Repair work-hours
- r. Product submittal data
- s. O&M submittal data
- t. Parts identification
- u. Warranty information

- v. Extended warranty information
- w. Personnel training requirements
- x. Testing equipment and special tool information
- y. Testing and performance data
- z. Contractor information
- aa. Field test reports

1.7.6 Data Package 5

- a. Safety precautions and hazards
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan, schedule, and procedures
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information
- r. Extended warranty information
- s. Testing and performance data
- t. Contractor information
- u. Field test reports
- [ v. Additional requirements for HVAC control systems

11.7.7 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 TRAINING

\*\*\*\*\*  
**NOTE: Use tailored option for Facility Management Specialist for Navy projects only.**  
\*\*\*\*\*

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the Facilities Management Specialist, building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS. Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

\*\*\*\*\*  
**NOTE: This paragraph contains tailoring for COMMISSIONING AUTHORITY.**  
  
Choose the COMMISSIONING AUTHORITY tailoring option (CxA) to oversee and approve the training plan if the project requires a CxA. If a CxA is not required, choose the bracketed option for the QC to oversee and approve the training plan and schedule.  
\*\*\*\*\*

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the [Quality Control Manager (QC)][Commissioning Authority (CxA)] prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and [QC][CxA]. Include within the plan the following elements:

- a. Equipment included in training
- b. Intended audience
- c. Location of training

- d. Dates of training
- e. Objectives
- f. Outline of the information to be presented and subjects covered including description
- g. Start and finish times and duration of training on each subject
- h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)
- i. Instructor names and instructor qualifications for each subject
- j. List of texts and other materials to be furnished by the Contractor that are required to support training
- k. Description of proposed software to be used for video recording of training sessions.

### 3.1.2 Training Content

\*\*\*\*\*  
**NOTE: In the second sentence, choose the CxA (Commissioning Authority) bracketed option to oversee and approve the training content if the project requires a CxA. Otherwise, choose the QC bracketed option for the QC to oversee and approve the training content.**  
 \*\*\*\*\*

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The [QC][CxA] is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

- a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. Relevant health and safety issues.
- c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.
- d. Design intent.
- e. Use of O&M Manual Files.
- f. Review of control drawings and schematics.
- g. Interactions with other systems.
- h. Special maintenance and replacement sources.
- i. Tenant interaction issues.

### 3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

### 3.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

### 3.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

### 3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

### 3.1.7 Quality Control Coordination

\*\*\*\*\*  
**NOTE: This paragraph contains tailoring for  
COMMISSIONING AUTHORITY.**

Choose the COMMISSIONING AUTHORITY tailoring option  
(CxA) for QC coordination if the project requires a  
CxA. If a CxA is not required, choose the bracketed  
option for the QC to approve the training content.

\*\*\*\*\*

Coordinate this training with the [QC][CxA] in accordance with Section  
01 45 00 QUALITY CONTROL.

## 3.2 SUBMITTAL SCHEDULING

### 3.2.1 Operation and Maintenance Manual, Progress Submittal

Submit the Progress submittal when construction is approximately 50 percent complete, to the Contracting Officer for approval. Provide

Operation and Maintenance Manual Files (Bookmarked PDF). Include the elements and portions of system construction completed up to this point. The purpose of this submittal is to verify progress is in accordance with contract requirements as discussed during the Operation and Maintenance Manual Coordination Meeting.

### 3.2.2 Operation and Maintenance Manual, Prefinal Submittal

\*\*\*\*\*  
**NOTE: Choose the bracketed option of submission of the Prefinal submittal 90 calendar days prior to BOD for MILCON and Special Projects. Choose 60 calendar days prior to BOD for renovations or repairs, or provide a timeframe practical to the project duration for smaller projects.**  
\*\*\*\*\*

Submit the 100 percent submittal of the Operation and Maintenance Prefinal Submittal to the Contracting Officer for approval within [90] [60] [\_\_\_\_\_] calendar days of the Beneficial Occupancy Date (BOD). This submittal must provide a complete, working document that can be used to operate and maintain the facility. Any portion of the submittal that is incomplete or inaccurate requires the entire submittal to be returned for correction. Any discrepancies discovered during the Government's review of Operation and Maintenance Progress submittal must be corrected prior to the Prefinal submission. The Prefinal Submittal must include Operation and Maintenance Manual Files (Bookmarked PDF).

### 3.2.3 Operation and Maintenance Manual, Final Submittal

\*\*\*\*\*  
**NOTE: In the first sentence, option for hard copies is tailored for ARMY.**  
\*\*\*\*\*

Submit completed Operation and Maintenance Manual Files (Bookmarked PDF)[ and [one ][\_\_\_\_\_] hard copy of the Operation and Maintenance Manuals]. The Final submittal is due at BOD. Any discrepancies discovered during the Government's review of the Prefinal submittal, including the Field Verification, must be corrected prior to the Final submission.

### 3.2.4 Final Operation and Maintenance Manual Submittal Translation

\*\*\*\*\*  
**NOTE: This paragraph is tailored for NAVFAC FE and NAVFAC EURAFCENT. For OCONUS locations, choose the appropriate foreign language that will be used based on the location of the project. If a foreign translation is not required, delete this bracketed paragraph.**  
\*\*\*\*\*

Provide a translation in [Italian] [Spanish] [Portuguese] [Greek] [Japanese] [\_\_\_\_\_] of the Operation and Maintenance Manual in electronic format. Provide drawings, charts and tables in both English and the foreign language. If required by Contracting Officer, provide a split format showing the foreign language on the left and English translation on the right.

-- End of Section --