PROJECT TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 15	02/24	LIST OF DRAWINGS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	02/24, CHG 1: 05/25	SUMMARY OF WORK
01 14 00	11/22, CHG 5: 05/25	WORK RESTRICTIONS
01 20 00	11/20, CHG 5: 02/25	PRICE AND PAYMENT PROCEDURES
01 30 00	11/20, CHG 5: 02/25	ADMINISTRATIVE REQUIREMENTS
01 31 23.13 20	08/23, CHG 1: 02/24	ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM (eCMS)
01 32 17.00 20	05/25	COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS)
01 33 00	08/18, CHG 4: 02/21	SUBMITTAL PROCEDURES
01 33 29	02/21, CHG 1: 08/25	SUSTAINABILITY REQUIREMENTS AND REPORTING
01 35 13.02 34	01/25	FACILITY-RELATED CONTROL SYSTEMS (FRCS) PROCUREMENT FOR NAVY
01 35 26	05/24, CHG 1: 05/25	GOVERNMENTAL SAFETY REQUIREMENTS
01 42 00	05/24	SOURCES FOR REFERENCE PUBLICATIONS
01 45 00	08/23, CHG 3: 08/25	QUALITY CONTROL
01 45 35	05/24	SPECIAL INSPECTIONS
01 50 00	11/20, CHG 3: 08/24	TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
01 57 19	08/22, CHG 2: 08/25	TEMPORARY ENVIRONMENTAL CONTROLS
01 57 19.01 20	12/23	SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS MCBCB EV
01 57 19.03 21	07/31/25	SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROL Secretary of the Navy (SECNAV) Explosive Safety Risk Acceptance Within Joint Region Marianas
01 58 00	08/19, CHG 5: 08/22	PROJECT IDENTIFICATION
01 74 19	02/19, CHG 3: 11/21	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 78 00	05/19, CHG 1: 08/21	CLOSEOUT SUBMITTALS
01 78 23	05/23, CHG 2: 11/25	OPERATION AND MAINTENANCE DATA
01 78 24.00 20	05/23, CHG 1: 11/23	FACILITY DATA WORKBOOK (FDW)
01 91 00.15	05/23, CHG 3: 08/24	BUILDING COMMISSIONING
01 91 19	05/2023	BUILDING ENCLOSURE COMMISSIONING

DIVISION 02 - EXISTING CONDITIONS

02 41 00	08/22	DEMOLITION
02 56 13.16	02/25	CLAY WASTE CONTAINMENT

DIVISION 03 - CONCRETE

03 30 00	02/19, CHG 10: 08/25	CAST-IN-PLACE CONCRETE
03 42 13.00 10	05/16	PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION

DIVISION 04 - MASONRY

04 20 00	05/25	UNIT MASONRY

DIVISION 05 - METALS

05 05 20	05/22, CHG 1: 08/24	POST-INSTALLED CONCRETE AND MASONRY ANCHORS
05 30 00	05/15, CHG 2: 08/18	STEEL DECKS
05 50 13	08/24, CHG 1: 08/25	MISCELLANEOUS METAL FABRICATIONS
05 51 33	08/24	METAL LADDERS
05 52 00	08/23	METAL RAILINGS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 20 00	08/24	FINISH CARPENTRY
06 41 16.00 10	08/25	PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
06 61 16	08/20	SOLID SURFACING FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 13 53	08/25	ELASTOMERIC SHEET WATERPROOFING
07 21 13	08/23, CHG 1: 08/25	BOARD AND BLOCK INSULATION
07 21 16	08/23, CHG 1: 08/25	MINERAL FIBER BLANKET INSULATION
07 24 00	08/23	EXTERIOR INSULATION AND FINISH SYSTEMS
07 27 10	08/23	BUILDING AIR BARRIER SYSTEM
07 56 00	08/09	FLUID-APPLIED ROOFING SYSTEM
07 60 00	08/23, CHG 1: 05/25	FLASHING AND SHEET METAL
07 84 00	05/10, CHG 1: 08/13	FIRESTOPPING
07 92 00	08/23	JOINT SEALANTS

DIVISION 08 - OPENINGS

08 11 13	08/20, CHG 1: 08/25	STEEL DOORS AND FRAMES
08 11 16	05/17, CHG 2: 11/18	ALUMINUM DOORS, FRAMES, AND WINDOW WALL
08 14 00	08/16, CHG 1: 08/18	WOOD DOORS
08 31 00	05/17, CHG 1: 08/18	ACCESS DOORS AND PANELS
08 33 23	08/20, CHG 1: 02/22	OVERHEAD COILING DOORS
08 34 73	11/19, CHG 1: 02/21	SOUND CONTROL DOOR ASSEMBLIES
08 51 13	05/19	ALUMINUM WINDOWS
08 71 00	02/16, CHG 4: 02/22	DOOR HARDWARE
08 81 00	05/19	GLAZING
08 91 00	08/20	METAL WALL AND DOOR LOUVERS

DIVISION 09 - FINISHES

09 22 00	08/24	SUPPORTS FOR PLASTER AND GYPSUM BOARD
09 29 00	08/24, CHG 1: 05/25	GYPSUM BOARD
09 30 10	08/20	CERAMIC TILING
09 51 00	08/20	ACOUSTICAL CEILINGS
09 65 00	11/24	RESILIENT FLOORING
09 67 23.13	11/19	STANDARD RESINOUS FLOORING
09 68 00	11/24	CARPETING
09 69 13	11/24	RIGID GRID ACCESS FLOORING
09 84 20	08/16, CHG 1: 08/18	ACOUSTICAL WALL PANELS
09 90 00	02/21	PAINTS AND COATINGS

DIVISION 10 - SPECIALTIES

10 14 00.10	08/17, CHG 1: 11/18	EXTERIOR SIGNAGE
10 14 00.20	08/20	INTERIOR SIGNAGE
10 14 53	02/15, CHG 1: 05/17	TRAFFIC SIGNAGE

10 21 13	08/20	TOILET COMPARTMENTS
10 22 13	08/24	WIRE MESH PARTITIONS
10 22 39	08/20	FOLDING PANEL PARTITIONS
10 26 00	08/20	WALL AND DOOR PROTECTION
10 28 13	08/20	TOILET ACCESSORIES
10 44 16	11/19	FIRE EXTINGUISHERS
10 99 00	04/06	MISCELLANEOUS BUILDING SPECIALTIES

DIVISION 12 - FURNISHINGS

12 00 01.00 20	02/23	FURNITURE, FIXTURES AND EQUIPMENT (FF&E) PACKAGE
12 24 13	08/20	ROLLER WINDOW SHADES
12 48 13	08/23	ENTRANCE FLOOR MATS AND FRAMES
12 93 00	08/17, CHG 1: 08/18	SITE FURNISHINGS

DIVISION 13 - SPECIAL CONSTRUCTION

13 48 73	05/25	SEISMIC CONTROL FOR NONSTRUCTURAL COMPONENTS

DIVISION 14 - CONVEYING EQUIPMENT

14 24 23	05/16	HYDRAULIC PASSENGER ELEVATORS

DIVISION 21 - FIRE SUPPRESSION

21 13 13	08/20	WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION

DIVISION 22 - PLUMBING

22 00 00	05/24, CHG 1: 11/24	PLUMBING, GENERAL PURPOSE

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 03 00	11/25	BASIC MECHANICAL MATERIALS AND METHODS
23 05 48.19	02/25	SEISMIC BRACING FOR MECHANICAL SYSTEMS
23 05 93	05/25	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00	08/24	THERMAL INSULATION FOR MECHANICAL SYSTEMS
23 08 00	05/23, CHG 1: 08/24	COMMISSIONING OF MECHANICAL AND PLUMBING SYSTEMS
23 09 00	08/24, CHG 1: 08/25	INSTRUMENTATION AND CONTROL FOR HVAC
23 09 13	11/15, CHG 2: 05/21	INSTRUMENTATION AND CONTROL DEVICES FOR HVAC
23 09 23.02	08/24	BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS
23 30 00	02/25	HVAC AIR DISTRIBUTION
23 64 10	05/25	WATER CHILLERS, VAPOR COMPRESSION TYPE
23 64 26	11/25	CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS
23 81 23	11/20	COMPUTER ROOM AIR CONDITIONING UNITS

DIVISION 25 - INTEGRATED AUTOMATION

25 05 11	08/24	CYBERSECURITY FOR FACILITY-RELATED

		CONTROL SYSTEMS
25 08 10	05/21	UTILITY MONITORING AND CONTROL SYSTEM TESTING
25 08 11.00 20	11/20	RISK MANAGEMENT FRAMEWORK FOR FACILITY-RELATED CONTROL SYSTEMS
25 10 10	02/19, CHG 1: 05/21	UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION

DIVISION 26 - ELECTRICAL

26 05 48	11/23	SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT
26 05 73	08/23	POWER SYSTEM STUDIES
26 08 00	11/22	APPARATUS INSPECTION AND TESTING
26 12 19	05/24	PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS
26 12 19.10	05/19, CHG 1: 11/19	THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS
26 20 00	05/25, CHG 1: 08/25	INTERIOR DISTRIBUTION SYSTEM
26 24 13	08/21	SWITCHBOARDS
26 27 14.00 20	02/21, CHG 1: 05/21	ELECTRICITY METERING
26 28 01.00 10	08/21	COORDINATED POWER SYSTEM PROTECTION
26 29 23	02/20, CHG 1: 05/21	ADJUSTABLE SPEED DRIVE (ASD) SYSTEMS UNDER 600 VOLTS
26 32 15	05/24	ENGINE-GENERATOR SET STATIONARY 15-2500 KW, WITH AUXILIARIES
26 36 23	05/20, CHG 1: 08/21	AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH
26 41 00	08/23	LIGHTNING PROTECTION SYSTEM
26 51 00	05/20, CHG 2: 11/21	INTERIOR LIGHTING
26 56 00	08/21	EXTERIOR LIGHTING

DIVISION 27 - COMMUNICATIONS

27 10 00	05/25	BUILDING TELECOMMUNICATIONS CABLING SYSTEM
27 41 00	11/21	AUDIO-VISUAL SYSTEMS
27 51 16	05/20, CHG 1: 05/22	PUBLIC ADDRESS SYSTEMS
27 51 20	10/22	TWO-WAY COMMUNICATION SYSTEM

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 31 76	08/20	INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE

DIVISION 31 - EARTHWORK

31 00 00	08/23	EARTHWORK
31 05 19.13	02/21	GEOTEXTILES FOR EARTHWORK
31 11 00	11/18	CLEARING AND GRUBBING
31 21 13	11/18	RADON MITIGATION
31 31 16.13	08/22, CHG 1: 11/23	CHEMICAL TERMITE CONTROL
31 31 16.19	08/22	TERMITE CONTROL BARRIERS
31 62 00	03/24	CEMENT DEEP SOIL MIXING

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 01 19.61	11/19 CHG 1: 11/24	SEALING OF JOINTS IN RIGID PAVEMENT
32 05 33	08/17	LANDSCAPE ESTABLISHMENT

32 11 20	05/22	BASE COURSE FOR RIGID PAVING
32 11 23	05/22	GRADED CRUSHED AGGREGATE BASE COURSE FOR FLEXIBLE PAVING
32 12 13	05/24	BITUMINOUS TACK AND PRIME COATS
32 12 16.16	11/20	ROAD-MIX ASPHALT PAVING
32 13 13.06	05/20	PORTLAND CEMENT CONCRETE PAVEMENT FOR ROADS AND SITE FACILITIES
32 16 19	05/18	CONCRETE CURBS, GUTTERS AND SIDEWALKS
32 17 23.16	11/24	ROAD AND PARKING LOT PAVEMENT MARKINGS
32 31 13.53	11/21	HIGH-SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES
32 84 24	08/11, CHG 1: 05/17	TEMPORARY IRRIGATION SPRINKLER SYSTEMS
32 92 19	08/17, CHG 1: 08/21	SEEDING
32 93 00	08/17, CHG 1: 08/21	EXTERIOR PLANTS

DIVISION 33 - UTILITIES

33 11 00	02/18, CHG 1: 02/22	WATER UTILITY DISTRIBUTION PIPING
33 30 00	05/18	SANITARY SEWERAGE
33 40 00	11/21	STORMWATER UTILITIES
33 52 40	05/25	FUEL SYSTEMS PIPING (NON-HYDRANT)
33 56 10	05/25	FACTORY-FABRICATED FUEL STORAGE TANKS
33 71 02	08/21	UNDERGROUND ELECTRICAL DISTRIBUTION
33 82 00	04/06	TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

-- End of Project Table of Contents --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS
11/20, CHG 5: 02/25

PART 1 GENERAL

1.1 REFERENCES

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View Location Map

Progress and Completion Pictures

1.3 CONTRACTOR WORKFORCE HOUSING LOGISTICS AND MATERIAL MANAGEMENT REQUIREMENTS

a. For the purposes of this specification, the term, "temporary resident worker" means all workers except the following:

(1) Permanent residents of Guam

(2) Managers and supervisors (U.S. citizens or resident aliens)

b. For the purpose of this specification, the term, "worksites" means locations at Finegayan, Naval Base, and Andersen Air Force Base.

c. For the purpose of this specification, the term, "peak hours" for traffic means 6:30 a.m. to 8:30 a.m. and 3:30 p.m. to 6:00 p.m.

d. Workforce Housing Logistics and Material Management (WHL&MM) Plan: The WHL&MM Plan shall address the requirements for Medical, Housing, Food, Material Management, Safety & Security, and Transportation set forth in this specification section. Approval of the WHL&MM Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the WHL&MM Plan and operations as necessary. Maintain the WHL&MM Plan and submit any changes for Contracting Officer review.

1.3.1 Medical

Assure that staffing, personnel assignment and other human resources practices result in development and maintenance of a healthy Contractor and Subcontractor workforce employed in the performance of this contract in accordance with all statutes and regulations of the U.S Federal Government or the GovGuam in effect on the date of award of this contract or thereafter promulgated by the aforementioned governmental authorities. Perform health care activities in accordance with 10 G.C.A. §§ 84 - 96 - Guam Public Health Act, 25 G.A.R. § 6 - Guam Board of Nurse Examiners, 25 G.A.R. § 11 - Guam Board of Medical Examiners, 26 G.A.R. §§ 4401, et seq., Health Certificate Regulations, and 26 G.A.R. §§ 6200, et seq., Ambulance and Emergency Medical Technician.

1.3.1.1 Medical Quality Control Manager (MQCM)

Medical QC Manager qualifications:

A licensed physician from a state or territory in the U.S. with either an Internal Medicine or Family Practic background or credentials. Also have occupational health or public health experience. Submit a copy of the medical license to the Contracting Officer for approval.

1.4 VIEW LOCATION MAP

Submit, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.5 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Contracting Officer. Submit with the monthly invoice two sets of digital photographs, each set on a separate compact disc (CD) or data versatile disc (DVD), cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Also provide the view location sketch on the CD or DVD as a digital file. Include a date designator in file names. Photographs provided are for unrestricted use by the Government.

1.6 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 Liability, during the entire period of performance under this contract. Provide other insurance coverage as required by Guam law.

1.7 SUPERVISION

1.7.1 Superintendent Qualifications

Provide project superintendent with a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on

projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

1.7.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

1.7.3 Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend Red Zone meetings, partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

1.7.4 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time or excess costs or damages by the Contractor.

1.8 CYBERSECURITY OF CONTROL SYSTEMS

Discuss Cybersecurity of building control system requirements and submittals as required for Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.

1.9 CANTONMENT COORDINATION MEETINGS WITH OTHER PRIME CONTRACTORS

All Prime Contractors executing Government contract construction efforts within the Camp Blaz cantonment area will ensure that they have appropriate representation at coordination meetings facilitated by the Government every two weeks. Where the level of activity dictates, the Contracting Officer may adjust the frequency of the meeting.

1.10 PRECONSTRUCTION MEETING CONFERENCE

Immediately after award, prior to commencing any work at the site, coordinate with the Contracting Officer a time and place to meet for the Preconstruction Meeting. The meeting must take place within 35 calendar days after **notice to proceed**, but prior to commencement of any work at the

site. The purpose of this meeting is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, base-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, cybersecurity, prosecution of the work, government acceptance, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

1.10.1 Attendees

Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), Quality Control Manager and major subcontractors.

1.11 MONTHLY BIM COORDINATION MEETING

The Contractor shall participate in monthly coordination meetings with the Contracting Officer and other Government representatives, as applicable. The Contractor shall be responsible for preparing the agenda in coordination with the Contracting Officer, distributing the agenda, conducting the meeting, preparing the meeting minutes, distributing the minutes, and tracking action items. The Contractor's superintendent, project manager, and QC Manager shall attend each meeting. A "virtual walk through" of the model shall be performed demonstrating model development progress and likeness to the actual field conditions. Typical topics shall consist of, but be limited to, the following: review of the previous month's modeling efforts & progress; forecast of the following month's modeling efforts & progress; concerns, and/or issues.

1.12 FACILITY TURNOVER PLANNING MEETINGS (Red Zone Meetings)

Meet with the Government to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start planning the turnover process at the Pre-Construction Conference meeting with a discussion of the Red Zone process and convene at regularly scheduled Red Zone Meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

1.12.1 Red Zone Checklist

a. Contracting Officer's Technical Representative (COTR) will provide the Contractor a copy of the Red Zone Checklist template.

b. Prior to 75 percent completion, modify the Red Zone Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Red Zone Checklist to the Contracting Officer. The Contracting Officer may request additional activities be added to the Red Zone Checklist at any time as necessary.

1.12.2 Meetings

a. Conduct regular Red Zone Meetings beginning at approximately 75 percent project completion, or three to six months prior to Beneficial Occupancy Date (BOD), whichever comes first.

b. The Contracting Officer will establish the frequency of the meetings,

which is expected to increase as the project completion draws nearer. At the beginning, Red Zone meetings may be every two weeks then increase to weekly towards the final month of the project.

c. Using the Red Zone Checklist as a Plan of Action and Milestones (POAM) and basis for discussion, review upcoming critical activities and strategies to ensure work is completed on time.

d. During the Red Zone Meetings discuss with the COTR any upcoming activities that require Government involvement.

e. Maintain the Red Zone Checklist by documenting the actual completion dates as work is completed and update the Red Zone Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current Red Zone Checklist to attendees at each Red Zone Meeting.

1.13 WAIVER FOR WORKER'S COMPENSATION

In addition to FAR 52.228-4 Workers' Compensation and War-Hazard Insurance Overseas, the Secretary of Labor has granted a waiver. The waiver does not apply to employees who are hired in the United States, or who are residents, or citizens of the United States.

1.14 PARTNERING

To most effectively accomplish this Contract, the Contractor and Government must form a cohesive partnership with the common goal of drawing on the strength of each organization in an effort to achieve a successful project without safety mishaps, conforming to the Contract, within budget and on schedule. The partnering team must consist of personnel from both the Government and Contractor including project level and corporate level leadership positions. Key Personnel from the supported command, end user, NAVFAC, PWD, FEAD/ROICC, Contractor, key subcontractors and the Designer of Record (DOR) (regardless of whether the contract is a design-build or a design-bid-build) are required to participate in the Partnering process.

1.14.1 Facilitated (Formal) Partnering

a. Within **45** calendar days after **notice to proceed** and prior to the start of work, host a Formal Partnering session with key personnel from the project team including both Contractor and Government personnel. All costs associated with the Partnering session including the third-party independent Facilitator Consultant, meeting room and other incidental items are the responsibility of the Contractor.

b. Before the Facilitated (Formal) Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note pads, pens/pencils, colored flash cards) and have these items available at the Partnering session. Provide copies of any documents required for distribution to all attendees. Participants will bear their own costs for meals, lodging and transportation associated with Partnering.

c. The Initial Partnering Session must be a duration of one day and be held at a location off base as agreed to by the Contracting Officer. Partnering session may take place concurrently with the

Pre-Construction Post-Award Kickoff Meeting.

d. Facilitator must be experienced in conducting corporate Partnering sessions and must be a third-party independent facilitating consultant - not an employee of the Contractor. The Facilitator is responsible for leading all aspects of the Partnering session necessary to achieve the Partnering goal.

e. An outcome of the Partnering session must be an escalation matrix agreed upon by both the Government and Contractor, which identifies key Government and Contractor decision makers by name and anticipated decision durations.

f. Host follow-on Partnering Sessions at three- to six-month intervals or more frequently if needed and lasting generally a half day or less. Attendees need only be those required to resolve current issues. The same Facilitator used in the Initial Partnering session must lead the follow-on sessions unless an alternative is permitted by the Contractor Officer. All costs associated with follow-on Partnering sessions are the responsibility of the Contractor.

1.15 MOBILIZATION

Mobilize to the jobsite within 30 calendar days after GEPA NPDES Permit is obtained. Mobilize is defined as having equipment AND having a physical presence of at least one person from the contractor's team on the jobsite.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 45 00

QUALITY CONTROL
08/23, CHG 3: 08/25

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C1077	(2025a) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D3740	(2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E90	(2023) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E329	(2025a) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E543	(2021) Standard Specification for Agencies Performing Non-Destructive Testing

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the applicable Bid Pricing Schedule item.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G

SD-06 Test Reports

Verification Statement

SD-07 Certificates

Certificate Of Readiness; G

1.4 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that complies with FAR 52.246-12 Inspection of Construction. QC is comprised of plans, procedures, and organization necessary to produce an end product that complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and must be keyed to the proposed design and construction sequence. The Quality Control Manager, Superintendent, Site Safety and Health Officer (SSHO), and all on-site supervisors are responsible for the quality of work and are subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. The Quality Control Manager must maintain a physical presence at the work site at all times and is the primary individual responsible for all quality control.

1.5 QUALITY CONTROL (QC) PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. This QC program is a key element in meeting the objectives of the Commissioning Process (Cx). The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, completion inspections, QC certifications, independent Special Inspections in accordance with Section 01 45 35 SPECIAL INSPECTIONS, and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations that comply with the requirements of this Contract. The QC program must cover on-site and off-site work and be keyed to the work sequence. No construction work or testing may be performed unless the QC Manager is on the work site. The QC Manager must report to an officer of the firm and not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

1.5.1 Meetings

1.5.1.1 Quality Control Plan Meeting

Prior to submission of the QC Plan, the Contractor may request a meeting with the Contracting Officer to discuss the QC Plan requirements of this Contract.

The purpose of this meeting is to develop a mutual understanding of the QC Plan requirements prior to plan development and submission and to agree on the Contractor's list of Definable Feature of Work (DFOW).

1.5.1.2 Coordination and Mutual Understanding Meeting

After the Preconstruction Conference,Post Award Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor, the Architect/Engineer (A/E), and the Government. Provide a copy of the signed minutes to all attendees and incorporate into the relevant QC Plan. At a minimum the Coordination and Mutual Understanding Meeting must be repeated when a new QC Manager is appointed. There can be other occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

1.5.1.2.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, Cx in accordance with Section 01 91 00.15 BUILDING COMMISSIONING, environmental requirements and procedures, coordination of activities to be performed, Special Inspections, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor must explain in detail how three phases of control will be implemented for each DFOW, as well as how each DFOW will be affected by each management plan or requirement as listed below:

a. Waste Management Plan.

b. Procedures for noise and acoustics management.

c. Environmental Protection Plan.

d. Environmental regulatory requirements.

e. Cx Plan requirements in accordance with Section 01 91 00.15 BUILDING COMMISSIONING.

f. Special Inspections.

g. Indoor Air Quality (IAQ) Management Plan.

1.5.1.2.2 Coordination of Activities

Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Schedule construction operations with consideration for indoor air quality as specified in the IAQ Management Plan.Coordinate Special Inspections.

1.5.1.2.3 Attendees

As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, Alternate QC Manager, QC Specialists, Special Inspector of Record, Commissioning Provider (CxC), Environmental Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities must have a principal of the firm at the meeting.

1.5.1.3 Quality Control (QC) Meetings

After the start of construction, conduct weekly QC meetings led by the QC Manager at the work site with the Project Superintendent, the QC Specialists, the Special Inspector of Record, CxC, and the other personnel as necessary. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, accomplish the following at each meeting:

a. Review the minutes of the previous meeting.

b. Review the schedule and the status of work and deficiencies/rework. Review the most current approved schedule (in accordance with schedule specification) and the status of work and deficiencies/rework.

c. Review the status of submittals and Request For Information (RFIs).

d. Review the work to be accomplished in the next 3 weeks as defined by the schedule section paragraph WEEKLY LOOK AHEAD in Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS) and all quality control documentation required for that work.

e. Review Testing Plan and Log including status of tests performed since last QC Meeting.

f. Resolve QC and production problems. Discuss status of pending change orders.

g. Address items that may require revising the QC Plan.

h. Review Accident Prevention Plan (APP) and effectiveness of the safety program.

i. Review environmental requirements and procedures.

j. Review Environmental Management Plan.

k. Review Waste Management Plan.

l. Review the status of training completion.

m. Review Cx Plan and progress. Review Issues Log and resolution.

n. Review IAQ Management Plan.

1.5.2 Contractor Quality Control (CQC) Plan

Submit no later than 30 days after Contract Award, the CQC Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. Design and Construction will be permitted to begin only after acceptance of the CQC Plan and other Contract requirements Design work is not permitted to start prior to approval of a Design Quality Control Plan.

1.5.2.1 Content of Contractor Quality Control (CQC) Plan

Provide a CQC Plan, prior to start of construction that includes a table of contents, with major sections identified, pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing quality control during the construction of the project. The CQC Plan must at a minimum include the following sections:

a. A description of the quality control organization and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified.

b. An organizational chart showing the quality control organization with individual names and job titles and lines of authority up to an executive of the company at the home office.

c. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, (including position titles and durations for qualifying experiences) for each person in the QC organization. Include the Construction Quality Management (CQM) for Contractors course certifications for the QC personnel as required by the paragraph CONSTRUCTION QUALITY MANAGEMENT TRAINING.

d. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

e. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

f. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager, Design Quality Control Manager, CxC, and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work that is not in compliance with the Contract. Letters of direction are to be issued by the QC Manager to all other QC Specialists or quality control representatives outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.

g. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving, scheduling, and managing submittals, including those of subcontractors, designers of record, consultants, architect-engineers (AE), offsite fabricators, suppliers, and purchasing agents. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval. Provide the initial submittal of the Submittal Register as

specified in Section 01 33 00 SUBMITTAL PROCEDURES.

h. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraph ACCREDITATION REQUIREMENTS, as applicable.

i. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, associated feature of work required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

j. Procedures to complete design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected. This phase is performed prior to beginning work on each definable feature of work, after all required plans, documents, materials are approved, and after copies are at the work site.

k. Reporting procedures, including proposed reporting formats.

l. Procedures for submitting and reviewing design changes/variations prior to submission to the Contracting Officer.

m. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DFOW is identified by different trades or disciplines, or it is work by the same trade in a different environment. A DFOW is by definition any item or activity on the construction schedule, and the schedule specification provides direction regarding how the DFOWs are to be structured. Include in the list of DFOWs for all activities on the Construction Schedule. Provide separate DFOWs in the Network Analysis Schedule for each design development stage and submittal package. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. Identify the specification section number and schedule activity ID for each DFOW listed. The DFOW list will be reviewed in coordination with the construction schedule and agreed upon during the Coordination and Mutual Understanding Meeting.

n. PROCEDURES FOR PERFORMING AND TRACKING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each Definable Feature of Work (DFOW), a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.

o. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Special Inspections Project Manual. Where the applicable code issued by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspections Project Manual requirements in the QC Plan.

p. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and

documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.

q. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.

r. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications required for entities such as subcontractors, testing laboratories, suppliers, and personnel. The QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the Contract that the work is being performed.

1.5.3 Preliminary Construction Work Authorized Prior to Acceptance

The only construction work that is authorized to proceed prior to the acceptance of the QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying with specific prior approval of the Contracting Officer.

1.5.4 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel. Proposed changes are subject to acceptance by the Contracting Officer.

1.5.5 Special Inspections

Perform all required Special Inspections per Section 01 45 35 SPECIAL INSPECTIONS, the statement of Special Inspections and the Schedule of Special Inspections.

1.6 QUALITY CONTROL (QC) ORGANIZATION

1.6.1 Quality Control (QC) Manager

1.6.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this Contract. The QC Manager must attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control except for those phases of control designated to be performed by QC Specialists, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC Specialists, testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities. The QC manager is responsible for notifying the Special Inspector of activities which require their review. The QC manager is responsible for coordinating the Special Inspection activities, see paragraph CONTRACTOR'S QUALITY CONTROL (QC) MANAGER, in Section 01 45 35 SPECIAL INSPECTIONS. The QC manager is responsible for the quality control for Sound Rated perimeter construction.

1.6.1.2 Qualifications

The QC Manager must possess at least a Bachelor's degree in engineering, architecture, or construction management, with a current professional engineer registration and a minimum of 10 years construction experience as a Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction Contracts which included the major trades that are part of this Contract. The individual must have at least 2 years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification, safety compliance, and sustainability.

The QC Manager and all members of the QC organization must be capable of reading, writing, and conversing fluently in the English language.

1.6.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager Alternate QC Manager, Superintendent, QC Specialist, and DQCM must have completed the CQM for Contractors course. If the QC Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Systems Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

The Construction Quality Management Training certificate expires after 5 years. If the QC Manager's certificate has expired, retake the course to remain current.

1.6.2 Organizational Changes

Maintain the QC staff with personnel as required by the specification section at all times. When it is necessary to make changes to the QC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

1.6.3 Alternate Quality Control (QC) Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed 2 weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager must be the same as for the QC Manager.

1.6.4 Commissioning

Commissioning (Cx) is a systematic, quality-focused process for delivery of a project focusing on verifying and documenting all commissioned systems and assemblies are installed, tested, and operating as they were planned and designed to meet the project requirements. The Quality Control requirements outlined in this specification section are key in supporting the objectives of the Cx process, specifically coordinating testing, documenting, and verifying proper system operation. Properly executed the Quality Control support of Cx ensures timely execution of necessary tasks to deliver the fully commissioned and operating systems in coordination with the overall construction and project schedule.

Provide Cx in addition to the quality control requirements of this section and not as a substitute for quality control requirements. The QC Manager is responsible for carrying out the three phases of control while ensuring the functional performance and integrated systems tests are coordinated with the Cx provider as required for each system to be commissioned.

1.6.4.1 Certificate of Readiness

The QC Manager must issue a Certificate of Readiness for Government approval for each system to be commissioned. Schedule Functional Performance Tests for each system only after the Certificate of Readiness has been approved by the Government for the system. The Certificate of Readiness certifies that all required inspections have been completed and deficiencies that were identified through any prior review, inspection, or test activity have been corrected before the start of Functional Performance Tests. Refer to Cx requirements in Section 01 91 00.15 BUILDING COMMISSIONING for a list of systems to be commissioned and detailed requirements for the Cx provider.

1.6.5 Quality Control (QC) Specialists

Provide a separate QC Specialist at the work site for each of the areas as listed in the Matrix listed below, who must assist and report to the QC Manager and who may perform production related duties but must be allowed sufficient time to perform their assigned quality control duties. These individuals or specialized technical companies are employees of the Prime or subcontractor including Designer of Record (DOR). QC Specialists must be physically present at the work site with frequency as indicated in the Experience Matrix below, to participate in the QC Meetings, perform the three phases of control, including participation in Preparatory and Initial Phase meetings, and to perform and document Follow-up inspections as an extension of the QC Manager for each definable feature of work in their area of responsibility. QC Specialist must assist and be present for training events, and Critical System Acceptance inspections by the Government. Qualification, experience, Area of Responsibility, and frequency of QC surveillance are provided in Matrix listed herein.

Qualification/Experience In Area of Responsibility	Area of Responsibility	Frequency
CQC personnel shall be certified by ACI as a Concrete Construction Special Inspector.	Inspection of Cast-in-Place Concrete operations. See Section 03 30 00, 1.6.7.a.	Continuous.
Exterior Finish System Exterior Finish System Inspector with 3-year minimum manufacturer's inspection experience.	Inspection of EFS installation.	As specified in Section 07 24 00 EXTERIOR FINISH SYSTEMS.

Qualification/Experience In Area of Responsibility	Area of Responsibility	Frequency
Fireproofing Manufacturer's Technical Representative with 5-year minimum in responsible position comparable to that required by this Project and pre-qualified by manufacturers of fireproofing and firesafing products.	Inspection of Fireproofing and Firesafing systems as per Division 07 Thermal and Moisture Protection.	sections of specifications Division 07 Thermal and Moisture Protection: Periodic Inspections to confirm substrate preparation and installations, and as required by IBC 1704.11.
Elevator Specialist and Elevator Inspector with qualifications as required by Section 14 24 23 HYDRAULIC ELEVATORS.	Field Quality Control for Hydraulic Passenger Elevators as per Section 14 24 23.	As specified intechnical sections of specifications Division 14 Conveying Equipment: Inspections required during progress of work as specified in Section 14 24 23.
U.S. Registered P.E., Fire Protection.	See requirements in 1.5.7.	See requirements in 1.5.7.
Registered Mechanical Engineer with 5-year minimum in responsible position comparable to that required for this Project.	Inspection of items in Division 23 Heating, Ventilating, and Air Conditioning.	As specified in technical sections of specifications Division 23 Heating, Ventilating, and Air Conditioning: Periodic inspections required during progress of work.
Registered Electrical Engineer with 5-year minimum in responsible position comparable to that required for this Project.	Inspection of items in Division 26 Electrical.	As specified in technical sections of specifications Division 26 Electrical: Periodic inspections when specified equipment is being installed.
U.S. Licensed Electrical Engineer (PE) with 5 years minimum experience in electrical engineering	Electrical installation of lightning protection and grounding system, primary (medium voltage) electrical system, uninterruptible power supply (UPS) system, and emergency back-up generator system.	Minimum 3 times a week during installation and full time during testing.
Electrical Inspector, International Conference of Building Officials (ICBO)/ 5 years minimum.	Building electrical systems and all other electrical systems not listed above for Licensed Electrical Engineer (PE).	Minimum 1 time a week during installation and full-time during testing.

Qualification/Experience In Area of Responsibility	Area of Responsibility	Frequency
BICSI Registered Communications Distribution Designer (RCDD) with a minimum of 5 years design experience with telecom infrastructure, pathways, spaces, and supporting utilities similar to those in the PRC design.	Telecom pathways spaces, infrastructure, and connectivity components. Inspection and documentation of all telecom-related components, including Divisions 23, 26, 27, 28, and 33.	Daily inspections while telecom-related (directly or indirectly) work is being performed on site.
Registered Landscape Architect with 5-year minimum in responsible position comparable to that required for this Project.	Landscape, Irrigation, Grassing, Maintenance and Hardscape Construction.	As specified in technical sections of Division 12 Furnishings; Division 32 Exterior Improvements.
Roofing Manufacturer's Technical Representative with 5-year minimum experience in responsible position comparable to that required for this project.	**Inspection of installation and testing of substrate and fluid-applied roofing system, inspection and completion of information card, completion of Construction Contract Roofing Signature Checklist. See Section 07 56 00 Fluid-Applied Roofing System.**	**As specified in Section 07 56 00, but at a minimum to include periodic inspections necessary to confirm substrate preparation, installation, inspection, and testing.**

1.6.5.1 Fire Protection QC Specialist (FPQC)

Provide a Fire Protection Quality Control Specialist (FPQC) within the QC organization to perform quality control related activities as specified herein on fire protection and life safety systems installed under this Contract.

1.6.5.1.1 Qualifications

The FPQC must have the following qualifications:

a. Be a registered Professional Engineer (P.E.) licensed by a Licensing Board in the United States, the District of Columbia, Guam or Puerto Rico, having passed the National Council of Examiners for Engineering and Surveying (NCEES) examination specifically in the discipline of Fire Protection Engineering.

b. Have a minimum of 5 years of Fire Protection Engineering experience on projects of similar relevance and complexity to the fire protection work specified under this Contract.

c. Other than the contractual obligations with the Prime Contractor, the FPQC must have no other business relationship (i.e., employee, owner, partner, operating officer, distributor, salesman, technical representative, family relationship, or financial investment) with the

Prime Contractor or subcontractors.

d. Be employed by an independent engineering firm or company or be the Fire Protection Engineer on the Prime Contractor's Design-Build team. The firm may identify multiple, to a maximum of five, licensed Fire Protection Engineers for the performance of the duties under this Contract but must submit the names and qualifications for Government approval for all individuals identified prior to them performing any work under this Contract. These individuals may not be substituted without prior approval from the Contracting Officer.

1.6.5.1.2 Responsibilities

FPQC duties and responsibilities:

a. Assist in the development of the QC Plan including the Testing Plan and Log and executing the three phases of control for work involving the installation and testing of fire protection and life safety systems as an extension of the QC Manager.

b. Participate in project QC Meetings. Participate in Preparatory and Initial Phase meetings and perform and Follow-up inspections for work involving the installation and testing of fire protection and life safety systems.

c. Combine and submit shop drawings (SD-02), product data (SD-03) and Calculations SD-05) in one complete section submittal package.

(1) Review and approve all section submittal packages pertaining to fire protection and life safety systems for completeness and accuracy prior to submission to the Government for surveillance. These include all Division 21 section specifications and specification 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE.

(2) Review and approve all section submittal packages pertaining to fire protection and life safety systems for completeness and accuracy prior to submission to the Government for surveillance. These include all Division 21 section specifications and specification 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM, ADDRESSABLE.

(3) Review section 07 84 00 FIRESTOPPING for compliance with contract requirements.

(4) Review section 10 44 16 FIRE EXTINGUISHERS for compliance with contract requirements.

d. The Government reserves the right to reject any submittal or construction that is not in compliance to Contract. Government reviews do not relieve the Contractor responsibility for providing adequate quality control measures and do not constitute or imply acceptance of Contract variation.

e. Perform construction surveillance in accordance with the Schedule of Fire Protection System Inspections. Construction surveillance includes but is not limited to performing periodic on-site inspections during construction at specified milestones, performing a pre-final inspection of installed systems and witnessing functional testing; and

participating and documenting in an on-site final acceptance inspection of fire protection and life safety systems with the Government FPE.

f. Document inspection results on a FPQC report prepared each day inspections are performed. The report must include a description of the visual inspection or observation performed, a written summary of findings, a conclusion on compliance with the Contract documents, and signature of the FPQC Specialist. In person inspection must be documented via video (.mp4) or photo (.jpeg) or both. Video/photographic documentation must include before and after conditions and physical measurements. Forward the FPQC daily report to the QC Manager who must include the report with the submission of their daily QC Report to the Government each day. Every site visit by the FPQC must be documented on a FPQC daily report.

1.6.5.1.3 Schedule of Fire Protection System Inspections

A schedule, prepared by the Fire Protection DOR, which lists each of the required visual inspections and observations required by the FPQC. The schedule is included at the end of this UFGS section.

1.6.5.2 Quality Control (QC) for Sound Rated Perimeter Construction

1.6.5.2.1 Periodic (Follow-Up Phase) Inspections

Once construction begins, perform periodic inspections of Sound Rated Area identified in the Contract drawings at least once every 2 weeks. Increase frequency to weekly inspections within 30 days of planned acceptance testing. Inspections must verify that construction and materials comply with the Contract documents, the description of the assembly in the ASTM E90 Factory Report for acoustical testing, and the approved submittals. Focus inspections on the construction of the sound rated assemblies, perimeter penetrations, perimeter doors, electronic security system, man-bar installation, and inspection ports. Document periodic inspections in Daily QC Reports.

1.6.5.2.2 Preliminary Inspection

The Government and QC Manager will perform a joint preliminary inspection of th Sound Rated Area after construction of the assembly is complete to verify compliance with the design requirements and other Contract documents. The Contracting Officer will participate in the preliminary inspection. Provide the Contracting Officer a minimum 14 calendar days notification in advance of the preliminary inspection.

As a result of the preliminary inspection, prepare a Sound Rated Area punch list with deficiencies identified. Include with the punch list the estimated date by which the deficiencies will be corrected. Document the preliminary inspection in the Daily QC Report and attach the punch list. Notify the Contacting Officer when deficiencies are corrected. Deficiencies from the Preliminary Inspection must be corrected prior to scheduling the Final Acceptance Inspection.

1.6.5.2.3 Acceptance Testing for Sound Attenuation

Perform acceptance testing for sound transmission loss of sound rated door assemblies as required in Section 08 34 73 SOUND CONTROL DOOR ASSEMBLIES and Section 09 29 00 GYPSUM BOARD for sound rated assemblies. Acceptance

testing must be performed during the preliminary inspection. The Contracting Officer must witness acceptance testing. Deficiencies identified during acceptance testing must be included in the Sound Rated Area punch list and corrected prior to the final acceptance inspection.

1.6.5.2.4 Final Inspection

Perform a final inspection of the Sound Rated Area after required testing has been successfully completed as part of the preliminary inspection and all punch list items corrected. Testing is not permitted during the final inspection. QC Manager and Superintendent must attend the final inspection and Government attendees will include the Contracting Officer. Request a final inspection by the Contracting Officer a minimum of 14 calendar days in advance.

1.6.6 Special Inspector of Record

The Special Inspector of Record (SIOR) must be an independent third party hired directly by the Prime Contractor. The SIOR must not be a company employee of the Contractor or any subcontractor performing the work to be inspected. The qualifications of the SIOR are defined in Section 01 45 35 SPECIAL INSPECTION.

1.6.7 Submittal Reviewers Duties and Qualifications

Provide Submittal Reviewers, other than the QC Manager or CxC, qualified in the disciplines being reviewed, to review and certify that the submittals meet the requirements of this Contract prior to certification or approval by the QC Manager. Fire protection and life safety submittals must be reviewed and approved by the FPQC as indicated in paragraph "Fire Protection QC Specialist (FPQC)" in this section.

Each submittal must be reviewed by a registered architect or professional engineer.

Each of the following submittals must be reviewed by individuals meeting the qualifications/experience specified below:

Qualification / Experience in Submittal Discipline	Submittals to be reviewed:	
	Section No	Submittal
U. S. Registered P.E., Fire Protection	07 84 00 Firestopping; 10 44 16 Fire Extinguisher; All Division 21 Specs; Division 28 Specs for fire alarm and fire alarm mass notification systems	All, except as noted otherwise

Qualification / Experience in Submittal Discipline	Submittals to be reviewed:	
	Section No	Submittal
Registered Mechanical Engineer with 5 years minimum experience in responsible position comparable to that required for this Project.	All Division 23 Specs	All, except as noted otherwise
Registered Electrical Engineer with 5 years minimum experience in responsible position comparable to that required for this Project.	26 05 48 26 08 00 26 12 19.10 26 20 00 26 24 13 26 27 14.00 20 26 28 01.00 10 26 32 15 26 36 23 26 41 00 26 51 00 26 56 00 33 71 02	Refer to each section for specific designated submittals, including: SD-02 Shop Drawings SD-03 Product Data SD-05 Design Data SD-06 Test Reports SD-07 Certificates SD-09 Manufacturer's Field Reports SD-10 Operation and Maintenance Data SD-11 Closeout Submittals As noted by Spec Section.
Certified Telecom (RCDD) Engineer with 5 years minimum experience in responsible position comparable to that required for this Project.	27 10 00 33 82 00	Refer to each section for specific designated submittals, including: SD-02 Shop Drawings SD-03 Product Data SD-06 Test Reports SD-07 Certificates SD-09 Manufacturer's Field Reports SD-10 Operation and Maintenance Data SD-11 Closeout Submittals As noted by Spec Section.
Registered Civil Engineer with 5 years minimum experience in responsible position comparable to that required for this Project.	31 00 00 31 62 00 32 12 13 32 13 13.06 32 17 23 33 11 00 33 30 00 33 40 00	Refer to each section for specific designated submittals, including: SD-01 Preconstruction Submittals SD-02 Shop Drawings SD-03 Product Data SD-04 Samples SD-05 Design Data SD-06 Test Reports SD-07 Certificates As noted by Spec Section.

Qualification / Experience in Submittal Discipline	Submittals to be reviewed:	
	Section No	Submittal
Registered Structural Engineer with 5 years minimum experience in responsible position comparable to that required for this project	03 30 00 03 42 13.00 10 04 20 00	All submittals in referenced sections
Registered Landscape Architect with 5 years minimum experience in responsible position comparable to that required for this Project.	12 93 00 32 05 33 32 84 24 32 92 19 32 93 00	All, except as noted otherwise.

1.6.7.1 CQC Geotechnical Specialist

Qualification/Experience in Area of Responsibility	Area of Responsibility	Frequency
Civil Engineer or Geotechnical Engineer licensed and registered in the United States of America with at least 10 years of licensed and registered experience, of which at least 8 years will be in responsible charge in geotechnical engineering practice in karst geology and limestone and coralline deposits. Responsible charge is defined as being in direct control or having personal supervision of geotechnical engineering work.	1. Proof Rolling: Section 31 00 00 EARTHWORK. 2. Foundation Probing & Grouting: Section 31 00 00 EARTHWORK. 3. Earthwork, excavation, filling and backfilling; subgrade preparation; pavement construction; and utility installation: Section 31 00 00 EARTHWORK. 4. Field Validation Program, Installation and Verification Testing of Cement Deep Soil Mixing: Section 31 62 00 CEMENT DEEP SOIL MIXING.	1. Minimum one (1) site visit during proof rolling work. 2. Minimum one (1) site visit during foundation probing and grouting work. 3. Minimum of five (5) periodic site visits during earthwork, excavation, filling and backfilling; subgrade preparation; pavement construction; and utility installation. 4. See Section 31 62 00 CEMENT DEEP SOIL MIXING

The CQC Geotechnical Specialist must be in responsible charge of the Geotechnical Field Representative described below in Paragraph 1.5.5.1 Geotechnical Field Representative. The CQC Geotechnical Specialist is responsible for ensuring all earthwork-related work, including temporary construction slopes, permanent cut or fill slopes, excavations, filling and backfilling, foundation probing and grouting, subgrade preparation and

verification, and pavement construction are performed in accordance with approved work plans and project contract documents. The CQC Geotechnical Specialist is also responsible to certify inspections and test results for subgrades, compaction of fill and backfill and field density quality control testing. These certifications must state that the inspections, tests, and observations were performed by or under the direct supervision of the CQC Geotechnical Specialist and/or the Geotechnical Field Representative, and that the inspections and test results are representative of the materials or conditions being certified by the tests.

1.6.7.1.1 Geotechnical Field Representative

Qualification/Experience in Area of Responsibility	Area of Responsibility	Frequency
University Degree in Civil Engineering with two (2) years of similar earthwork & soil testing experience, University Degree in Geology with two (2) years of similar earthwork & soil testing experience or four (4) years of similar earthwork & soil testing experience; or Meets the requirements of Special Inspector or Associate Special Inspector in Section 01 45 35, Paragraph Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements.	1. Proof Rolling: Section 31 00 00 EARTHWORK 2. Foundation Probing & Grouting: Section 31 00 00 EARTHWORKL 3. Earthwork, excavation, filling and backfilling; subgrade preparation; pavement construction; and utility installation: Section 31 00 00 EARTHWORK.	1. Full-time 2. Full-time 3. Minimum once a week.

The Geotechnical Field Representative is the onsite representative under the direct supervision of the CQC Geotechnical Specialist.

Submit Geotechnical Field Representative qualification and experience in a resume format for review and approval by the Contracting Officer or their representative.

1.7 SUBMITTAL AND DELIVERABLES REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES. Procedures must include field verification of relevant dimensions and component characteristics by the QC organization prior to submittal being sent to the Contracting Officer. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the Contract. When Section 01 91 00.15 BUILDING COMMISSIONING are included in the Contract, the submittals required by those sections have to be coordinated with Section 01 33 00 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

1.8 THREE PHASES OF CONTROL

CQC enables the Contractor to ensure that the construction, including that of subcontractors and suppliers, complies with the requirements of the Contract. At least three phases of control must be conducted by the QC Manager to adequately cover both on-site and off-site work for each definable feature of the construction work as follows:

1.8.1 Preparatory Phase

Document the results of the preparatory phase actions by separate minutes prepared by the QC Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required to meet Contract specifications.

Notify the Contracting Officer at least 2 business days in advance of each preparatory phase meeting. The meeting will be conducted by the QC Manager and attended by the QC Specialists, the Project Superintendent, the CxC, the Special Inspector of Record, and the foreman responsible for the DFOW. When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman must attend the preparatory phase meeting. This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections, reference codes, and standards. Make available during the prepatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review the Contract drawings.

c. Verify that field measurements are as indicated on construction or shop drawings or both before confirming product orders, to minimize waste due to excessive materials.

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing.

f. Examine the work area to ensure that the required preliminary work has been completed and complies with the Contract and ensure any deficiencies/rework items in the preliminary work have been corrected and confirmed by the Contracting Officer.

g. Review coordination of product/material delivery to designated prepared areas to execute the work.

h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data and are properly stored.

i. Check to assure that all materials and equipment have been tested,

submitted, and approved.

j. Discuss specific controls to be used, construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW. Ensure any portion of the plan requiring separate Contracting Officer acceptance has been approved.

k. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Safety Data Sheets (SDS) are submitted.

l. Review the Cx requirements in accordance with Section 01 91 00.15 BUILDING COMMISSIONING and ensure all preliminary work items have been completed and documented.

m. Review Special Inspections required by Section 01 45 35 SPECIAL INSPECTION, the Statement of Special Inspections and the Schedule of Special Inspections.

1.8.2 Initial Phase

Notify the Contracting Officer at least 2 business days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the QC Specialists, the Project Superintendent, the Special Inspector of Record, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site when acceptable levels of specified quality are not being met. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases. Perform the following for each DFOW:

a. Check work to ensure that it is in full compliance with Contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full Contract compliance. Verify required control inspection and testing comply with the Contract.

c. Establish level of workmanship and verify that it meets the minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve any workmanship issues.

e. Ensure that testing is performed by the approved laboratory.

f. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

g. Review project specific work plans (i.e., Cx, HAZMAT Abatement, Stormwater Management) to ensure all preparatory work items have been completed and documented.

h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

1.8.3 Follow-Up Phase

Perform the following for on-going DFOW daily, or more frequently as necessary, until the completion of each DFOW. The Final Follow-Up for any DFOW will clearly note in the daily report the DFOW is completed, and all deficiencies/rework items have been completed in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST. Each DFOW that has completed the Initial Phase and has not completed the Final Follow-up must be included on each daily report. If no work was performed on that DFOW for the period of that daily report, it must be so noted. Document all Follow-Up activities for DFOWs in the daily CQC Report:

a. Ensure the work including control testing complies with Contract requirements until completion of that particular work feature. Record checks in the CQC documentation.

b. Maintain the quality of workmanship required.

c. Ensure that testing is performed by the approved laboratory.

d. Ensure that deficiencies/rework items are being corrected. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work.

e. Do not build upon nor conceal non-conforming work.

f. Assure manufacturers' representatives have performed necessary inspections if required and perform safety inspections.

g. Review the Cx requirements in accordance with Section 01 91 00.15 BUILDING COMMISSIONING.

h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

1.8.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW has not started within 45 days of the initial preparatory meeting or has resumed after 45 days of inactivity, or if other problems develop.

1.8.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least 2 weeks prior to the start of the preparatory and initial phases.

1.8.6 Deficiency/Rework Items List

The QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be corrected, the activity ID number associated with the item, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected.

The QC Manager reviews the list at each weekly QC Meeting:

a. There is no requirement to report a deficiency/rework item that is corrected the same day it is discovered.

b. No successor task may be advanced beyond the preparatory phase meeting until all deficiencies/rework items have been cleared by the QC Manager and concurred with by the Contracting Officer. This must be confirmed as part of the Preparatory Phase activities.

c. Attach a copy of the "Deficiency/Rework Items List" to the last daily CQC Report of each month.

d. The Contractor is responsible for including those items identified by the Contracting Officer.

e. All deficiencies/rework items must be confirmed as corrected by the QC Manager, and concurred by the Contracting Officer, prior to commencement of any completion inspections per paragraph COMPLETION INSPECTIONS unless specifically exempted by the Contracting Officer.

1.9 TESTING

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to Contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance tests when specified. Procure the services of an U.S. Army Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site or within Guam. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with Contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all test documentation requirements, have been prepared.

e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting

Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

1.9.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and must submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (ASTM E329, ASTM C1077, ASTM D3666, ASTM D3740, ASTM E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing must meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.9.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at https://www.nist.gov/nvlap, the American Association of State Highway and Transportation Officials (AASHTO) Accreditation Program at http://www.aashtoresource.org/aap/overview, International Accreditation Services, Inc. (IAS) at https://www.iasonline.org/, U.S. Army Corps of Engineers Materials Testing Center (MTC) at https://www.erdc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/476661/materials-testing-center/, the American Association for Laboratory Accreditation (A2LA) program at https://a2la.org/, the Washington Association of Building Officials (WABO) at https://www.wabo.org/ (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) at https://www.wacel.org/lab-accreditation-and-inspection-agency-audit-programs/laboratory-accreditation-program/(Approval authority by WACEL is limited to projects within Facilities Engineering Command (FEC) Washington geographical area).

1.9.3 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract. Laboratories utilized for testing soils, concrete, asphalt, and steel must meet criteria detailed in ASTM D3740 and ASTM E329.

1.9.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results must be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month, in accordance with paragraph DOCUMENTATION

AND INFORMATION FOR THE CONTRACTING OFFICER.

1.9.5 Test Reports and Monthly Summary Report of Tests

Furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily CQC Report of each month. Provide a copy of the signed test reports and certifications to the Operation and Maintenance Support Information (OMSI) preparer for inclusion into the OMSI documentation, in accordance with Sections 01 78 23 OPERATION AND MAINTENANCE DATA and 01 78 24.00 20 FACILITY DATA WORKBOOK (FDW).

1.10 COMPLETION INSPECTIONS

1.10.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager must conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications, and Contract. Include in the punch list any remaining items on the "Deficiency/Rework Items List", that were not corrected prior to the Punch-Out Inspection as approved by the Contracting Officer in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST. Include within the punch list the estimated date by which the deficiencies will be corrected. Provide a copy of the punch list to the Contracting Officer.

The QC Manager, or staff, must make follow-on inspections to ascertain that all deficiencies have been corrected. All punch list items must be confirmed as corrected by the QC Manager and concurred by the Contracting Officer. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.10.2 Pre-Final Inspection

The Government and QC Manager will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-Final Punch List" will be documented by the QC Manager as a result of this inspection. The QC Manager will ensure that all items on this list are corrected and concurred by the Contracting Officer prior to notifying the Government that a "Final" inspection with the Client can be scheduled. All items noted on the "Pre-Final" inspection must be corrected and concurred by the Contracting Officer in a timely manner and be accomplished before the Contract completion date for the work, or any increment thereof, if the project is divided into increments by separate completion dates unless exceptions are directed by the Contracting Officer.

1.10.3 Final Acceptance Inspection

Notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. State within the notice that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor must be represented by the QC Manager, the Project Superintendent, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other Government QA personnel, and personnel

representing the Client. Failure of the Contractor to have all Contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction."

1.11 QUALITY CONTROL (QC) CERTIFICATIONS

1.11.1 Contractor Quality Control (CQC) Report Certification

Contain the following statement within the CQC Report: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used, and work performed during this reporting period is in compliance with the Contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.11.2 Completion Certification

Upon completion of work under this Contract, the QC Manager must furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract." Provide a copy of this final QC Certification for completion to the preparer of the Operation & Maintenance (O&M) documentation.

1.11.3 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current, coordinated and attesting that the work for which payment is requested, including stored material, complies with Contract requirements.

1.12 DOCUMENTATION AND INFORMATION FOR THE CONTRACTING OFFICER

1.12.1 Construction Documentation

Prepare a Construction Production Report and a Contractor Quality Control Report for each day that work is performed. Attach the Construction Production Report to the Contractor Quality Control Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities.
Account for each calendar day throughout the life of the Contract.

The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The reporting of work must be identified by terminology consistent with the construction schedule. In the "Remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, and meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.12.2 Building Information Management (BIM)

As part of the contractor quality control, the Contractor shall model the Battle Staff Training Facility and Generator Building/Fuel Yard (Option Item #2), to include equipment, piping systems, under slab conduits, exhaust stacks, radiators, load bank, ballistic wall, etc. using a 3-dimensional modeling software such as Autodesk Revit. The software shall be capable of generating 3D and 2D views and performing clash detection of modeled elements. Submit the modeling software to be used with the Contractor Quality Control (CQC) Plan specified above in this section. Note that the design model utilizes Autodesk Revit.

The 3-dimensional model shall be used to verify, prior to construction placement that elements being constructed are coordinated spatially and that adequate space is provided for equipment, equipment access, structural steel, seismic bracing, and other elements. A "virtual walkthrough" of the model shall be performed at the monthly coordination meetings specified in 01 30 00 ADMINISTRATIVE REQUIREMENTS demonstrating model development progress and likeness to the actual field conditions. Utilities modeled to or from the said elements shall extend to the first contract interface point (such as manhole, etc.). Model shall meet the requirements stated in the USACE Minimum Modeling Matrix (M3 version 1.3) for RECORD MODEL except as indicated below. This content can be accessed through the CAD/BIM Technology Center website, https://cadbimcenter.erdc.dren.mil/**.**

a. M3 Categories Not Required to be Modeled:

(1) Category

(2) Substructure Related Activities

(3) Interior Specialties

(4) Interior Finishes

(5) Water and Gas Mitigation

(6) Exterior Windows

(7) Interior Windows

(8) Stair Finishes

(9) Ceiling Finishes

(10) Vertical Conveying Systems

(11) Horizontal Conveying Systems

(12) Operable Access Systems

(13) Facility Grounding

(14) Residential Equipment

(15) Entertainment and Recreational Equipment

(16) Furnishings

(17) Demolition

(18) Site Improvements

b. Additions to M3 Categories Required to be Modeled with M3 Level of Detail (LOD) of 300 and Grade of (A+):

(1) Category

(2) Electrical Service

(3) Power Distribution/Branch Wiring/Lighting Wiring for conduits 1.5 inches and larger above grade/finished floor

(4) Power Distribution/Branch Wiring/Lighting Wiring for all conduits 1 inch and larger below finished floor in CLSM

(5) Seismic Bracing for All Equipment and Distribution Systems

(6) Integrated Automation and Controls

(7) Communication System Panels and Racks and Tray

(8) Structural Gusset Plates

(9) Conduits Running Underneath Slab

1.12.2.1 Submission Requirements

Submit the following items monthly:

1.12.2.1.1 Data DVD's

Provide two sets of data DVD's containing the current BIM model native files in the format of the modeling software and a narrative report. Label each DVD with the full contract number, data and file name. Each submittal must have a unique file name and project specific data.

1.12.2.1.2 Narrative Report

Provide a Narrative Report with each BIM model submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the model output and the plan to compensate for any problems, either current or potential, which are revealed through the analysis. Include the following information as a minimum in the narrative report:

a. Identify and discuss the modeling effort scheduled to start in the next update period.

b. A description of current anticipated problem areas, or delaying factors, their impact, and an explanation of corrective actions taken.

1.12.3 Quality Control Activities

CQC and Contractor Production reports will be prepared daily to maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the

work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. The name and area of responsibility of the Contractors and any subcontractors.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When a Network Analysis Schedule (NAS) is used, identify each item of work performed each day by NAS activity number.

d. Control phase activities performed. Preparatory, and Initial phase Checklists associated with the DFOW referenced to the construction schedule. Follow-up phase activities identified to the DFOW. If testing or specific QC Specialist activities are associated with the Follow-up phase activities for a specific DFOW note this and include those reports.

e. Test and control activities performed with results and references to specifications and drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST.

f. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications and drawings requirements.

g. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.

h. Offsite surveillance activities, including actions taken.

i. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

j. Instructions given/received and conflicts in plans and specifications.

1.12.4 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract.

Furnish the original and one copy of these records in report form to the Government by 10:00 AM the next working day after the date covered by the report. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the Contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the QC Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the QC Manager Report.

1.12.5 Reports from the Quality Control (QC) Specialist(s)

Document inspection results on a QC specialist report prepared each day work is performed in their area of responsibility. The report must include a description of the visual inspection or observation performed, a written summary of findings, a conclusion on compliance with the Contract documents, and signature of the QC Specialist. In person inspections must be documented with Video/photographs. Video/photographic documentation of deficiencies must include before and after conditions and physical measurements, as necessary. Forward the QC daily report to the QC Manager who must include the report with the submission of their daily QC Report to the Government each day. Every site visit by the QC Specialist must be documented on a QC Specialist daily report.

1.12.6 Quality Control Validation

Establish and maintain the following in an electronic folder. Divide folder into a series of tabbed sections as shown below. Ensure folder is updated at each required progress meeting.

a. CQC Meeting minutes in accordance with paragraph QUALITY CONTROL (QC) MEETINGS.

b. All completed Preparatory and Initial Phase Checklists, arranged by specification section, further sorted by DFOW referenced to the construction schedule. Submit each individual Phase Checklist the day the phase event occurs as part of the CQC daily report.

c. All milestone inspections, arranged by Activity Number referenced to the construction schedule.

d. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section referenced to the DFOW to which individual reports results are associated. Individual field test reports will be submitted within 2 working days after the test is performed in accordance with the paragraph QUALITY CONTROL ACTIVITIES.
Monthly Summary Report of Tests: Submit the report as an electronic attachment to the CQC Report at the end of each month.

e. Copies of all Contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

f. An up-to-date copy of the paragraph DEFICIENCY/REWORK ITEMS LIST.

g. Cx documentation in accordance with Section 01 91 00.15 BUILDING COMMISSIONING.

h. Special Inspection reports.

i. Upon commencement of Completion Inspections of the entire project or any defined portion, maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and subcontractors and all punch lists issued by the Government in accordance with the paragraph COMPLETION INSPECTIONS.

1.12.7 Testing Plan and Log

As tests are performed, the CxC and the QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month. Provide a copy of the final "Testing Plan and Log" to the preparer of the Operation & Maintenance (O&M) documentation.

1.12.8 As-Built Drawings

The QC Manager must ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The as-built drawings document commences with the QC Manager ensuring all amendments, or changes to the Contract prior to Contract award are accurately noted in the initial document set creating the accurate baseline of the Contract prior to any work starting. Ensure each deviation has been identified with the appropriate modifying documentation (e.g., PC No., Modification No., Request for Information No.). The QC Manager or QC Specialist assigned to an area of responsibility must initial each revision. Upon completion of work, the QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.13 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the Contract. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, is deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of a claim for extension of time for excess costs or damages by the Contractor.

1.14 DELIVERY, STORAGE, AND HANDLING

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

TEST REQUIREMENTS LIST

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This report lists all the test requirements cited in the text.

HINT: With this file opened as a report from the SI Processed Files folder, double-clicking a Section number will open the Section in the Editor.
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SECTION: 01 14 00 **SUBPART:** 1.6.1

Submit for approval, at least 21 days prior to the desired date of entry, an original alphabetical list of personnel who require entry into Government property to perform work on the project.

SECTION: 01 91 19 **SUBPART:** 3.5.4.1

The test envelope is the architectural air barrier boundary as defined on the Contract drawings. This boundary includes connecting walls, roof and floor which comprise a complete, whole, and continuous three-dimensional envelope. Perform both a positive pressure test and a negative pressure test on this envelope

SECTION: 01 91 19 **SUBPART:** 3.5.4.2

Perform both a positive pressure test and a negative pressure test on this envelope

SECTION: 02 41 00 **SUBPART:** 1.3

Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

SECTION: 03 30 00 **SUBPART:** 3.13.2

Collect samples of fresh concrete to perform tests specified.

SECTION: 03 30 00 **SUBPART:** 3.13.3.1

Take concrete samples during concrete placement/discharge.

SECTION: 03 30 00 **SUBPART:** 3.13.3.2

Test the concrete delivered and the concrete in the forms

SECTION: 03 30 00 **SUBPART:** 3.13.3.3

ASTM C39/C39M. Make six

SECTION: 03 30 00 **SUBPART:** 3.13.3.4

Determine unit weight of lightweight and normal weight concrete.

SECTION: 03 30 00 **SUBPART:** 3.13.3.5

Determine water soluble ion concentration in accordance with

ASTM C1218/C1218M.

SECTION: 03 30 00 **SUBPART:** 3.13.3.8

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C42/C42M, and as follows:

a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

b. Test cores after moisture conditioning in accordance with ASTM C42/C42M if concrete they represent is more than superficially wet under service.

c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

d. Strength of cores from each member or area are considered satisfactory if their average compressive strength is equal to or greater than 85 percent of the design compressive strength, and if no single core strength is less than 75 percent of the design compressive strength. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted only when approved by the Contracting Officer.

SECTION: 05 05 20 **SUBPART:** 3.3.1

For mechanical anchors whose strength is dependent on a minimum installation torque, the installer under the supervision of the Special Inspector must torque test the anchors with a calibrated torque wrench.

SECTION: 05 05 20 **SUBPART:** 3.3.1

For mechanical anchors whose strength is not dependent on a minimum installation torque, the Special Inspector must perform proof loading on the first three anchors of each type and size, for each installer and a minimum of 5 percent of randomly selected anchors.

SECTION: 05 05 20 **SUBPART:** 3.3.2

The Special Inspector must perform proof loading on the first three anchors of each type and size, for each installer, and a minimum of 5 percent of randomly selected anchors.

SECTION: 05 30 00 **SUBPART:** 3.2.4

inspect installed decking

SECTION: 05 50 13 **SUBPART:** 3.5

Perform welding, welding inspection, and corrective welding in accordance with AWS D1.1/D1.1M.

SECTION: 05 51 33 **SUBPART:** 3.4

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M.

SECTION: 05 52 00 **SUBPART:** 1.4.1

welding inspections testing

SECTION: 05 52 00 **SUBPART:** 1.4.2

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test.

SECTION: 07 13 53 **SUBPART:** 3.1

Notify the Contracting Officer of defects or conditions anticipated to prevent a satisfactory application.

SECTION: 07 13 53 **SUBPART:** 3.6

SECTION: 07 13 53 **SUBPART:** 3.7

After installation has been inspected and approved by the Contracting Officer, apply a protective covering to the membrane waterproofing prior to backfilling.

SECTION: 08 33 23 **SUBPART:** 3.2.1

Test the door opening and closing operation when activated by controls or system. Adjust controls. Replace damaged and malfunctioning controls and equipment.

SECTION: 08 33 23 **SUBPART:** 3.2.1.1

Not more than 90 calendar days after completion and acceptance of the project, examine, lubricate, test, and re-adjust doors as required for proper operation.

SECTION: 08 34 73 **SUBPART:** 2.4.2

When required to achieve STC, manufacturer to furnish laboratory test data certifying hinges have been cycled a minimum of 1,000,000 while supporting a minimum door weight of 350 pounds.

SECTION: 08 34 73 **SUBPART:** 3.5

Provide third party testing in accordance with ASTM E336.

SECTION: 08 51 13 **SUBPART:** 1.5.1

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

SECTION: 08 51 13 **SUBPART:** 1.5.1

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests.

SECTION: 08 51 13 **SUBPART:** 2.1

Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

SECTION: 08 71 00 **SUBPART:** 1.8

Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

SECTION: 08 71 00 **SUBPART:** 3.5

Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer.

SECTION: 08 81 00 **SUBPART:** 1.7.1

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

SECTION: 09 65 00 **SUBPART:** 3.3

MOISTURE, ALKALINITY, AND BOND TESTS

SECTION: 09 67 23.13 **SUBPART:** 3.1

Relative Humidity Test: Use in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement. Provide moisture mitigation system if required by the manufacturer.

SECTION: 09 69 13 **SUBPART:** 2.4

FACTORY TESTS

SECTION: 09 69 13 **SUBPART:** 2.4.2

Impose a test load of800 pounds on the test assembly through a 3 inches in diameter and 1 inch wide hard plastic caster. Roll the caster completely across the center of the panel. The panel must withstand 20 passes of the caster with no delamination or separation of the covering.

SECTION: 09 69 13 **SUBPART:** 3.2.1

Conduct acceptance tests after installation of floor system. Make at least one test for each 400 square feet of floor area. Conduct tests in presence of Contracting Officer and representatives of manufacturer and

installer. Submit certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

SECTION: 09 69 13 **SUBPART:** 3.2.3

Total system resistance from wearing surface of floor to building grounding electrode must be within range of 0.5 to 20,000 megohms.

SECTION: 09 69 13 **SUBPART:** 3.2.3.2

Electrical joint resistance between individual stringer and pedestal junctions must be less than 10 ohms. Electrical resistance between stringers and floor panels, as mounted in normal use, must be less than 10 ohms when tested in accordance with ASTM F150.

SECTION: 09 69 13 **SUBPART:** 3.2.4

Conduct testing of electrical resistance, in the completed installation, in the presence of the Contracting Officer in accordance with NFPA 99, modified by placing one electrode on the center of the panel surface and connecting the other electrode to the metal flooring support

SECTION: 09 69 13 **SUBPART:** 3.2.5

Perform special inspections and testing for seismic-resisting systems and components in accordance with UFC 3-301-01 and Section 01 45 35 SPECIAL INSPECTIONS.

SECTION: 21 13 13 **SUBPART:** 3.8.1.1

Flushing

SECTION: 21 13 13 **SUBPART:** 3.8.1.2

Hydrostatic Test

SECTION: 21 13 13 **SUBPART:** 3.8.2.1

Hydrostatic Test

SECTION: 21 13 13 **SUBPART:** 3.8.2.2

Backflow Prevention Assembly Forward Flow Test

SECTION: 21 13 13 **SUBPART:** 3.8.3

Main Drain Flow Test

SECTION: 22 00 00 **SUBPART:** 3.9.1

Plumbing System

SECTION: 22 00 00 **SUBPART:** 3.9.4

Operational Test

SECTION: 23 05 93 **SUBPART:** 3.1.5

Conduct DALT Field work on the ductwork selections in compliance with the procedures specified in SMACNA 016, as supplemented and modified by this section.

SECTION: 23 05 93 **SUBPART:** 3.2.4

Conduct TAB Field Work in conformance with the TAB Standard, as supplemented and modified by this section.

SECTION: 23 05 93 **SUBPART:** 3.2.5

Conduct sound measurements and assessments in accordance with the TAB Firm certifying body's sound standard, either AABC MN-1, NEBB MASV, or SMACNA 1858 for TABB, as supplemented and modified by this section.

SECTION: 23 05 93 **SUBPART:** 3.2.6.2

Conduct thermal performance (capacity) tests to verify thermal energy transfer components, devices, and equipment meet the indicated design capacity.

SECTION: 23 09 00 **SUBPART:** 3.5.1.1

Include a one-point accuracy check of each sensor in the PVT procedures.

SECTION: 23 09 00 **SUBPART:** 3.5.1.2

Include a one-week endurance test as part of the PVT during which the system is operated continuously.

Use the building control system BACnet Trend Log or Trend Log Multiple Objects to trend all points shown as requiring a trend on the Point Schedule for the entire endurance test. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost.

Use the building control system Niagara Trend Log Objects to trend all points shown as requiring a trend on the Point Schedule for the entire endurance test. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost.

SECTION: 23 81 23 **SUBPART:** 2.9.3

Conduct the factory testing in compliance with the Contracting Officer approved manufacturer's field test plan, and in accordance with additional field testing requirements specified herein. Record the required data using the test reporting forms approved of the approved field test plan. Conduct the test for each CRAC for the continuous test period in the approved test plan. A CRAC shutdown before the continuous test period is completed must result in the test period being started again and run for the required duration.

SECTION: 23 81 23 **SUBPART:** 3.3.4

Conduct the field testing in compliance with the Contracting Officer approved manufacturer's field test plan, and in accordance with additional

field testing requirements specified herein. Record the required data using the test reporting forms approved of the approved field test plan. Conduct the test for each CRAC for a continuous 24-hour test period. A CRAC shutdown before the continuous 24-hour test period is completed must result in the 24-hour test period being started again and run for the required duration.

SECTION: 25 05 11 **SUBPART:** 3.2.3.4

Wireless Communication Testing

SECTION: 25 10 10 **SUBPART:** 1.7

Pre-Construction QC Checklist

SECTION: 25 10 10 **SUBPART:** 1.7

Post-Construction QC Checklist

SECTION: 25 10 10 **SUBPART:** 1.7

Closeout QC Checklist

SECTION: 25 10 10 **SUBPART:** 3.1

Perform factory testing of the UMCS as specified.

SECTION: 25 10 10 **SUBPART:** 3.2

Perform a field survey, including but not limited to testing and inspection of equipment to be part of the UMCS

SECTION: 25 10 10 **SUBPART:** 3.7

Test all equipment and perform all other tests necessary to ensure the system is installed and functioning as specified. Prepare a Start-Up and Start-Up Testing Report documenting all tests performed and their results and certifying that the system meets the requirements specified in the contract documents.

SECTION: 25 10 10 **SUBPART:** 3.8

PERFORMANCE VERIFICATION TEST (PVT)

SECTION: 26 12 19 **SUBPART:** 3.7.1

Perform in accordance with the manufacturer's recommendations

SECTION: 26 12 19 **SUBPART:** 3.7.2

Upon completion of acceptance checks and tests, show by demonstration in

service that circuits and devices are in good operating condition and properly performing the intended function.

SECTION: 26 12 19.10 **SUBPART:** 3.7.1

Perform in accordance with the manufacturer's recommendations

SECTION: 26 12 19.10 **SUBPART:** 3.7.2

Upon completion of acceptance checks and tests, show by demonstration in

service that circuits and devices are in good operating condition and properly performing the intended function.

SECTION: 26 20 00 **SUBPART:** 3.5.1

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

SECTION: 26 20 00 **SUBPART:** 3.5.2

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring per NETA ATS to provide direct reading of resistance.

SECTION: 26 20 00 **SUBPART:** 3.5.4

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 943.

SECTION: 26 20 00 **SUBPART:** 3.5.5

Test arc-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 1699.

SECTION: 26 20 00 **SUBPART:** 3.5.6

Test grounding system to ensure continuity, and that resistance to ground is not excessive.

SECTION: 26 20 00 **SUBPART:** 3.5.7

Perform phase rotation test to ensure proper rotation of service power prior to operation of new or reinstalled equipment using a phase rotation meter.

SECTION: 26 24 13 **SUBPART:** 3.5.1

Perform in accordance with the manufacturer's recommendations

SECTION: 26 24 13 **SUBPART:** 3.5.2

Upon completion of acceptance checks, settings, and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function.

SECTION: 26 24 13 **SUBPART:** 3.5.2

Test each item to perform its function not less than three times.

SECTION: 26 27 14.00 20 **SUBPART:** 3.2.1

Perform in accordance with the manufacturer's recommendations

SECTION: 26 27 14.00 20 **SUBPART:** 3.2.1

Visual and mechanical inspection

SECTION: 26 27 14.00 20 **SUBPART:** 3.2.1

Electrical tests

SECTION: 26 27 14.00 20 **SUBPART:** 3.2.1

Electrical Tests

SECTION: 26 27 14.00 20 **SUBPART:** 3.2.2

System Functional Verification

SECTION: 26 41 00 **SUBPART:** 3.1.4

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SECTION: 26 41 00 **SUBPART:** 3.5.2

A 100 percent test point resistance test and inspection is required. Identify all test points for grounding system connections and bonds. Provide a sketch (NTS) with identified test points as part of the contract acceptance. Number points in a manner consistent with the installation (Base or Post) nomenclature for existing grounding systems; for example, use letters or numbers to track the test results. Test each grounding system connection or bond to ensure resistance-to-ground is 25 ohms or less or as excepted by NFPA 70 or NFPA 780. Record the resistance measurement on a copy of the test form located at the back of DAFMAN 32-1065 for Air Force or a similar form provided by the Army or Navy. Test the ground rod for resistance to ground before making connections to the rod. Tie the grounding system together and test for resistance to ground. Make resistance measurements in dry weather, and not earlier than 48 hours after rainfall. Include in the written report:

locations of test points, measured values for continuity and ground resistances, and soil conditions at the time that measurements were made. Submit results of each test to the Contracting Officer.

SECTION: 26 51 00 **SUBPART:** 3.1.2.1

Obtain architect approval of the exact mounting height on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Support suspended luminaires from structural framework of ceiling or from inserts cast into slab.

SECTION: 27 10 00 **SUBPART:** 2.10.1

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with ANSI/TIA-568.2 for BTP copper ANSI/TIA-568.3 and ANSI/TIA-526-7 for single mode optical fiber cables.

SECTION: 28 31 76 **SUBPART:** 3.6.2

Pre-Government Testing

SECTION: 28 31 76 **SUBPART:** 3.6.4

Government Final Tests

SECTION: 28 31 76 **SUBPART:** 3.7.1

System Tests

SECTION: 28 31 76 **SUBPART:** 3.7.2

Audibility Tests

SECTION: 28 31 76 **SUBPART:** 3.7.3

Intelligibility Tests

SECTION: 31 00 00 **SUBPART:** 3.3.2.1

Removal of hard material and rock beyond lines and grades indicated will not be grounds for a claim for additional payment unless previously authorized by the Contracting Officer. Excavation of the material claimed as rock must not be performed until the material has been cross sectioned by the Contractor and approved by the Contracting Officer. Common excavation must consist of all excavation not classified as rock excavation.

SECTION: 31 00 00 **SUBPART:** 3.14.1

Take the number and size of samples required to perform the following tests.

SECTION: 31 00 00 **SUBPART:** 3.14.2

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

SECTION: 31 00 00 **SUBPART:** 3.14.2.1

Test select granular material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D698 or ASTM D1557 for moisture density relations, ASTM D1883 for CBR and swell potential,as applicable.

SECTION: 31 00 00 **SUBPART:** 3.14.2.2

Test porous fill in accordance with ASTM C136/C136M for conformance to gradation specified in ASTM C33/C33M.

SECTION: 32 13 13.06 **SUBPART:** 3.7.2

Perform concrete slump tests in accordance with ASTM C143/C143M. Take samples for slump determination from concrete during placement. Perform tests at the beginning of a concrete placement operation and for each batch (minimum) or every 20 cubic yards (maximum) of concrete to ensure that specification requirements are met. In addition, perform tests each time test beams are made.

SECTION: 32 13 13.06 **SUBPART:** 3.7.3

Test for flexural strength in accordance with ASTM C78/C78M. Fabricate and cure four test specimens in accordance with ASTM C31/C31M for each set of tests. Test two specimens at 7 days, and the other two at 28 days. Concrete strength will be considered satisfactory when the minimum of the 28-day test results equals or exceeds the specified 28-day flexural strength, and no individual strength test is less than the tolerance indicated on Table 1. If the ratio of the 7-day strength test to the specified 28-day strength is less than 65 percent, make necessary adjustments for conformance. Fabricate, cure and test a minimum of one set of four beams for each shift of concrete placement. Remove concrete which is determined to be defective, based on the strength acceptance criteria therein, and replace with acceptable concrete.

SECTION: 32 13 13.06 **SUBPART:** 3.7.4

Test air-entrained concrete for air content at the same frequency as specified for slump tests. Determine percentage of air in accordance with ASTM C231/C231M on samples taken during placement of concrete in forms.

SECTION: 32 13 13.06 **SUBPART:** 3.7.10

Inspect dowel placement prior to placing concrete to verify that dowels are of the size indicated, and are spaced, aligned and painted and oiled as specified. Do not permit dowels to exceed the tolerances shown in paragraph: DOWEL BARS.

SECTION: 32 16 19 **SUBPART:** 3.3.4

Surface and Thickness Tolerances

SECTION: 32 16 19 **SUBPART:** 3.4.5

Surface and Thickness Tolerances

SECTION: 32 16 19 **SUBPART:** 3.8.2.1

Strength Testing

SECTION: 32 16 19 **SUBPART:** 3.8.2.2

Air Content

SECTION: 32 16 19 **SUBPART:** 3.8.2.3

Slump Test

SECTION: 32 17 23 **SUBPART:** 3.1.1

Test the pavement surface for moisture before beginning pavement marking after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point.

SECTION: 32 17 23 **SUBPART:** 3.1.1

Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 12 inch by 12 inch section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap. Re-test surfaces when work has been stopped due to rain.

SECTION: 32 17 23 **SUBPART:** 3.1.2

Prior to surface preparation, demonstrate the proposed procedures and equipment. Prepare areas large enough to determine cleanliness, adhesion of remaining coating and rate of cleaning. Approved demonstration area establishes the standard for the remainder of the work.

SECTION: 32 17 23 **SUBPART:** 3.1.3

Prior to paint application, demonstrate test stripe application within the work area using the proposed materials and equipment. Apply separate test stripes in each of the line widths and configurations required herein using the proposed equipment. Make the test stripes long enough to determine the proper speed and operating pressures for the vehicle(s) and machinery, but not less than 50 feet long.

SECTION: 32 17 23 **SUBPART:** 3.1.4

During the Test Stripe Demonstration, demonstrate compliance with the application rates specified herein. Document the equipment speed and operating pressures required to meet the specified rates in each configuration of the equipment and provide a copy of the documentation to the Contracting Officer prior to proceeding with the work.

SECTION: 32 17 23 **SUBPART:** 3.1.5

After the test stripes have cured to a "no-track" condition, demonstrate compliance with the average retroreflective values specified herein. Take a minimum of ten readings on each test stripe with a Retroreflectometer with a direct readout in millicandelas per square meter per lux (mcd/m2/lx). Perform testing in accordance with ASTM D4061, ASTM E1710, ASTM E2177, and ASTM E2302.

SECTION: 32 17 23.16 **SUBPART:** 3.1

Before the performance of any marking application, demonstrate to the Government, using the equipment, materials, and personnel identified in the approved quality control plan, that the requirements for acceptance of the final product(s) are attainable. The minimum length of the test section is 50 feet of marking for each line width, color, and wet film thickness. Perform demonstrations in a location designated by the Contracting Officer within the project scope of work. Do not perform the test section(s) until the Contracting Officer is present to observe the test. Table III identifies minimum and maximum wet film thickness based on glass bead type. Each test section's result is the standard of performance for the color, width, wet film thickness, and glass bead application rate for each marking element. Submit the color, line width, wet film thickness, and measured reflectivity.

SECTION: 32 17 23.16 **SUBPART:** 3.1.1

Prepare an area large enough to determine cleanliness, adhesion of remaining markings, and cleaning rate and removal rate. Use the means, methods, and equipment identified in the approved quality control plan. Adjust the means, methods, equipment, or equipment settings until the prepared surface is free of dirt, debris, oils and greases, algae, mold, mildew, and loose or flaking paint without damage to the pavement. Remove any equipment that fails to provide an acceptable product during the demonstration and provide new equipment that will produce an acceptable product. Approved demonstration area establishes the standard for the work.

SECTION: 32 17 23.16 **SUBPART:** 3.1.2

Adjust the marking application rate for equipment speed, operating pressure, and line width, to provide a minimum wet film thickness, full coverage, and reflective media anchoring. Minimum and maximum wet film thickness is identified in Table III. Measure the wet film thickness using a wet film gauge at three points along the test section. Wet film thickness is determined using ASTM D4414 as the performance standard. When the average of the three readings is less than the minimum specified in Table III, repeat the test section. Submit the results of the marking application wet film thickness test to the Contracting Officer

SECTION: 32 17 23.16 **SUBPART:** 3.1.3

Measure the reflectivity at three points, along the length of the marking placed for wet film thickness. After the application is cured, measure the retro-reflective value using a Retro-Reflectometer with a direct readout in millicandelas per square meter per lux (mcd/m2/lx) using ASTM E1710. Take three readings on each test section. When the average of the three readings is less than the minimum specified in Table V repeat the test section. Document the application rate of the reflective media required to meet the specified minimum reflectivity. Submit the results of the reflective media reflectivity test to the Contracting Officer before proceeding with work on the project.

SECTION: 32 31 13.53 **SUBPART:** 3.2.3.1

Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Ensure post movement measured at the point where the force is applied is less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity.

When a post fails this test, make further tests on the next four posts on either side of the failed post. Remove, replace, and retest all failed parts at the Contractor's expense.

SECTION: 32 84 24 **SUBPART:** 3.2.1.1

During pressure test, maintain a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi.

SECTION: 32 84 24 **SUBPART:** 3.2.2.1

At conclusion of pressure test, install irrigation heads and test entire system for operation under normal operating pressure. Make necessary corrections or adjustments to raise or lower pressure for each system if tests results do not match pressure requirements.

SECTION: 32 84 24 **SUBPART:** 3.2.2.2

Operation test is acceptable if system operates through at least one complete cycle for areas to be irrigated.

SECTION: 32 92 19 **SUBPART:** 2.1.1

Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer.

SECTION: 32 93 00 **SUBPART:** 2.13

The Contracting Officer will inspect plant materials at the project site and approve them. Tag plant materials for size and quality.

SECTION: 33 11 00 **SUBPART:** 3.3.1

Perform field tests, and provide labor, equipment, and incidentals required for testing.

SECTION: 33 11 00 **SUBPART:** 3.3.1.1

Test the water system in accordance with the applicable AWWA standard specified below. Where water mains provide fire service, test in accordance with the special testing requirements given in the paragraph SPECIAL TESTING REQUIREMENTS FOR FIRE SERVICE. Test PVC_plastic water systems made with PVC pipe in accordance with the requirements of AWWA C605 for pressure and leakage tests. The amount of leakage on pipelines made of PVC water main pipe is not to exceed the amounts given in AWWA C605, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed.

SECTION: 33 11 00 **SUBPART:** 3.3.1.2

The hydrostatic pressure sewer test will be performed in accordance with the applicable AWWA standard for the piping material or AWWA C600.

SECTION: 33 11 00 **SUBPART:** 3.3.1.3

For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

SECTION: 33 11 00 **SUBPART:** 3.3.1.4

Perform bacteriological tests in accordance with AWWA C651 Option A.

SECTION: 33 11 00 **SUBPART:** 3.3.1.5

After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

SECTION: 33 11 00 **SUBPART:** 3.3.1.6

Test water mains and water service lines providing fire service or water and fire service in accordance with NFPA 24. The additional water added to the system must not exceed the limits given in NFPA 24

SECTION: 33 11 00 **SUBPART:** 3.3.1.7

Test tracer wire for continuity after service connections have been completed and prior to final pavement or restoration. Verify that tracer wire is locatable with electronic utility locating equipment. Repair breaks or separations and re-test for continuity.

SECTION: 33 30 00 **SUBPART:** 3.3.1.1

When unusual conflicts are encountered between sanitary sewer and waterlines a hydrostatic pressure sewer test will be performed in accordance with the applicable AWWA standard for the piping material or AWWA C600 with a minimum test pressure of 30 psi.

SECTION: 33 30 00 **SUBPART:** 3.3.1.2.1.1

Test PVC pipe in accordance with UBPPA UNI-B-6. The allowable pressure drop is located in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

SECTION: 33 30 00 **SUBPART:** 3.3.1.3

Perform a dye test from the projects sanitary sewer point of connection to the first downstream manhole on the next active sanitary sewer branch main. Use nontoxic non-staining sewer tracing dye. Test results are to be noted in the daily Construction Quality Control (CQC) Report as required in 01 45 00 Quality Control.

SECTION: 33 40 00 **SUBPART:** 3.9.1.1

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. Test results shall be

furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

SECTION: 33 40 00 **SUBPART:** 3.9.1.2

Perform a deflection test on entire length of installed flexible pipeline upon completion of work adjacent to and over the pipeline, including backfilling, placement of fill, grading, paving, placement of concrete, and any other superimposed loads.

SECTION: 33 40 00 **SUBPART:** 3.9.1.2.2

Test drainage rock, pea gravel, and filter sand in accordance with ASTM C136/C136M for conformance to gradation limits and ASTM D1140 for material finer than 75 micrometers. Materials shall be sampled and tested at a rate of 1 test per 5,400 square feet of stormwater treatment area being constructed.

SECTION: 33 40 00 **SUBPART:** 3.9.2.1

SECTION: 33 71 02 **SUBPART:** 2.16.1

Manufacturer must test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing tape per manufacturer's instructions.

SECTION: 33 71 02 **SUBPART:** 3.7

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables.

SECTION: 33 71 02 **SUBPART:** 3.18.2

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function.

SECTION: 33 82 00 **SUBPART:** 2.13.1

Test 100 percent OTDR test of FO media at the factory in accordance with TIA-568.1 and TIA-568.3. Use TIA-526-7 for single mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), shall meet the requirements of ICEA S-84-608. Enhanced performance air core OSP copper cables shall meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

SECTION: 33 82 00 **SUBPART:** 3.5.1

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

SECTION: 33 82 00 **SUBPART:** 3.5.1.1

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

SECTION: 33 82 00 **SUBPART:** 3.5.1.2

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

SECTION: 33 82 00 **SUBPART:** 3.5.2.1

Perform the following acceptance tests in accordance with TIA-758 OSP copper testing shall be conducted from the respective J-875 PET to the respective ADN.:

a. Wire map (pin to pin continuity)

b. Continuity to remote end

c. Crossed pairs

d. Reversed pairs

e. Split pairs

f. Shorts between two or more conductors

SECTION: 33 82 00 **SUBPART:** 3.5.2.2

a. OTDR Test: The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 66 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with TIA-526-7 for single-mode fiber and TIA-526-14 for multimode fiber. Splice losses shall not exceed 0.3 db.

SECTION: 33 82 00 **SUBPART:** 3.5.2.2

b. Attenuation Test: End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1310 and 1550 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with TIA-526-7 for single-mode fiber optic cables. The measurement method shall be in accordance with TIA-455-78-B.

SECTION: 33 82 00 **SUBPART:** 3.5.2.2

c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth

measurements shall be in accordance with TIA/EIA-455-204.

SECTION: 33 82 00 **SUBPART:** 3.5.3

Determine soil-density relationships for compaction of backfill material in accordance with ASTM D1557, Method D.

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

1. INSTRUCTIONS for FPQC Specialist:

Perform surveillance of fire protection system installation during construction and during pre-final and final acceptance inspections. Surveillance includes either visual inspections or observations performed by the FPQC as indicated in the following Schedule of Fire Protection System Inspections. Check boxes in the schedule indicate the inspections or observations that are applicable to this project, which must be performed and documented by the FPQC.

Surveillance of fire protection system inspections is divided into three phases:

Surveillance During Construction – Includes periodic on-site visits by the FPQC during construction

Pre-Final Acceptance Inspection – FPQC must be onsite during pre-final acceptance inspection

Final Acceptance inspection – FPQC must be onsite during final acceptance inspection

2. INSPECTION TYPE

VISUAL INSPECTION:

Perform on-site visual inspections as indicated in the Schedule of Fire Protection System Inspections as construction progresses to confirm work conforms with the contract requirements including but not limited to verifying proper installation of equipment and materials in accordance with applicable codes. Where work will be covered up by finished walls and ceilings, inspections must be scheduled and performed when work is still visible.

OBSERVATION:

Observe component and system testing in person on-site as indicated in the Schedule of Fire Protection System Inspections. Confirm testing is completed in accordance with applicable codes and that testing was successful.

DOCUMENTATION:

Document all inspections and observations in the FPQC Report in accordance with UFGS 01 45 00. Document any deficiencies and all work observed that has been successfully performed in accordance with the contract documents. Record deficiencies in the rework list.

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

PERFORM SURVEILLANCE DURING CONSTRUCTION

~ FIRE SUPPRESSION SYSTEM ~

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☒	1. Verify proper installation of underground service main and service; laterals, thrust blocks, tie-rods and connection to above ground piping.	**VISUAL INSPECTION**	✓ Visually inspect materials ✓ Visually inspect installation
☒	2. Verify proper orientation of fire hydrants and fire department access	**VISUAL INSPECTION**	✓ Visually inspect installation and orientation
☐	3. Verify proper installation of interior and exterior attachments, coatings, and vortex plate prior to filling fire protection water tank	**VISUAL INSPECTION**	✓ Visually inspect fire protection water tank installation
☒	4. Hydrostatic/leak test for underground piping	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☒	5. Hydrostatic/leak test for above ground piping prior to ceiling installation	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☒	6. Underground system flush prior to connection to the riser	**OBSERVE**	✓ Verify system was properly flushed
☒	7. Forward flow test for Backflow preventer	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☐	8. Suction pipe flush prior to fire pump startup	**OBSERVE**	✓ Verify system was properly flushed
☐	9. Hydrostatic test fire pump suction and discharge piping	**OBSERVE**	✓ Verify proper test method ✓ Confirm test was successful
☐	10. Fire pump startup	**OBSERVE**	✓ Confirm successful startup
☒	11. Verify proper installation of sprinkler piping prior to wall or ceiling installation	**VISUAL INSPECTION**	✓ Inspect pipe hangars, bracing, sprinkler heads ✓ Inspect for sprinkler obstructions; damaged, painted or covered heads ✓ Verify proper location of control valves, drains, vents, backflow, test header ✓ Verify proper component mounting heights
☒	12. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Annotate deficiencies and satisfactory work observed ✓ Record rework items in FPQC report

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

~ SPECIAL FIRE SUPPRESSION SYSTEM ~

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☐	1. Verify proper installation of gaseous fire suppression system	**VISUAL INSPECTION**	✓ Inspect gas cylinders, initiating controls, shutdowns, aborts, and visual warning
☐	2. Verify proper installation of IR hangar detector	**VISUAL INSPECTION**	✓ Inspect detector and nozzle layout ✓ Inspect for obstructions, abort stations ✓ Inspect riser piping
☒	3. Verify proper installation of elevator fire protection	**VISUAL INSPECTION**	✓ Inspect elevator recall functions ✓ Inspect two-way communication
☒	4. Verify proper installation of fire suppression in secure spaces	**VISUAL INSPECTION**	✓ Inspect location of sprinkler piping and sprinklers
☒	5. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Document deficiencies and satisfactory work observed in FPQC Report ✓ Record deficiencies in rework list

~ PASSIVE FIRE PROTECTION SYSTEMS ~

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☒	1. Verify proper construction of fire rated assemblies	**VISUAL INSPECTION**	✓ Inspect partitions for proper fire rated construction per design ✓ Inspect doors and door hardware for proper fire rating ✓ Inspect glass for proper fire rating
☐	2. Verify proper installation of fireproofing	**VISUAL INSPECTION**	✓ Inspect for use of proper fireproofing materials ✓ Inspect for cracking, spalling or delaminating ✓ Inspect for proper application thickness
☒	3. Verify proper installation of firestopping	**VISUAL INSPECTION**	✓ Inspect to confirm firestopping system is UL tested or an engineering judgement has been obtained and submitted ✓ Inspect for use of proper firestopping materials ✓ Inspect penetrations through fire rated walls, partitions and ceilings ✓ Inspect construction joints and gaps
☒	4. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

			✓ Document deficiencies and satisfactory work observed in FPQC Report ✓ Record deficiencies in rework list
~ FIRE ALARM SYSTEMS ~			
PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☒	1. Verify proper installation of fire alarm system after conduit is installed and wiring pulled, but before devices are installed	**VISUAL INSPECTION**	✓ Inspect conduit, wiring, conduit fill, wire type ✓ Inspect installation heights of back boxes
☒	2. Document inspections and observations in FPQC Report	**DOCUMENT**	✓ Submit report for each day inspections or observations occur ✓ Document deficiencies and satisfactory work observed in FPQC Report ✓ Record deficiencies in rework list

~ END OF SURVEILLANCE DURING CONSTRUCTION SECTION

PERFORM DURING PRE-FINAL ACCEPTANCE INSPECTION

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☒	1. Inspect all fire protection systems and all life safety features	**VISUAL INSPECTION**	✓ Verify proper installation of fire protection and life safety systems
☒	2. Witness functional testing of all fire protection and life safety systems	**OBSERVE**	✓ Verify proper testing is performed on fire protection and life safety systems
☒	3. Identify deficiencies that require correction	**VISUAL INSPECTION**	✓ Document deficiencies in FPQC Report and record in rework list
☒	4. Verify rework items have been corrected	**VISUAL INSPECTION**	✓ Record re-inspection results on FPQC Report
☒	5. Document results of pre-final inspection and photograph unsatisfactory conditions	**DOCUMENT**	✓ Document results of pre-final inspection in FPQC Report
☒	6. Certify installation and operation of all fire protection and life safety systems conform to the contract documents	**DOCUMENT**	✓ Provide separate letter certifying conformance with contract requirements

~ END OF PRE-FINAL INSPECTION SECTION

SCHEDULE OF FIRE PROTECTION SYSTEM INSPECTIONS BY FPQC SPECIALIST

PERFORM DURING FINAL ACCEPTANCE INSPECTION

PERFORM TASK IF CHECKED	TASK	INSPECTION TYPE	DESCRIPTION
☒	1. Verify proper installation and operation of all fire protection systems and all life safety features	**VISUAL INSPECTION**	✓
☒	2. Note any deficiencies identified by Government FPE on deficiency list	**DOCUMENT**	✓ Document deficiencies identified by Government FPE on deficiency list
☒	3. Verify all deficiencies have been corrected	**VISUAL INSPECTION**	✓ Inspect rework to confirm all deficiencies have been corrected
☒	4. Certify that all deficiencies have been corrected	**DOCUMENT**	✓ Document inspection results on FPQC Report

~ END OF FINAL ACCEPTANCE INSPECTION SECTION

SECTION 01 57 19.03 21

SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS
Secretary of the Navy (SECNAV) Explosive Safety Risk Acceptance Within Joint Region Marianas
07/31/25

PART 1 GENERAL

1.1 SUMMARY

This construction contract is exempt from explosive safety requirements in Department of Defense Explosive Safety Regulation (DESR 6055.09) and other corresponding Department of Defense and Department of the Navy Policies.

This specification identifies contract requirements conditional to the exemption:

a. UXO Safety Awareness Training (3Rs Training) for personnel conducting ground disturbing activities

b. Protocol to stop work, evacuate and notify if suspected Munitions and Explosives of Concern (MEC) are encountered.

c. Geographic Information System (GIS) Electronic Submittals documenting

- Initial GIS Data File(s) of Project Limits

- Final GIS Data File(s) of Project Limits and lowest ground disturbance

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

MEC Work Plan; G

Initial GIS Data File(s)

SD-11 Closeout Submittals

Final GIS Data File(s)

1.2.1 MEC Work Plan

MEC Work Plan is a concise pre-construction submittal documenting Project Limits, Notification Protocol, 3Rs Training Compliance Plan, and Initial 3Rs Training Log. MEC Work Plan must be Government approved prior to starting ground disturbing activities.

a. Project Limits. Graphic depiction of Project Limits that may be reproduced from contract documents. Notify Contracting Officer of discrepancies in ground disturbing work and contract Project Limits.

b. Notification Protocol for suspected MEC encounters. Include names, phone and email contacts. Notification protocol is listed in paragraph 3.3.1, unless directed otherwise by Contracting Officer. To prepare the MEC Work Plan, Contracting Officer will provide point of contact information for Government MEC Quality Assurance (QA) Personnel.

c. 3Rs Training Compliance Plan. See paragraph 1.3 3RS TRAINING REQUIREMENT. Include relevant sections of the Accident Prevention Plan including:

- Requests and scheduling of Government provided group training by Government MEC QA Personnel

- SSHO controls to ensure 3Rs Training compliance, including controls for annual re-certification and template for the on-site 3Rs Training Log.

d. Initial 3Rs Training Log. Names of personnel anticipated to require 3Rs Training per paragraph 1.3, effective/expiration dates and valid Certificates of Completion for all listed personnel.

1.2.2 Initial GIS Data File(s)

Pre-construction submittal of electronic GIS data file(s) documenting only the Project Limits as indicated in contract. GIS data must conform to "Navy Installation Geospatial Information & Services Specifications for Vector GIS Deliverables," appended to this specification.

Additional to SUBMITTAL PROCEDURES, email data files(s) directly to NAVFAC Marianas MEC Program Manager. Contracting Officer will provide contact information for the MEC Program Manager.

1.2.3 Final GIS Data File(s)

Provide electronic GIS data file(s) documenting the lowest ground disturbance. Data shall be three-dimensional vector GIS deliverable documenting the extent and depth of ground disturbance. GIS data must conform to "Navy Installation Geospatial Information & Services Specifications for Vector GIS Deliverables," appended to this specification. Upon request, Contracting Officer will provide an empty Elevation Contour Feature Class in a file or personal geodatabase as a template for vector GIS data file submission.

Additional to SUBMITTAL PROCEDURES, email data files(s) directly to NAVFAC Marianas MEC Program Manager. Contracting Officer will provide contact information for the MEC Program Manager.

1.3 3RS TRAINING REQUIREMENT

Incorporate UXO Safety Awareness Training (3Rs Training) requirements into the Accident Prevention Plan, under oversight responsibility of the Site Safety and Health Officer (SSHO).

3Rs Training Requirement is fulfilled individually by accessing online training at https://www.3Rs.mil, passing the quiz, and receipt of a certificate of completion. Individual online training takes approximately 20 minutes. Alternatively, the Government may provide group 3Rs Training, by Government MEC QA Personnel, at Contractor request and scheduling. Training must be completed annually.

The following personnel are required to take 3Rs Training:

a. Superintendent(s), SSHO, and Quality Control Manager (QCM)

b. All personnel involved in ground disturbing activities. Personnel involved in ground disturbing activities during pre-construction and preparatory phases of work are also subject to this requirement.

c. As designated by SSHO: other personnel that could encounter MEC.

PART 2 PRODUCTS

2.1 GIS DATA COLLECTION

Global Positioning System (GPS) data collection shall be used to produce the final GIS Data File(s) mapping the lowest ground disturbance. Provide professional grade GPS with accuracy level of plus/minus less than 1 m and differential correction to target accuracies of plus/minus 0.5 m.

Contractor may substitute data from higher accuracy survey equipment in lieu of GPS data collection, where higher accuracy survey equipment is used in concert with excavation operations.

PART 3 EXECUTION

3.1 3RS TRAINING CONTROLS

SSHO shall maintain an updated 3Rs Training Log and non-expired certificates of completion for individuals required to take 3Rs Training. 3Rs Training certificates of completion expire; training must be re-taken annually.

Only the Initial 3Rs Training Log must be submitted as part of the MEC Work Plan for Government approval. Updates for the 3Rs Training Log do not require official resubmission, but must be maintained by the SSHO and be available on-site to Government Representatives on-demand (i.e. new personnel not listed in the initial log, 3Rs Training renewals, etc.).

3.2 UPDATE MEC WORK PLAN

Update and resubmit MEC Work Plan for Government approval upon changes to Project Limits, Notification Protocol (i.e. point of contacts, etc.), or 3Rs Training Compliance Plan. Maintain updated MEC Work Plan, available on-site to Government Representatives on-demand. Official resubmission is not required exclusively for updates to the 3Rs Training Log.

3.3 3.3 REQUIREMENTS WHEN SUSPECTED MEC IS ENCOUNTERED

If during any phase of the project work, a suspected MEC item is found, immediately stop-work, evacuate and secure area within 1,000 feet of the suspected MEC item.

3.3.1 Notification Protocol

For suspected MEC encounters immediately notify:

a. Contracting Officer: to confirm evacuation and securing of area within 1,000 feet of the suspected MEC item.

b. Government MEC Quality Assurance (QA) Personnel: to mobilize for verification of suspected MEC item.

3.3.2 Verification of Suspected MEC

Government will verify suspected MEC items, by Government MEC QA Personnel.

3.3.3 Resumption of Work

Contracting Officer or designated representative will direct resumption of work if item is not MEC.

Should item be confirmed MEC, Contracting Officer or designated representative will provide direction to:

a. Resume work outside the MEC item's exclusion zone.

b. Resume work within the area of the MEC following removal of MEC by Government Explosive Ordnance Disposal (EOD).

3.4 UNINTENTIONAL EXPLOSIVE EVENT

If during any phase of the project work there is an unintentional explosive event, the exemption under the SECNAV Explosive Safety Risk Acceptance will cease to apply to this contract. All ground intrusive work will stop until new explosive requirements can be established, approved, and implemented.

MEC GIS requirements:

a. Deliver all data collected in the suitable GIS format in conjunction with NAVFAC GeoReadiness Center (GRC) standards

b. The GIS format is as follows:
   I. Spatial Data (GIS Map Themes): Spatial data shall be delivered as an ArcGIS file geodatabase. PDFs will not be accepted as suitable format. File geodatabases are relational databases that contain geographic information. File geodatabases contain feature classes and tables.
   II. All GIS/geospatial projects (i.e., MPK) shall be delivered containing all related source files in a specific project file, including extension, graphics, photos, CAD, source code (non-encrypted, Visual Basic) based on the current approved ArcGIS version being used by the Navy
   III. MEC does not currently fit in the current NDM. A copy of the current MEC data model implementation shall be provided to the contractor.

c. GIS data shall include but not be limited to:
   I. field survey/project areas
   II. survey transects
   III. collected data points, polygons, and lines
   All the attribution (data fields) collected about them.
   IV. Pictures (must be GeoTagged) and delivered with a the appropriate pathway appended

d. All maps created and used in deliverable reports shall be turned in as a standing MPK file created in the current approved ArcGIS version

e. Data charts shall be delivered in Microsoft excel format (PDF is unacceptable)

f. GPS unit standards for field data collection are required.
   I. The contractor shall utilize conventional and other methods, such as a Global Positioning System (GPS) in accordance with the applicable Geospatial Positioning Accuracy Standards published by the Federal Geographic Data Committee (FGDC).
   II. At a minimum, the contractor shall provide resource grade GPS collection at an accuracy level of +/- < 1m and shall use differential correction to target accuracies of +/- .5 m. This is a GPS unit with an internal or external GNSS antenna.
   III. All survey-grade data collected shall be provided to the Government in a digital format with an attached Survey Report identifying survey method, equipment list, calibration documentation, survey layout, description of control points, control diagrams, quality control report and field survey data.

g. GIS data shall be submitted monthly (or as directed by the COR) for review before the final submittal.

h. For further guidance on NAVFAC GIS standards guidance please see appendix A & B

MEC Geodatabase Instruction for Construction Projects

(1) Construction Projects
(a) MPPEH reports - Contractors shall submit reports via email to the GRC Marianas (GRC_Marianas@fe.navy.mil).
(b) MPPEH and MDAS finds along with current excavation perimeters, depths, and soil movement routes shall be submitted at minimum the last day of each month or at project completion, whichever completes first. This deliverable shall be in the appropriate GIS format in compliance with the DoD SDSFIE and the current NAVFAC MEC data model.
(c) After Action Reports (AAR) - Contractors shall submit ESS AARs with a final GIS geodatabase, as described in the previous paragraph (b).

(2) Reporting requirements
(a) All reports and the GIS deliverables mentioned above shall be sent to the GRC Marianas (GRC_Marianas@fe.navy.mil) for inclusion in the GIS system. The GIS administrator will confirm with the report generator once the data is verified and loaded.

MEC Database		
MECEncounter - All MEC finds discovered. Exclude non MEC items		
Attribute	**Description**	**Values**
MECEncounterIDFK	Unique Identification Number of the MEC find.	String: ex. ProjID-GridID-Find# J001B-Y34-01
Feature Name	Type of MEC noted	String: ex. MPPEH, MEC Find
Feature Description	Specific details of MEC object found	String: Length 255
Meta Notes:	Meta data description about Find	String: Length 255
Creator:	Person digitizing feature	String: Length 20
Date Created:	Date added to database	Date: MM/DD/YY
Collection Source:	What was the data point Collected with	String: Length 76(ex MappingGradeGPS)
Location Accuracy:	Accuracy of Collection	String: Length 50 (ex. +/- 1m)
Media IDFK:	Provide the link to multimedia files	String: Length 20

PROJID:	Construction Project ID	String: Length 50
PROJTITLE:	Long Name for Project	String: Length 100
MECTYPEID:	General category of MEC	String: Length 50
		(Grenade)
		(Fuze)
		(H.E Projectile >20mm)
		(Incendiary)
		(Fragmentation Bomb)
		(General Purpose Bomb)
		(Illumination)
		(Mortar Round)
		(Mine Land)
		(Mine Marine)
		(Ordnance Component)
		(Practice Round)
		(Rocket)
		(TNT)
		(Torpedo)
		(Unknown)
		(WP Smoke)
MEC Count:	Amount of specific MEC found	Integer: Long
OBSERVATION DATE:	Date of the MEC find	Date: MM/DD/YYYY
DEPTH:	Depth and unit of measure	Integer: Long
DEPTH UOM:	Unit of measure depth collected in.	String: ex. Feet; Centimeters; Meters; Inches
MEC CONTRACTOR:	Who is the MEC Contractor	String: Length 100
CONTRACT NUMBER:	What is the contract number	String: Length 50
LocationDescription:	Description of where the object was found	String: Length 255

RSPDone:	Was render safe procedures used by EoD	Integer Long: 0=No 1=1,2=2,3=3

MECSurveyArea - All areas surveyed for MEC to include grid systems, project footprints and clearance areas. Exclude test sites.		
Attribute	**Description**	**Values**
MECSurveyAreaIDFK	Unique Identifying number	String: ex. ProjectID -GridID
Feature Name	Type of feature	String: MEC Clearance; Survey Grid
Feature Description	Specific details of MEC Clearance or grid	String: Length 255
Meta Notes:	Meta data description about Find	String: Length 255
Creator:	Person digitizing feature	String: Length 20
Date Created:	Date added to database	Date: MM/DD/YY
Collection Source:	What was the data point Collected with	String: Length 76 (ex MappingGradeGPS)
Location Accuracy:	Accuracy of Collection	String: Length 50 (ex. +/- 1m)
Media IDFK:	Provide the link to multimedia files	String: Length 20
PROJID:	Construction Project ID	String: Length 50
PROJTITLE:	Long Name for Project	String: Length 100
DEPTH:	Depth and unit of measure	String: Length 50
MEC CONTRACTOR:	Who is the MEC Contractor	String: Length 100
CONTRACT NUMBER:	What is the contract number	String: Length 50
COMPLETIONDATE:	Date of excavation complete	Date: MM/DD/YYYY
TOISIZE:	Soil Screening Size	String: Length 50
MECDISC:	Was MEC discovered during project	String: Length 100
		(None)
		(Yes;See ARR for spot reports)
		(On Going MEC Investigation)
ANOMILIES:	Number of anomalies found	Integer Long: 1,000,000+
CYREMOVED:	Cubic yards of soil removed	Integer Long: 1,000,000+
Documentation:	Record source	String: Length 255

MECDisposalSite - Unearthed previous MEC disposal area. Including burn pits.		
Attribute	**Description**	**Values**
MECDisposalSiteIDFK	Unique Identifying number	String: ex. ProjectID-Dump/Burn site#
Feature Name	Type of feature	String: ex. Dump Site; Burn Pit
Feature Description	Specific details of Site	String: Length 255
Meta Notes:	Meta data description about Site	String: Length 255
Creator:	Person digitizing feature	String: Length 20
Date Created:	Date added to database	Date: MM/DD/YY
Collection Source:	What was the data point collected with	String: Length 76 (ex MappingGradeGPS)
Location Accuracy:	Accuracy of Collection	String: Length 50 (ex. +/- 1m)
Media IDFK:	Provide the link to multimedia files	String: Length 20
PROJID:	Construction Project ID	String: Length 50
PROJTITLE:	Long Name for Project	String: Length 100
DEPTH:	Depth and unit of measure	String: Length 50
MEC CONTRACTOR:	Who is the MEC Contractor	String: Length 100
CONTRACT NUMBER:	What is the contract number	String: Length 50
COMPDATE:	Date of end of use or project	Date: MM/DD/YYYY
TOISIZE:	Soil Screening Size	String: Length 50
ANOMILIES:	Number of anomalies found	Integer: Long
	(If Excavated)	
CYREMOVED:	Cubic yards of soil removed	Integer: Long
Documentation:	Record source	String: Length 255

Appendix A: NAVFAC Standards for Geographic Information System (GIS)

1. Overview

The GeoReadiness Center (GRC) is the single, authoritative source and distribution point for all geospatial shore installation data within the region. The GRC houses the most current geospatial information for the entire region and provides access to the comprehensive data set and analysis tools to Regional and DOD decision makers/managers, sponsored contractors, and other sponsored individuals via a secure government Internet site.

2. Basic Deliverable Requirements:

a. Submittals, Government Review and Acceptance:

i. All data used and developed under contract is intellectual property of the U.S. Government, and shall be turned over to the U.S. Navy upon completion of this amendment.
ii. All submittals shall be reviewed for accuracy, structure and completeness by a GeoReadiness representative before acceptance. Contractors shall submit data and documentation samples at 25% and 75% project completion to avoid the rejection of final deliverables.
iii. All source code (e.g. Python scripts, html files, etc.) and map files (ESRI ArcGIS .mpk) shall be provided to the government.
iv. Failure to adhere to any of the stated delivery specifications could result in rejection of deliverables and nonpayment.

b. GIS Data Format: NAVFAC's GIS data is an ERSI Geodatabase format. **Check for the Navy approved current version of ArcGIS.**

i. All GIS/geospatial projects (i.e., MPK) shall be delivered containing all related source files in a specific project file, including extension, graphics, photos, CAD, source code (non-encrypted, Visual Basic) based on version of ArcGIS Desktop specified for the task order. Submittal format shall be determined by the COR.
ii. Spatial Data (GIS Map Themes): Spatial data shall be delivered as an ArcGIS file geodatabase. File geodatabases are relational databases that contain geographic information. File geodatabases contain feature classes and tables. The names of these geodatabases should reflect the location of the geographic information it contains at the appropriate level of detail (region, special area, activity). The general format of personal geodatabase names is as follows:

Location_yyyymmdd.gdb

iii. Location = Location of the geographic information, defined to the appropriate level of detail. Names begin at the regional level, using the 2-digit country code from iNFADS (e.g. HI=Hawaii, GQ=Guam, JA=Japan, etc.) and may narrow into an area of interest within the region (e.g. Pearl Harbor, Yokosuka, Apra Harbor, etc.). The location can be further narrowed down to the activity level where the geodatabase can be identified by the activity's UIC (N68032, N58003, etc.)

iv. yyyymmdd= Date that the geodatabase was created or amended, as expressed in year (yyyy), month (mm), and date

c. Data Retention: all proprietary data (electronic and paper formats) must be removed from contractor equipment and possession and returned to the government at the end of the period of performance and before the final invoice is approved.

d. Data Structure:

I. Unless specifically directed otherwise, all data shall be structured according to the current version of the Spatial Data Standards (SDSFIE) in use by NAVFAC. **This is the current version of the Navy Data Model (NDM).** Information on the SDSFIE data model can be found at: https://sdsfie.org, and a copy of the current data model implementation shall be provided to the contractor. The data collection guide can be accessed at: http://datacollectionadvisor.com/

i. If new data is being created and the corresponding SDSFIE data structure exists, the government shall provide unpopulated layers to the contractor structured per current NAVFAC standards.

ii. If new data is being created and the corresponding data structure does NOT yet exist, the contractor shall provide the GRC with a data dictionary identifying all of the SDSFIE Entity Types, attributes, and/or domain values associated with the new feature(s), the geographic area(s) covered by the data and Spatial extent information prior to the creation/editing of GIS data. Acceptable formats: MS Excel or MS Word. (Adobe PDF is not an acceptable format. New non-SDS compliant attributes (meeting SDSFIE criteria) will require precise schema definitions.

e. Government Source Data: The contractor will be provided access to any GIS data required for the project via a government computer, which will require Contractor Common Access Card (CAC). Government GIS repository is in an ESRI format. All data shall be returned in this format and structure unless the government specifies otherwise. A completed NAVFAC GIS Data Release form is required prior to data being released to the Contractor if editing is required to be completed on Contractor equipment.

f. Attribute Population:

i. The contractor shall consult with the COR before populating attribute tables to ensure the results match the current GeoReadiness interpretation of the SDSFIE.

ii. The contractor shall identify the classification, type, location, ID number, and any other necessary attributes (specified by the Government) for all new/updated/edited features.

iii. For new field collected data, attribution must include the date collected in the following format.

1. **Name: Date**
Description: Date that the feature was edited from its original or previous value.
Data Type: Date
Default Value: null

3. Data Integrity:

a. Data accuracy standards for all deliverables will be in accordance with those set forth in the section entitled 'Data Collection Procedures'. All deliverables should include an accuracy report in the metadata.
b. The contractor shall employ appropriate QA/QC standards to ensure that data is topologically correct, accurate and complete (to include):
c. No erroneous overshoots, undershoots, dangles or intersections in the line work
d. Point and line features will be snapped together where appropriate to support networks. For example, do not break linear features for labeling or other aesthetic purposes.
e. Lines should be continuous and point features should be digitized as points. For example, point features, such as manholes, should not be drawn using only a circle (polygon) to represent its location. Preferably, use an attribute block symbol that has an insertion point in the center of the manhole.
f. No sliver polygons
g. Digital representation of the common boundaries for all graphic features must be coincident, regardless of feature layer
h. Geometric network connectivity must be maintained for utility networks.

Note: This excludes field collected "walked" survey transect data

A summary of the methods used to correct inconsistencies and any remaining errors by case should be included in the metadata under the 'Logical Consistency Report' and 'Completeness Report' sections.

4. CAD Format Deliverables:

a. CAD drawings may be accepted as GIS deliverables, if COR approves.
b. All files must be accurately georeferenced and adhere to the requirements regarding the coordinate system, metadata, and the specified data Quality Control and Quality Assurance requirements.
c. CAD file conversions must have a unique identifier and a related table to link critical attribution normally found in GIS data. I.E: Pipe size, capacity, locational accuracy, etc.
d. CAD deliverables shall include AutoCAD (DWG) files. CAD symbols placed within the design/drawing file shall adhere to the A/E/C CAD Standard. CAD symbol libraries can be found on the Tri-Service CAD/BIM Technology Center website. https://cadbim.usace.army.mil/CAD https://www.wbdg.org/ffc/army-coe/cad-bim-technology-center or https://cadbimcenter.erdc.dren.mil/default.aspx?p=a&t=1&i=7.

5. Coordinate System:
All geospatial data, unless specified otherwise, shall be in the

Coordinate System: GCS_WGS_1984, Datum: D_WGS_1984.

6. Metadata:

a. **Feature Level Metadata:** Feature-level (record level) attribute metadata is required to be populated for each GIS feature/record, per the current SDSFIE version.

Attributes for the current version are listed in **APPENDIX B**

b. **Layer Level Metadata:** Layer level metadata is required for all deliverables, structured according to the FGDC Content Standard for Digital Geospatial Data (CSDGM). Details on the standard can be found at http://www.fgdc.gov/metadata/geospatial-metadata-standards.

7. Quality Control and Quality Assurance:

The contractor shall take all appropriate and needed QA/QC measures to ensure data is complete, topologically correct, accurate, structured correctly, and formatted correctly per the scope of work and complete (to include):

a. **All data shall be visually inspected before submittal to the government.**
b. The numbers of records for all joined tables shall match, or the specific unmatched records shall be identified and explained to the satisfaction of the government.
c. All required attributes (per NDM current version shall be populated).
d. All domain constraints shall be adhered to, unless approved by the government, prior to submittal.
e. No erroneous overshoots, undershoots, dangles or intersections in the line work.
f. All area type features shall be closed polygons.
g. Line features shall be snapped together where appropriate to support networks. For example, do not break linear features for labeling or other aesthetic purposes.
h. Lines shall be continuous and point features shall be digitized as points. For example, point features, such as manholes, shall not be drawn using only a circle (polygon) to represent its location.
i. No sliver polygons
j. Digital representation of the common boundaries for all graphic features must be coincident, regardless of feature layer
k. Geometric network connectivity shall be maintained for utility networks, where specified by the scope of work.

8. Field Collection:

a. Where field data collection is required, the contractor shall utilize conventional and other methods, such as a total station, or Global Positioning System (GPS) in accordance with the applicable Geospatial Positioning Accuracy Standards published by the Federal Geographic Data Committee (FGDC).
b. At a minimum, the contractor shall provide resource grade GPS collection at an accuracy level of +/- < 1m and shall use differential correction to target accuracies of +/- .5 m.
c. Where appropriate (as stipulated in the contract or as otherwise determined by the Government), the contractor shall use survey grade GPS, at an accuracy level of +/- 3 cm. Global Positioning

System (GPS) data collection activities will be based on a post-processed environment using an accurately sighted base station. Base station files for post processing acquired locally (off-site CORS Continuous Operating Reference Station) will be verified for accuracy.

d. GPS data on the location of utility lines and other features shall be captured at a minimum at the beginning, end, and at each turn or bend in the line and processed as a line feature type. GPS data on the location of utility points and other features shall be captured at the centroid of the feature unless signal obstruction or access prohibits; otherwise points will be captured at a uniform distance and direction from the centroid and the offset captured in the metadata for that feature. Data on polygon features shall be collected at every vertex of the feature and processed as a polygon.
e. All survey-grade data collected shall be provided to the Government in a digital format with an attached Survey Report identifying survey method, equipment list, calibration documentation, survey layout, description of control points, control diagrams, quality control report and field survey data.
f. A digital Survey Control Database (consisting of a survey marker database and a survey traverse database) will be produced for all survey control points established under this contract, including the horizontal and vertical order and coordinate location of each point.
g. Digitizing/Conversion: Where Digitizing/Conversion is stipulated in the contract, the contractor shall digitize/convert features from designated sources (including remotely sensed data, hardcopy scans and vector data) to support various GIS applications. Digitizing/conversion routines will insure that 90 percent of all features will measure within 0.01 inches when reproduced at the scale of original imagery or data source.

9. Photography

a. Photography on-base must be approved in advance of visiting the base, the Contractor shall identify the personnel designated as photographers for this contract and shall identify the proposed areas/facilities to be photographed and provide installation (via COR) with any required photographic equipment information.
b. All photographs to be delivered/used in the final report must be geotagged with the UTM of the picture location.

APPENDIX B: Specifications for GIS Layers and Attributes

The contractor shall consult with the government points of contact to ensure data is placed into the appropriate layer. Please see http://datacollectionadvisor.com/ for full guidance.

This section lists:

* **SDSFIE Required Global Attributes:** These must be populated for each record in all layers

* **SDSFIE Required Global Metadata Attributes:** These must be populated for each record in all layers

* **Project Specific GIS Layer and Attribute Descriptions:** Specific to the scope of work, the DCG provides the full descriptions of each layer and available attributes. The contractor shall consult with the government points of contact to identify which specific non-required attributes to populate. At minimum the following for and dataset must be populated.

Attribute	Attribute Definition	Mandatory	Population Guidance	Data Type	Field Size	Example Value
***IDPK	Primary Key. A unique, user defined identifier for each record or instance of an entity.	No	Populate with unique ID or ID series agreed upon prior to project start. DO NOT use the objectID	Text	40	CR 66-02-1998

Attribute	Attribute Definition	Mandatory	Population Guidance	Data Type	Field Size	Example Value
InstallationID	The official code assigned by the Military Service (includes Washington Headquarters Services) to identify the Headquarters Services) to identify the site or group of sites that make up an installation. For the Navy it is site is site identifier as represented by the iNFADS Site Code.	Yes	Populate with the appropriate value from the SiteCode constraint table based on iNFADS or RPAO guidance.	Text	11	Code: N61755 Description:Na Base Guam, JRM
FeatureName	The name of the feature	Yes	For features that are not stored in iNFADS, populate with a common name of the feature if one exists, using Proper Case	Text	80	Threatened and endangered Species observation

Attribute	Attribute Definition	Mandatory	Population Guidance	Data Type	Field Size	Example Value
FeatureDescripti	The narrative describing the feature.	No	For any attribute being populated with the domain value of "other" include the attribute name along with the description, and separate each using a semicolon (e.g., natureOfConst Plastic; purposeType: Recreation). In addition, where appropriate, populate with text that further describes the feature (e.g., a local common name such as Commercial Gate, or a physical label on a feature in the field such as "Fly Navy").	Text	255	Location of host plant of 30 Dendrobium guamense an epiphytic species listed by USFW and found in a construction footprint J001B.
Owner	The DoD Component or other entity that owns the feature.	Yes	Populate with the appropriate value from the Owner constraint table.	Text	17	Code: USN Description: US Navy

Attribute	Attribute Definition	Mandatory	Population Guidance	Data Type	Field Size	Example Value
Creator	The name of the department or contractor that collected the information for the feature for the first time. For example, NAVFAC SE GRC, attribute as NAVFACSEGRC	Yes	The name of the federal employee or name of the contracting company that created the information for the feature (e.g., Art Vandelay as "VandelayA" or Vandelay Industries as "Vandelayindustries".	Text	20	PetermanJ
DateCreated	The date the feature was created for the first time.	Yes	Populate with the date the feature was created (Geometry and Attribute).	Date	NA	6/28/1974
CollectionMethod	The method used to collect the geometry of the feature.	Yes	Populate with the appropriate value from the CollectionMet constraint table.	Text	28	Code: HeadsUpImageryMgGPSVrfy Description: Heads Up Imagery Mapping Grade GPS Verify
LocationAccuracy	The location accuracy for the data that was collected and verified.	Yes	Populate with the accuracy value followed by a space and then the abbreviation of the unit of measurement in lower case.	Text	50	+/-1m

Attribute	Attribute Definition	Mandatory	Population Guidance	Data Type	Field Size	Example Value
Editor	The contractor or person that edited the feature attribution or geometry from its original or previous value. This is to be stated as last name of the person and then their first initial. For example, Jane Smith would be attributed as SmithJ.	Yes	The name of the federal employee or name of the contracting company that last edited the information for the feature (e.g., Art Vandelay as "VandelayA" or Vandelay Industries as "Vandelay Industries"). If editing within Citrix M&A Spatial Database Engine (SDE) environment, this attribute will be auto populated with the Citrix user name.	Text	20	PetermanJ
DateEdited	The date that the feature was edited from its original or previous value.	Yes	If editing within the Citrix M&A SDE environment, this attribute will be auto populated. Otherwise, populate with the date the feature was edited (Geometry and/or Attribute).	Date	NA	6/28/1974

-- End of Section --

ALL PURPOSE CHECKLIST

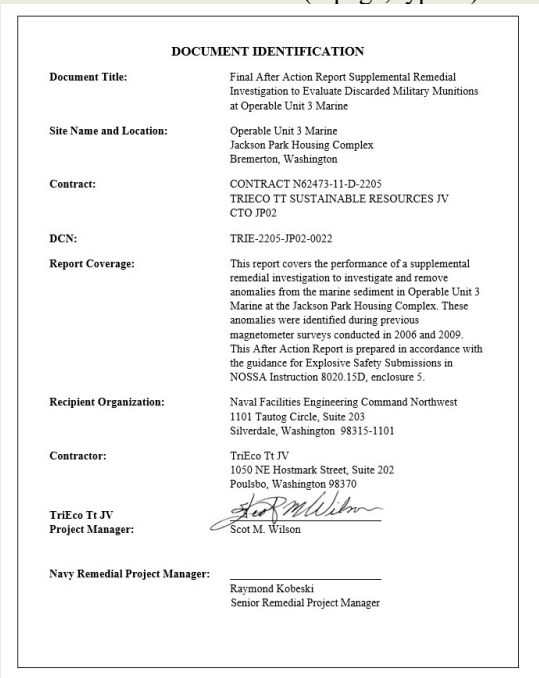
TITLE/SUBJECT/ACTIVITY/FUNCTIONAL AREA	OPR	DATE
J3 SOP, AAR QC Checklist	**J3/McAfee**	**02 Oct 2020**

NO.	ITEM	YES	NO	N/A

PROJECT INFORMATION		NOTES
Project Number & Short Title		The purposes of an AAR are: [1] - To allow NOSSA to cancel all ESQD arcs - To allow DDESB to closeout site files For a completed munitions response an AAR:[2] - Summarizes how munitions response actions were executed; and - Documents that the explosives safety aspects of the selected response have been completed per the approved ESS
MPIT WO#		
Installation		
Site Location		
Munition Response Area		

AAR Format Elements (Must Have Punch List)

			YES	NO	N/A
1. Title Page (1-page, typical) [3]	Is the following format clearly present? Primary Title: "AFTER ACTION REPORT" Secondary Title: Project Short Title	If YES, then YES and continue; otherwise, NO and rework.			
	Is the contract number/designation present?				
	Is contractor company name present?				
	Is the Area Designation (City, State) of the project present?				
2. Document Identification (1-page, typical) [4]	Are the following elements present and similar to the example?	If YES, then YES and continue; otherwise, NO and rework.			
	- Document Title				
	- Site Name and Location				
	- Contract				
	- DCN				
	- Report Coverage Statement: SAMPLE → "This report covers the performance of a supplemental remedial investigation to investigate and remove anomalies from the marine sediment in Operable Unit 3 Marine at the Jackson Park Housing Complex. These anomalies were identified during previous magnetometer surveys conducted in 2006 and 2009. This After Action Report is prepared in accordance with the guidance for Explosive Safety Submissions in NOSSA Instruction 8020.15D, enclosure 5."				
	- Recipient Organization				
	- Contractor Information				
	- Project Manager Signature				
	- USN Project Manager Signature				



DOCUMENT IDENTIFICATION

Document Title: Final After Action Report Supplemental Remedial Investigation to Evaluate Discarded Military Munitions at Operable Unit 3 Marine

Site Name and Location: Operable Unit 3 Marine
Jackson Park Housing Complex
Bremerton, Washington

Contract: CONTRACT N62473-11-D-2205
TRIECO TT SUSTAINABLE RESOURCES JV
CTO JP02

DCN: TRIE-2205-JP02-0022

Report Coverage: This report covers the performance of a supplemental remedial investigation to investigate and remove anomalies from the marine sediment in Operable Unit 3 Marine at the Jackson Park Housing Complex. These anomalies were identified during previous magnetometer surveys conducted in 2006 and 2009. This After Action Report is prepared in accordance with the guidance for Explosive Safety Submissions in NOSSA Instruction 8020.15D, enclosure 5.

Recipient Organization: Naval Facilities Engineering Command Northwest
1101 Tautog Circle, Suite 203
Silverdale, Washington 98315-1101

Contractor: TriEco Tt JV
1050 NE Hostmark Street, Suite 202
Poulsbo, Washington 98370

TriEco Tt JV Project Manager: Scot M. Wilson

Navy Remedial Project Manager: _____
Raymond Kobeski
Senior Remedial Project Manager

3. Signature Page – AARs shall be signed by at least the…[5]	Are the following signatures present?	If YES, then YES and continue; otherwise, NO and rework.			
	- Project Superintendent				
	- Project QC Manager				
	- Project SSHO				
	- Project UXOSO				
	- Project UXOQCS				
	- Project SUXOS				
4. Table of Contents (1-page, typical) [6]	Are the following elements/features present?	If YES, then YES and continue; otherwise, NO and rework.			
	- Table of Contents				
	- List of Tables				
	- List of Figures				
	- List of Appendices				
5. Site Description. Provide a brief description of the site which provides an over-arching summary no more than two paragraphs in length.[7]	Does this section present the following to the reader/reviewer?	If YES, then YES and continue; otherwise, NO and rework.			
	- Contains description of the MRA. Itemize MRS(s) within the MRA, if applicable.				
	- Plot identification numbers (if available)				
	- Declaration of land use prior to start of project.				
	- Declaration of intended land use after finishing of project.				
	- Description of property lines and what's included within those lines.				
	- Declaration of associated ESS(s), annexes, deviations, etc.				
6. Authorized Actions. Provide a brief summary of the actions authorized under the approved ESS or ESS amendment. Directly reference the approved ESS or ESS amendments relating to the AAR. [8]	Does this section present the following to the reader/reviewer?	If YES, then YES and continue; otherwise, NO and rework.			
	(1-2 paragraphs per UXO Clearance CTR, typical) If the activities covered by a single ESS will be completed by multiple unexploded ordnance (UXO) contractors, the Navy project manager must ensure that each contractor's efforts are documented in the AAR format.[9]				
	(1 paragraph/change, typical) All changes to the MGFD will be documented in the AAR.[10]				
	(1 paragraph, typical) Summarize the various processes (e.g., hardware, software, storage media) which will be employed to collect, process, and archive data amassed during the response action.[11]				

7. MEC and/or MPPEH recovered. In this section, provide: [12]	A summary of the MEC/MPPEH recovered including: [13] - The total number of live and suspect MEC/MPPEH items - Unexpected or unusual munitions items	If YES, then YES and continue; otherwise, NO and rework.			
	Include a table shown below: [14/15] - Add column showing depths at which the items was found.				
	(1 paragraph/instance, typical) Details regarding the discovery of any MEC with MSDs larger than the primary and implementation of the minimum separation distances for the contingency item(s) or the discovered item. [16]				
	Any information gathered during the response that impacts the MEC- and MPPEH-related portions of the conceptual site model (CSM). Include potential changes to the vertical depth and horizontal extent of the site. [17]				
8. Relative Effectiveness and Limitations. Provide a description of the relative effectiveness and any limitations of the technologies used during the munitions response and the effects on residual risk relative to that originally projected.[18/19]	(1-page, 4 paragraphs, typical) Did writer provide a description of the relative effectiveness and any limitations of the technologies used during the munitions response and the effects on residual risk relative to that originally projected?	If YES, then YES and continue; otherwise, NO and mark for rework.			
9. Quality Control (QC)/Quality Assurance (QA) Performed.[20/21] (1-page, 3-4 paragraphs, typical)	Provide a summary of the QC and QA methodology and reports for the response, including the entity that provided third-party QA.	If YES, then YES and continue; otherwise, NO and mark for rework.			
	Provide a summary of the Quality Assurance Surveillance Plan and any associated reports that were provided.				
	Describe the use of blind seeds by QC and QA, including corrective actions taken if any blind seeds were missed.				
	Address any other QC or QA failures and associated corrective actions.				
	If a NOSSA audit was conducted, summarize the audit finding(s) and corresponding corrective action(s) taken.				

No.	MEC/MPPEH Description	Quantity	Initial Classification	Condition	Final Classification
1	20mm cartridges	4	MPPEH	empty/expended	MDAS
2	37mm cartridges	3	MPPEH	empty/expended	MDAS
3	37mm cartridges	1	Suspect MEC	fired	MDAS
4	M100 bomb fuze	2	MEC	Fired/live	MEC
5	5-inch projectile	1	MPPEH	empty/expended	MDAS
	TOTALS	11			2 MEC/9 MDAS

10. Land Use Controls (LUC). Provide a summary of the land use controls that were implemented, if any, and the areas to which they apply.[22/23] (1/2 page, 3-paragraphs, typical)	If MEC and/or MPPEH cannot be removed to the degree necessary to safely allow the current, determined or anticipated future land use, then declare/explain the applied land use restrictions.[24]	If YES, then YES and continue; otherwise, NO and mark for rework.			
11. Long-term Management (LTM). Provide a summary of provisions for long-term management and indicate whether follow-on actions at the site are or may be necessary.[25/26] (1/2 page, 4-paragrahs, typical)		If YES, then YES and continue; otherwise, NO and mark for rework.			
12. Exclusion Zone (EZ) Cancellation Request. Include a request to cancel any EZ or site approval established in the ESS. This request will ensure that encumbering arcs are removed from the site.[27/28] (1 paragraph, typical)	Describe the EZ in question.	If YES, then YES and continue; otherwise, NO and mark for rework.			
	Request cancellation: "It is requested that_____be canceled."				
13. Maps. Discuss and include maps showing:[29/30] For all maps: - Comprehensive legends are required; colors/symbols shown on the map must be in the legends; all colors/symbols in the legends must be shown on the map - Grids must be clearly present and readable; grids are used as common cross-references among all maps	Areas from which MEC/MPPEH was removed, to include horizontal and vertical limits.	If YES, then YES and continue; otherwise, NO and mark for rework.			
	Specific locations within these areas where MEC/MPPEH was recovered.				
	Areas within the site where response actions were not performed, and the rationale for not addressing those areas.				
	The revised CSM (both horizontal and vertical) based on actions completed under the ESS.				
	The known or reasonably anticipated end use of each area, including any associated LUCs.				
	All munitions response-related operations and storage locations must be shown on (ESQD) maps.[31]				
	Is a sufficient pre-project Conceptual Site Model (CSM) presented?				
	Is a sufficient post-project Conceptual Site Model (CSM) presented?				
	Is a sufficient Land Use map presented? - The known or reasonably anticipated end use of each area, including any associated land use controls. [32] -				

14. Documentation Appendix. An appendix containing documentation relevant to the actions performed under the approved ESS or ESS Amendment. This documentation must include:[33]	Paperwork supporting the disposition of the items recovered and classified as outlined in paragraph 3,	If YES, then YES and continue; otherwise, NO and mark for rework.			
	All MDAS documentation (e.g. signed DD Form 1348-1As,				
	DoD single item issue release/receipt document, if used)				
	Certificates of Destruction specifically for the MDAS.				
	NOTE: The weights of the MDAS on the 1348s must match those provided on the Certificates of Destruction. If they do not match, provide rationale for differing amounts.				
	NOSSA audit reports that were performed at the site and corresponding corrective actions taken in response to the audit report.				
15. Note: For historical purposes, the Navy project manager may forward additional information to NOSSA, including copies of the field logs, daily activity reports, QC/QA reports, photographs, etc, via separate correspondence. This supplemental information will be retained in the NOSSA Information Center, but will not be forwarded by NOSSA to the Department of Defense Explosives Safety Board.[34]	May be on an accompanying CD with Final-AAR. These files shall not be included in the hard copy, nor will they be included in the AAR forwarded by NOSSA to the DDESB. [35]	If YES, then YES and continue; otherwise, NO and mark for rework.			
	All field logs				
	All Daily Activity Reports				
	All QC/QA Reports				
	Photographs				
	Bedrock Determinations [36]				
	MEC/MPPEH Spot Reports [37]				
	Quality Assurance Surveillance Plan (QASP) – includes associated reports. [38]				
	NOSSA Audit – includes reports, corrective actions, and associated records. [39]				

Timelines					
AARs must be submitted to NOSSA within 6 months of the completion of the munitions response actions authorized by the ESS.[40]					
NOSSA will review each draft AAR within 1 month of receipt of each draft, including reviewing and endorsing the final AAR to the DDESB.[41]					
Upon completion of all actions authorized under the ESS, the Navy project manager must ensure that a final AAR documenting all actions completed by all UXOUXO contractors is prepared and submitted to NOSSA.[42]					

DRAFT Elements / Processing / Timelines					
The title of the AAR will not change during the review process.[43]		If YES, then YES and continue; otherwise, NO and mark for rework.			
Must be submitted either as an Adobe Acrobat® Portable Document Format (PDF) or Microsoft® Word file.[44]					
All lines of the draft text will be numbered, with numbers restarting on each page.[45]					
The cover page of a draft AAR must include the word "draft" and the date (month and year) in the title and in page headers or footers.[46]					
If NOSSA directs that a draft AAR be revised, all modified text must be identified using "track changes." [47]					
Page Check	Are all pages are present and in numerical order (1→N)?				
Contents Indexes – SECTIONS	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Contents Indexes – FIGURES	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Contents Indexes – TABLES	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Contents Indexes – APPENDICES	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Do the following summaries of MEC/MPPEH match? If NO, then are differences explained/justified?	SECTION: Summary of the MEC and/or MPPEH Found				
	MAP: MEC/MPPEH				
	MAP: CSM				
	APPENDIX: Description of all Recovered MEC/MPPEH Items				

FINAL Elements / Processing / Timelines					
A Navy project manager must prepare and submit the AAR to NOSSA via WebESS for review and endorsement to the DDESB.[48]					
The title of the AAR will not change during the review process.[49]					
Must be submitted either as an Adobe Acrobat® Portable Document Format (PDF) or Microsoft® Word file.[50]					
The final AAR must be submitted under a formal cover letter addressed to Commanding Officer (CO), NOSSA and signed by the cognizant Facilities Engineering Command (FEC) CO, Base Realignment and Closure (BRAC) Program Management Office (PMO) Director, or personnel delegated by-direction authority by one of these authorities.[51]	NOTE: When projects are not being managed by either a FEC or BRAC PMO, the cover letter must be signed by the agency or activity that provides funding or operational project oversight, or personnel delegated by-direction authority of that authority.[52]				
The final AAR cover page will be marked "Final" with the date (month and year).[53]					
The final AAR page footers will be marked "Final" with the date (month and year).[54]					
The final AAR map legends will be marked "Final" with the date (month and year).[55]					
The final AAR will have all line numbers removed.[56]					
Page Check	Are all pages are present and in numerical order (1→N)?				
Contents Indexes – SECTIONS	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Contents Indexes – FIGURES	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Contents Indexes – TABLES	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Contents Indexes – APPENDICES	Are all listed items present within the document?				
	Are all items within the document listed on the index?				
Do the following summaries of MEC/MPPEH match? If NO, then are differences explained/justified?	SECTION: Summary of the MEC and/or MPPEH Found	If YES, then YES and continue; otherwise, NO and mark for rework.			
	MAP: MEC/MPPEH				
	MAP: CSM				
	APPENDIX: Description of all Recovered MEC/MPPEH Items				

----- NOTHING FURTHER -----

[1] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec-11, pg-11

[2] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec-11, pg-11 & Encl-4, pg-1

[3] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Sample FINAL-AAR

[4] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Sample FINAL-AAR

[5] NFM. Sampling of Contract Specifications

[6] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Sample FINAL-AAR

[7] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[8] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[9] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[10] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec-3.2.7, Bullet-2, Encl-1, pg-7

[11] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec 5.5, Encl-1, pg-9/10

[12] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Sample FINAL-AAR /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[13] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[14] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[15] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec 5.5, Encl-1, pg-9/10

[16] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[17] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[18] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[19] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Pg-1 /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[20] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[21] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Pg-1 /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[22] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[23] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Pg-1 /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[24] NFM OPSNOTE 2019-005; Ref (a) NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-6.2

[25] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[26] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Sample FINAL-AAR /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[27] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[28] NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2 & para 14-7.6

[29] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2/3

[30] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Pg-1 /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[31] NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-7

[32] ALTMAN, D P (Pat) CIV USN. 19MAR2020. GUIDE FOR PREPARING AN AAR. Pg-1 /// NAVSEA OP 5, Ammunition and Explosive Safety Ashore, para 14-13.2

[33] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-3

[34] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-3

[35] NOSSAINST 8020.15D; Ser N49/2094; 18 Apr 13. Encl-5 /// NOSSAINST 8020.15D Encl (5) Guide for Preparing a Munitions Response Site AAR

[36] NFM. Sampling of Contract Specifications

[37] NFM. Sampling of Contract Specifications

[38] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[39] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-2

[40] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec-11, pg-11

[41] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec-11.b.2, pg-12

[42] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[43] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[44] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[45] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[46] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[47] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[48] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Sec-11.b.1, pg-12

[49] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[50] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[51] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[52] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[53] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[54] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[55] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

[56] NOSSAINST 8020.15E, Ser N45H/779, 11 Sep 2020, Encl-4, pg-1

Construction Contractor Roofing Signature Checklist

Project Title: _____

Contract Number: _____

1. The Roofing QC Specialist meets the qualification/experience requirements and has executed the assigned roles and responsibilities in accordance with Section 01 45 00.00 20 and the roofing specification sections.

Roofing QC Specialist Name: _____

2. All roofing system submittals (shop drawings, product data, design data, certificates, manufacturer's instructions, close-out submiitals, etc.) have been reviewed by the QC Submittal Reviewer and approved by the QC Manager per specifications. Copies have been submitted to the OICC CM representative with a copy forwarded to the OICC TSG Architect.

YES ____ NO _____ If no, provide explanation on a separate sheet.

3. The Roofing QC Specialist has been physically present at the construction site at the frequency specified, has performed the three phases of control, and has prepared the required documentation. Documentation includes a detailed explanation of how the three phases of control has been implemented (along with the Preparatory and Initial Phase checklist) and the inspection results of the roofing system installation as a definable feature of work as required per specifications. Copies of the documentation have been submitted to the OICC CM with a copy forwarded to the OICC TSG Architect.

YES ____ NO _____ If no, provide explanation on a separate sheet.

4. Roofing system installation has been witnessed by the Roofing QC Specialist.

As the Roofing QC Specialist and QC Manager, we certify that the roofing system submittals and installation have been satisfactorily completed in compliance with contract plans and specifications. The roofing system is ready for technical acceptance.

Roofing QC Specialist signature: _____ Date: _____

Roofing QC Specialist name (print): _____

QC Manager Signature: _____ Date: _____

QC Manager Name (print): _____

5. OICC MCM representatives have witnessed the installation of the roofing system and confirm that project roofing system is ready for technical acceptance by the OICC TSG Architect.

OICC CM signature: _____ Date: _____

OICC CM name (print): _____

Phone number: _____ E-mail: _____

SECTION 08 71 00

DOOR HARDWARE
02/16, CHG 4: 02/22

PART 1 GENERAL

1.1 REFERENCES

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.

ASTM INTERNATIONAL (ASTM)

ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2021) Butts and Hinges
ANSI/BHMA A156.3	(2020) Exit Devices
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.5	(2020) Cylinder and Input Devices for Locks
ANSI/BHMA A156.6	(2021) Architectural Door Trim
ANSI/BHMA A156.7	(2016) Template Hinge Dimensions
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.16	(2023) Auxiliary Hardware
ANSI/BHMA A156.17	(2019) Self Closing Hinges & Pivots
ANSI/BHMA A156.18	(2020) Materials and Finishes
ANSI/BHMA A156.21	(2019) Thresholds
ANSI/BHMA A156.22	(2021) Gasketing
ANSI/BHMA A156.25	(2013) Electrified Locking Devices
ANSI/BHMA A156.26	(2012) Continuous Hinges
ANSI/BHMA A156.36	(2010) Auxiliary Locks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 72	(2025) National Fire Alarm and Signaling Code
NFPA 80	(2025) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2024) Life Safety Code
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8	(2023) Specifications for Standard Steel Doors and Frames

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UL SOLUTIONS (UL)

UL Bld Mat Dir	(updated continuously online) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Manufacturer's Detail Drawings; G

Verification of Existing Conditions

Hardware Schedule; G

Keying System; G

SD-03 Product Data

Hardware Items; G

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1; G

SD-11 Closeout Submittals

Key Bitting

1.3 SHOP DRAWINGS

Submit manufacturer's detail drawings indicating all hardware assembly components and interface with adjacent construction. Indicate power components and wiring coordination for electrified hardware. Base shop drawings on verified field measurements and include verification of existing conditions.

1.4 PRODUCT DATA

Indicate fire-ratings at applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by 36 CFR 1191 Appendix D - Technical.

1.5 HARDWARE SCHEDULE

Provide Hardware Item List and Hardware Schedule containing the following information, and additional information as needed to identify the complete make up of each hardware set and its application to each opening:

1.5.1 Hardware Item List:

a. Hardware Type

b. Item Number

c. Quantity

d. Size(s)

e. Reference Publication / Type Number

f. Manufacturer's Name / Catalog Number

g. Key Control Symbols

h. UL Mark (If fire rated and listed)

i. BHMA Finish(es)

j. Remarks

1.5.2 Hardware Schedule

a. Hardware Set Number

b. Opening Number(s)

c. Opening Description (single/double leaf, hand, size, door/frame material)

d. Fire Rating

e. Sound Rating

f. Hardware Items

g. Quantity

h. Size

i. BHMA Finish

j. Remarks

In addition, submit hardware schedule data package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6 KEY BITTING CHART REQUIREMENTS

1.6.1 Requirements

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys (e.g. AA1 and AA2).

b. Complete listing of all key cuts (AA1-123456, AA2-123458).

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.7 QUALITY ASSURANCE

1.7.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, pivots, and closers of one lock, hinge, pivot, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.7.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware Subcontractor, using Activity and Base Locksmith must meet to discuss and coordinate key requirements for the facility.

1.8 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown on hardware schedule. Deliver permanent keys and removable cores to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware applied to metal or to prefinished doors must be manufactured using a template. Provide templates to door and frame manufacturers in accordance with ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 80 for fire doors, NFPA 101 for exit doors, NFPA 252 for fire tests of door assemblies, ABA/ADA accessibility requirements, and all other requirements indicated, even if such hardware is not specifically mentioned in paragraph HARDWARE SCHEDULE. Provide Underwriters Laboratories, Inc. labels for such hardware in accordance with UL Bld Mat Dir or equivalent labels in accordance with another testing laboratory approved in writing by the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark is visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover. Coordinate electrified door hardware components with corresponding components specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

2.3.1 Hinges

Provide in accordance with ANSI/BHMA A156.1. Provide hinges that are 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for interior doors and reverse-bevel exterior doors so that pins are non-removable when door is closed. Other anti-friction bearing hinges may be provided in lieu of ball bearing hinges.

2.3.2 Continuous Hinges

Where continuous hinges are required, provide in accordance with ANSI/BHMA A156.26.

2.3.3 Spring Hinges

Provide in accordance with ANSI/BHMA A156.17.

2.3.4 Locks and Latches

a. At exterior locations provide locksets of full stainless steel type 302 or 304 construction including fronts, strike, escutcheons, knobs, bolts and all interior working parts. Marine Grade I, fully non-ferrous.

b. In humid interior environments, provide interior locksets on the same Marine Grade I, fully non-ferrous as exterior locksets.

2.3.4.1 Mortise Locks and Latches

Provide in accordance with ANSI/BHMA A156.13, Series 1000, Operational

Grade 1, Security Grade 2.

2.3.4.2 Auxiliary Locks

Provide in accordance with ANSI/BHMA A156.36, Grade 1.

2.3.4.3 Electromechanical Combination Locks

Notwithstanding any other provision of this contract and because integrated locksets using the KABA MAS X-10 locks are limited to KABA MAS locksets, provide KABA MAS LKM10K Fed Spec FF-L-2890C Type II and Type IV pedestrian door deadbolt device with integrated high security lockset and integrated electronic security capability. No other product shall be acceptable.

2.3.5 Exit Devices

Provide in accordance with ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide touch bars in lieu of conventional crossbars and arms. Provide escutcheons not less than 7 by 2-1/4 inch.

Use stainless steel or bronze base metal with plated finishes. Also include stainless steel fasteners and screws.

2.3.6 Cylinders and Cores

Provide cylinders and cores for new locks, including locks provided under other sections of this specification. Provide cylinders and cores with seven pin tumblers. Provide cylinders from the products of one manufacturer, and provide cores from the products of one manufacturer. Rim cylinders, mortise cylinders, and knobs of bored locksets have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.

2.3.7 Electrified Hardware

2.3.7.1 Electrified Mortise Locks

Provide in accordance with ANSI/BHMA A156.25, Grade 1. Provide electrified mortise locks that remain secure during power failure. Provide facility interface devices that use dc power to energize solenoids.

2.3.7.1.1 Power Transfer Hinges

Provide power transfer hinges with each electrified lock that route power and monitoring signals from the lockset to the door frame. Coordinate power transfer hinges with door frames.

2.3.7.2 Card Readers and Keypad Access Control Hardware

Card readers and Keypad Access Control Hardware will be provided by others and will be provided in accordance with ANSI/BHMA A156.5 and ANSI/BHMA A156.25, Grade 1 components. Provide devices that are tamper alarmed, tamper and vandal resistant, solid state, and do not contain electronics which could compromise the access control subsystem should the subsystem be attacked. Provide surface, semi-flush, pedestal, or

weatherproof mountable devices as specified for each individual location. Each device to contain a visual display, either mounted on the face, or on an integral part of the device, to indicate access or exit request processing, request approval, and request denial. Access control cards are compatible with base wide standards. Keypads contain an integral 12-digit tactile keyboard with digits arranged in numerical order. Keypads are a standalone device or integrated into the card reader. Coordinate access control hardware with corresponding devices and systems specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

2.3.8 Keying System

Provide a grand master keying system. Provide construction interchangeable cores. Provide key cabinet as specified. Provide schematic diagram of the Keying System.

2.3.9 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

2.3.9.1 Lever Handles

Provide lever handles. Provide in accordance with ANSI/BHMA A156.3 for mortise locks of lever handles for exit devices.

2.3.10 Keys

Furnish one file key, one duplicate key, and one working key for each key change and for each master keying system. Furnish one additional working key for each lock of each keyed-alike group. Furnish 6 great grand master keys, 20 construction master keys, and 2 control keys for removable cores. Furnish a quantity of key blanks equal to 20 percent of the total number of file keys. Stamp each key with appropriate key control symbol and "U.S. property - do not duplicate." Do not place room number on keys.

2.3.11 Door Bolts

Provide in accordance with ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except at doors having metal thresholds. Provide automatic latching flush bolts in accordance with ANSI/BHMA A156.3, Type 25.

2.3.12 Closers

Provide in accordance with ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers, except at storefront mounting, and other features necessary for the particular application. Size closers in accordance with manufacturer's printed recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

Use stainless steel inside bracketed or door mounted closers on exterior doors. Non-ferrous closers, such as aluminum or cast bronze, are permissible where door utilization is minimal. On interior doors use closers of 302 or 304 stainless steel or non-ferrous materials. On surface-mounted closers use or apply rust inhibiting finish on all ferrous parts. Also apply this finish on concealed closers.

2.3.12.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation in locations that will be visible after installation.

2.3.13 Overhead Holders

Provide in accordance with ANSI/BHMA A156.8.

2.3.14 Door Protection Plates

Provide in accordance with ANSI/BHMA A156.6.

2.3.14.1 Sizes of Kick Plates

2 inch less than door width for single doors; 1 inch less than door width for pairs of doors. Provide 10 inch kick plates for flush doors.

2.3.15 Door Stops and Silencers

Provide in accordance with ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.16 Thresholds

Provide in accordance with ANSI/BHMA A156.21.

2.3.17 Weatherstripping Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph HARDWARE SCHEDULE. Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weatherstripped doors not to exceed 1.25 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283.

2.3.18 Soundproofing Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide adjustable doorstops at heads,jambs and automatic door bottoms in accordance with the hardware set, of extruded aluminum, bronze anodized, surface applied, with vinyl fin seals between plunger and housing. Provide doorstops with solid neoprene tube, silicone rubber, or closed cell sponge gasket. Provide door bottoms with adjustable operating rod and silicone rubber or closed cell sponge neoprene gasket. Provide doorstops that are mitered at corners. Provide type and function designation where specified in paragraph HARDWARE SETS.

2.3.19 Rain Drips

2.3.19.1 Door Rain Drips

Approximately 1-1/2 inch high by 5/8 inch projection. Align bottom with bottom edge of door.

2.3.19.2 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection. Align bottom with door frame rabbet.

2.3.20 Auxiliary Hardware (Other than locks)

Provide in accordance with ANSI/BHMA A156.16, Grade 1.

2.3.21 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, as required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of type, quality, size, and quantity appropriate to the specific application. Fastener finish to match hardware. Provide stainless steel or nonferrous metal fasteners in locations exposed to weather. Verify metals in contact with one another are compatible and will avoid galvanic corrosion when exposed to weather.

2.5 FINISHES

Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except aluminum paint. Provide hinges for exterior doors in stainless steel with BHMA 630 finish. Furnish exit devices in BHMA 630 finish. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

2.6 KEY CABINET AND CONTROL SYSTEM

Provide in accordance with ANSI/BHMA A156.5, Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.

PART 3 EXECUTION

3.1 INSTALLATION

Provide hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weatherstripping Installation

Provide full contact, weathertight seals that allow operation of doors without binding the weatherstripping.

3.1.2 Soundproofing Installation

Provide as specified for stop applied weatherstripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves. For aluminum thresholds placed on top of concrete surfaces, coat the underside surfaces that are in contact with the concrete with fluid applied waterproofing as a separation measure prior to placement.

3.2 FIRE DOORS AND EXIT DOORS

Provide hardware in accordance with NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, and NFPA 252 for fire tests of door assemblies.

3.3 HARDWARE LOCATIONS

Provide in accordance with SDI/DOOR A250.8, unless indicated or specified otherwise.

a. Kick Plates: Push side of single-acting doors.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where indicated. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Provide complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

a. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

    1. Quantities listed are for each pair of doors, or for each single door.

    2. The supplier is responsible for handing and sizing all products.

    3. Where multiple options for a piece of hardware are given in a

single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

b. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

Hardware Sets			
Set: 1.0			
Doors: 109C, 109D			
Description: By Door Supplier			
1	**All Hardware**	**BY DOOR SUPPLIER**	
Set: 2.0			
Doors: 001, 004			
Description: Padlock			
1	**All Hardware**	**BY DOOR SUPPLIER**	
1	**Padlock**	**TO MATCH BASE STD**	
Set: 3.0			
Doors: 002			
Description: Gate x Storeroom			
1	**Storeroom/Closet Lock**	**F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL**	**US32D**
1	**Core**	**6PIN LFIC PERMANENT CORE x GMK / 6300 GMK**	**US15**
1	**All Hardware**	**BY DOOR SUPPLIER**	

Note - Verify hardware compatibility with door supplier.

Set: 4.0

Doors: 005, 006

Description: Gate x LP1000

3	Gate Hinge	BY DOR MANUFACTURER	
1	Exit Device (cipher)	9300 W/LP1000 CIPHER LOCK	
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Gate Closer	BY DOOR MANUFACTURER	

Note - Verify hardware compatibility with door supplier.

Set: 5.0

Doors: 007

Description: Gate x 8100

3	Gate Hinge	BY DOR MANUFACTURER	
1	Cipher Lock	8100 x LEVER TO SUIT	US26D
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Gate Closer	BY DOOR MANUFACTURER	

Note - Verify hardware compatibility with door supplier.

Set: 6.0

Doors: 101F

Description: Pair x AL x ED Nightlatch MELR x DO x Seals - CR

2	Continuous Hinge	A31021G x POWER TRANSFER PREP x HEIGHT / CFMXXSLF-HD1 PT HEIGHT	
2	Electric Power Transfer	EPT	
1	Concealed Vert Rod Exit, Dummy	TYPE6 F01 x REX x PULL / 55 AD8410 862	US32D
1	Concealed Vert Rod Exit, Nightlatch	TYPE6 F12 x PULL x ELR x REX x 6PIN LFIC CONST CYL / 55 56 64 AD8410 106 x 862	US32D
2	Shim Kit	541	
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
2	Conc Overhead Stop	1-X36	689
1	Surface Closer	C02011 / 7500	689
1	Drop Plate	7786OH	689
1	Automatic Opener	6011	689
1	Threshold	BY OTHERS	
1	Gasketing	BY DOOR MANUFACTURER	
2	Door Bottom	BY DOOR MANUFACTURER	
1	Astragal	BY DOOR MANUFACTURER	
2	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	
2	Door Actuator	505 x 555	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	

Note - Auto door operator(s) are supply only. 120VDC is required at the head of the door for all door operators. 15A dedicated circuit. Reinforce wall / frame for automatic operator mounting. All conduit and back boxes with pull cords are to be provided by the electrical contractor or by others.

Operational Narrative:

1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. ADA access by actuator switch. In locked condition, actuator energized only upon valid card reader presentation.
4. Egress free for immediate exit. ADA egress by actuator switch.
5. REX switch in push rail allows authorized exit without alarm condition.
6. Door position switches monitor open/closed status.
7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.
Set: 7.0
Doors: 101E
Description: Pair x AL x ED Nightlatch MELR x CL OHS x Seals - CR

2	**Continuous Hinge**	**A31021G x POWER TRANSFER PREP x HEIGHT / CFMXXSLF-HD1 PT HEIGHT**	
2	**Electric Power Transfer**	**EPT**	
1	**Concealed Vert Rod Exit, Dummy**	**TYPE6 F01 x REX x PULL / 55 AD8410 862**	**US32D**
1	**Concealed Vert Rod Exit, Nightlatch**	**TYPE6 F12 x PULL x ELR x REX x 6PIN LFIC CONST CYL / 55 56 64 AD8410 106 x 862**	**US32D**
1	**Shim Kit**	**541**	
1	**Core**	**6PIN LFIC PERMANENT CORE x GMK / 6300 GMK**	**US15**
2	**Conc Overhead Stop**	**1-X36**	**689**
2	**Surface Closer**	**C02011 / 7500**	**689**
2	**Drop Plate**	**7786OH**	**689**
1	**Threshold**	**BY OTHERS**	
1	**Gasketing**	**BY DOOR MANUFACTURER**	
2	**Door Bottom**	**BY DOOR MANUFACTURER**	
1	**Astragal**	**BY DOOR MANUFACTURER**	
2	**Harness (in door)**	**10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER**	

2	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	

Note - Verify hardware compliance with door supplier.

Note - Minimum stile width 6".

Operational Narrative:

1. Doors normally closed and secure.

2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.

3. Egress free for immediate exit.

5. REX switch in push rail allows authorized exit without alarm condition.

6. Door position switches monitor open/closed status.

7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 8.0

Doors: 103, 201

Description: Single x AL x 2190 x STC35

1	Continuous Hinge	A31021G x HEIGHT / CFMXXSLF-HD1 HEIGHT	
1	Mortise Lock (narrow stile)	2190 1-01-CURVE	US32D
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	BY DOOR MANUFACTURER	

1	Door Bottom	BY DOOR MANUFACTURER	
Set: 9.0			
Doors: 101C			
Description: Single x AL x 2190 x CL x Seals			
1	Continuous Hinge	A31021G x HEIGHT / CFMXXSLF-HD1 HEIGHT	
1	Mortise Lock (narrow stile)	2190 1-01-CURVE	US32D
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02011 / 7500	689
1	Floor Stop	L02141 / 441H	US26D
1	Threshold	BY OTHERS	
1	Gasketing	BY DOOR MANUFACTURER	
1	Door Bottom	BY DOOR MANUFACTURER	
Set: 10.0			
Doors: 101D			
Description: Single x AL x 2190 x UNIJ x Seals			
1	Continuous Hinge	A31021G x HEIGHT / CFMXXSLF-HD1 HEIGHT	
1	Mortise Lock (narrow stile)	2190 1-01-CURVE	US32D
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT	689
1	Threshold	BY OTHERS	
1	Gasketing	BY DOOR MANUFACTURER	
1	Door Bottom	BY DOOR MANUFACTURER	

Set: 11.0			
Doors: 116B			
Description: Pair x Ext x ED EO x UNIJ x DC			
6	Hinge, Hvy Wt (storm pro)	A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"	US32D
2	Concealed Vert Rod Exit, Exit Only	TYPE6 F01 / (12) XX8610 EO	US32D
1	Coordinator	TYPE 21B / 1700	Black
2	Surface Closer	C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
1	Astragal (overlapping)	357C HEIGHT	
2	Door Contact	DPS-M-BK	
Note - Install gasketing before installing the closer.			
Set: 12.0			
Doors: 101B			
Description: Pair x Ext x ED Nightlatch x UNIJ x Seals			
6	Hinge, Hvy Wt (storm pro)	A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"	US32D
1	Concealed Vert Rod Exit, Dummy	TYPE6 F02 / XX8610 862	US32D
1	Concealed Vert Rod Exit, Nightlatch	TYPE6 F12 x PULL x 6PIN LFIC CONST CYL / (12) 64 XX8610 106 x 862	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Coordinator	TYPE 21B / 1700	Black
2	Surface Closer	C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT	689

2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
2	Sweep (w/raindrip)	R3D534 WIDTH / 3452AV WIDTH	
1	Astragal (overlapping)	357C HEIGHT	
Note - Mechanical dogging.			
Note - Install gasketing before installing the closer.			
Set: 13.0			
Doors: 101A			
Description: Pair x Ext x ED Nightlatch MELR x DO x Seals			
6	Hinge, Hvy Wt (storm pro)	A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Concealed Vert Rod Exit, Dummy	TYPE6 F02 / MD8610 862	US32D
1	Concealed Vert Rod Exit, Nightlatch	TYPE6 F12 x PULL x MELR x 6PIN LFIC CONST CYL / (12) 56 64 XX8610 106 x 862	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Coordinator	TYPE 21B / 1700	Black
1	Surface Closer	C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT	689
1	Automatic Opener	6021	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
2	Sweep (w/raindrip)	R3D534 WIDTH / 3452AV WIDTH	
1	Astragal (overlapping)	357C HEIGHT	

1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Actuator	505 x 555	
1	Power Supply	AQD1	

Note - Auto door operator(s) are supply only. 120VDC is required at the head of the door for all door operators. 15A dedicated circuit. Reinforce wall / frame for automatic operator mounting. All conduit and back boxes with pull cords are to be provided by the electrical contractor or by others.

Note - Install gasketing before installing the closer.

Operational Narrative:

1. Doors normally closed and secure.

2. Exit device latches can be electrically or mechanically held retracted for open access.

3. ADA access by actuator switch.

4. Egress free for immediate exit. ADA egress by actuator switch.

5. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 14.0

Doors: 119, 120A, 130

Description: Pair x Ext x ED Nightlatch MELR x CPS x Seals

6	Hinge, Hvy Wt (storm pro)	A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"	US32D
2	Electric Power Transfer	EL-EPT	
1	Concealed Vert Rod Exit, Dummy	TYPE6 F02 REX / (12) 55 XX8610 862	US32D
1	Concealed Vert Rod Exit, Nightlatch	TYPE6 F12 MELR REX x 6PIN LFIC CONST CYL / (12) 55 56 64 XX8610 106 x 862	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
2	Surface Closer	C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT	689

2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
2	Sweep (w/raindrip)	R3D534 WIDTH / 3452AV WIDTH	
1	Astragal (overlapping)	357C HEIGHT	
2	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	

Note - Install gasketing before installing the closer.

Operational Narrative:

1. Doors normally closed and secure.

2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.

3. Egress free for immediate exit.

5. REX switch in push rail allows authorized exit without alarm condition.

6. Door position switches monitor open/closed status.

7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 15.0

Doors: 003

Description: Pair x Ext x Storeroom x CPS x Seals - EAC Infrastructure

6	Hinge, Hvy Wt (storm pro)	A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"	US32D

1	Electric Power Transfer	EPT	
2	Flush Bolt (storm pro)	L04251 / 556WS	US26D
1	Dust Proof Strike	L04021 / 570	US26D
1	Storeroom/Closet Lock	F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surf Overhead Stop	C02541 / 9-336	689
1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
2	Sweep (w/raindrip)	R3D534 WIDTH / 3452AV WIDTH	
1	Astragal (overlapping)	357C HEIGHT	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	

Note - Install gasketing before installing the closer.

Set: 16.0

Doors: 109E, 125C

Description: Single x Ext x ED EO x UNIJ x DC - EAC Infrastructure

3	Hinge, Hvy Wt (storm pro)	A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EPT	
1	Rim Exit Device, Exit Only (hurricane rated)	TYPE1 F01 / (12) HC 8810 EO	US32D
1	Surface Closer	C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D

1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
1	Sweep (w/raindrip)	R3D534 WIDTH / 3452AV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	

Note - Install gasketing before installing the closer.

Set: 16.1

Doors: 109B

Description: Single x Ext x ED EO x CL x DC x STC50

1	Continuous Hinge	FM3500 HEIGHT	630
1	Rim Exit Device, Exit Only (hurricane rated)	TYPE1 F01 / (12) HC 8810 EO	US32D
1	Door Operator	SW200i FULL WIDTH HEADER (TO BE USED AS A CLOSER) (INSTALL TO SUIT)	
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32139 WIDTH / 253xXAFG WIDTH	
1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	
1	Rain Guard	346C WIDTH	
1	Door Contact	DPS-M-BK	

Note – Verify hardware compatibility with door supplier.

Note - Install gasketing before installing the closer.

Note - Maximum weight capacity 600lbs.

Set: 17.0			
Doors: 107B, 111B, 126F			
Description: Single x Ext x ED EO x UNIJ x Seals x DC			
3	**Hinge, Hvy Wt (storm pro)**	**A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"**	**US32D**
1	**Rim Exit Device, Exit Only (hurricane rated)**	**TYPE1 F01 / (12) HC 8810 EO**	**US32D**
1	**Surface Closer**	**C02021 TOP JAMB W/INTEGRATED STOP x DROP PLATE TO SUIT / UNI7500 DROP PLATE TO SUIT**	**689**
1	**Kick Plate**	**J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK**	**US32D**
1	**Threshold (saddle)**	**J32139 WIDTH / 253xXAFG WIDTH**	
1	**Gasketing**	**2891APK 1WIDTH x 2HEIGHT**	
1	**Rain Guard**	**346C WIDTH**	
1	**Sweep (w/raindrip)**	**R3D534 WIDTH / 3452AV WIDTH**	
1	**Door Contact**	**DPS-M-BK**	
Note - Install gasketing before installing the closer.			
Set: 18.0			
Doors: 120			
Description: Single x Ext x Fail Secure x CPS x Seals			
3	**Hinge, Hvy Wt (storm pro)**	**A5111 NRP 4-1/2" x 4-1/2" / SP3386 NRP 4-1/2" x 4-1/2"**	**US32D**
1	**Electric Power Transfer**	**EL-EPT**	
1	**Fail Secure Lock (NAC)**	**FAIL SECURE x LEVER x REX x R01 x 6PIN LFIC CONST CYL / R01 64 NAC-88271-24V LNL**	**US32D**
1	**Core**	**6PIN LFIC PERMANENT CORE x GMK / 6300 GMK**	**US15**
1	**Surface Closer**	**C02021 W/INTEGRATED STOP / CPS7500**	**689**
1	**Kick Plate**	**J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK**	**US32D**
1	**Threshold (saddle)**	**J32139 WIDTH / 253xXAFG WIDTH**	

1	Gasketing	2891APK 1WIDTH x 2HEIGHT	
1	Rain Guard	346C WIDTH	
1	Sweep (w/raindrip)	R3D534 WIDTH / 3452AV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	

Note - Install gasketing before installing the closer.

Operational Narrative:

1. Door normally closed and secure.

2. Authorized access by card reader unlocking lever trim for a predetermined time limit. Trim can remain unlocked for open access.

3. Egress free for immediate exit.

4. Mortise lock REX switch allows authorized exit without alarm condition.

5. Integral door position switch monitors open/closed/latched status.

6. Lever remains locked (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 19.0

Doors: 108A, 108B, 109, 111, 209, 214

Description: Single x X10 FF-L2890C IV x CL x STC50

1	Continuous Hinge	FM3500 EL-EPT HEIGHT	630
1	Combination Exit Device	KABA MAS X-10 FF-L2890C TYPE IV PDLAP	
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15

1	Door Operator	SW200i FULL WIDTH HEADER (TO BE USED AS A CLOSER) (INSTALL TO SUIT)	
1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	
2	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	
1	Motion Sensor (REX)	XMS2	
1	Card Reader. Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	

Note – Verify hardware compatibility with door supplier.

Note - Maximum weight capacity 600lbs.

Set: 19.1

Doors: 109

Description: Single x Fail Secure x CL x STC50

1	Continuous Hinge	FM3500 EL-EPT HEIGHT	630
1	Fail Secure Lock (NAC)	FAIL SECURE x LEVER x REX x R01 x 6PIN LFIC CONST CYL / R01 64 NAC-88271-24V LNL	US32D
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Door Operator	SW200i FULL WIDTH HEADER (TO BE USED AS A CLOSER) (INSTALL TO SUIT)	
1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	

1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Note – Verify hardware compatibility with door supplier.			
Note - Maximum weight capacity 600lbs.			
Set: 20.0			
Doors: 109A			
Description: Single x X10 FF-L2890 IV x CL OHS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Combination Exit Device	KABA MAS X-10 FF-L2890C TYPE IV PDLAP	
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Conc Overhead Stop	1-X36	689
1	Surface Closer	C02011 / 7500	689
1	Drop Plate	7786OH	689
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	

1	Door Contact	DPS-M-BK	
1	Motion Sensor (REX)	XMS2	
1	Card Reader. Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Set: 20.1			
Doors: 111A			
Description: Single x ED EO RX x CL OHS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Rim Exit Device, Exit Only	TYPE1 F01 RX / (12) 55 8810 EO	US32D
1	Conc Overhead Stop	1-X36	689
1	Surface Closer	C02011 / 7500	689
1	Drop Plate	7786OH	689
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Power Supply	AQD1	

Hardware Sets

Set: 21.0

Doors: 114, 211, 212

Description: Single x X10 FF-L2890 II x CL x STC50

1	Continuous Hinge	FM3500 EL-EPT HEIGHT	630
1	Combination Lock	KABA MAS LKM10K FF-L-2890C TYPE II	
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15

1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Door Operator	SW200i FULL WIDTH HEADER (TO BE USED AS A CLOSER) (INSTALL TO SUIT)	
1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Motion Sensor (REX)	XMS2	
1	Card Reader. Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	

Note – Verify hardware compatibility with door supplier.

Note - Maximum weight capacity 600lbs.

Note - Install floor stop 441H where suitable.

Set: 22.0

Doors: 115, 116, 213

Description: Single x X10 FF-L2890 IV x CPS x STC45

3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 5" x 4-1/2" / T4A3386 NRP 5" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Combination Exit Device	KABA MAS X-10 FF-L2890C TYPE IV PDLAP	
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	

1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Motion Sensor (REX)	XMS2	
1	Card Reader. Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Note – Verify hardware compatibility with door supplier.			
Set: 23.0 - NOT USED			
Description: Single x X10 FF-L2890 x CL x STC50			
1	Continuous Hinge	FM3500 EL-EPT HEIGHT	630
1	Combination Lock	KABA MAS LKM10K FF-L-2890C TYPE II	
1	Cylinder	6PIN LFIC CONST CYL x CAM/TAILPIECE TO SUIT / 64 41/34 x CAM TO SUIT	US15
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Door Operator	SW200i FULL WIDTH HEADER (TO BE USED AS A CLOSER) (INSTALL TO SUIT)	
1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Motion Sensor (REX)	XMS2	
1	Card Reader. Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Note – Verify hardware compatibility with door supplier.			

Note - Maximum weight capacity 600lbs.			
Note - Install floor stop 441H where suitable.			
Set: 24.0			
Doors: 117C			
Description: Pair x ED Classroom x CPS x Seals			
6	**Hinge, Full Mortise, Hvy Wt**	**A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"**	**US32D**
1	**Concealed Vert Rod Exit, Exit**	**TYPE6 F01 / (12) XX8610 EO**	**US32D**
1	**Concealed Vert Rod Exit, Classroom**	**TYPE6 F08 x 6PIN LFIC CONST CYL / (12) 64 XX8613 ETL**	**US32D**
1	**Core**	**6PIN LFIC PERMANENT CORE x GMK / 6300 GMK**	**US15**
2	**Surface Closer**	**C02021 W/INTEGRATED STOP / CPS7500**	**689**
2	**Kick Plate**	**J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK**	**US32D**
1	**Threshold**	**BY OTHERS**	
1	**Gasketing**	**R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT**	
2	**Sweep**	**29326CV WIDTH**	
2	**Astragal (split)**	**R3G734 HEIGHT / 305CN HEIGHT**	
Set: 25.0			
Doors: 215A			
Description: Pair x ED Classroom x CL OHS x Seals			
6	**Hinge, Full Mortise, Hvy Wt**	**A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"**	**US32D**
1	**Concealed Vert Rod Exit, Exit Only**	**TYPE6 F01 / (12) XX8610 EO**	**US32D**
1	**Concealed Vert Rod Exit, Classroom**	**TYPE6 F08 x 6PIN LFIC CONST CYL / (12) 64 XX8613 ETL**	**US32D**

1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
2	Surf Overhead Stop	C02541 / 9-336	689
2	Surface Closer	C02011 / 7500	689
2	Drop Plate	7786OH	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
2	Sweep	29326CV WIDTH	
2	Astragal (split)	R3G734 HEIGHT / 305CN HEIGHT	
Set: 26.0			
Doors: 116A			
Description: Pair x ED Nightlatch MELR x CL OHS x Seals			
6	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
2	Electric Power Transfer	EL-EPT	
1	Concealed Vert Rod Exit, Dummy	TYPE6 F02 REX / (12) 55 XX8610 862	US32D
1	Concealed Vert Rod Exit, Nightlatch	TYPE6 F12 MELR REX x 6PIN LFIC CONST CYL / (12) 55 56 64 XX8610 106x862	US32D
2	Surf Overhead Stop	C02541 / 9-336	689
2	Surface Closer	C02011 / 7500	689
2	Drop Plate	7786OH	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
2	Sweep	29326CV WIDTH	
2	Astragal (split)	R3G734 HEIGHT / 305CN HEIGHT	

2	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Set: 27.0 - NOT USED			
Description: Pair x Storeroom x CPS x Seals			
5	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Flush Bolt (self latching)	TYPE 27 / 2845	US26D
1	Dust Proof Strike	L04021 / 570	US26D
1	Storeroom/Closet Lock	F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL	US32D
1	Coordinator	TYPE 21B / 1700	Black
2	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
2	Sweep	29326CV WIDTH	
1	Astragal (overlapping)	357C HEIGHT	
Set: 27.1			
Doors: 112, 204, 223			
Description: Pair x Fail Secure x CPS x Seals			
6	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D

1	Electric Power Transfer	EL-EPT	
1	Flush Bolt (self latching)	TYPE 27 / 2845	US26D
1	Dust Proof Strike	L04021 / 570	US26D
1	Fail Secure Lock (NAC)	FAIL SECURE x LEVER x REX x R01 x 6PIN LFIC CONST CYL / R01 64 NAC-88271-24V LNL	US32D
1	Coordinator	TYPE 21B / 1700	Black
2	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
2	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
2	Sweep	29326CV WIDTH	
1	Astragal (overlapping)	357C HEIGHT	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
2	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Set: 28.0			
Doors: 126D			
Description: Pair x Storeroom x OHS x Seals			
6	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Flush Bolt (self latching)	TYPE 27 / 2845	US26D
1	Dust Proof Strike	L04021 / 570	US26D
1	Storeroom/Closet Lock	F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
2	Surf Overhead Stop	C02541 / 9-336	689

1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
2	Sweep	29326CV WIDTH	
Set: 29.0 - NOT USED			
Description: Single x ED Nightlatch MELR x CL OHS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Rim Exit Device, Storeroom	TYPE1 F03 MELR x 6PIN LFIC CONST CYL / (12) RX 55 56 64 8804 ETL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02011 / 7500	689
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
Operational Narrative:			
1. Doors normally closed and secure.			
2. Authorized access by card reader retracting exit device latch for predetermined time limit. Exit device latch can be electrically held retracted for open access.			
4. Egress free for immediate exit.			
5. REX switch in push rail allows authorized exit without alarm condition.			

6. Door position switch monitor open/closed status.

7. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 30.0

Doors: 207A

Description: Single x ED EO x CL OHS x Seals

3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Rim Exit Device, Exit Only	TYPE1 F01 / (12) 8810 EO	US32D
1	Surf Overhead Stop	C02541 / 9-336	689
1	Surface Closer	C02011 / 7500	689
1	Drop Plate	7786OH	689
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	

Set: 30.1

Doors: 107A, 126E

Description: Single x ED EO x CL OHS x Seals - EAC Infrastructure

3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Rim Exit Device, Exit Only	TYPE1 F01 / (12) 8810 EO	US32D
1	Surface Closer	C02011 / 7500	689
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	

1	Sweep	29326CV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
Set: 31.0			
Doors: 125B, 223A			
Description: Single x ED Passage x CL OHS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Rim Exit Device, Classroom	TYPE1 F14 x TRIM x 6PIN LIFC CONST CYL / (12) 64 8815 ETL	US32D
1	Surface Closer	C02011 / 7500	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
Set: 32.0			
Doors: 117A, 217, 217A			
Description: Single x Fail Secure x CPS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EL-EPT	
1	Fail Secure Lock (NAC)	FAIL SECURE x LEVER x REX x R01 x 6PIN LFIC CONST CYL / R01 64 NAC-88271-24V LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15

1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
		Set: 32.1	
Doors: 102			
Description: Single x Fail Secure x CL x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Electric Power Transfer	EPT	
1	Fail Secure Lock (NAC)	FAIL SECURE x LEVER x REX x R01 x 6PIN LFIC CONST CYL / R01 64 NAC-88271-24V LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02011 / 7500	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Floor Stop	L02141 / 441H	US26D
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
1	Harness (in door)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	
1	Harness (in frame)	10 CONDUCTOR (2x18AWG x 8 x 22AWG) x LENGTH BY ACCESS CONTROL SUPPLIER	

1	Door Contact	DPS-M-BK	
1	Card Reader, Keypad	BY ACCESS CONTROL SUPPLIER	
1	Power Supply	AQD1	
		Set: 33.0	
Doors: 122, 126C, 128C, 210, 215, 218A			
Description: Single x Storeroom x CL x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Storeroom/Closet Lock	F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02011 / 7500	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
		Set: 34.0	
Doors: 220			
Description: Single x Storeroom x CL OHS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Storeroom/Closet Lock	F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surf Overhead Stop	C02541 / 9-336	689
1	Surface Closer	C02011 / 7500	689

1	Drop Plate	7786OH	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
Set: 35.0			
Doors: 218			
Description: Single x Storeroom x CPS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Storeroom/Closet Lock	F07 x LEVER x 6PIN LFIC CONST CYL / 64 8204 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
Set: 36.0			
Doors: 124			
Description: Single x Office x CL x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Office/Entry Lock	F04 x LEVER x 6PIN LFIC CONST CYL / 64 8205 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15

1	Surface Closer	C02011 / 7500	689
1	Floor Stop	L02141 / 441H	US26D
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
Set: 37.0			
Doors: 118, 216			
Description: Single x Office x CPS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Office/Entry Lock	F04 x LEVER x 6PIN LFIC CONST CYL / 64 8205 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
1	Threshold	BY OTHERS	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
Set: 38.0			
Doors: 126			
Description: Single x Office x CPS x STC50			
1	Continuous Hinge	FM3500 HEIGHT	630
1	Office/Entry Lock	F04 x LEVER x 6PIN LFIC CONST CYL / 64 8205 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Door Operator	SW200i FULL WIDTH HEADER (TO BE USED AS A CLOSER) (INSTALL TO SUIT)	

1	Gasketing, Door Bottom, Threshold, Astragal (STC)	BY DOOR SUPPLIER TO SUIT	
Note - Maximum weight capacity 600lbs.			
Note – Verify hardware compatibility with door supplier.			
Note - Provide floor stops 441H as needed.			
Set: 39.0			
Doors: 105A, 105B, 106, 107, 110A, 110B, 205A, 205B, 206A, 206B, 208A, 208B, 225A, 225B, 226A, 226B, 227A, 227B			
Description: Single x Office x CPS x STC35			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Office/Entry Lock	F04 x LEVER x 6PIN LFIC CONST CYL / 64 8205 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Door Bottom	R3G324 WIDTH / STC411APK WIDTH	
Set: 40.0			
Doors: 104, 113, 125, 127, 128, 129, 203, 207, 222, 224			
Description: Single x Office x CL x STC35			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Office/Entry Lock	F04 x LEVER x 6PIN LFIC CONST CYL / 64 8205 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15

1	Surface Closer	C02011 / 7500	689
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Door Bottom	R3G324 WIDTH / STC411APK WIDTH	
Set: 41.0			
Doors: 202			
Description: Single x Classroom x CL x STC35			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Classroom Lock	F05 x LEVER x 6PIN LFIC CONST CYL / 64 8237 LNL	US32D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Surface Closer	C02011 / 7500	689
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Door Bottom	R3G324 WIDTH / STC411APK WIDTH	
Set: 42.0			
Doors: 125A, 126A, 126B, 127A, 127B, 128A, 128B, 211A, 211B, 211C, 211D, 211E, 211F			
Description: Single x Passage x STC35			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Passage Latch	F01 x LEVER / 8215 LNL	US32D
1	Floor Stop	L02141 / 441H	US26D
1	Threshold (saddle)	J32130 WIDTH / 171A WIDTH	

1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Door Bottom	R3G324 WIDTH / STC411APK WIDTH	
Set: 43.0			
Doors: 215A, 219A			
Description: Single x Passage x CPS x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 NRP 4-1/2" x 4-1/2" / T4A3386 NRP 4-1/2" x 4-1/2"	US32D
1	Passage Latch	F01 x LEVER / 8215 LNL	US32D
1	Surface Closer	C02021 W/INTEGRATED STOP / CPS7500	689
1	Gasketing	R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT	
1	Sweep	29326CV WIDTH	
Set: 44.0			
Doors: 121, 123, 219, 221			
Description: Single x PP DL x CL x Seals			
3	Hinge, Full Mortise, Hvy Wt	A5111 4-1/2" x 4-1/2" / T4A3386 4-1/2" x 4-1/2"	US32D
1	Deadbolt	E0151 x 6PIN LFIC CONST CYL / 64 485	US26D
1	Core	6PIN LFIC PERMANENT CORE x GMK / 6300 GMK	US15
1	Door Pull	J402 12" / BF152	US32D
1	Push Plate	J301 4" x 16" x SA / 70C-RKW SA	US32D
1	Surface Closer	C02011 / 7500	689
1	Kick Plate	J102 8" x WIDTH x CSK / K1050 8" x WIDTH CSK	US32D
1	Floor Stop	L02141 / 441H	US26D
1	Threshold	BY OTHERS	

1	**Gasketing**	**R0E154 1WIDTH x 2HEIGHT / S773BL 1WIDTH x 2HEIGHT**	
1	**Sweep**	**29326CV WIDTH**	

-- End of Section --

SECTION 10 26 00

WALL AND DOOR PROTECTION
08/20

PART 1 GENERAL

1.1 REFERENCES

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.

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	**(2025a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications**
ASTM B221	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D256	(2010; R 2018) Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D543	(2020) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM E84	(2024) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F476	(2014) Standard Test Methods for Security of Swinging Door Assemblies
ASTM G21	(2015; R 2021; E 2021) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2017; Version 1.2) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545	(2005; R 2021) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2022) Adhesive and Sealant Applications

UL SOLUTIONS (UL)

UL 2818	(2022) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards

Wall Guards

Wall Covering and Panels

SD-03 Product Data

Corner Guards

Wall Guards

Wall Covering and Panels

Recycled content for aluminum component of corner guards; S

Recycled content for steel component of corner guards; S

Recycled content for aluminum component of wall guards; S

SD-04 Samples

Corner Guards; G

Wall Guards; G

Wall Covering and Panels; G

SD-06 Test Reports

Fire Resistance Rating

SD-07 Certificates

Indoor air quality for wall covering/panels; S

Indoor air quality for adhesives; S

SD-10 Operation and Maintenance Data

Corner Guards, Data Package 1

Wall Guards, Data Package 1

Wall Covering and Panels, Data Package 1

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality

1.3.1.1 Wall Covering and Panels

Provide sheet and high impact resistant resilient materials certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this section. Provide current product certification documentation from certification body.

1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party program that products meet the requirements of this section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Store materials at approximately 70 degrees F for at least 48 hours prior to installation.

1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for a 1 year period of one year from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, provide wall protection items that are standard products of a single manufacturer and furnished as detailed.

Drawings show general configuration of products required, and items differing in minor details from those shown are acceptable.

Submit detailed shop drawings of each wall protection item indicated. Include elevations, dimensions, clearances, details of construction and anchorage, and details of joints and connections.

Submit manufacturers' descriptive product data for each wall protection item indicated. Include manufacturers' literature, finishes, profiles and thicknesses of materials.

Submit manufacturers' operations and maintenance data for each wall and door protection item indicated in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded PVC free conforming to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance must be 18 ft-lbs/sq. inch when tested in accordance with ASTM D256, (Izod impact, ft-lbs per sq inch notched). Minimum impact resistance must be 49.62 ft-lbs/sq. inch when tested in accordance with ASTM F476.

2.1.1.2 Fire Resistance Rating

Provide the following surface burning characteristics when tested and labeled in accordance with ASTM E84 by a qualified testing agency: maximum flame spread of 25 and a smoke developed rating of 450 or less. Provide material rated as self extinguishing when tested in accordance with ASTM D635.

2.1.1.3 Integral Color

Provide colored components having integral color and matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Provide materials resistant to chemicals and stains reagents in accordance with ASTM D543.

2.1.1.5 Fungal and Bacterial Resistance

Provide materials resistant to fungi and bacteria in accordance with ASTM G21, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards **(CG)**

Provide surface mounted corner guards, radius formed to profile shown. Provide corner guards that extend as indicated. Furnish mounting hardware, cushions, and base plates. Provide assembly consisting of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous PETG retainer. Provide with 1/4 inch radius and 2

inch legs. Provide data identifying percentage of recycled content for aluminum component of corner guards. Furnish factory fabricated end closure caps for top and bottom of surface mounted corner guards. Manufacturer to provide insulating materials that are an integral part of the corner guard system.

2.2.2 Stainless Steel Corner Guards (CG-1)

Provide stainless steel base material that contains a minimum of 60 percent recycled content. Provide data identifying percentage of recycled content for steel component of corner guards. Fabricate stainless steel base material of 16 gauge thick material conforming to ASTM A240/A240M, type 430 or 304. Provide corner guards that extend to height as indicated on drawings. Form corner guard to dimensions shown.

2.3 WALL GUARDS

Provide product with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Extruded continuous aluminum retainers must conform to ASTM B221, alloy 6063, temper T5 or T6. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of wall guards. Field adjust all end caps and corners to assure close alignment.

2.4 WALL COVERING AND PANELS

Provide wall covering and panels consisting of high impactrigid acrylic vinyl or polyvinyl chloride resilient material. Panel sizes are 4 by 8 feet 4 by 10 feet. Provide wall covering material used on the interior of the building (defined as inside of the weatherproofing system) that meets either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) the VOC content requirements of SCAQMD Rule 1168, or VOC content requirements of GS-36. Provide certification of indoor air quality for wall covering/panels.

2.4.1 Rigid Vinyl Acrylic Wall Covering

Provide 0.040 inch thick wall covering.

2.4.2 High Impact Wall Panels

Provide wall panel face and edge thickness that are 0.040 inch. Factory bond panel face to a 0.375 inch thick fiberboard core. Laminate the backside of the panel with a moisture resistant vapor barrier.

2.5 TRIM, FASTENERS AND ANCHORS

Provide PVC free trim, fasteners and anchors for each specific installation as indicated.

2.6 FINISH

Submit samples indicating color and texture of materials requiring color and finish.

2.6.1 Resilient Material Finish

Provide resilient material finish of texture with colors as indicated in accordance with SAE J1545.

2.6.2 Stainless Steel Finish

Provide stainless steel finish in accordance with ASTM A240/A240M, Type 302 or 304, finish number 4.

2.7 ADHESIVES

Provide adhesive for resilient material in accordance with manufacturers recommendations. Provide sealants and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) the VOC content requirements of SCAQMD Rule 1168, or VOC content requirements of GS-36. Provide certification of indoor air quality for adhesives.

2.8 COLOR

Provide color as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install items that show visual evidence of biological growth. Install items on surfaces that are clean, smooth, and free of obstructions.

3.1.1 Corner Guards and Wall Guards

Mount guards as indicated on external corners of interior walls, partitions and columns and in accordance with manufacturer's written installation instructions.

3.1.1.1 Stainless Steel Guards

a. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

b. Mount guards as indicated and in accordance with manufacturer's recommendations.

c. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as indicated. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Overlap corner guards on finish plaster surfaces.

d. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, anchor corner guards as indicated. Grout spaces solid between guards and backing

with portland cement and sand mortar.

e. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

f. For wall guards, space brackets at no more than 3 feet on center and anchor to the wall in accordance with the manufacturer's installation instructions.

3.1.2 Wall Coverings and Panels

Install as indicated in accordance with manufacturer's written instructions.

-- End of Section --

SECTION 10 44 16

FIRE EXTINGUISHERS
11/19

PART 1 GENERAL

1.1 REFERENCES

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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1	(2024) Fire Code
NFPA 10	(2026) Standard for Portable Fire Extinguishers
NFPA 101	(2024) Life Safety Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.157	(2003) Portable Fire Extinguishers

UL SOLUTIONS (UL)

UL 299	(2024; Reprint Aug 2025) Dry Chemical Fire Extinguishers

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Accessories

Cabinets

Schedule

SD-03 Product Data

Fire Extinguishers

Accessories

Cabinets

SD-04 Samples

Equipment Samples

SD-07 Certificates

Fire Extinguishers Certifications

Manufacturer's Warranty with Inspection Tag

1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

1.3.1 Samples

Provide the following equipment samples: One of each type of fire extinguisher being installed and one full-sized sample of each type of cabinet being installed.

Use approved samples for installation, with proper identification and storage.

1.4 WARRANTY

Guarantee that Fire Extinguishers are free of defects in materials, fabrication, finish, and installation and that they will remain so for a period of not less than 2 years after completion.

Submit the manufacturer's warranty with inspection tag.

1.5 PROJECT SCHEDULE

For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

PART 2 PRODUCTS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: Fire Extinguishers; Accessories, and cabinets.

2.1 SYSTEM DESCRIPTION

2.1.1 Type

Submit fire extinguishers certifications showing compliance with local codes and regulations.

Provide fire extinguishers conforming to NFPA 10. Provide quantity and placement in compliance with the applicable sections of NFPA 1, NFPA 101, and 29 CFR 1910.157.

Provide dry chemical type fire extinguishers compliant with UL 299.

2.1.2 Material

Provide enameled steel extinguisher shell.

2.1.3 Size

10 pounds extinguishers.

2.1.4 Accessories

Pressure gage

2.2 FIRE EXTINGUISHER CABINETS

Cabinets shall be Type 304, 18 gage, satin finished stainless steel. Design style shall be semi-recessed and surface-mounted with flush full glass door. Cabinets shall have the size and be located as indicated on the drawings. The cabinet and door shall have 1 1/4-inch face trim. Cabinet and door construction shall consist of rolled edges with welded corners ground and buffed smooth. Glass shall be factory installed 1/4-inch clear tempered and be held in place by extruded vinyl glazing strips. Hardware shall include stainless steel continuous hinge, door pull and spring tension friction catch.

PART 3 EXECUTION

3.1 INSTALLATION

Install Fire Extinguishers where indicated on the drawings. Verify exact locations prior to installation.

Provide extinguishers which are fully charged and ready for operation upon installation. Provide extinguishers complete with Manufacturer's Warranty with Inspection Tag attached.

Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

Comply with the manufacturer's recommendations for all installations.

3.2 PROTECTION

3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new work at no additional cost to the Government.

3.2.2 Cleaning

Clean all surfaces of the work, and adjacent surfaces which are soiled as a result of the work. Remove from the site all construction equipment, tools, surplus materials and rubbish resulting from the work.

-- End of Section --

SECTION 23 08 00

COMMISSIONING OF MECHANICAL AND PLUMBING SYSTEMS
05/23, CHG 1: 08/24

PART 1 GENERAL

Building Commissioning is a systematic, quality-focused process for enhancing the delivery of a project that focuses on verifying and documenting that all of the commissioned systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the project requirements. The purpose is to reduce the cost and performance risks associated with delivering facilities projects, and to increase value to owners, occupants, and users. Comply with specification Section 01 91 00.15 BUILDING COMMISSIONING.

1.1 SEQUENCING AND SCHEDULING

Complete functional performance testing prior to performance verification testing required by Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. Complete the following prior to starting Functional Performance Tests of mechanical systems:

a. All equipment and systems completed, cleaned, flushed, disinfected, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications

b. Final DALT Report submitted and approved in accordance with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

c. Pre-final Testing, Adjusting, and Balancing Report submitted in accordance with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

d. The Certificate of Readiness submitted and approved in accordance with Section 01 91 00.15 BUILDING COMMISSIONING

e. Air Leakage Test Reports and Diagnostic Test Reports submitted and approved in accordance with Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING

f. Tests, Flushing, and Disinfection in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Test Equipment; G

SD-06 Test Reports

Pipe Flushing, Testing, And Water Treatment Reports; G

Completed Pre-Functional Checklists; G

Seasonal Test Report; G

Full-Load Test Report; G

Post-Construction Trend Log Report; G

SD-07 Certificates

Certificate Of Readiness; G

1.3 ACCESSIBILITY REQUIREMENTS

Equipment, systems, and devices for commissioned systems must be accessible. Make necessary modifications if systems and devices are not accessible for inspections and testing.

Assist commissioning team in testing by removing equipment covers, opening access panels, and other required activities that assist with visual oversight. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

1.4 COORDINATION

Refer to Section 01 91 00.15 BUILDING COMMISSIONING for requirements pertaining to coordination during the commissioning process. Coordinate with the Commissioning Provider in accordance with Section 01 91 00.15 and in accordance with the Commissioning Plan to schedule inspections as required to support the commissioning process. Furnish additional information requested by the Commissioning Provider. Coordinate scheduling of Functional Performance Testing with the commissioning team. Provide plans, reports, notes, and other documentation to the Commissioning Provider as specified in the commissioning plan, as it is completed.

1.5 PIPE FLUSHING, TESTING, AND WATER TREATMENT REPORTS

Test requirements are specified in Division 22 and 23 piping Sections. Prepare a pipe system cleaning, flushing, and hydrostatic testing log. Provide cleaning, flushing, testing, and water treatment log and final reports.

Include the following in the pipe system cleaning, flushing, and hydrostatic testing log:

a. Minimum flushing water velocity.

b. Water treatment reports.

c. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

1.6 CERTIFICATE OF READINESS

Submit Certificate of Readiness documentation in accordance with Section 01 91 00.15 BUILDING COMMISSIONING for all equipment and systems including

start-up reports; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; Issues Log; HVAC Controls Start-Up Reports. Do not schedule Functional Performance Tests for the system until the Certificate of Readiness for that system receives approval by the Government. The CxC, Quality Control Manager, and the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and date the Certificate of Readiness.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

Provide all testing equipment required to perform testing for the systems to be commissioned, except for equipment specific to and used by TAB as required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Provide a sufficient quantity of two-way radios for each subcontractor. Submit list of Test Equipment and instrumentation to be used for testing including equipment/instrument identification number, equipment application or planned use, manufacturer, make, model, and serial number, and calibration history with certificates. Also list special equipment and proprietary tools specific to a piece of equipment required for testing.

2.1.1 Proprietary Equipment

Provide manufacturer's proprietary test equipment and software required by any equipment manufacturer for programming and start-up, whether specified or not. Provide manufacturer test equipment, demonstrate its use, and assist in the commissioning process as needed. Provide data logging equipment and software required to test equipment.

2.1.2 Calibration and Accuracy

Comply with equipment manufacturer's test equipment calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to Contracting Officer upon request.

Provide all testing equipment of sufficient quality and accuracy to test and measure system performance with the tolerances specified. Unless otherwise noted, the following minimum requirements apply: Provide temperature sensors and digital thermometers with a certified calibration within the past year to an accuracy of 0.5 degrees F and a resolution of plus or minus 0.1 degrees F. Provide pressure sensors with an accuracy of plus or minus 2.0 percent of the value range being measured (not full range of meter) and calibrated within the last year.

PART 3 EXECUTION

3.1 MEETINGS

Attend all meetings in accordance with Section 01 91 00.15 BUILDING COMMISSIONING.

Provide timely updates on construction schedule changes to allow the Commissioning Provider to execute commissioning process efficiently. Notify Contracting Officer of anticipated construction delays to commissioning activities not yet performed or not yet scheduled.

3.2 COMMISSIONING CONSTRUCTION OBSERVATION CHECKLISTS

Commissioning construction observation checklists include Pre-Functional Checklists, Integrated Systems Test Checklists, and Functional Performance Test Checklists. Provide commissioning construction observation checklists for the Interim and Final Construction Phase Commissioning Plan in accordance with Section 01 91 00.15 BUILDING COMMISSIONING.

3.2.1 Pre-Functional Checklists

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.

3.2.2 Functional Performance Test Checklists

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 TESTING. 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 and maintenance

b. Conclusions and recommendations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements and specifications. 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. **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 TESTING.

3.2.3 Integrated Systems Test Checklists

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 TESTING. 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 and specifications. 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 TESTING.

3.3 PRE-FUNCTIONAL CHECKS

Pre-Functional Checks are a type of Commissioning Inspection in accordance with Section 01 91 00.15 BUILDING COMMISSIONING. 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, and controls. Include manufacturer start-up checklists associated with equipment with the submission of the Pre-Functional Checklists. Provide manufacturer's installation manual for each type of unit. 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. Required commissioning team members for Pre-Functional Checks includes the CxC, Mechanical Commissioning Specialist, Quality Control Manager, sub-contractor representative for each trade responsible for construction/installation of the checklist item, and the TAB representative (for items impacting TAB). 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.

3.4 STARTUP AND INITIAL CHECKOUT

Document start-up and initial testing procedures, and include in the Completed Pre-Functional Checklists submittal, including:

a. Startup tests and factory testing reports.

b. Manufacturer's representative start-up, operating, troubleshooting and maintenance procedures.

c. Additional documentation necessary for third party certification programs.

d. Perform and clearly document system operational checks and quality control checks as they are completed, and providing a copy to the commissioning team.

e. Correct deficiencies and sign the Certificate of Readiness for each system before functional performance testing

3.5 DUCT AIR LEAKAGE TEST (DALT) REPORT REVIEW AND VERIFICATION

3.5.1 Duct Air Leakage Test (DALT) Report Review

The Mechanical System Technical Commissioning Specialist must review the pre-final DALT Report required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel and include in the issues log. The Commissioning Specialist is responsible for reviewing the pre-final DALT Report required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identifying any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. All deficiencies must be resolved prior to DALT Report approval.

3.5.2 Duct Air Leakage Test (DALT) Report Verification

The Mechanical System Technical Commissioning Specialist must witness the DALT Field Acceptance Testing specified by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel and include in the issues log. The Commissioning Specialist is responsible for witnessing the DALT Field Acceptance Testing specified by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identifying any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. All deficiencies must be resolved prior to DALT Report approval.

3.6 TESTING, ADJUSTING, AND BALANCING REPORT REVIEW AND VERIFICATION

3.6.1 Testing, Adjusting, and Balancing (TAB) Report Review

The Mechanical System Technical Commissioning Specialist must review the pre-final TAB Report required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel and include in the issues log. The Commissioning Specialist is responsible for reviewing the pre-final TAB Report required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identifying any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. All deficiencies must be resolved prior to TAB Report approval.

3.6.2 Testing, Adjusting, and Balancing (TAB) Report Verification

The Mechanical System Technical Commissioning Specialist must witness the TAB Field Acceptance Testing specified by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel and include in the issues log. The Commissioning Specialist is responsible for witnessing the TAB Field Acceptance Testing specified by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and identifying any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. All deficiencies must be resolved prior to TAB Report approval.

3.7 HVAC CONTROLS START-UP AND PERFORMANCE VERIFICATION TEST REVIEW

The Mechanical System Technical Commissioning Specialist must review the Start-Up Testing Report, PVT Procedures and PVT Reports, including endurance testing trend submittals, required by Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and Section 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION. The Mechanical System Technical Commissioning Specialist must review each submittal and identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel and include in the issues log. The Commissioning Specialist is responsible for reviewing the Start-Up Testing Report, PVT Procedures and PVT Reports including endurance testing trend data required by Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and Section 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION and identifying any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. All deficiencies must be resolved prior to final acceptance.

3.8 FUNCTIONAL PERFORMANCE AND INTEGRATED SYSTEMS TESTING

Functional Performance and Integrated Systems Testing are a type of Commissioning Testing in accordance with Section 01 91 00.15 BUILDING COMMISSIONING. Conduct Functional Performance Testing in accordance with Section 01 91 00.15 BUILDING COMMISSIONING and requirements in this Section. Prior to Functional Performance Testing, complete all prerequisites in accordance with paragraph SEQUENCING AND SCHEDULING. 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.

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.

3.8.1 Test Scheduling and Coordination

Schedule and 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.

3.8.2 Preparation

Put equipment and systems into operation and continue operation during each working day of functional performance and integrated systems testing, as required. Verify temperature and pressure taps in accordance with Contract Documents. Provide a pressure/temperature plug at each water sensor which is an input point to control system.

Perform minor adjustments to equipment and systems during Functional Performance Tests as deemed necessary by the commissioning team. Where calibrated DDC sensors cannot be used to record test data, provide measuring instruments, logging devices, and data acquisition equipment to record data for the complete range of test data for the required test period.

3.8.3 Testing Procedures

Provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures, and other conditions necessary to execute the test according to the specified conditions. At completion of the test, return the affected building equipment and systems to their pre-test condition.

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, 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.

3.8.4 Simulating Conditions

Functional performance testing is conducted by simulating conditions at control devices to initiate a control system response. Before testing, calibrate all sensors, transducers and devices. Over-writing control input values through the control system is not acceptable unless approved by the Contracting Officer. Perform each test under conditions that simulate actual conditions as close as is practically possible. Specific examples of simulating conditions are provided below. Do not simulate conditions when damage to the system or building may result.

a. When varying static pressures inside ductwork cannot be simulated within the duct, and where a sensor signals the controls system to initiate sequences at various duct static pressures, it is acceptable to simulate the various pressures with a Pneumatic Squeeze-Bulb Type Signaling Device with gauge temporarily attached to the sensing tube leading to the transmitter. It is not acceptable to reset the various set-points, nor to simulate an electric analog signal (unless approved as noted above).

b. Dirty filter pressure drops can be simulated by partially blocking filter face.

c. Freeze-stat safeties can be simulated by packing portion of sensor with ice.

d. High outside air temperatures can be simulated with a hair blower.

e. Raising entering cooling coil temperatures by activating a heating/preheat coil can be used to simulate entering cooling coil conditions.

f. Do not use signal generators to simulate sensor signals unless approved by the Contracting Officer, as noted above, for special cases.

g. Control set points can be altered. For example, to see the air conditioning compressor lockout work at an outside air temperature below 55 degrees F, when the outside air temperature is above 55 degrees F, temporarily change the lockout set point to be 0 degrees F above the current outside air temperature. Caution: Set points are not to be raised or lowered to a point to cause damage to the components, systems, or the building structure and contents.

h. Test duct mounted smoke detectors in accordance with the manufacturer's recommendations. Perform the tests with air system at minimum airflow condition.

i. Test current sensing relays used for fan and pump status signals to control system to indicate unit failure and run status by resetting the set point on the relay to simulate a lost belt or unit failure while the unit is running. Confirm that the failure alarm was generated and received at the control system. After the test is conducted, return the set point to its original set-point or a set-point as indicated by the Contracting Officer.

3.8.5 Manufacturer's Representative

Provide a factory trained representative authorized by the equipment manufacturer to perform Functional Performance Testing for the following equipment:

Chillers

Packaged Direct-Expansion Refrigeration Equipment, including variable refrigerant flow (VRF) systems

Packaged Computer Room Air Handlers (CRAH) Air Conditioners (CRAC)

Booster Pumps

Water Quality and Chemical Treatment Systems

Ensure the test representative reviews, approves, and signs the completed field test report. Include person's name with signatures.

3.8.6 Integrated Systems Tests

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 HVAC systems and other systems such as fire protection systems, smoke control systems, or back-up electrical supply. 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 or correct operation of uninterruptible power supplies or energy generators and connected systems.

3.8.7 Sample Strategy

Perform Functional Performance Tests using the sample strategy identified herein. Test all central plant equipment, primary air handling units, and process cooling or heating equipment. Test all system-level equipment serving multiple zones. Twenty-five percent sample testing is allowed for large groups of identical equipment with identical controllers serving single zones such as air terminal units, fan coil units, unitary equipment, and plumbing fixtures. Sample size may be no less than three units. Refer to Section 01 91 00.15 BUILDING COMMISSIONING for sample strategy. Complete a Functional Performance Test Checklist for each item of equipment or system to be tested. During testing, Government representatives may select the specific equipment or system to be tested for sample sizes less than 100 percent.

3.8.7.1 100 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.

3.8.7.2 Less than 100 Percent Sample Procedures

Randomly test each sample group of identical equipment. 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 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 INTEGRATED SYSTEMS TEST

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.

3.10 RETESTING REQUIREMENTS

Abort tests if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. Re-test only after all deficiencies identified during the original tests 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. Correct deficiencies as identified by the commissioning team and retest the systems to be commissioned.

3.11 SYSTEM ACCEPTANCE

Systems may be partially accepted prior to seasonal testing if they comply with all construction contract and accepted design requirements that can be tested during initial Functional Performance Tests. All test procedures must be successful completed prior to full systems acceptance.

3.12 SEASONAL TESTS

Perform Initial Functional Performance Tests as soon as all contract work is completed, but prior to facility turnover, regardless of the season.

In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems during peak heating and cooling seasons during outdoor air condition design extremes. Schedule Seasonal Functional Performance Tests in coordination with the Contracting Officer. Submit Seasonal Test Report within 14 days of test completion. Include seasonal test report in the Updated Final Commissioning Report as specified in Section 01 91 00.15 BUILDING COMMISSIONING

Execute seasonal functional performance testing, witnessed by the Contracting Officer. Correct deficiencies and make adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

3.13 FULL-LOAD TESTS

Perform Initial Functional Performance Tests as soon as all contract work is completed, but prior to facility turnover. In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems under full-load conditions. Develop and implement means of artificial loading to demonstrate the ability of the process cooling systems to handle peak process loads. Schedule Full-Load Functional Performance Tests in coordination with the Contracting Officer. Submit Full-Load Test Report within 14 days of test completion.

Execute full-load functional performance testing, witnessed by the Contracting Officer. Correct deficiencies and make adjustments to O&M manuals and as-built drawings for applicable issues identified in any full load testing.

3.14 TRAINING

The Mechanical Systems Technical Commissioning Specialist must review the training plan required by Section 01 78 23 OPERATION AND MAINTENANCE DATA and identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel.

The Commissioning Provider is responsible for overseeing and approving the training plan required by Section 01 78 23 OPERATION AND MAINTENANCE DATA and identifying any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel.

Coordinate, schedule, and document all required training. At a minimum, include the following items in the training report for commissioned systems:

a. Complete commissioning documentation

b. Complete O&M data

c. Complete Training

d. Purpose of equipment.

e. Principle of how the equipment works.

f. Important parts and assemblies.

g. How the equipment achieves its purpose and necessary operating conditions.

h. Most likely failure modes, causes and corrections.

i. On site demonstration.

j. Provide updates to O&M manuals based on field modifications.

k. Provide training of the post-occupancy operations and maintenance staff.

3.15 COMMISSIONING REPORT

Include all completed Pre-Functional Checklists and Functional Performance

and Integrated Systems Test Checklists in the Commissioning Report as specified in Section 01 91 00.15 BUILDING COMMISSIONING. Include the approved TAB Report.

3.16 POST-CONSTRUCTION ENDURANCE TEST

Perform an Endurance Test in accordance with the paragraph ENDURANCE TESTING in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC once during the peak heating season and once during the peak cooling season during outdoor air condition extremes with the exception that network bandwidth usage measurement and recording is not required. Use the Temporary Trending Hardware, if necessary, in accordance with Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

The Mechanical System Commissioning Specialists must review the trend logs from the Endurance Tests to ensure that the systems have stable operation and operate as required by the construction contract, the accepted design. The Commissioning Specialists must provide a Post-Construction Trend Log Report that identifies any deficiencies noted in operation, recommendations for correction, and includes a graphical representation of the trends. Provide one Trend Log Report for the peak cooling season and one Trend Log Report for the peak heating season. Submit the Post-Construction Trend Log Reports no later than 14 calendar days following receipt of the trend log data by the Commissioning Specialist. Provide a Post-Construction Trend Log Report meeting the same requirements as the Endurance Testing Results Format in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. Provide one Trend Log Report for the peak cooling season and one Trend Log Report for the peak heating season. Submit the Post-Construction Trend Log Reports no later than 14 calendar days following download of the trended data. Include the Post-Construction Trend Log Reports in the Updated Final Commissioning Report as specified in Section 01 91 00.15 BUILDING COMMISSIONING

-- End of Section --

SECTION 23 64 26

CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS
11/25

PART 1 GENERAL

1.1 REFERENCES

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4	(2015; R 2020) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.9	(2024) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2021) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2021) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2024) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	(2025) Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B31.9	(2025) Building Services Piping
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2020) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2019) Specification for Filler Metals for Brazing and Braze Welding
AWS BRH	(2007; 5th Ed) Brazing Handbook
AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel
AWS Z49.1	(2021) Safety in Welding, Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2025) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A733	(2016; R 2022) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B42	(2020) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2020) Standard Specification for Seamless Copper Tube
ASTM B88	(2022) Standard Specification for Seamless Copper Water Tube
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B813	(2024) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM D520	(2025) Standard Specification for Zinc Dust Pigment

ASTM D3308	(2012; R 2022) Standard Specification for PTFE Resin Skived Tape
ASTM E84	(2024) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F1199	(2021) Standard Specification for Cast (All Temperatures and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
ASTM F1545	(2015a; R 2021) Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings and Flanges

HYDRAULIC INSTITUTE (HI)

HI 1.1-1.2	(2014) Rotodynamic (Centrifugal) Pump for Nomenclature and Definitions

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(2018) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2025) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2022) Butterfly Valves
MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(2019) Bronze Gate, Globe, Angle, and Check Valves
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends
MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 00001	(2024) Motors and Generators

NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code
NFPA 90A	(2024) Standard for the Installation of Air Conditioning and Ventilating Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Calibrated Balancing Valves; G

Pressure Relief Valve

Pumps; G

Combination Strainer and Pump Suction Diffuser

Expansion Tanks

Air Separator Tanks

Water Treatment Systems; G

SD-06 Test Reports

Pressure Tests Reports; G

SD-07 Certificates

Employer's Record Documents (For Welding)

Welding Procedures and Qualifications

SD-08 Manufacturer's Instructions

Lesson Plan for the Instruction Course; G

SD-10 Operation and Maintenance Data

Water Treatment Systems; G

Calibrated Balancing Valves, Data Package 3; G

Water Pressure Reducing Valve, Data Package 3; G

Pressure Relief Valve, Data Package 2; G

Pumps, Data Package 3; G

Combination Strainer and Pump Suction Diffuser, Data Package 2; G

Expansion Tanks, Data Package 2; G

Air Separator Tanks, Data Package 2; G

1.3 ADMINISTRATIVE REQUIREMENTS

a. In each of the publications referred to herein, consider the advisory provisions to be mandatory. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

b. For the International Code Council (ICC) Codes referenced in the contract documents, consider advisory provisions as mandatory, and the word "should" is to be interpreted as "must." Interpret references to the "code official" to mean the "Contracting Officer." For Navy owned property, interpret references to the "owner" to mean the "Contracting Officer." For leased facilities, interpret references to the "owner" to mean the "lessor." Interpret references to the "permit holder" to mean the "Contractor."

c. For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in ICC Codes to sections of Chapter 1, must be applied appropriately by the Contracting Officer as authorized by this administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation must be the Contractor's responsibility. Replace, at the Contractor's expense, any materials found to be damaged. During installation, cap piping and similar openings to keep out dirt and other foreign matter. Any porous materials found to be contaminated with mold or mildew will be replaced at the Contractor's expense. Non-porous materials found to be contaminated with mold or mildew will be disinfected and cleaned prior to installation.

1.5 QUALITY CONTROL

1.5.1 Employer's Record Documents (For Welding)

Submit for review and approval the following documentation. This documentation and the subject qualifications must be in compliance with ASME B31.9.

a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.

b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.

c. List of qualified weld examination personnel that are proposed to be used to provide the work specified in this specification section.

1.5.2 Welding Procedures and Qualifications

a. Specifications and Test Results: Submit copies of the welding procedures specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.

b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification must state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

1.5.3 Examination of Piping Welds

a. The Contractor must perform visual examinations to detect surface and internal discontinuities in completed welds. NDE on piping welds covered by ASME B31.9 is visual inspection only. Verify piping welds meet the acceptance criteria. Submit a NDE report meeting the requirements specified in ASME B31.9. Visually examine all welds. When examination indicates defects in a weld joint, the weld must be repaired by a qualified welder. Remove and replace defects as specified in ASME B31.1, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited. Whenever a defect is removed, and repair by welding is not required, blend the affected area into the surrounding surface, eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, examine the area by the same methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. Any indication of a defect must be regarded as a defect unless reevaluation by surface conditioning and reexamination shows that no unacceptable defects are present. The use of any foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder and welding operator qualifications. The certification must state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

1.5.4 Standard Commercial Products

a. Materials and equipment must be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products must have been in satisfactory commercial or industrial use for 2

years prior to bid opening.

b. The 2 year use must include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures.

c. Products having less than a 2 year field service record may be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. System components must be environmentally suitable for the indicated locations.

d. Support the equipment items by service organizations, located reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6 PROJECT/SITE CONDITIONS

1.6.1 Safety Requirements

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Install safety devices so that proper operation of equipment is not impaired.

1.6.2 Verification of Dimensions

The Contractor must become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.6.3 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor must carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.6.4 Accessibility

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

1.7 OPERATION AND MAINTENANCE DATA

Requirements for data packages are specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified by this specification section.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide the water systems having the minimum service (design) temperature-pressure rating indicated. Provision of the piping systems, including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing must be in accordance with the required and advisory provisions of ASME B31.9 except as modified or supplemented by this specification section or design drawings. This specification section covers the water systems piping which is located within, on, and adjacent to building(s) within the building(s) 5 foot line and for connections aboveground to cooling towers or air-cooled chillers.

2.2 STEEL PIPING

Provide steel piping with a minimum ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

2.2.1 Pipe

Steel pipe, conform to ASTM A53/A53M, Schedule 40, Type E or S, Grades A or B. Do not use Type F pipe.

2.2.2 Fittings and End Connections (Joints)

Piping and fittings 1 inch and smaller must have threaded connections. Piping and fittings larger than 1 inch and smaller than 3 inches may have either threaded or welded connections. Piping and fittings 3 inches and larger may have welded, or flanged connections. The manufacturer of each fitting must be permanently identified on the body of the fitting in accordance with MSS SP-25.

2.2.2.1 Threaded Connections

Use threaded valves and pipe connections conforming to ASME B1.20.1. Use threaded fittings conforming to ASME B16.3. Use threaded unions conforming to ASME B16.39. Use threaded pipe nipples conforming to ASTM A733.

2.2.2.2 Flanged Connections

Flanges must conform to ASME B16.1, Class 125. Gaskets must be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. These gaskets must contain aramid fibers bonded with styrene butadeine rubber (SBR) or nitrile butadeine rubber (NBR). Bolts, nuts, and bolt patterns must conform to ASME B16.1.

2.2.2.3 Welded Connections

Welded valves and pipe connections (both butt-welds and socket-welds types) must conform to ASME B31.9. Butt-welded fittings must conform to ASME B16.9. Socket-welded fittings must conform to ASME B16.11. Identify welded fittings with the appropriate grade and marking symbol.

2.2.2.4 Dielectric Waterways and Flanges

Provide ASTM F1545 compliant dielectric waterways with a water impervious

insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint. When dry, insulation barrier must be able to withstand a 600-volt breakdown test. Provide dielectric waterways constructed of galvanized steel and have threaded end connections to match connecting piping. Provide dielectric waterways suitable for the required operating pressures and temperatures. Provide dielectric flanges with the same pressure ratings as standard flanges and provide complete electrical isolation between connecting pipe and or equipment as described herein for dielectric waterways.

2.3 COPPER TUBING

Provide copper tubing and fittings with a minimum ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

2.3.1 Tube

Use copper tube conforming to ASTM B88, Type L or M for aboveground tubing, and Type K for buried tubing.

2.3.2 Fittings and End Connections (Solder and Flared Joints)

Wrought copper and bronze solder joint pressure fittings, including unions and flanges, must conform to ASME B16.22 and ASTM B75/B75M. Provide adapters as required. Cast copper alloy solder-joint pressure fittings, including unions and flanges, must conform to ASME B16.18. Cast copper alloy fittings for flared copper tube must conform to ASME B16.26 and ASTM B62. ASTM B42 copper pipe nipples with threaded end connections must conform to ASTM B42.

Copper tubing of sizes larger than 4 inches must have brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints may be used if produced with an acceptable tool and installed in accordance with tool manufacturer's written procedures.

2.3.3 Solder

Provide solder in conformance with ASTM B32, grade Sb5, tin-antimony alloy. Provide solder flux in non-corrosive liquid or paste form, conforming to ASTM B813.

2.3.4 Brazing Filler Metal

Filler metal must conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

2.4 VALVES

Provide valves with a minimum ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

Valves in sizes larger than 1 inch and used on steel pipe systems, may be provided with rigid grooved mechanical joint ends. Such grooved end valves are subject to the same requirements as rigid grooved mechanical joints and fittings and must be furnished by the same manufacturer as the grooved pipe joint and fitting system.

2.4.1 Gate Valve

Gate valves 2-1/2 inches and smaller must conform to MSS SP-80 Class 125 and must be bronze with wedge disc, rising stem and threaded, soldered, or flanged ends. Gate valves 3 inches and larger must conform to MSS SP-70, Class 125, cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.4.2 Globe and Angle Valve

Globe and angle valves 2-1/2 inches and smaller must conform to MSS SP-80, Class 125. Globe and angle valves 3 inches and larger must conform to MSS SP-85, Class 125.

2.4.3 Check Valve

Check valves 2-1/2 inches and smaller must conform to MSS SP-80. Check valves 3 inches and larger must conform to MSS SP-71, Class 125.

2.4.4 Butterfly Valve

Provide butterfly valves conforming to MSS SP-67, Type 1 and either the wafer or lug type. Valves smaller than 8 inches with throttling handles with a minimum of two locking positions. Provide valves 8 inches and larger with totally enclosed manual gear operators with adjustable balance return stops and position indicators.

2.4.5 Ball Valve

Full port design. Ball valves 1/2 inch and larger must conform to MSS SP-72 or MSS SP-110 and be cast iron or bronze construction with threaded, soldered, or flanged ends. Provide valves 8 inches or larger with manual gear operators with position indicators. Ball valves may be provided in lieu of gate valves.

2.4.6 Calibrated Balancing Valves

Valves bodies must be composed of copper alloy or cast iron, and valve internal working parts must be composed of copper alloy or stainless steel. Provide valve calibrated so that flow can be determined when the temperature and pressure differential across valve is known. Provide an integral pointer which registers the degree of valve opening. Valve must function as a service valve when in fully closed position. Construct valves with internal seals to prevent leakage and with removable and reusable insulated cover.

Provide valve bodies with tapped openings and pipe extensions with positive shutoff valves outside of pipe insulation. Provide with quick connecting hose fittings for a portable differential pressure meter connections to verify the pressure differential. Provide metal tag on each valve showing the gallons per minute flow for each differential pressure reading.

2.4.7 Water Pressure Reducing Valve

Valve, ASSE 1003 for water service, copper alloy body.

2.4.8 Pressure Relief Valve

Valve must prevent excessive pressure in the piping system when the piping system reaches its maximum heat buildup. Provide ANSI Z21.22/CSA 4.4 valves with cast iron bodies and corrosion resistant internal working parts. The discharge pipe from the relief valve must be the size of the valve outlet unless otherwise indicated.

2.4.9 Drain Valves

Valves, MSS SP-80 gate valves. Provide manually-operated valve, 3/4 inch pipe size and above with a threaded end connection. Provide valve with a water hose nipple adapter.

2.4.10 Air Venting Valves

Manually-operated general service type air venting valves, brass or bronze valves that are furnished with threaded plugs or caps. Provide ball-float type automatic air venting valves with brass/bronze or brass bodies, 300 series corrosion-resistant steel float, linkage and removable seat. Provide air venting valves on water coils with not less than 1/8 inch threaded end connections. Provide air venting valves on water mains with not less than 3/4 inch threaded end connections. Provide air venting valves on all other applications with not less than 1/2 inch threaded end connections.

2.5 PIPING ACCESSORIES

2.5.1 Strainer

Strainer, ASTM F1199, except as modified and supplemented in this specification. Strainer may be either the cleanable, basket or "Y" type, the same size as the pipeline. Fabricate strainer bodies of cast iron with bottoms drilled, and tapped. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. Provide strainer bodies with arrows clearly cast on the sides indicating the direction of flow.

Provide strainer with removable cover and sediment screen. Provide screen with minimum 22 gauge brass sheet, monel, corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. Provide flow into the screen and out through the perforations.

2.5.2 Combination Strainer and Pump Suction Diffuser

Angle type body with removable strainer basket and internal straightening vanes, a suction pipe support, and a blowdown outlet and plug. Strainer must be in accordance with ASTM F1199, except as modified and supplemented by this specification. Provide unit body with arrows clearly cast on the sides indicating the direction of flow. Provide strainer screen made of minimum 22 gauge brass sheet, monel, corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. Direct flow into the screen and out through the perforations. Provide an auxiliary disposable fine mesh strainer which must be removed 30 days after start-up. Provide warning tag for operator indicating scheduled date for removal.

Provide casing with connection sizes to match pump suction and pipe sizes, and be provided with adjustable support foot or support foot boss to relieve piping strains at pump suction. Provide unit casing with blowdown port and plug. Provide a magnetic insert to remove debris from system.

2.5.3 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid. Equip flanged assemblies with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, provide flexible connectors as recommended by the manufacturer for the service intended. Provide internal sleeves or liners, compatible with circulating medium, when recommended by the manufacturer. Provide covers to protect the bellows where indicated.

2.5.4 Pressure and Vacuum Gauges

Gauges, ASME B40.100 with throttling type needle valve or a pulsation dampener and shut-off valve. Provide gauges with 4.5 inch dial, brass or aluminum case, bronze tube, and siphon. Provide gauge with a range from 0 psig to approximately 1.5 times the maximum system working pressure. Select each gauge range so that at normal operating pressure, the needle is within the middle-third of the range.

2.5.5 Temperature Gauges

Provide industrial-duty temperature gauges for the required temperature range. Provide gauges with fixed thread connection, dial face gasketed within the case; and an accuracy within 2 percent of scale range. Provide Fahrenheit scale in 2 degree graduations scale (black numbers) on a white face, with an adjustable pointer. Provide rigid stem type temperature gauges in thermal wells located within 5 feet of the finished floor. Provide universal adjustable angle type or remote element type temperature gauges in thermal wells located 5 to 7 feet above the finished floor or in locations indicated. Provide remote element type temperature gauges in thermal wells located 7 feet above the finished floor or in locations indicated.

2.5.5.1 Stem Cased-Glass

Provide stem cased-glass with polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.5.5.2 Bimetallic Dial

Provide bimetallic dial type case with not less than 3-1/2 inches, stainless steel, and hermetically sealed with clear acrylic lens. Provide silicone-dampened, bimetallic element fitted with external calibrator adjustment.

2.5.5.3 Liquid-, Solid-, and Vapor-Filled Dial

Provide liquid-, solid-, and vapor-filled dial type cases with not less than 3-1/2 inches, stainless steel or cast aluminum with clear acrylic lens. Fill must be nonmercury, suitable for encountered cross-ambients. Provide connecting capillary tubing constructed of double-braided bronze.

2.5.5.4 Thermal Well

Provide thermal well of identical size, 1/2 or 3/4 inch NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 1/2 inch NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Do not use mercury thermometers. Extended neck thermal wells must be of sufficient length to clear insulation thickness by 1 inch.

2.5.6 Pipe Hangers, Inserts, and Supports

Design and fabrication of pipe hangers, inserts, supports, and welding attachments must conform to MSS SP-58 and ASME B31.9. Hanger types and supports for bare and covered pipe must conform to MSS SP-58 for the temperature range. Type 5, 12, and 26 are prohibited. If ferrous materials are used, provide hot-dipped galvanized hangers, inserts and supports.

2.6 PUMPS

Provide electrically driven, non-overloading, centrifugal type pumps which conform to HI 1.1-1.2. Select pumps at or within 5 percent of peak efficiency. Pump curve must rise continuously from maximum capacity to shutoff. Pump motor must conform to NEMA MG 00001, be totally enclosed, and have sufficient horsepower for the service required. Pump motor must have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pump speed must not exceed 3,600 rpm, except where the pump head is less than 60 feet of water, the pump speed must not exceed 1,750 rpm. Provide pump motor with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in the cover.

2.6.1 Construction

a. Specify the pump casing to withstand the discharge head specified plus the static head on system plus 50 percent of the total, but not less than 125 psig. Provide pump casing and bearing housing constructed of close grained cast iron. Provide manual air vents at the high points in the casing and drain plugs at the low points. Provide threaded suction and discharge pressure gage tapping with square-head plugs.

b. Impeller must be statically and dynamically balanced. Fabricate the impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve of bronze. Shaft may be carbon or alloy steel, turned and ground. Bearings may be ball-bearings, roller-bearings, or oil-lubricated bronze-sleeve type bearings, and be efficiently sealed or isolated to prevent loss of oil or entrance of dirt or water.

c. Mount pump and motor on a common cast iron base having lipped edges and tapped drainage openings or structural steel base with lipped edges or drain pan and tapped drainage openings. Provide pump with a steel shaft-coupling guard. Bolt the base-mounted pump, coupling guard, and motor to a fabricated steel base fabricated with bolt holes for securing base to supporting surface. Provide close-coupled integrally cast or fabricated steel feet with bolt holes for securing feet to supporting surface. Provide close-coupled pumps with drip pockets and tapped openings. Install pump to be accessible for servicing without disturbing piping connections. Shaft seals may be mechanical-seals or stuffing-box type.

2.6.2 Mechanical Shaft Seals

Provide single, inside mounted, end-face-elastomer bellows type shaft seals with stainless steel spring, brass or stainless steel seal head, carbon rotating face, and tungsten carbide or ceramic sealing face. Fabricate glands of bronze and of the water-flush design to provide lubrication flush across the face of the seal. Provide a bypass line from pump the discharge to the flush connection in the gland, with filter or cyclone particle separator in line.

2.7 EXPANSION TANKS

Construct tank of welded steel, constructed for, and tested to pressure-temperature rating of 125 psi at 150 degrees F. Provide tanks precharged to the minimum operating pressure. Provide a captive air type tank with a polypropylene or butyl lined replaceable bladder which keeps the air charge separated from the water.

Tanks must accommodate expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. Fit each tank air chamber with a drain, fill, an air charging valve, and system connections. Support tank by steel legs or bases for vertical installation or steel saddles for horizontal installations. The only air in the system must be the permanent sealed-in air cushion contained within the expansion tank.

2.8 AIR SEPARATOR TANKS

Provide external air separation tank with an internal design constructed of stainless steel and suitable for creating the required vortex and subsequent air separation. Construct tank of be steel, constructed for, and tested to pressure-temperature rating of 125 psi at 150 degrees F. Tank must have tangential inlets and outlets connections, threaded for 2 inches and smaller and flanged for sizes 2-1/2 inches and larger. Release air captured in a tank vented as indicated. Provide tank with a blow-down connection.

Design to separate air from water and to direct released air to automatic air vent. Fabricate unit of one piece cast-iron construction with internal baffles and two air chambers at top of unit; provide one air chamber with an outlet to the expansion tank and the other air chamber with an automatic air release device. Fabricate tank of steel, constructed for, and tested to an ANSI Class 125 pressure-temperature rating.

2.9 WATER TREATMENT SYSTEMS

When water treatment is specified, the use of chemical-treatment products containing hexavalent chromium (CPR) is prohibited.

Provide a water treatment plan including a layout, control scheme, a list of existing make-up water conditions including the items listed in paragraph WATER ANALYSIS, a list of chemicals, the proportion of chemicals to be added, the final treated water conditions, and a description of environmental concerns for handling the chemicals.

2.9.1 Chilled Water

Treat water to be used in the chilled and condenser water systems to maintain the conditions recommended by this specification as well as the recommendations from the manufacturers of the condenser and evaporator coils. Chemicals must meet all required federal, state, and local environmental regulations for the treatment of evaporator coils and direct discharge to the sanitary sewer.

2.9.2 Water Treatment Services

Provide the services of a company regularly engaged in the treatment of chilled water systems to determine the correct chemicals required, the concentrations required, and the water treatment equipment sizes and flow rates required. The company must maintain the chemical treatment and provide all chemicals required for the chilled water systems for a period of 1 year from the date of occupancy. The chemical treatment and services provided over the 1 year period must meet the requirements of this specification as well as the recommendations from the manufacturers of the condenser and evaporator coils. Do not use acid treatment or proprietary chemicals.

2.9.3 Chilled Water System

Provide a shot feeder on the chilled water piping as indicated. Base the size and capacity of the feeder on local requirements and water analysis. Furnish the feeder with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.10 ELECTRICAL COMPONENTS

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, the manufacturer must provide controllers including the required monitors and timed restart.

b. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11.

c. Provide polyphase, squirrel-cage medium induction motors, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 00001. Provide motors in accordance with NEMA MG 00001 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

d. Motors must be rated for continuous duty with the enclosure specified. Motor duty requirements must allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque must be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters

complete with thermal overload protection and other necessary appurtenances. Provide motor bearings with grease supply fittings and grease relief to outside of the enclosure.

e. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and adjustable frequency drives for larger motors. Provide variable frequency drives for motors as specified in Section 26 29 23 ADJUSTABLE SPEED DRIVE (ASD) SYSTEMS UNDER 600 VOLTS.

2.11 PAINTING OF NEW EQUIPMENT

New equipment painting may be factory applied or shop applied, as specified herein, and provided under each individual section.

2.11.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided. The factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test.

Conduct salt-spray fog test in accordance with ASTM B117, and as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of 0.125 inch on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment must not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system must be designed for the temperature service

2.11.2 Shop Painting Systems for Metal Surfaces

Clean, retreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil, and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F must be cleaned to bare metal.

Where hot-dip galvanized steel has been cut, resulting surfaces with no galvanizing must be coated with a zinc-rich coating conforming to ASTM D520, Type I. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat must be either aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F must receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F must receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum

thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F must receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

2.12 FACTORY APPLIED INSULATION

Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors must have a flame spread index no higher than 25 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces must have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes must be determined by ASTM E84.

Test insulation in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket must be tested as a composite material. Jackets, facings, and adhesives must have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E84.

2.13 NAMEPLATES

Major equipment including pumps, pump motors, expansion tanks, and air separator tanks must have the manufacturer's name, type or style, model or serial number on a plate secured to the item of equipment. The nameplate of the distributing agent will not be acceptable. Plates must remain durable and legible throughout equipment life and made of stainless steel. Plates must remain fixed in prominent locations with nonferrous screws or bolts.

PART 3 EXECUTION

3.1 INSTALLATION

Cut pipe accurately to measurements established at the jobsite, and work into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation is not permitted without written approval. Cut pipe or tubing square, remove burrs by reaming, and fashion to permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.1.1 Welding

Provide welding work specified in this section for piping systems in conformance with ASME B31.9, as modified and supplemented by this specification section and the accompanying drawings. The welding work

includes: qualification of welding procedures, welders, welding operators, brazers, brazing operators, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

3.1.1.1 Welding Safety

Welding and cutting safety requirements must be in accordance with AWS Z49.1.

3.1.2 Directional Changes

Make changes in direction with fittings, except that bending of pipe 4 inches and smaller is permitted, provided a pipe bender is used and the centerline radius of pipe bends are not less than 6 pipe diameters. Piping bends showing kinks, wrinkles, flattening, or other malformations are not acceptable. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted.

3.1.3 Functional Requirements

a. Pitch horizontal supply mains down in the direction of flow as indicated. The grade must not be less than 1 inch in 40 feet. Do not use reducing fittings for changes in pipe sizes. Cap or plug open ends of pipelines and equipment during installation to keep dirt or other foreign materials out of the system.

b. Unless otherwise specified provide uncoated pipe. Provide connections to appliances with malleable iron unions for steel pipe 2-1/2 inches or less in diameter, and with flanges for pipe 3 inches and above in diameter. Provide connections between ferrous and copper piping with electrically isolated from each other with dielectric waterways or flanges.

c. Piping located in air plenums must conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs must be welded. Fit equipment and piping arrangements into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance. Provide electric isolation fittings between dissimilar metals.

3.1.4 Fittings and End Connections

3.1.4.1 Threaded Connections

Make threaded connections with tapered threads and made tight with PTFE tape complying with ASTM D3308 or equivalent thread-joint compound applied to the male threads only. Allow not more than three threads to show after the joint is made.

3.1.4.2 Brazed Connections

Brazing, AWS BRH, except as modified herein. During brazing, fill the pipe and fittings with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, clean both the outside of the tube and the inside of the fitting with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Remove surplus brazing material at all joints. Make steel tubing joints in accordance with the manufacturer's

recommendations. Prior to brazing, support piping so as not to force or cause to be sprung.

3.1.4.3 Welded Connections

Make branch connections with manufactured pipe fittings that match piping material and schedule. Field-fabricated direction changes and branch connections formed by mitering or notching pipe or other similar construction to form elbows and tees is not permitted. Thoroughly clean pipe of all scale and foreign matter before the piping is assembled. During welding, fill the pipe and fittings with an inert gas, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld must conform to ASME B31.9. Remove weld defects and rewelded at no additional cost to the Government. Electrodes must be stored and dried in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Do not use electrodes that have been wetted or that have lost any of their coating.

3.1.4.4 Flared Connections

When flared connections are used, use a suitable lubricant between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.1.4.5 Flanges and Unions

Except where copper tubing is used, provide union or flanged joints in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Assemble flanged joints square and tight with matched flanges, gaskets, and bolts. Gaskets must be suitable for the intended application.

3.1.5 Valves

Install isolation gate, ball, or butterfly valves on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Identify each valve except check valves. Install valves in horizontal lines with stems at or above the horizontal plane.

Install calibrated balancing valves with a minimum unrestricted straight pipe length equivalent to 3-pipe diameters upstream and 1-pipe diameter downstream immediately adjacent the valve, or the manufacturer's recommended amounts, if greater. Calibrated balancing valves are not permitted to serve as isolation valves.

3.1.6 Air Vents

Provide air vents at all high points, on all water coils, and where indicated to ensure adequate venting of the piping system.

3.1.7 Drains

Provide drains at all low points and where indicated to ensure complete drainage of the piping. Drains must be accessible, and consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.8 Flexible Pipe Connectors

Attach connectors to components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the connectors, of the type recommended by the flexible pipe connector manufacturer and at the intervals recommended.

3.1.9 Temperature Gauges

Locate temperature gauges on coolant supply and return piping at each heat exchanger, on condenser water piping entering and leaving a condenser, at each automatic temperature control device without an integral thermometer, and where indicated or required for proper operation of equipment. Thermal wells for insertion thermometers and thermostats must extend beyond thermal insulation surface not less than 1 inch.

3.1.10 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports must conform to MSS SP-58, except as supplemented and modified in this specification section. Do not use pipe hanger types 5, 12, and 26. Fabricate hangers used to support piping 2 inches and larger to permit adequate adjustment after erection while still supporting the load. Support piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, by variable spring hangers and supports or by constant support hangers.

3.1.10.1 Hangers

Do not use Type 3 hangers on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.1.10.2 Inserts

Secure Type 18 inserts to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

3.1.10.3 C-Clamps

Type 19 and 23 C-clamps must be torqued per MSS SP-58 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

3.1.10.4 Angle Attachments

Furnish Type 20 attachments used on angles and channels with an added malleable-iron heel plate or adapter.

3.1.10.5 Saddles and Shields

Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, must be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields must be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. A high density insulation insert of cellular glass must be used under the Type 40 shield for piping 2 inches and larger.

3.1.10.6 Horizontal Pipe Supports

Horizontal pipe supports must be spaced as specified in MSS SP-58 and a support installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Space pipe supports not over 5 feet apart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 50 pounds must have the excess hanger loads suspended from panel points.

3.1.10.7 Vertical Pipe Supports

Support vertical pipe at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations, or with manufacturer's recommendation and requirements, whichever is less.

3.1.10.8 Pipe Guides

Provide Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides where required to allow longitudinal pipe movement. Provide lateral restraints as required. Slide materials must be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.1.10.9 Steel Slides

Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle must be used. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

3.1.10.10 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, use a clip or clamp where each pipe crosses the base support member. Spacing of the base support members must not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.10.11 Structural Attachments

Attachment to building structure concrete and masonry may be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Apply inserts and anchors with a safety factor not less than 5. Supports must not be attached to metal decking. Do not attach supports to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer. Construct masonry anchors for overhead applications of ferrous materials only. Provide under this section structural steel brackets required, but not shown, to support piping, headers, and equipment.

3.1.11 Pipe Alignment Guides

Provide pipe alignment guides where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

3.1.12 Pipe Anchors

Provide anchors where indicated. Unless indicated otherwise, anchors must comply with the requirements specified. Anchors must consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Install anchor braces in the most effective manner to secure the desired results using turnbuckles where required.

Do not attach supports, anchors, or stays where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, anchor these items immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal.

3.1.13 Building Surface Penetrations

Do not install sleeves in structural members except where indicated or approved. Except as indicated otherwise, piping sleeves must comply with requirements specified. Sleeves in nonload bearing surfaces must be galvanized sheet metal, conforming to ASTM A653/A653M, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces must be uncoated carbon steel pipe, conforming to ASTM A53/A53M, Standard weight. Apply sealants to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Do not install sleeves in structural members.

3.1.13.1 General Service Areas

Extend each sleeve through its respective wall, floor, or roof, and cut flush with each surface. Provide pipes passing through concrete or masonry wall or concrete floors or roofs with pipe sleeves fitted into place at the time of construction. Sleeves must be of such size as to provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve must be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

3.1.13.2 Waterproof Penetrations

Install pipes passing through roof or floor waterproofing membrane through a .17 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange.

Flashing sleeve must be suitably formed, and skirt or flange must extend not less than 8 inches from the pipe and be set over the roof or floor membrane in a troweled coating of bituminous cement. Extend the flashing sleeve up the pipe a minimum of 2 inches above the roof or floor penetration. Seal the annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation as indicated. Seal penetrations by either one of the following methods.

a. Waterproofing Clamping Flange: Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Clamp waterproofing membrane into place and place sealant in the

caulking recess.

b. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping flange, a modular mechanical type sealing assembly may be installed. Provide seals of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Loosely assemble links with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut.

c. After the seal assembly is properly positioned in the sleeve, tightening of the bolt must cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Size each seal assembly as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals must provide sleeves of the proper diameters.

3.1.13.3 Fire-Rated Penetrations

Seal penetration of fire-rated walls, partitions, and floors as specified in Section 07 84 00 FIRESTOPPING.

3.1.13.4 Escutcheons

Provide escutcheons for finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Where sleeves project slightly from floors, use special deep-type escutcheons. Secure escutcheons to pipe or pipe covering.

3.1.14 Access Panels

Provide access panels where indicated for all concealed valves, vents, controls, and additionally for items requiring inspection or maintenance. Provide access panels of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Provide access panels as specified in Section 08 31 00 ACCESS DOORS AND PANELS, Section 05 51 33 METAL LADDERS, Section 05 52 00 METAL RAILINGS.

3.2 ELECTRICAL INSTALLATION

Install electrical equipment in accordance with NFPA 70 and manufacturers instructions.

3.3 CLEANING AND ADJUSTING

Clean pipes free of scale and thoroughly flush of all foreign matter. Provide a temporary bypass for all water coils to prevent flushing water from passing through coils. Thoroughly clean strainers and valves. Prior to testing and balancing, remove air from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel must be taken to avoid water damage during the venting process. Plug or cap air vents after the system has been vented. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed.

3.4 FIELD TESTS

Conduct field tests in the presence of the QC Manager and Contractor Officer's Representative (COR) or designated representative(s) to verify systems comply with specifications. Any material, equipment, instruments, and personnel required for the test must be provided by the Contractor.

3.4.1 Equipment and Component Isolation

Prior to testing, isolate equipment and components that cannot withstand the tests.

3.4.2 Pressure Tests

Hydrostatically test each piping system, except for polypropylene piping, at a pressure 1.5 times the maximum operating pressure for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Monitor the test pressure by a currently calibrated test pressure gauge. Repair leaks and retest piping until test requirements are met. No leakage or reduction in gage pressure is allowed for the duration of the test. Repair leaks by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Test concealed and insulated piping in place before concealing.

Submit for approval pressure tests reports covering the above specified piping pressure tests; describe the systems tested, test results, defects found and repaired, and signature of the pressure tests' director. Obtain approval from the QC Manager before concealing piping or applying insulation to tested and accepted piping. Provide report in bound 8-1/2 by 11 inch booklets. In the reports, document all phases of the tests performed. Include initial test summaries, all repairs and adjustments made, and the final test results.

3.4.3 Related Field Inspections and Testing

3.4.3.1 Piping Welds

Examination of Piping Welds is specified in the paragraph EXAMINATION OF PIPING WELDS (above).

3.4.3.2 HVAC TAB

Requirements for testing, adjusting, and balancing (TAB) of HVAC water piping, and associated equipment is specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Coordinate with the TAB team, and provide support personnel and equipment as specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC to assist TAB team to meet the TAB work requirements.

3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements and Legionella minimization of the chilled water, chilled-hot water, in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Instructors must be thoroughly familiar with all parts of the installation and must be instructed in operating theory as well as practical operation and maintenance work. Submit a lesson plan for the instruction course for

approval. The lesson plan and instruction course must be based on the approved operation and maintenance data and maintenance manuals.

Conduct a training course for the operating staff and maintenance staff selected by the Contracting Officer. Give the instruction during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. Furnish one man-day continuous man-days. Use approximately half of the time for classroom instruction and the other time for instruction at the location of equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

-- End of Section --

SECTION 25 08 10

UTILITY MONITORING AND CONTROL SYSTEM TESTING
05/21

PART 1 GENERAL

1.1 DEFINITIONS

In addition to the definitions provided in this Section, 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and 25 10 10 UTILITY MONITORING AND CONTROL (UMCS) FRONT END AND INTEGRATION contain definitions related to this Section.

1.1.1 Algorithm

A set of well-defined rules or procedures for solving a problem or providing an output from a specific set of inputs.

1.1.2 Analog

A signal that can take on continuous (as opposed to discrete) values. Sensors (e.g. temperature, pressure, flow) typically provide analog signals as outputs to represent the measured variable. Within the UMCS, analog signals are generally represented by either 0-10 volt or a 4-20 milliamp signal.

1.1.3 Binary

A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level.

1.1.4 Change-Of-Value (COV)

A type of data transmission over the network where the point value is transmitted over the network only when its value changes. COV is an efficient use of network bandwidth.

1.1.5 Control Wiring

This includes conduit, wire, and wiring devices to install complete HVAC control systems, including motor control circuits, interlocks, sensors, PE and EP switches, and like devices. This also includes all wiring from node to node, and nodes to all sensors and points defined in the I/O summary shown on drawings or specified herein, and required to execute the sequence of operation. Does not include line voltage power wiring.

1.1.6 Demand

The maximum rate of use of electrical energy averaged over a specific interval of time, usually expressed in kW.

1.1.7 Graphical User Interface (GUI)

Human-machine interfacing allows the operator to manage, command, monitor, and program the system.

1.1.8 Integration

Establishing communication between two or more systems to create a single system.

1.1.9 Protocol

In control systems, "protocol" is generally shorthand for "communication protocol"; a defined method by which digital information is exchanged electronically. Often more than one protocol is used in a BAS, for example, a typical BACnet system will use at a minimum (in addition to BACnet/IP and BACnet MS/TP) IP, UDP, ARP, Ethernet, and RS-485 protocols (and this does not include any protocols used internally in the front end or for communication with front end client workstations).

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Sequencing

Performance Verification Testing required by this Section must be proceeded by successful and accepted "contractors field testing" or "start-up and start-up testing" of the control system to be tested.

1.2.2 Scheduling

Coordinate testing schedules with the Government and with work in other Sections performed on the components or systems to be tested.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

PVT Plan; G

PVT Phase I Report; G

PVT Phase II Report; G

SD-07 Certificates

Test Instrumentation Calibration Certificates; G

1.4 TEST EQUIPMENT

Provide all test equipment unless otherwise noted in the contract documents. Use only test equipment with current calibration traceable to the National Institute of Science and Technology (NIST). For each test instrument, submit Test Instrumentation Calibration Certificates demonstrating calibration traceable to NIST. Use test equipment and test methods such that the overall accuracy of the test method, including all test instrumentation and any errors inherent in the test procedure, is at least 50 percent better than the accuracy specified for the sensor. For example, if a temperature sensor has an accuracy requirement of plus or minus 1 degree Fahrenheit degree overall accuracy of the test method, must

be 0.5 degree Fahrenheit or better.

When validating sensor accuracy, the test instrument is treated as if it is perfectly accurate; that is, the measured value from the test instrument must lie within the bounds of the specified accuracy of the sensor. Expressed mathematically:

Given:
Sensor accuracy: Plus or minus X
Sensor reading: Y
Test equipment reading: Z
Where X, Y and Z are real numbets.

Then
Sensor passes if: (Y-X) <= Z <= (Y+X)
otherwise, sensor fails

PART 2 PRODUCTS

Not applicable

PART 3 EXECUTION

3.1 PERFORMANCE VERIFICATION TEST (PVT)

Perform a Performance Verification Test (PVT) to demonstrate that the installed control system meets all requirements of the project specifications. Coordinate scheduling of the PVT with the Government, and do not begin the PVT until the PVT Plan submittal is accepted.

3.1.1 PVT PLAN

Provide a PVT Plan including system documentation and PVT Procedures.

3.1.1.1 PVT Plan System Documentation

Include the following system documentation in the PVT Plan:

a. Copies of the most recent as-built drawings for the system, including but not limited to one-line drawings and Points Schedules as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC showing device address, point descriptions, network point names and types, hardware point types, settings and ranges including units.

b. Copies of manufacturer's product data sheets when needed to demonstrate compliance with project requirements. In particular, provide data sheets showing that surge protection requirements have been met.

c. Operation or user manuals for all software and all DDC Hardware to be tested.

d. List of test equipment.

3.1.1.2 PVT Equipment List

Include in the PVT procedures a control system performance verification test equipment list that lists the equipment to be used during performance verification testing. For each piece of equipment include manufacturer

name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration

3.1.1.3 PVT Procedures

Develop PVT procedures using the test procedures in this Section, modifying the procedures and adding tests as appropriate to develop procedures that test all requirements of the project specifications. The test procedures must consist of detailed instructions for test setup, execution, and evaluation of test results.

When developing additional procedures, provide the same information and fields as shown in the Test Template.

3.1.2 PVT Phases

Conduct PVT testing in two phases:

I. Field testing for devices, components, subsystems and the overall system using the approved PVT Procedures.

II. A one-week endurance test during which the system is operated continuously.

3.1.2.1 PVT Phase I (Field Tests)

Demonstrate compliance of the control system with the contract documents. Using test plans and procedures approved by the Government, demonstrate all physical and functional requirements of the project. Show, step-by-step, the actions and results demonstrating that the control systems fully and correctly implement the sequences of operation. PVT for surge protection is not required to include introducing a surge to the equipment; surge protection may instead be demonstrated through product documentation.

Do not start the performance verification test until after receipt of written permission by the Government, based on Government approval of the PVT Plan and Draft As-Builts and completion of balancing of the HVAC System. Do not conduct tests during scheduled seasonal off periods of base heating and cooling systems. At the completion PVT Phase I and in accordance with the project schedule and project sequencing provide a PVT Phase I Report documenting all PVT testing including all approved test procedures with test results indicated on the procedures, and a record of all actions taken to address PVT test failures.

3.1.2.2 PVT Phase II (Endurance Test)

Complete an endurance test as part of the PVT in which the system is operated continuously for one-week without failure. During the endurance test trend all points shown as requiring a trend on the Points Schedule for the entire duration of the endurance test. If insufficient buffer or storage capacity exists to trend the entire endurance test, offload trend logs during the course of the endurance test to ensure that no trend data is lost. If the control system specification includes bandwidth requirements for bandwidth usage on a non-IP network, measure and record the network bandwidth usage on each non-IP channel during the endurance test.

If the system experiences any failures during the endurance test portion

of the PVT, repair the system and repeat the endurance test portion of the PVT until the system operates continuously and without failure for the specified endurance test period. At the completion of PVT Phase II and in accordance with the project schedule and project sequencing provide a PVT Phase II Report documenting failures and repair actions taken during PVT Phase II.

3.1.2.2.1 Temporary Trending Capability

Unless trending capability exists, either within the building control system or through a connected Utility Monitoring and Control System (UMCS) Front End, temporarily install hardware on the building control network to perform trending during the endurance test as indicated. Remove the temporary hardware at the completion of all testing and commissioning activities.

3.2 FACTORY TEST

Perform a Factory Test to demonstrate the capability of the proposed control system solution to meet the requirements of project specifications. Coordinate scheduling of the Factory Test with the Government, and do not begin the Factory Test until the Factory Test Plan submittal is accepted.

3.2.1 Factory Test Setup

Design the Factory Test Setup to represent the system as it will be fielded and to demonstrate the capability of the system to meet the requirements of the project specification. At a minimum:

a. Include at least one of each model of DDC hardware, instrumentation and control device to be used on the project.

b. Include at least one network of each type to be used on the project.

c. Include a programmable controller programmed as it will be installed, or, if no programmable controller is to be installed on the project, include a programmable controller with a sample application.

d. Include sample hardware to provide a mock field control system for the front end to communicate with if the project requires a front end but does not require a field control system.

3.2.2 Factory Test Plan

Provide a Factory Test Plan documenting the test setup and procedures.

3.2.2.1 Factory Test Plan Setup Documentation

Include the following information, at a minimum, to document the factory test setup:

a. System one-line block diagram of equipment used in the factory test identifying computers (servers and workstations), network hardware, DDC hardware, and other instrumentation including, but not limited to, sensors, actuators, test signal generators, and meters.

b. System hardware description used in the factory test.

c. System software description used in the factory test.

d. Points Schedules for each controller showing the configuration to be used during the test. Points Schedules must be as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC include the following information at a minimum: device address, point descriptions, network point names and types, hardware point types, settings and ranges including units.

e. Required passwords for each operator access level.

f. List of other test equipment.

3.2.2.2 Test Procedures

Develop factory test procedures using the Test Procedures in this Section, modifying the procedures and adding tests as appropriate to develop test procedures that test all requirements of the specification. The test procedures must consist of detailed instructions for test setup, execution, and evaluation of test results. Factory test procedures must include testing of surge protection by introducing a surge to the equipment and demonstrating that the equipment survives.

When developing additional procedures, provide the same information and fields as shown in the Test Template.

3.2.3 Factory Test Report

Upon completion of the Factory Test provide a complete test report, consisting of a short summary of the factory test, a copy of the Factory Test Plan, and copies of the executed test procedures separated by test. For each test, include date performed and identify the Government representative who witnessed and approved the test.

If a portion of any test failed, document the failure and corrective action.

3.2.4 Factory Test Execution

Conduct the Factory Test at a location and time approved by the Government. The Government will witness the factory test.

If the system fails a portion of a test, the Government will determine whether the entire test or only the portion that failed must be repeated.

3.3 TEST PROCEDURES

Develop test procedures using the template procedure in the Appendix. A test template and sample test procedures in electronic format are available at the Whole Building Design Guide page for this section: https://www.wbdg.org/dod/ufgs/ufgs-25-08-10
Refer to the Sample Test Procedures Table to view the existing sample tests.

Sample Test Procedures	
Test No.	Test Title
1	System Equipment Verification
2	System Start-up
3	Monitoring and Control (M&C) Software Passwords
4	Graphic Display of Data
5	Graphic Navigation Scheme
6	Command Functions
7	Command Input Errors
8	Special Functions
9	Software Editing Tools
10	Scheduling
11	Alarm function
12	Trending
13	Demand Limiting
14	Report Generation
15	Uninterruptable Power Supply (UPS) Test
16	Routers and Repeaters
17	Gateways (Building Level)
18	Gateways (Device Level)
19	Local Display Panel (LDP)
20	Open Network Point Verification
21	Custom Test Template

APPENDIX A
TEST NUMBER: <TEST NUMBER>
TEST TITLE: <TEST TITLE>

OBJECTIVE: <STATE TEST OBJECTIVE>

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals: <LIST REQUIRED SUBMITTALS>

2. Equipment: <LIST EQUIPMENT REQUIRED FOR TEST>

3. Reference Documentation: <LIST REQUIRED REFERENCE DOCUMENTATION>

Date of Test: _____
Time of Test: _____
Contractor's Representative: _____
Government's Representative: _____

Specification References for this verification:
<LIST SECTIONS REFERENCED FOR THIS TEST>

TEST PROCEDURES: <USE THE FOLLOWING FORMAT FOR TEST PROCEDURES, EXPAND AS NECESSARY TO CAPTURE ALL TEST ITEMS>

Item	Action	Expected Results	Approved
1			
2			
3			
4			

Item	Action	Expected Results	Approved
Notes:			

-- End of Section --

SECTION 25 10 10

UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION
02/19, CHG 1: 05/21

PART 1 GENERAL

1.1 SUMMARY

Provide a Utility Monitoring and Control System (UMCS) which performs supervisory monitoring and supervisory control of base-wide building control systems and utility control systems using one or more of: ASHRAE 135 (BACnet), OPC DA, or the Niagara Framework with Fox protocol as indicated and shown. Integrate field control systems installed per Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS and other field control systems to the UMCS as specified.

1.1.1 System Requirements

Provide a UMCS and integration of control systems to the UMCS as specified and indicated, and in accordance with the following characteristics::

1.1.1.1 General System Requirements

a. The system performs supervisory monitoring and control functions including but not limited to Scheduling, Alarm Handling, Trending, Overrides, Report Generation, and Electrical Demand Limiting as specified.

b. The system includes a Graphical User Interface which allows for graphical navigation between systems, graphical representations of systems, access to real-time data for systems, ability to override points in a system, and access to all supervisory monitoring and control functions.

c. All software used by the UMCS and all software used to install and configure the UMCS is licensed to and delivered to the installation.

d. All necessary documentation, configuration information, configuration tools, programs, drivers, and other software is licensed to and otherwise remains with the Government such that the Government or their agents are able to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor. Software licenses must not require periodic fees and must be valid in perpetuity.

e. Provide sufficient documentation and data, including rights to documentation and data, such that the Government or their agents can execute work to repair, replace, upgrade, and expand the system without subsequent or future dependence on the Contractor.

f. The UMCS interfaces directly to ASHRAE 135, OPC DA, and Niagara Framework field control systems as specified and may interface to field control systems using other protocols via an M&C Software protocol driver or a Gateway.

g. For UMCS systems with Monitoring and Control Software functionality implemented in Monitoring and Control (M&C) Controller Hardware,

provide sufficient additional controller hardware to support the full capacity requirements as specified.

1.1.1.2 BACnet Requirements

a. The UMCS must communicate using ASHRAE 135 Annex J over the Government furnished IP network as specified.

b. All communication between the UMCS and ASHRAE 135 field control networks must be via the ASHRAE 135 protocol over the IP network.

c. All communication between the M&C Software and the field control system devices must be via standard ASHRAE 135 services other than PrivateTransfer and ConfirmedPrivateTransfer except as follows:

(1) PrivateTransfer and ConfirmedPrivateTransfer may be used for device configuration and device programming.

(2) PrivateTransfer and ConfirmedPrivateTransfer may be used for communication between the M&C Software and the field control system if and only if both the M&C Software and the field control system devices automatically (without requiring reconfiguration) revert to the use of other standard ASHRAE 135 services when one of the components is modified or replaced.

1.1.1.3 OPC Requirements

The UMCS must communicate using OPC DA over the Government furnished IP network as shown and specified.

1.1.2 Symbols, Definition and Abbreviations

Use symbols, definitions, and engineering unit abbreviations indicated in the contract drawings for displays, submittals and reports. For symbols, definitions and abbreviations not in the contract drawings use terms conforming at a minimum to IEEE Stds Dictionary and the ASHRAE FUN IP, as applicable.

1.1.3 System Units and Accuracy

Use English (inch-pound) units for displays, print-outs and calculations. Perform calculations with an accuracy of at least three significant figures. For displays and printouts present values to at least three significant figures.

1.1.4 Data Packages/Submittals Requirements

Technical data packages consisting of computer software and technical data (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications must be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered must be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered shop drawings under the Federal Acquisition Regulation Supplement (FARS) and must contain no proprietary information and must be delivered with

unrestricted rights.

1.2 RELATED SECTIONS

Cybersecurity requirements related to this Section are specified in a separate cybersecurity specification derived from UFGS 25 05 11. Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS specifies cybersecurity requirements related to this Section.

1.3 REFERENCES

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI INCITS 154	(1988; R 2004) Office Machines and Supplies - Alphanumeric Machines - Keyboard Arrangement

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

ASHRAE 135	(2024; INT 1-3 2025; Errata 1 2025; INT 4-6 2025; Addenda CU 2025) BACnet—A Data Communication Protocol for Building Automation and Control Networks
ASHRAE FUN IP	(2025) Fundamentals Handbook, I-P Edition

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D	(2014) Control Network Protocol Specification
CEA-852-C	(2014) Tunneling Device Area Network Protocols Over Internet Protocol Channels

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.11	(2024; BE 2024; BH 2024; BK 2025) Information Technology— Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks—Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 1: Operations with Randomized and Changing MAC Addresses
IEEE 1815	(2015; CORR 2016) Exchanging Information Between Networks Implementing IEC 61850 and IEEE Std 1815 Distributed Network Protocol (DNP3)
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNET ENGINEERING TASK FORCE (IETF)

IETF RFC 7465	(2015) Prohibiting RC4 Cipher Suites
RFC 821	(2001) Simple Mail Transfer Protocol (SMTP)

LONMARK INTERNATIONAL (LonMark)

LonMark Interoperability Guide	(2005) LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4
LonMark SNVT List	(2014) LonMark SNVT Master List; Version 15
LonMark XIF Guide	(2001) LonMark External Interface File Reference Guide; Revision 4.402

MODBUS ORGANIZATION, INC (MODBUS)

MODBUS Protocol	(2012) Modbus Application Protocol Specification; Version 1.1b3
MODBUS TCP/IP	(2006) Modbus Messaging on TCP/IP Implementation Guide; Version V1.0b

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code
NFPA 262	(2023) Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

OPC FOUNDATION (OPC)

OPC DA	(Ver 3.0; Errata) OPC Data Access (DA)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

ANSI/TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
ANSI/TIA-606	(2021d) Administration Standard for Telecommunications Infrastructure
ANSI/TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

TRIDIUM, INC (TRIDIUM)

Niagara Framework	(2021) NiagaraAX User's Guide
Tridium Open NiCS	(2021) Understanding the NiagaraAX Compatibility Statement (NiCS)

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC EMC	(2002) FCC Electromagnetic Compliance Requirements
FCC Part 15	Radio Frequency Devices (47 CFR 15)

UL SOLUTIONS (UL)

UL 1778	(2014; Reprint Apr 2023) UL Standard for Safety Uninterruptible Power Systems
UL 60950	(2000; Reprint Oct 2007) Safety of Information Technology Equipment

1.4 DEFINITIONS

The following list of definitions may contain terms not found elsewhere in this Section but are included here for completeness. Some terms are followed with a protocol reference in parenthesis indicating to which protocol the term and definition applies. Inclusion of protocol-specific definitions does not create a requirement to support that protocol, nor does it relax any requirements to support specific protocols as indicated elsewhere in this section.

These definitions include terms specific to LonWorks. While new UMCS Front Ends based on LonWorks are not permitted, these definitions are retained for reference as part of an integration project to an existing LonWorks based UMCS.

1.4.1 Alarm Generation

The process of comparing a point value (the point being alarmed) with a pre-defined alarm condition (e.g. a High Limit) and performing some action based on the result of the comparison.

1.4.2 Alarm Handling

see Alarm Routing

1.4.3 Alarm Routing

Alarm routing is M&C software functionality that starts with a notification that an alarm exists (typically as the output of an Alarm Generation process) and sends a specific message to a specific alarm recipient or device.

1.4.4 BACnet (BACnet)

The term BACnet is used in two ways. First meaning the BACnet Protocol Standard - the communication requirements as defined by ASHRAE 135 including all annexes and addenda. The second to refer to the overall

technology related to the ASHRAE 135 protocol.

1.4.5 BACnet Advanced Application Controller (B-AAC)(BACnet)

A hardware device BTL Listed as a B-AAC. A control device which contains BIBBs in support of scheduling and alarming but otherwise has limited resources relative to a B-BC. It may be intended for specific applications and supports some degree of programmability.

1.4.6 BACnet Advanced Operator Workstation (B-AWS)(BACnet)

Monitoring and Control (M&C) Software BTL Listed as an Advanced Operator Workstation and includes the ability to manage scheduling, alarming and trending in an open manner. The B-AWS is the advanced operator's window into a BACnet system. It is primarily used to monitor the performance of a system and to modify parameters that affect the operation of a system.

1.4.7 BACnet Application Specific Controller (B-ASC)(BACnet)

A hardware device BTL Listed as a B-ASC. A controller with limited resources relative to a B-AAC. It is intended for use in a specific application and supports limited programmability.

1.4.8 BACnet Building Controller (B-BC)(BACnet)

A hardware device BTL Listed as a B-BC. A general-purpose, field-programmable device capable of carrying out a variety of building automation and control tasks including control and monitoring via direct digital control (DDC) of specific systems and data storage for trend information, time schedules, and alarm data. Like the other BTL Listed controller types (B-AAC, B-ASC etc.) a B-BC device is required to support the server ("B") side of the ReadProperty and WriteProperty services, but unlike the other controller types it is also required to support the client ("A") side of these services. Communication between controllers requires that one of them support the client side and the other support the server side, so a B-BC is often used when communication between controllers is needed.

1.4.9 BACnet Internetwork (BACnet)

Two or more BACnet networks connected with BACnet routers. In a BACnet Internetwork, there exists only one message path between devices.

1.4.10 BACnet Interoperability Building Blocks (BIBBs) (BACnet)

A BIBB is a collection of one or more BACnet services intended to define a higher level of interoperability. BIBBs are combined to build the BACnet functional requirements for a device in a specification. Some BIBBs define additional requirements (beyond requiring support for specific services) in order to achieve a level of interoperability. For example, the BIBB DS-V-A (Data Sharing-View-A), which would typically be used by an M&C client, not only requires the client to support the ReadProperty Service, but also provides a list of data types (Object / Properties) which the client must be able to interpret and display for the user.

1.4.11 BACnet Operator Display (B-OD)(BACnet)

A hardware device BTL Listed as a B-OD. A basic operator interface with limited capabilities relative to a B-OWS. It is not intended to perform

direct digital control. The B-OD profile could be used for wall-mounted LCD devices, displays affixed to BACnet devices; hand-held terminals or other very simple user interfaces.

1.4.12 BACnet Operator Workstation (B-OWS)(BACnet)

Monitoring and Control (M&C) Software BTL Listed as a B-OWS. An operator interface with limited capabilities relative to a B-AWS. The B-OWS is used for monitoring and basic control of a system, but differs from a B-AWS in that it does not support configuration activities, nor does it provide advanced troubleshooting capabilities.

1.4.13 BACnet Smart Actuator (B-SA)(BACnet)

A hardware device BTL Listed as a B-SA. A simple control output device with limited resources; it is intended for specific applications.

1.4.14 BACnet Smart Sensor (B-SS)(BACnet)

A hardware device BTL Listed as a B-SS. A simple sensing device with very limited resources.

1.4.15 BACnet Testing Laboratories (BTL)(BACnet)

Established by BACnet International to support compliance testing and interoperability testing activities and consists of BTL Manager and the BTL Working Group (BTL-WG). BTL also publishes Implementation Guidelines.

1.4.16 BACnet Testing Laboratories (BTL) Listed (BACnet)

A device that has been certified by BACnet Testing Laboratory. Devices may be certified to a specific device profile, in which case the certification indicates that the device supports the required capabilities for that profile, or may be certified as "other".

1.4.17 Binary

A two-state system or signal; for example one where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level. 'Digital' is sometimes used interchangeably with 'binary'.

1.4.18 Broadcast

Unlike most messages, which are intended for a specific recipient device, a broadcast message is intended for all devices on the network.

1.4.19 Building Control Network (BCN)

The network used by the Building Control System. Typically the BCN is a BACnet ASHRAE 135 or LonWorks CEA-709.1-D network installed by the building control system contractor.

1.4.20 Building Control System (BCS)

One type of Field Control System. A control system for building electrical and mechanical systems, typically HVAC (including central plants) and lighting. A BCS generally uses Direct Digital Control (DDC) Hardware and generally does NOT include its own local front end.

1.4.21 Commandable (BACnet)

A point (Object) is commandable if its Present_Value Property is writable and it supports the optional Priority_Array Property. This functionality is useful for Overrides.

1.4.22 Control Logic Diagram

A graphical representation of control logic for multiple processes that make up a system.

1.4.23 Device Object (BACnet)

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object_Identifier number on the BACnet Internetwork. This number is often referred to as the device instance or device ID.

1.4.24 Field Point Of Connection (FPOC)

The FPOC is part of the UMCS IP network and acts as the point of connection between the UMCS IP Network and the field control IP network. The FPOC is an IT device such as a switch, IP router, or firewall, typically managed by the site IT staff. (Note that the field control IP network may consist of a single IP device, or that integration may require installation of a field control network IP device.)

1.4.25 Field Control Network

The network used by a field control system.

1.4.26 Field Control System (FCS)

A building control system or utility control system.

1.4.27 Fox Protocol (Niagara Framework)

The protocol used for communication between components in the Niagara Framework. By default, Fox uses TCP port 1911

1.4.28 Gateway

A device that translates from one protocol to another. Devices that change only the transport mechanism of the protocol - "translating" from LonWorks over TP/FT-10 to LonWorks over IP for example - are not gateways as the underlying protocol (data format) does not change. Gateways are also called Communications Bridges or Protocol Translators.

1.4.29 Internetwork (BACnet)

See BACnet Internetwork.

1.4.30 JACE (Niagara Framework)

Java Application Control Engine. See Niagara Framework Supervisory Gateway

1.4.31 LNS Plug-in (LonWorks)

Software which runs in an LNS compatible software tool, typically a network configuration tool. Device configuration plug-ins provide a 'user friendly' method to edit a device's configuration properties.

1.4.32 Master-Slave/Token Passing (MS/TP)(BACnet)

Data link protocol as defined by the BACnet standard. Multiple speeds (data rates) are permitted by the BACnet MS/TP standard.

1.4.33 Monitoring and Control (M&C) Software

The UMCS 'front end' software which performs supervisory functions such as alarm handling, scheduling and data logging and provides a user interface for monitoring the system and configuring these functions.

1.4.34 Network (BACnet)

In BACnet, a portion of the control internetwork consisting of one or more segments of the same media connected by repeaters. Networks are separated by routers.

1.4.35 Niagara Framework

A set of hardware and software specifications for building and utility control owned by Tridium Inc. and licensed to multiple vendors. The Framework consists of front end (M&C) software, web based clients, field level control hardware, and engineering tools. While the Niagara Framework is not adopted by a recognized standards body and does not use an open licensing model, it is sufficiently well-supported by multiple HVAC vendors to be considered a de-facto Open Standard.

1.4.36 Niagara Framework Supervisory Gateway (Niagara Framework)

DDC Hardware component of the Niagara Framework. A typical Niagara architecture has Niagara specific supervisory gateways at the IP level and other (non-Niagara specific) controllers on field networks (TP/FT-10, MS/TP, etc.) beneath the Niagara supervisory gateways. The Niagara specific controllers function as a gateway between the Niagara framework protocol (Fox) and the field network beneath. These supervisory gateways may also be used as general purpose controllers and also have the capability to provide a web-browser based user interface.

Note that different vendors refer to this component by different names. The most common name is "JACE"; other names include "EC-BOS", "FX-40", and "UNC".

1.4.37 Object (BACnet)

A BACnet Object. The concept of organizing BACnet information into standard components with various associated Properties. Examples include Analog Input objects and Binary Output objects.

1.4.38 Override

To change the value of a point outside of the normal sequence of operation where this change has priority over the sequence. An override can be accomplished in one of two ways: the point itself may be Commandable and

written to with a priority or there may be a separate point on the controller for the express purpose of implementing the override.

Typically this override is from the Utility Monitoring and Control System (UMCS) Monitoring and Control (M&C) Software. Note that this definition is not standard throughout industry.

1.4.39 Point, Calculated

A value within the M&C Software that is not a network point but has been calculated by logic within the software based on the value of network points or other calculated points. Calculated points are sometimes called virtual points or internal points.

1.4.40 Point, Network

A value that the M&C Software reads from or writes to a field control network.

1.4.41 Polling

A requested transmission of data between devices, rather than an unrequested transmission such as Change-Of-Value (COV) or Binding where data is automatically transmitted under certain conditions.

1.4.42 Property (BACnet)

A BACnet Property - a data element associated with an Object. Different Objects have different Properties, for example an Analog Input Object has a Present_Value Property (which provides the value of the underlying hardware analog input), a High_Limit Property (which contains a high limit for alarming), as well as other properties.

1.4.43 Protocol Implementation Conformance Statement (PICS)(BACnet)

A document, created by the manufacturer of a device, which describes which potions of the BACnet standard are implemented by a given device.

1.4.44 Repeater

A device that connects two control network segments and retransmits all information received on one side onto the other.

1.4.45 Router (BACnet)

A device that connects two or more BACnet networks and controls traffic between the networks by retransmitting signals received from one network onto another based on the signal destination. Routers are used to subdivide an internetwork and to control bandwidth usage.

1.4.46 Segment

A 'single' section of a control network that contains no repeaters or routers. There is generally a limit on the number of devices on a segment, and this limit is dependent on the topology/media and device type. For example, a BACnet MS/TP segment is limited to 32 devices.

1.4.47 Service (BACnet)

A BACnet Service. A defined method for sending a specific type of data between devices. Services are always defined in a Client-Server manner, with a Client initiating a Service request and a Server Executing the Service. Some examples are ReadProperty (a client requests a data value from a server), WriteProperty (a client writes a data value to a server), and CreateObject (a client requests that a server create a new object within the server device).

1.4.48 Standard BACnet Object/Property/Service (BACnet)

BACnet Objects, Properties, or Services that are standard Objects, Properties, or Services enumerated and defined in ASHRAE 135. Clause 23 of ASHRAE 135 defines methods to extend ASHRAE 135 to non-standard or proprietary information. Standard BACnet Objects/Properties/Services specifically exclude any vendor specific extensions.

1.4.49 Supervisory Controller

A controller implementing a combination of supervisory logic (global control strategies or optimization strategies), scheduling, alarming, event management, trending, web services or network management. Note this is defined by use; many supervisory controllers have the capability to also directly control equipment.

1.4.50 Supervisory Gateway

A device that is both a supervisory controller and a gateway.

1.4.51 UMCS Network

An IP network connecting multiple field control systems to the Monitoring and Control Software using one or more of: LonWorks (CEA-709.1-D and CEA-852-C), BACnet (ASHRAE 135 Annex J), or OPC DA.

1.4.52 Utility Control System (UCS)

One type of field control system. Used for control of utility systems such as an electrical substation, sanitary sewer lift station, water pump station, etc. Building controls are excluded from a UCS, however it is possible to have a Utility Control System and a Building Control System in the same facility, and for those systems to share components such as the FPOC. A UCS may include its own local front-end.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES and TABLE 1: PROJECT SEQUENCING:

SD-02 Shop Drawings

UMCS Contractor Design Drawings; G

Draft As-Built Drawings; G

Final As-Built Drawings; G

SD-03 Product Data

Product Data Sheets; G

Computer Software; G

Enclosure Keys; G

SD-05 Design Data

UMCS IP Network Bandwidth Usage Estimate; G

SD-06 Test Reports

Pre-Construction QC Checklist; G

Post-Construction QC Checklist; G

Factory Test Procedures; G

Factory Test Report; G

Existing Conditions Report; G

Start-Up and Start-Up Testing Report; G

PVT Phase I Procedures; G

PVT Phase I Report; G

PVT Phase II Report; G

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G

Preventive Maintenance Work Plan; G

Basic Training Documentation; G

Advanced Training Documentation; G

Refresher Training Documentation; G

SD-11 Closeout Submittals

Closeout QC Checklist; G

1.6 PROJECT SEQUENCING

TABLE I: PROJECT SEQUENCING specifies the sequencing of submittals as specified in paragraph SUBMITTALS (denoted by an 'S' in the 'TYPE' column) and activities as specified in PART 3 EXECUTION (denoted by an 'E' in the 'TYPE' column).

1.6.1 Sequencing for Submittals

The sequencing specified for submittals is the deadline by which the submittal must be initially submitted to the Government. Following submission there will be a Government review period as specified in Section 01 33 00 SUBMITTAL PROCEDURES. If the submittal is not accepted by the Government, revise the submittal and resubmit it to the Government within 14 days of notification that the submittal has been rejected. Upon re-submittal there will be an additional Government review period. If the submittal is not accepted the process repeats until the submittal is accepted by the Government.

1.6.2 Sequencing for Activities

The sequencing specified for activities indicates the earliest the activity may begin.

1.6.3 Abbreviations

In TABLE I the abbreviation AAO is used for 'after approval of' and 'ACO' is used for 'after completion of'.

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1		Acceptance of Factory Test Report Notice to proceed	
2	S	Existing Conditions Report	**14** days after #1
3	S	Design Drawings	**14** days after #1
4	S	Product Data Sheets	**14** days after #1
5	S	UMCS IP Network Bandwidth Usage Estimate	**14** days after #1
6	S	Pre-construction QC Checklist	**14** days after #1
7	E	Install UMCS	AAO #2 thru #6
8	E	Start-Up and Start-Up Testing	ACO #7
9	S	Post-Construction QC Checklist	_____ days ACO #8

TABLE I. PROJECT SEQUENCING

ITEM	TYPE	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
10	S	Computer Software	_____ days ACO #8
11	S	Start-Up and Start-Up Testing Report	_____ days ACO #8
12	S	Draft As-Built Drawings	_____ days ACO #8
13	S	PVT Phase I Procedures	_____ days before scheduled start of #14 and AAO #11
14	E	PVT Phase I	AAO #13 and #12
15	S	PVT Phase I Report	_____ days ACO #14
16	S	Preventive Maintenance Work Plan	AAO #11
17	S	O&M Instructions	AAO #11
18	S	Basic Training Documentation	AAO #11 and _____ days before scheduled start of #19
19	E	Basic Training (PVT Phase II)	AAO #16, #17 and #18
20	S	PVT Phase II Report	_____ days ACO #19
21	S	Final As-Built Drawings	_____ days AAO #20
22	S	Advanced Training Documentation	_____ days before schedule start of #23 and AAO #18
23	E	Advanced Training	ACO #19, _____ days AAO #22, and no later than 60 days ACO #19
24	S	Refresher Training Documentation	_____ days before #25 and AAO #18 and #22
25	E	Refresher Training	between _____ and _____ days ACO #19 and AAO #24
26	S	Closeout QC Checklist	ACO #23

1.7 QUALITY CONTROL (QC) CHECKLISTS

The Contractor's Chief Quality Control (QC) Representative must complete the QC Checklist in APPENDIX A, and must submit the Pre-Construction QC

Checklist, Post-Construction QC Checklist and Closeout QC Checklist as specified. The QC Representative must verify each item in the Checklist and initial in the provided area to indicate that the requirement has been met. The QC Representative must sign and date the Checklist prior to submission to the Government.

The APPENDIX A QC Checklist is available as an editable file at https://www.wbdg.org/dod/ufgs/ufgs-25-10-10.

1.7.1 Pre-Construction QC Checklist

Complete items indicated as Pre-Construction QC Checklist items in the QC Checklist. Submit four copies of the Pre-Construction QC Checklist.

1.7.2 Post-Construction QC Checklist

Complete items indicated as Post-Construction QC Checklist items in the QC Checklist. Submit four copies of the Pre-Construction QC Checklist.

1.7.3 Closeout QC Checklist

Complete items indicated as Closeout QC Checklist items in the QC Checklist. Submit four copies of the Pre-Construction QC Checklist.

1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

Provide UMCS Operation and Maintenance Instructions which include:

a. Procedures for the UMCS system start-up, operation and shut-down.

b. Final As-Built drawings.

c. Routine maintenance checklist, arranged in a columnar format: The first column listing all installed devices, the second column stating the maintenance activity or stating that no maintenance required, the third column stating the frequency of the maintenance activity, and the fourth column providing any additional comments or reference.

d. Qualified service organization list including points of contact with phone numbers.

e. Start-Up and Start-Up Testing Report.

f. Performance Verification Test (PVT) Procedures and Reports.

Submit four bound O&M Instructions and _____ copies of the Instructions in PDF format on optical disc. Index and tab bound instructions. Submit instructions in PDF form as a single PDF file, or as multiple PDF files with a PDF file table of contents containing links to the other files. O&M Instructions may be submitted as a Technical Data Package.

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

2.1.1 Product Certifications

For computing devices, as defined in FCC Part 15, supplied as part of the UMCS provide devices which are certified to comply with the requirements

of Class B computing devices.

2.1.2 Product Sourcing

For units of the same type of equipment, provide products of a single manufacturer. For each major component of equipment provide equipment with the manufacturer's name and the model and serial number in a conspicuous place. For materials and equipment, provide new standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products.

2.1.3 General Requirements

Provide components that meet the following requirements:

a. Portions of the data communications equipment system installed in unconditioned spaces must operate properly in an environment with ambient temperatures between 32 and 120 degrees F and ambient relative humidity between 10 percent and 90 percent noncondensing.

b. Components must accept 100 to 125 volts AC (Vac), 60 Hz, single phase, three wire with a three-pronged, dedicated circuit outlet or be provided with a transformer to meet the component's power requirements.

c. The equipment must meet the requirements of NFPA 70, UL 60950, NFPA 262, FCC EMC, and FCC Part 15.

2.1.4 Nameplates

Provide nameplates of laminated plastic identifying the function, network address, if applicable, and identifier of the device. Laminated plastic must be at least 0.125 inch thick, white with black center core. Nameplates must be a minimum of 1 by 3 inch with minimum 0.25 inch high engraved block lettering.

2.1.5 Product Data Sheets

For all products (equipment) specified in PART 2 and supplied under this contract, submit copies of all manufacturer catalog cuts and specification sheets to indicate conformance to product requirements. For Monitoring and Control (M&C) Software also include the PICS verifying BTL Listing as a B-AWS.

2.2 CONTROL HARDWARE

2.2.1 Control Protocol Routers

2.2.1.1 BACnet/IP Router

Provide BACnet/IP Routers which perform layer 3 routing of ASHRAE 135 packets over an IP network in accordance with ASHRAE 135 Annex J and Clause 6. The router must provide the appropriate connection to the IP network and connections to a ASHRAE 135 MS/TP, or other ASHRAE 135 network. Devices used as BACnet/IP Routers must be BTL Listed and must support the Network Management-Router Configuration-B (NM-RC-B) BIBB.

2.2.2 Monitoring and Control (M&C) Controller Hardware

Provide Monitoring and Control (M&C) Controller Hardware which is a

microprocessor-based direct digital control hardware and which communicates over the UMCS IP network using one of:

a. CEA-709.1-D in accordance with CEA-852-C and using only Standard Network Variable Types (SNVTs) as defined by the LonMark SNVT List.

b. ASHRAE 135 in accordance with ASHRAE 135 Annex J and using only Standard ASHRAE 135 services.

Monitoring and Control (M&C) Controller Hardware must either meet the requirements of the LonMark Interoperability Guide or be BTL Listed.

2.2.3 BACnet Supervisory Controller Hardware

Provide BACnet Supervisory Controller Hardware which is direct digital control hardware and which:

a. is BTL Listed

b. communicates using ASHRAE 135 over an IP network in accordance with ASHRAE 135 Annex J

c. has a configurable Object_Name Property

d. supports the following BIBBS

(1) DS-RP-B (Data Sharing Read Property B) BIBB for Objects requiring read access from the M&C Software

(2) DS-WP-B (Data Sharing Write Property B) BIBB for Objects requiring write access from the M&C Software.

(3) SCHED-E-B (Scheduling-External-B)

(4) AE-N-I-B (Alarm and Event-Notification Internal-B)

(5) AE-ACK-B (Alarm and Event-ACK-B)

(6) T-VMT-I-B (Trending-Viewing and Modifying Trends-Internal-B)

(7) T-ATR-B (Trending-Automated Trend Retrieval-B)

e. has a Writable Recipient_List Property of the Notification Class Object

2.2.4 Control Protocol Gateways

Provide Control Protocol Gateways which perform bi-directional protocol translation between two of the following protocols, or between one of the following protocols and another protocol: CEA-709.1-D, ASHRAE 135, and OPC DA. Provide Control Protocol Gateways which also meet the following requirements.

a. Gateways must have two or more separate network connections, each appropriate for the protocol and media used. A single network connection must not be used for both protocols.

b. Gateways must be capable of being installed, configured and programmed through the use of instructions in the manual supplied by the Contractor.

c. Provide and license to the Government all software required for gateway configuration.

d. Gateways must retain their configuration after a power loss of an indefinite time, and must automatically return to their pre-power loss state once power is restored.

e. Gateways must provide capacity for mapping all required points as indicated plus an additional 10 percent between the two protocols it uses.

f. Gateways must, in addition, meet all requirements specified (in the following subparagraphs) for each of the two protocols it translates.

2.2.4.1 Gateway for CEA-709.1

For a gateways using CEA-709.1-D provide gateways which meet the following requirements in addition to the requirements for all gateways:

a. It must allow bi-directional mapping of data in the Gateway to Standard Network Variable Types (SNVTs) according to the LonMark SNVT List.

b. Gateways communicating CEA-709.1-D over an IP network must communicate in accordance with CEA-852-C.

c. It must allow of its standard network variables (SNVTs) and support transmitting data using the "min, max, and delta" (throttling and heartbeat) methodology.

d. It must provide the ability to label SNVTs.

e. It must supply a LonMark external interface file (XIF) as defined in the LonMark XIF Guide for use with LNS tools and utilities.

f. It must have a "service pin" which, when pressed, will cause the Gateway to broadcast its 48-bit NodeID and ProgramID over the network.

g. It must provide a configurable self-documenting string.

2.2.4.2 Gateway for ASHRAE 135

For gateways using ASHRAE 135 provide gateways which meets the following requirements in addition to the requirements for all gateways:

a. It must allow bi-directional mapping of data in the Gateway to Standard Objects as defined in ASHRAE 135.

b. All ASHRAE 135 Objects must have a configurable Object_Name Property.

c. It must be BTL Listed.

d. Gateways communicating ASHRAE 135 over an IP network must communicate in accordance with ASHRAE 135 Annex J.

e. Gateways communicating ASHRAE 135 to a field control systems must support the DS-RP-A (Data Sharing Read Property A) BIBB and the DS-WP-A (Data Sharing Write Property A) BIBB.

f. Gateways communicating ASHRAE 135 to the M&C Software or to a BACnet Supervisory Controller must support the DS-RP-B (Data Sharing Read Property B) BIBB for Objects requiring read access from the M&C Software and the DS-WP-B (Data Sharing Write Property B) BIBB for Objects requiring write access from the M&C Software

2.2.4.3 Gateway for OPC

For gateways that use OPC DA, provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway using OPC DA tags and which communicate over an IP network in accordance with OPC DA.

2.2.4.4 Gateway for DNP3

For gateways that use DNP3, provide gateways that meet the requirements specified for all gateways and which allow bi-directional mapping of data in the Gateway to DNP3 object groups and variations as defined by IEEE 1815. Gateways communicating DNP3 over an IP network must communicate in accordance with the LAN/WAN Networking volume of IEEE 1815.

2.2.4.5 Niagara Framework Supervisory Gateway

Niagara Framework Supervisory Gateway Hardware must:

a. be direct digital control hardware.

b. have an unrestricted interoperability license and a Niagara Compatibility Statement (NiCS) that follows the Tridium Open NiCS Specification.

c. manage communications between a field control network and the Niagara Framework Monitoring and Control Software and between itself and other Niagara Framework Supervisory Gateways. Niagara Framework Supervisory Gateway Hardware must use Fox protocol for communication with other Niagara Framework Components.

d. be fully programmable using the Niagara Framework Engineering Tool and support the following:

(1) Time synchronization, Calendar, and Scheduling using Niagara Scheduling Objects

(2) Alarm generation and routing using the Niagara Alarm Service

(3) Trending using the Niagara History Service and Niagara Trend Log Objects

(4) Integration of field control networks using the Niagara Framework Engineering Tool

(5) Configuration of integrated field control system using the Niagara Framework Engineering Tool when supported by the field control system

e. meet the following minimum hardware requirements:

(1) OneTwo 10/100/1000 Mbps Ethernet Ports

(2) One port compatible with the field control system to be integrated using this product.

(3) Central Processing Unit of 600 Mhz or higher.

(4) Embedded operating system.

f. provide access to field control network data and supervisory functions via web interface and support a minimum of 16 simultaneous users

2.3 COMPUTER HARDWARE

For computer hardware furnished under this specification provide standard products of a single manufacturer which advertises service in all 48 contiguous states, and provide only model currently in production. Except for PCI-E cards installed into expansion slots provided in a desktop or server computer in order to meet the requirements of this specification, do not modify computer hardware from the manufacturer configuration.

2.3.1 Server Hardware

Computer Server Hardware (server) will be furnished by the Government must be a desktop or server computer meeting the following minimum requirements:

2.3.1.1 Processor

Multi-core processor designed for server applications. Processor speed must be at least 50 percent of the speed of the fastest Intel server processor commercially available.

2.3.1.2 Random Access Memory (RAM)

300 percent of the recommended requirements of the software to be installed on the server and no less than 24GB.

2.3.1.3 Communications Ports

Four USB ports.

2.3.1.4 Hard Drives

2.3.1.4.1 Internal Hard Drives

Hard drives with SATA-3 Controller providing at least 2TB usable disk space. Hard drives must use RAID (Redundant Array of Inexpensive Disks) at levels 1 or 5 (RAID-1 or RAID-5).

2.3.1.4.2 External Hard Drive

4TB disk space with a USB 3.0 interface.

2.3.1.5 Optical Drive

Blueray burner drive.

2.3.1.6 Video Output

32-bit color at a minimum resolution of 1920 by 1080 at a minimum refresh rate of 70 Hz and a DVI or display port output.

2.3.1.7 Network Interface

Two integrated 1000Base-T Ethernet with RJ45 connector.

2.3.1.8 Monitor

Widescreen flat panel LCD monitor sized as indicated but no less than 24 inch nominal with a minimum resolution of 1600 by 1050 pixels and a minimum refresh rate of 70Hz.

2.3.1.9 Keyboard

101 key wired USB keyboard having a minimum 64 character standard ASCII character set based on ANSI INCITS 154 and an integral smart card reader compatible with a Department of Defense Common Access Card (CAC).

2.3.1.10 Mouse

2-button wired USB optical scroll mouse with a minimum resolution of 400 dots per inch.

2.3.1.11 Power Supplies

Hot-swappable redundant power supplies.

2.3.2 Workstation Hardware (Desktop and Laptop)

The Government will provide the Provide a standard desktop computer or a laptop meeting the following minimum requirements for the Computer Workstation Hardware (workstation) as indicated.

2.3.2.1 Processor

2.3.2.1.1 Desktop

Quad-core processor designed for desktop applications. Processor speed must be at least 75 percent of the speed of the fastest Intel desktop processor commercially available.

2.3.2.1.2 Laptop

Quad-core processor designed for laptop applications. Processor speed must be at least 50 percent of the speed of the fastest Intel laptop processor commercially available.

2.3.2.2 Random Access Memory (RAM)

300 percent of the recommended requirements of the software to be installed on the server and no less than 8GB.

2.3.2.3 Communications Ports

2.3.2.3.1 Desktop

Six USB ports.

2.3.2.3.2 Laptop

Two USB ports, plus a PCMCIA card slot or an additional USB port, plus an integral RS-232 serial port or an additional USB port and a USB to RS-232 serial adapter.

2.3.2.4 Hard Drive and Controller

2.3.2.4.1 Desktop

1.5TB or larger with a SATA-3 controller.

2.3.2.4.2 Laptop

250GB or larger solid state drive.

2.3.2.5 Optical Drive

DVD-RW drive

2.3.2.6 Video Output

2.3.2.6.1 Desktop

32-bit color with dual monitor support minimum resolutions of 1920 by 1080 at minimum refresh rates of 70 Hz and dual DVI or display port outputs.

2.3.2.6.2 Laptop

32-bit color with a minimum resolution of 1920 by 1080 at minimum refresh rates of 70 Hz and VGA or HDMI output.

2.3.2.7 Network Interface

2.3.2.7.1 Desktop

Integrated 1000Base-T Ethernet with RJ45 connector.

2.3.2.7.2 Laptop

Integrated 1000Base-T Ethernet with RJ45 connector and an integrated IEEE 802.11b/g/n wireless interface. The Laptop must have a physical switch for activation and deactivation of the wireless interface.

2.3.2.8 Monitor

2.3.2.8.1 Desktop

Dual widescreen flat panel LCD monitors sized as indicated but no less than 24 inch nominal with minimum resolutions of 1920 by 1080 pixels and a minimum refresh rate of 70Hz.

2.3.2.8.2 Laptop

LCD Screen sized as indicated but no less than 325 mm 13 inch nominal with a maximum supported resolution of no less than 1600 by 900 pixels.

2.3.2.9 Keyboard and Smart Card Reader

2.3.2.9.1 Desktop

101 key wired USB keyboard having a minimum 64 character standard ASCII character set based on ANSI INCITS 154 and an integral smart card reader compatible with a Department of Defense Common Access Card (CAC).

2.3.2.9.2 Laptop

Standard laptop keyboard. Internal smart card reader compatible with a Department of Defense Common Access Card (CAC).

2.3.2.10 Mouse

2.3.2.10.1 Desktop

2-button wired USB optical scroll mouse with a minimum resolution of 400 dots per inch.

2.3.2.10.2 Laptop

Integrated touch-pad plus a 2-button wired USB optical scroll mouse with a minimum resolution of 400 dots per inch.

2.3.3 Printers

Provide local or network printers as indicated. Provide local printers which have a USB interface. Provide network printers which have a 100Base-T or faster interface with an RJ45 connection and a firmware print spooler compatible with the Operating System print spooler.

2.3.3.1 Alarm Printer

Provide alarm printers which use sprocket-fed fanfold paper with adjustable sprockets for paper width up to 11 inches. Alarm printers must have programmable control of top-of-form. Provide floor stands with paper racks for alarm printers.

2.3.3.2 Laser Printer

Provide laser printers as indicated meeting the following minimum requirements:

Resolution	600 by 600 dots per inch
Printing Time	10 pages per minute
Data Buffer Size	16 Megabytes
Media Type	Paper and transparency film
Media Size	ANSI A(8.5 by 11 inches) and other sizes as indicated

Paper Cassette	250 sheet capacity

2.4 COMPUTER SOFTWARE

2.4.1 Operating System (OS)

Provide the latest version of the DISA Gold Master Windows Operating System. The Operating System media will be furnished by the Government. Provide The Government will provide the Operating System license.

2.4.2 Office Automation Software

Provide Office Automation Software consisting of the e-mail, spreadsheet and word processing portions of the project site's standard office automation software. Office Automation Software will be furnished by the Government.

2.4.3 Virus Protection Software

Provide Virus Protection Software consisting of the project site's standard virus protection software complete with a virus definition update subscription Virus Protection Software will be furnished by the Government.

2.4.4 Disk Imaging (Backup) Software

Provide Disk imaging (backup) software capable of performing a bare-metal restore (imaging and restoring to a new blank hard drive such that restoration of the image is sufficient to restore system operation to the imaged state without the need for re-installation of software). Provide Disk imaging (backup) software consisting of the project site's standard disk imaging software. Disk imaging (backup) software will be furnished by the Government.

2.4.5 M&C Controller Hardware Configuration Software

Provide M&C Controller Hardware Configuration Software consisting of the software required to configure, program, or configure and program each Monitoring and Control (M&C) Controller Hardware provided for the functions it performs.

2.4.6 BACnet Network Browser

Provide a BACnet Network Browser software that:

a. Can perform full discovery of a ASHRAE 135 system including but not limited to discovery of all ASHRAE 135 devices, the ASHRAE 135 Objects and Properties of each device, and the standard ASHRAE 135 services supported by each device.

b. Can read any ASHRAE 135 Property of any Object in any device. Proprietary Properties may be presented as read without further interpretation.

c. Can write any Standard ASHRAE 135 Property of any Object in any device.

d. Supports segmentation.

e. Supports all of the following BIBBs:

(1) DM-ANM-A (Device Management-Automatic Network Management-A)

(2) DM-ADM-A (Device Management-Automatic Device Management-A)

(3) DM-DDB-A (Device Management-Dynamic Device Binding-A)

(4) DM-DOB-A (Device Management-Dynamic Object Binding-A)

(5) DS-RP-A (Data Sharing-Read Property-A)

(6) DS-RPM-A (Data Sharing-Read Property Multiple-A)

(7) DS-WP-A (Data Sharing-Write Property-A)

2.4.7 Monitoring and Control (M&C) Software

Provide monitoring and control (M&C) software which is a client-server software package with a graphical user interface (GUI) using web-browser based clients. Provide M&C Software which communicates via ASHRAE 135, and OPC DA. The M&C Software may support other field control protocols. Provide M&C Software which is BACnet Testing Laboratories Certified ("Listed") as a B-AWS.

Provide a single software package which implements the Scheduling, Alarming, Trending, Graphical System Display, and System Display Editor functionality. Other specified M&C functionality may be implemented in the same software package or in additional software packages. As specified in PART 3 EXECUTION, the M&C Software must operate on Server hardware, except that software for Point Calculations and Demand Limiting may operate on M&C Controller Hardware.

2.4.7.1 M&C Software License

License the M&C Software as specified. Use of multiple copies of M&C Server software working in coordination and sharing data between them such that they function as, and appear to an operator as, a single M&C Server is permitted to meet these requirements.

2.4.7.1.1 Network Points

Provide M&C Software and licensing to support no less than _____ network points, and to be capable of expansion to support no less than 50,000 network points.

2.4.7.1.2 Web Clients

Provide M&C Software and licensing to support no less than 10 simultaneous web clients with no limit on the total number of web clients. M&C Software must be capable of expansion to support no less than 30 simultaneous web clients.

2.4.7.1.3 Calculations

Provide M&C Software and licensing to support no less than one calculated point for every ten network points (see "Network Points" above).

2.4.7.1.4 Other Points

For installations using M&C Software installed on M&C Controller Hardware (as opposed to Server hardware), provide additional licensing to support additional network points for the communications between portions of the M&C Software installed on different hardware. For example, if the Calculations requirement is performed by M&C Software installed on Controller hardware, the M&C Software must be licensed for additional network points to cover the network points required for communication between the Controller hardware and the Server hardware.

2.4.7.1.5 Alarming

Provide M&C Software and licensing to support alarm generation and the handling (routing) of alarms for no less than 10,000 points and ASHRAE 135 Alarm Event Notifications.

2.4.7.1.6 Trending

Provide M&C Software and licensing to support a minimum of 8,000 simultaneous trends.

2.4.7.1.7 Scheduling

Provide M&C Software and licensing to support a minimum of 200 user-definable schedules.

2.4.7.2 M&C Software Update Licensing

In addition to all other licensing requirements, provide M&C Software licensing which includes licensing of the following software updates for a period of no less than 5 years:

a. Security and bug-fix patches issued by the M&C Software manufacturer.

b. Security patches to address any vulnerability identified in the National Vulnerability Database at http://nvd.nist.gov with a Common Vulnerability Scoring System (CVSS) severity rating of MEDIUM or higher.

2.4.7.3 Supported Field Control Protocols

Provide M&C Software which supports field control protocols as follows:

a. The M&C Software must include a driver to ASHRAE 135 over IP in accordance with ASHRAE 135 Annex J.

b. The M&C Software must include a driver to over TCP/IP. The M&C Software must be capable of reading and writing the Modbus data types as defined in paragraph MODBUS REQUIREMENTS and must, in addition, be capable of manipulating and presenting arbitrary data formats derived from the four standard Modbus data types.

c. The M&C Software must be an OPC DA client.

d. The M&C Software may, in addition, include drivers to other protocols.

Provide M&C Software capable of reading values from and writing values to points via any supported field protocol, and capable of reading values

from one field protocol and writing them to another. All points obtained from any field protocol must be available to all M&C Software functionality.

2.4.7.4 Supported Enterprise Protocols

Provide M&C Software which supports oBIX, BACnet Web Services or OPC as an enterprise protocol and which meets the following requirements:

a. It is able to read values from any point or collection of points (network point, internal point, trend log or schedule) and transmit these values via the enterprise protocol.

b. It is able to receive data via the enterprise protocol and use this data to change the value of any point.

c. License the enterprise protocol interface to the project site and document the interface such that any system capable of communicating with that protocol can be used to read and write data from the M&C Software.

2.4.7.5 Point Information

Every point, both network and internal, in the M&C Software must contain the following fields:

2.4.7.5.1 Name

A configurable name used for identification of the point within the M&C Software.

2.4.7.5.2 Description

A configurable description of no less than 80 alpha-numeric characters.

2.4.7.5.3 Value

A field containing the current point value.

2.4.7.5.4 Units

A field containing the engineering units.

2.4.7.5.5 Source

A field identifying the source of the point. For network points, this is generally the address or identification of the field device (for example, the DeviceID for BACnet devices).

2.4.7.6 Point Calculations

Provide M&C software capable of performing calculations and computing the value of a calculated point based on the values of two or more network points and calculated points. Mathematical operators must include: addition, subtraction, multiplication, division, exponentiation (y^x, power), square root, reciprocal, natural logarithm, sin, cos, tan, arcsin, arccos, arctan, and parenthesis. Pi and e must be available as constants for use in calculations.

2.4.7.7 Browser-Based Graphical User Interface (GUI)

Provide M&C Software which includes a web-browser based (client-server) graphical user interface through which all M&C Software functionality, except for the Graphics Editor, System Display Editor, report configuration, point calculation configuration, and enterprise protocol configuration, is accessible.

Provide graphical user interface web server and web clients meeting the following requirements:

a. The web server must use HTTPS based on the Transport Layer Security (TLS) Protocol in accordance with IETF RFC 7465 using a Government-furnished certificate.

b. The graphical user interface must be Common Access Card (CAC) enabled: It must support web client authentication using certificates obtained from a Department of Defense Common Access Card (CAC) Smart Card.

c. The web client must operate on any version of Windows currently supported by Microsoft.

d. The web client must function in the most recent three version of Internet Explorer and the most recent three versions of Firefox.

e. The web client must not require a connection to any server other than the M&C Server.

f. The web client must function in a browser with Java, Shockwave, Silverlight, and Flash installed. The client may require a download of mobile code from the M&C Server, but must not require the download of additional browser plug-ins or add-ins and there must be no limit on the number of downloads. The client must not require ActiveX.

2.4.7.8 Passwords

Provide M&C software with user-based access control to M&C functionality. The M&C Software must recognize at least 100 separate users and have at least 4 levels of user permissions. User permission levels (from most restrictive to most permissive) must include:

a. Permission Level 1: View-only access to the graphical user interface.

b. Permission Level 2: Permission Level 1 plus acknowledge alarms and set up (configure) trends and reports.

c. Permission Level 3: Permission Level 2 plus override points and set up (configure) alarms, schedules and demand limiting.

d. Permission Level 4: Permission Level 3 plus create and modify Graphical System Displays using the System Display Editor.

Passwords must not be displayed and must not be logged. The system must maintain a disk file on the server hardware logging all activity of the system. This file must maintain, as a minimum, a record of all operators logged onto the system, alarm acknowledgments, commands issued and all database modifications. If the file format is not plain ASCII text, provide a means to export or convert the file to plain ASCII text. Provide a mechanism for archiving the log files for long term record

storage.

2.4.7.9 Graphical System Displays

Provide M&C Software with functionality to provide graphical displays consisting of building system (air handler units, VAV boxes, chillers, cooling towers, boilers, etc.) graphic displays. Data associated with an active display must be updated at least once every 5 seconds.

2.4.7.9.1 Navigation Scheme

System graphic displays of building systems and points must be hierarchical displays using a building-to-equipment point-and-click navigation scheme which allows navigation from a garrison-wide display, through a building-wide display to the individual units. Each display must show the building name and number. Each display must show system wide data such as outside air temperature and humidity in the case of an HVAC system application.

a. For each Building or Building Sub-Area display, show the building foot print and basic floor plan, and clearly show and distinguish between the individual zones and the equipment serving each zone and space. Show all space sensor and status readings, as applicable, for the individual zones such as space temperature, humidity, occupancy status, etc. Show the locations of individual pieces of monitored and controlled equipment.

b. For each equipment display show a one-line diagram control schematic 3-dimensional representation of the individual pieces of equipment using the symbols and M&C point data types as specified. Use different colors and textures to indicate various components and real time data. Use consistent color and texture meanings across all displays.

c. Provide displays which clearly distinguish between the following point data types and information:

(1) Real-time data.

(2) Other user-entered data.

(3) Devices in alarm (unacknowledged).

(4) Out-of-range, bad, or missing data.

(5) Points which are overridden.

2.4.7.9.2 Navigation Commands

Provide system displays which support English language operator commands via point-and-click mouse or keyboard entry for defining and selecting points, parameters, graphics, report generation, and all other functions associated with operation. The operator commands must be usable from any operator workstation with individual operator passwords as specified.

2.4.7.10 Graphic Editor

Provide a fully featured graphics editor and capable of creating custom graphics and graphic symbols for use by the System Display Editor.

2.4.7.11 System Display Editor

Provide a system display editor which allows the user to create, modify, and delete graphic displays. The display editor may have a separate user interface and is not required to be accessible via the web browser interface. Provide a display editor which includes the following functions:

a. Create and save displays. Save an existing or modified display as a new display (i.e. "save as")

b. Group and ungroup graphics, where graphics include both alphanumeric and graphic symbols, and where a grouped graphic is manipulated as a single graphic.

c. Place, locate, resize, move, remove, reposition, rotate and mirror a graphic on a display.

d. Overlay graphics over other graphics and assign depths such that when there are coincident graphics the one on top is visible.

e. Modify graphic properties based on the value of network points and create conditions governing the display of a graphics such that different graphics are visible based on the value of network points or calculated points

f. Integrate real-time data with the display.

g. Establish connecting lines.

h. Establish sources of latest data and location of readouts.

i. Display analog values as specified.

j. Assign conditions which automatically initiate a system display.

k. Include library of display symbols which include: Pump, Motor, Two- and Three-way Valves, Flow Sensing Element, Point and Averaging Temperature Sensors, Pressure Sensor, Humidity Sensor, Single and Double Deck Air Handling Unit, Fan, Chiller, Boiler, Air Compressor, Chilled Water Piping, Steam Piping, Hot Water Piping, Ductwork, Unit Heater, Pressure Reducing Valve, Damper, Electric Meter, Limit Switch, Flow Switch, High- and Low- Point and Averaging Temperature Switches, High- and Low- Pressure Switches, Coil, Solenoid Valve, Filter, Condensing Unit, Cooling Tower, Variable Frequency Drive (VFD), Heat Exchanger, Current Sensing Relays, Generator, Circuit Breaker, Transformer, Tank. Symbols must at a minimum conform to ASHRAE FUN IP where applicable.

2.4.7.12 Scheduling

a. Provide M&C software capable of changing the value of any network point according to a schedule. The M&C Software must be capable of scheduling points to any value, including a "null" or invalid value if one is defined for the data type of the point.

b. The specified scheduling functions must be operator accessible and adjustable via the graphical user interface. Each schedule must be

able to change the value of multiple points. The M&C software must reinforce all schedules by transmitting the scheduled value no less than once every 30 minutes.

c. The M&C software must be capable of performing time synchronization and configuring Schedule Objects in ASHRAE 135 field devices in accordance with the DM-MTS-A (Device Management-Manual Time Synchronization-A).

e. The M&C Software must include a scheduling graphic display, accessible via the graphical user interface, with the following fields and functions:

(1) Current date and time.

(2) System identifier(s) and name(s), including location information such as Building name(s) and number(s).

(3) System group. Systems grouped by the user to perform according to a common schedule.

(4) Weekly schedules. For each system, a weekly schedule based on a seven day per week schedule with independent schedules for each day of the week including no less than 6 value changes per day.

(5) Holiday and special event schedules. Support for holiday and special event calendar schedules independent of the daily schedule. Special event schedules include one-time events and recurring events. Scheduling of one-time events include the beginning and ending dates and times of the event. Holiday and special event schedules must have precedence over device weekly schedules.

2.4.7.13 Alarms

Provide M&C Software meeting the following minimum requirements for alarms:

a. The M&C software must be capable of generating alarms by comparing the value of any point from any connected system to user-configurable limits, and configuring alarms in ASHRAE 135 field devices in accordance with the B-AWS BIBBs

b. The M&C software must be capable of handling (routing) alarms generated by the M&C Software, and alarms received as an ASHRAE 135 Alarm Event Notifications.

c. The M&C software must support at least two alarm priority levels: critical and informational. Critical alarms must remain in alarm until acknowledged by an operator and the alarm condition no longer exists; informational alarms must remain in alarm until the alarm condition no longer exists or until the alarm is acknowledged.

d. The creation, modification, and handling (routing) of alarms must be fully accessible and fully adjustable from the graphical user interface.

e. Alarm Data. Alarm data to be displayed and stored must include:

(1) Identification of alarm including building, system (or sub-system), and device name.

(2) Date and time to the nearest second of occurrence.

(3) Alarm type:

(a) Unreliable: Indicates that the source device has failed due to the sensing device or alarm parameter being out-of-range or bad data.

(b) High Alarm.

(c) Low Alarm.

(4) Current value or status of the alarm point, including engineering units

(5) Alarm limits, including engineering units.

(6) Alarm priority.

(7) Alarm Message: A unique message with a field of at least 60 characters. Assignment of messages to an alarm must be an operator editable function.

(8) Acknowledgement status of the alarm including the time, date and user of acknowledgement.

f. Alarm Notification and Routing: The M&C software must be capable of performing alarm notification and routing functions. Upon receipt of ASHRAE 135 event notification, OPC alarm, or upon generation of an alarm the M&C software must immediately perform alarm notification and routing according to an assigned routing for that alarm. The M&C software must support at least 100 alarm routes, where an alarm route is a unique combination of any of the following activities:

(1) Generate a pop-up active clients. The pop-up display must include the Alarm Data. Alarms must be capable of being acknowledged from the pop-up display by operators with sufficient permissions. Pop-up must be displayed until acknowledged.

(2) Send an e-mail message via simple mail transfer protocol (SMTP; RFC 821). The e-mail must contain a configurable message and all alarm data. The e-mail recipient and scripted message must be user configurable for each alarm route.

(3) Print alarms to designated alarm printers. The printed message must be the same as the pop-up message.

g. Alarm Display and Acknowledgement. The M&C software must include an alarm display. Alarms must be available for display at each workstation as shown, along with all associated alarm data. Alarms must be capable of being acknowledged from this display. Multiple alarms must be capable of being acknowledged using a single command. Operator acknowledgment of one alarm must not automatically be considered as acknowledgment of any other alarm nor may it inhibit reporting of subsequent alarms.

h. Alarm Storage and Reports: The M&C software must store each alarm and its associated alarm data to hard disk and retain this information

after the alarm no longer exists. The stored data must be sortable, searchable, and printable.

2.4.7.14 Trending

Provide M&C software capable of creating, modifying, uploading and archiving ASHRAE 135 Trend Objects in field devices in accordance with the B-AWS BIBBs and of performing real-time trending with a minimum trending rate of 100 points per second .

a. The M&C Software must include a graphical display for trend configuration, creation, and deletion accessible through the graphical user interface. Each trend must be user-configurable for:

(1) Point to trend.

(2) Sampling interval: adjustable between 1 second and 1 hour.

(3) Start and Stop Time of Trend: Start and stop times determined by one or more of the following methods:

(a) Start time and stop time

(b) Start time and duration

(c) Start time and number of samples

b. The M&C software must be capable of displaying and printing a graphical representation of each trend, and of multiple trended points on the same graph. The software must be capable of saving trend logs to a file. If the file format is not plain ASCII text in a Comma-Separated-Value (CSV) format, provide a means to export or convert the file to plain ASCII text in a CSV format.

2.4.7.15 Electrical Power Demand Limiting

Provide M&C software which includes demand limiting functionality capable of performing electrical demand limiting such that it can change the occupancy mode or setpoint of field control system hardware via a network point based on a projected demand in order to maintain demand below a configured target. The demand target must incorporate real-time pricing data. The demand limiting algorithm must incorporate priority levels such that low priority equipment is adjusted before high-priority equipment. The demand limiting algorithm must generate a critical alarm when it begins to impact the system and a critical alarm if the demand target is exceeded.

2.4.7.16 Report Generation

Provide M&C Software capable of generating, saving and printing reports. Dynamic operation of the system must not be interrupted to generate a report. The report must contain the time and date when the samples were taken, and the time and date when the report was generated. The software must be capable of saving reports to a PDF file and to a file compatible with the provided Office Automation Software.

The software must allow for automatic and manual generation of reports. For automatic reports an operator must be able to specify the time the initial report is to be generated, the time interval between reports, end of period, and the output format for the report. Manual report generation

must allow for the operator to request at any time the output of any report.

2.4.7.17 Custom Report Generation

Provide M&C software capable of generating custom reports, including but not limited to the following standard reports:

2.4.7.17.1 Electrical Power Usage Report

An electrical power Usage summary, operator selectable for substations, meters, or transducers, individual meters and transducers, any group of meters and transducers, and all meters for an operator selected time period. The report must include the voltage, current, power factor, electrical demand, electrical power consumption, reactive power (Kvar) for each substation, facility, system or equipment as selected by the operator. The report must be automatically printed at the end of each summary period and include:

a. Total period consumption.

b. Demand interval peak for the period, with time of occurrence.

c. Energy consumption (kWh) over each demand interval.

d. Time-of-use peak, semi-peak, off-peak, or baseline total kWh consumption.

e. Reactive power during each demand interval.

f. Power factor during each demand interval.

g. Outside air (OA) temperature and relative humidity (RH) taken at the maximum and minimum of OA temperature of the report period with the time and dates of occurrence. At the installation's peak demand interval, the OA temperature and RH must also be recorded.

h. Calculated heating and cooling degree days based on a 65 degrees F balance point.

2.4.7.17.2 Electrical Peak Demand Prediction Report

A report based on the demand limiting program, which includes:

a. Electrical Demand Target (EDT).

b. Actual peak and predicted peak for each demand interval for that day.

c. Predicted demand for the next demand interval.

2.4.7.17.3 Energy usage Report

An energy usage summary, operator selectable, for a unit, building, area, installation, and the entire UMCS. The report must be divided by utility, and must be capable of reporting on at least four separate utilities. The report must include the following information:

a. Beginning and ending dates and times.

b. Total energy usage for each utility for the current and previous day.

c. Total energy usage for each utility for the current and previous month.

d. Maximum 15-minute interval average rate of consumption for each utility for the current and previous day and current and previous month.

e. Outside air (OA) temperature and OA humidity for current and previous month and current and previous day:

(1) Average temperature and humidity.

(2) Temperature and humidity at maximum and minimum OA temperature with time and date of occurrence.

(3) Temperature and humidity at maximum and minimum humidity with time and date of occurrence.

(4) Temperature and humidity at the installation's peak demand interval with the time and date of occurrence

f. Calculated degree days. Reports which include humidity must be configurable to report either dewpoint or relative humidity.

2.4.7.17.4 Water Usage Report

A water usage summary, operator selectable, for a unit, building, area, installation, and the entire UMCS. The report must include the following information:

a. Beginning and ending dates and times.

b. Total energy water usage for the current and previous day.

c. Total water usage for the current and previous month.

2.4.7.17.5 Alarm Report

Outstanding alarms by building or unit, including time of occurrence.

2.4.7.17.6 M&C Software Override Report

Points overridden by the M&C Software, including time overridden, and identification of operator overriding the point.

2.4.7.17.7 Run Time Reports

A report totalizing the accumulated run time of individual pieces of equipment. The operator must be able to define equipment groupings and to generate reports based on these groupings.

2.4.7.17.8 Cooling Tower Profiles

A cooling tower profile for each cooling tower as indicated, including:

a. Total daily and monthly on-time (each fan).

b. Number of on and off transitions (each fan).

c. Maximum and minimum daily condenser water temperature and the time of occurrence for the current and previous months.

d. Total daily and monthly makeup water consumption.

2.4.7.17.9 Chiller usage Report

A report of the operation of each chiller as shown on a daily and monthly basis, for each of at least 10 discrete loading levels. The report must include:

a. Average power for the month at each level in kW

b. Total monthly energy use in kWh at each level

c. Total monthly energy use in kWh for the chiller (all levels)

d. Total daily run hours at each level

e. Total Monthly run hours at each level

2.4.7.17.10 Device Offline Report

A report listing all offline devices in all ASHRAE 135 building control systems integrated to the M&C Software.

2.4.8 Computer Software

Provide the most recent versions of all computer software provided under this specification delivered as a Technical Data Package. Submit the user manuals for all software delivered for this project with the software.

2.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)

Provide uninterruptible power supplies (UPS) as self contained devices suitable for installation and operation at the location of Server and Workstation hardware and sized to provide a minimum of 20 minutes of operation of the connected hardware. Equipment connected to the UPS must not be affected in any manner by a power outage of a duration less than the rated capacity of the UPS. Provide the UPS complete with all necessary power supplies, transformers, batteries, and accessories. Provide UPS which include visual indication of normal power operation, UPS operation, abnormal operation and visual and audible indication of AC input loss and low battery power. Provide UL 1778 approved UPS. UPS powering Server Hardware must notify the server via USB interface of impending battery failure.

2.6 RACKS AND ENCLOSURES

2.6.1 Enclosures

Enclosures supplied as an integral (pre-packaged) part of another product are acceptable. Provide two Enclosure Keys for each lockable enclosure on a single ring per enclosure with a tag identifying the enclosure the keys operate. Provide enclosures meeting the following minimum requirements:

2.6.1.1 Outdoors

For enclosures located outdoors, provide enclosures meeting NEMA 250 Type 3 Type 4 requirements.

2.6.1.2 Mechanical and Electrical Rooms

For enclosures located in mechanical or electrical rooms, provide enclosures meeting NEMA 250 Type 2 Type 4 requirements.

2.6.1.3 Other Locations

For enclosures in other locations including but not limited to occupied spaces, above ceilings, and in plenum returns, provide enclosures meeting NEMA 250 Type 1 requirements.

2.6.2 Equipment Racks

Provide standard 19 inch equipment racks compatible with the electronic equipment provided. Racks must be either aluminum or steel with bolted or welded construction. Steel equipment racks must be painted with a flame-retardant paint. Guard rails must be included with each equipment rack and have a copper grounding bar installed and grounded to the earth.

PART 3 EXECUTION

3.1 FACTORY TEST

Perform factory testing of the UMCS as specified. The Contractor is responsible for providing personnel, equipment, instrumentation, and supplies necessary to perform required testing. Provide written notification of planned testing to the Government at least 21 days prior to testing, and do not give this notice until after receiving written Government approval of the specific Factory Test Procedures. Provide Factory Test Procedures which define the tests required to ensure that the system meets technical, operational, and performance specifications. Within the Procedures define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required. Provide procedures which test all capabilities and functions specified and indicated. Develop Procedures from the design documentation and in accordance with Section 25 08 10 UTILITY MONITORING AND CONTROL SYSTEM TESTING. Perform the Factory Test using equipment and software of the same manufacturer, model and revision as will be used for the specified project. Include detailed instructions for test setup, execution, and evaluation of test results in the Procedures. Upon completion of the test, prepare a Factory Test Report, documenting the results of the Test, and submit it as specified.

Perform the Factory Test and provide Factory Test Submittals as shown in TABLE II. FACTORY TEST SEQUENCING.

TABLE II. FACTORY TEST SEQUENCING

ITEM #	DESCRIPTION	SEQUENCING (START OF ACTIVITY or DEADLINE FOR SUBMITTAL)
1	Submit Factory Test Procedures	_____ days after notice to proceed _____
2	Perform Factory Test	After Approval Of #1
3	Submit Factory Test Report	_____days After Completion Of #2

3.1.1 Factory Test Procedures

Submit Four copies of the Factory Test Procedures. The Factory Test Procedures may be submitted as a Technical Data Package.

3.1.2 Factory Test Report

Submit Four copies of the Factory Test Report. The Factory Test Report may be submitted as a Technical Data Package.

3.2 EXISTING CONDITIONS SURVEY

Perform a field survey, including but not limited to testing and inspection of equipment to be part of the UMCS, and submit an Existing Conditions Report documenting the current status and its impact on the Contractor's ability to meet this specification. For field control systems to be integrated to the UMCS which are not already connected to the UMCS IP network, verify the availability of the building network backbone at the FPOC location, and verify that FPOCs shown as existing are installed at the FPOC location.

3.2.1 Existing Conditions Report

Submit Four copies of the Existing Conditions Report.

3.3 DRAWINGS AND CALCULATIONS

3.3.1 UMCS IP Network Bandwidth Usage Estimate

Provide a UMCS IP Network Bandwidth Usage Estimate for a small, medium or large systems. In this estimate account for field control systems using all M&C required protocols and the integration of field control system via gateways. Define all assumptions used to create the estimate, including but not limited to: trending, fast trends for commissioning, schedules, alarms, display of system graphics and load shedding.

Submit Four copies of the UMCS IP Network Bandwidth Usage Estimate.

3.3.2 UMCS Contractor Design Drawings

Revise and update the Contract Drawings to include details of the system design and all hardware components, including contractor provided and Government furnished components. Details to be shown on the Design

Drawing include:

a. The logical structure of the network, including but not limited to the location of all Control Hardware (including but not limited to each BACnet Supervisory Controller, Control Protocol Gateway, Control Protocol Router, and Monitoring and Control (M&C) Controller).

b. Manufacturer and model number for each piece of Computer Hardware and Control Hardware.

c. Physical location for each piece of Computer Hardware and Control Hardware.

d. Version and service pack number for all software and for all Control Hardware firmware.

Submit UMCS Contractor Design Drawings as a single complete package: _____ hard copies and _____ copies on CDROM. Submit hardcopy drawings on ISO A1 34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in both PDF and AutoCAD Microstation Bentley BIM V8 Autodesk Revit 2013 format.

3.3.3 As-Built Drawings

Prepare draft as-built drawings consisting of Points Schedule drawings for the entire UMCS, including Points Schedules for each Gateway, and an updated Design Drawing including details of the actual installed system as it is at the conclusion of Start-Up and Start-Up Testing. Provide As-Built Drawings which include details of all hardware components, including contractor provided and Government furnished components. In addition to the details shown in the design drawings, the as-built drawing must include:

a. IP address(es) and Ethernet MAC address(es) as applicable for each piece of Control Hardware (including but not limited to each BACnet Supervisory Controller, Control Protocol Gateway, Control Protocol Router, and Monitoring and Control (M&C) Controller).

b. IP address and Ethernet MAC address for each computer server, workstation, and networked printer.

c. Network identifier (name) for each printer, computer server and computer workstation.

d. List of ports, protocols and network services for each device connected to an IP network.

e. Network Addresses: ASHRAE 135 address and Object_ID of the Device Object for all Control Hardware using ASHRAE 135. address for all Control Hardware using MODBUS Protocol/MODBUS TCP/IP.

Prepare Draft As-Built Drawings upon the completion of Start-Up and Start-Up Testing and Final As-Built Drawings upon completion of PVT Phase II.

3.3.3.1 Draft As-Built Drawings

Submit Draft As-Built Drawings as a single complete package: _____ hard copies and _____ copies on CDROM. Submit hardcopy drawings must on ISO A1

34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in both PDF and AutoCAD Microstation Bentley BIM V8 Autodesk Revit 2013 format.

3.3.3.2 Final As-Built Drawings

Submit Final As-Built Drawings as a single complete package: _____ hard copies and _____ copies on CDROM. Submit hardcopy drawings on ISO A1 34 by 22 inches or A3 17 by 11 inches sheets, and electronic drawings in both PDF and AutoCAD Microstation Bentley BIM V8 Autodesk Revit 2013 format.

3.4 INSTALLATION REQUIREMENTS

3.4.1 General

Install system components as shown and specified and in accordance with the manufacturer's instructions and provide necessary interconnections, services, and adjustments required for a complete and operable system. Install communication equipment and cable grounding as necessary to preclude ground loops, noise, and surges from adversely affecting system operation. Install Fiber Optic cables and wiring in exposed areas, including low voltage wiring but not including network cable in telecommunication closets, in metallic raceways or EMT conduit as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Do not install equipment in any space which experiences temperatures or humidity outside of the rated operating range of the equipment.

3.4.2 Isolation, Building Penetrations and Equipment Clearance

Provide dielectric isolation where dissimilar metals are used for connection and support. Make all penetrations through and mounting holes in the building exteriors watertight. Drill or core drill holes in concrete, brick, steel and wood walls with proper equipment. Seal conduits installed through openings with materials which are compatible with existing materials. Seal openings with materials which meet the requirements of NFPA 70 and SECTION 07 84 00 FIRESTOPPING.

3.4.3 Nameplates

Provide Nameplates for all Control Hardware and all Computer Hardware. Attach Nameplates to the device in a conspicuous location.

3.5 INSTALLATION OF EQUIPMENT

3.5.1 Wire and Cable Installation

Install system components and appurtenances in accordance with NFPA 70, manufacturer's instructions and as indicated. Provide necessary interconnections, services, and adjustments required for a complete and operable signal distribution system. Label components in accordance with ANSI/TIA-606. Firestop Penetrations in fire-rated construction in accordance with Section 07 84 00 FIRESTOPPING. Install conduits, outlets and raceways in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install wiring in accordance with ANSI/TIA-568.1 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Mark wiring terminal blocks and outlets in accordance with ANSI/TIA-606. Do not install non-fiber-optic cables in the same cable tray, utility pole compartment, or floor trench compartment with power cables. Properly secure and install neat in appearance cables not installed in conduit or raceways.

3.5.2 Grounding

Install signal distribution system ground in accordance with ANSI/TIA-607 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Connect equipment racks to the electrical safety ground.

3.5.3 Power-Line Surge Protection

Protect equipment connected to ac circuits must be protected against or withstand power-line surges. Provide equipment protection which meets the requirements of IEEE C62.41. Do not use fuses for surge protection.

3.5.4 IP Addresses

For all Control Hardware requiring an IP address on the UMCS IP Network, coordinate with the _____ to obtain IP addresses use the following IP addresses:obtain static IP addresses from a DHCP server.

3.5.5 Computer Hardware and Software

3.5.5.1 Hardware Installation

Install Computer Hardware as specified and indicated. Power Computer Servers through a UPS, and install and configure them such that the server automatically undergoes a clean shutdown upon low battery signal from the UPS.

3.5.5.2 Software Installation

Install software as follows:

a. BACnet Network Browser: Install the BACnet Network Browser software as indicated. Install the BACnet Network Browser on workstation hardware.

b. Monitoring and Control Software: Install the monitoring and control (M&C)software as shown. Except for M&C Software performing Point Calculations or Electrical Peak Demand Limiting, install M&C Software on server hardware. Install M&C Software performing Point Calculations or Electrical Peak Demand Limiting on either server hardware or Monitoring and Control (M&C) Controller Hardware. Install M&C Software in a manner consistent with its B-AWS listing such that it provides all functionality of a B-AWS.

   Provide sufficient computer hardware and M&C Controller Hardware and install M&C Software to support the number of points required in PART 2 (PRODUCTS), regardless of the number of points integrated under this project specification. Note that meeting this requirement may entail the installation of unused hardware or spare point licenses to accommodate the full number of required points in order to allow for integration of future field control systems.

c. M&C Controller Hardware Configuration Software: Install the M&C Controller Hardware Configuration Software on server hardware.

d. Operating system: Install the OS on each Server and Workstation and configure usernames and passwords. Coordinate with _____ for usernames and passwords.

e. Office Automation Software: Install the office automation software on each server and workstation.

f. Virus Protection software: Install the virus protection software on each server and workstation and configure weekly virus scans. Configure the virus protection software to update virus definitions automatically from the update server at ____. Coordinate with ____ to obtain update server information.

g. Disk Imaging (Backup) Software: Install the disk imaging (backup) software on each server and configure for imaging the internal hard drive to external hard drive.

Where software requires connection to an IP device outside of the UMCS, coordinate with ____ to obtain access to a Government-furnished server to provide the needed functionality. Do not connect to any device outside of the UMCS without explicit permission from ____.

3.5.5.3 Monitoring and Control (M&C) Software Configuration

Configure the Monitoring and Control (M&C) Software as specified, as indicated and as follows:

a. Set up M&C Software user accounts and passwords. Coordinate user accounts, passwords and permissions with the Controls HVAC Electrical shop supervisor.

b. Change the default password on all accounts. Remove or disable any accounts which do not require authentication (such as guest accounts).

c. Configure e-mail capability to use the government furnished SMTP server using the following server information____. a Government furnished SMTP server. Coordinate with ____for SMTP server information.

d. Disable all ports, protocols, and network services other than those required or specifically permitted by this Section. Services to be disabled include but are not limited to: FTP, Telnet and SSH.

e. Install web server certificate. Obtain certificate from ____.

3.5.5.4 Control Hardware

Install Control Hardware in an enclosure in a lockable enclosure and as specified. Configure Control Hardware as specified, as required to meet the functions for which the hardware is used and as follows:

a. Disable all ports, protocols, and network services other than those required or specifically permitted by this Section. Services to be disabled include but are not limited to: FTP, Telnet, SSH, and HTTP. When disabling of ports, protocols and services is not supported by a product, obtain an exception from this requirement prior to using the product and document non-compliance on the Product Data Sheets and As-Built drawings.

b. Change the default passwords in all Control Hardware which have passwords. Coordinate new passwords with the Controls HVAC Electrical shop supervisor.

3.6 INTEGRATION OF FIELD CONTROL SYSTEMS

Fully integrate the field control systems in accordance with the following three step sequence and as specified and shown.

STEP 1: Install and configure Control Hardware as necessary to connect the field control system to the FPOC, which is part of the UMCS IP network, and to provide control protocol translation and supervisory functionality.

STEP 2: Add Field Control System to M&C Software: Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to the field control system.

STEP 3: Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and trending.

3.6.1 Integration Step 1: Install Control Hardware

Install Control Hardware as specified at the FPOC location as shown to connect the field control system to the UMCS IP network via the FPOC and, if necessary, to provide control protocol translation and supervisory functionality. Coordinate all connections and other activities related to an FPOC with _____. Depending on the field control system media and protocol this must be accomplished through one of the following:

a. Connect the existing field control network hardware at the FPOC location to the FPOC.

b. Install a Control Protocol Gateway connected to both the field control network and the FPOC.

c. Install a Control Protocol Router connected to both the field control network and the FPOC.

d. Install a Control Protocol Gateway connected to the field control network. Then install a Control Protocol Router connected to both the Control Protocol Gateway and the FPOC.

In addition, for integration of field control systems via ASHRAE 135, also install a BACnet Supervisory Controller as needed to implement scheduling, alarming and trending in the field control system. The BACnet supervisory controller may be the same device as the control protocol gateway or router.

3.6.1.1 Installation of Control Protocol Gateway

If the field control system uses a protocol which is not supported by the M&C Software, install a gateway to convert the field control system protocol to ASHRAE 135, or to CEA-709.1-D, or to OPC DA. Install additional field control system network media and hardware as needed to connect the Gateway to the field control system. Connect the Gateway according to one of the two following methods:

a. Connect the Gateway to the field control network and to the FPOC.

b. Connect the Gateway to the field control network and to a BACnet/IP

Router, or to a LonWorks/IP Router, or to a Modbus/IP Router installed as specified.

Create and configure points and establish network communication between the Control Protocol Gateway and the field control system to provide points from the field control system to the M&C software.

3.6.1.2 Installation of Control Protocol Router

If there is not an existing connection between the FPOC and the field control network, install a BACnet/IP Router, or a LonWorks/IP Router, or a Modbus/IP Router to connect the field control network to the FPOC. Install additional field control system network media as needed to connect the Router to the field control system.

3.6.1.3 Installation of BACnet Supervisory Controller

If required for implementation of scheduling, alarming and trending, install a BACnet Supervisory Controller connected to the building control system IP network and configure it to provide scheduling, alarming and trending functions for the field control system. When the BACnet Supervisory Controller is the same device as a control protocol router or gateway, install it in accordance with the installation requirements for a router or gateway.

3.6.2 Integration Step 2: Add Field Control System to M&C Software

Perform system discovery, system database merges, or any other actions necessary to allow M&C Software access to points and data in the field control system.

3.6.2.1 Integration of Field Control Systems Via ANSI-709.1-C

a. When a LNS Database of the field control system is not available, use the Network Configuration Tool software to discover the field control system and create an LNS Database for the field control system.

b. When the UMCS does not already contain an LNS Server, provide an LNS Server to support the UMCS LNS Database.

c. When there is no existing UMCS LNS Database, use the field control system database as the UMCS Database.

d. When there is an existing UMCS LNS Database, merge the field control system with the UMCS LNS database.

3.6.2.2 Integration of Field Control Systems Via ASHRAE 135

Use the M&C Software to fully discover the field control system. Full discovery of a field control system includes but is not limited to discovery of all ASHRAE 135 devices, all standard ASHRAE 135 Objects and Properties of each device, and all standard ASHRAE 135 services supported by each device.

3.6.2.3 Integration of Field Control Systems Via OPC DA

Establish a connection between the M&C Software OPC DA client and the field control system OPC DA server and make all points as shown on the Points Schedule from the field control system available in the M&C

Software.

3.6.2.4 Integration of Field Control Systems Via Other (non-ASHRAE 135, non-CEA-709.1-D, non-Modbus, non-OPC DA) Protocols

Perform all actions necessary to make all points as shown on the Points Schedule from the field control system available in the M&C Software.

3.6.3 Integration Step 3: Configure M&C Software

Configure M&C Software to provide monitoring and control of the field control system, including but not limited to the creation of system displays and the configuration of scheduling, alarming, and trending.

3.6.3.1 Configure M&C Software Communication

Create and configure points and establish network communication between M&C Software and Field Control Systems as specified to support M&C Software functionality:

a. Update points on currently active displays via polling as necessary to meet M&C Software display refresh requirements.

b. Send points used for overrides to the device receiving the override as shown on the Points Schedule. For LonWorks systems, for points used for overrides use the network variable and SNVT type indicated on the Points Schedule. For SNVTs for overriding schedules (via the Simple Scheduler) use SNVT type SNVT_occupancy and support the following values: OC_OCCUPIED, OC_UNOCCUPIED, OC_STANDBY and OC_NUL. For SNVTs used to override schedules or setpoints for Demand Limiting functions use the acknowledged service. For BACnet systems write operator overrides with a priority of 8 and demand limiting overrides with a priority of 10.

c. For Notification Class Objects used for Alarms, configure the Recipient_List Property to point to the appropriate M&C Software process. Use the ConfirmedEventNotification service for events from ASHRAE 135 field control systems used for alarms. Bind points from CEA-709.1-D field control systems used using acknowledged service or poll the point at 5 minute intervals. Poll points from MODBUS Protocol /MODBUS TCP/IP field control systems used for alarms at 5 minute intervals. For points from OPC DA field control systems used for alarms use a subscription or poll the point at 5 minute intervals.

d. Update points used for currently active trends via polling as necessary to meet trend interval requirements.

e. Send points used for scheduling to the field control system with a maximum time between subsequent transmissions of the point of 30 minutes. For LonWorks field control systems, send points used for scheduling to the appropriate System Scheduler using SNVTs of type SNVT_occupancy which support the following values: OC_OCCUPIED, OC_UNOCCUPIED and OC_STANDBY.

Edit the Description field of each point to include the Real Property Unique IDs (RPUID) associated with that point as shown on the Points Schedule

3.6.3.2 Configure M&C Software Functionality

Fully configure M&C Software functionality using the M&C Software capabilities specified in PART 2 of this Section.

a. Create System Displays using the project site sample displays, including overrides, as shown on the Points Schedule and as specified. Label all points on displays with full English language descriptions the point name as shown on the Points Schedule the point description as shown on the Points Schedule. Configure user permissions for access to and executions of action using graphic pages. Coordinate user permissions with the Controls HVAC Electrical shop supervisor

b. Configure alarm generation and alarm handling as shown on the Points Schedule, as shown on the Alarm Routing Schedule, and as specified. Create and configure Objects in BACnet Supervisory Controllers and in the field control system to support alarming as shown on the Points Schedule and as specified. Alarm events with priority 112 are critical and events with priority 224 are non-critical. For alarm events with other priorities, treat events with priorities of 200 or above as non-critical, and all others as critical. For alarms requiring notification via text message or e-mail, configure the alarm notification to use the specified Government furnished SMTP server to send the alarm notification.

c. Configure scheduling as indicated and as shown on the points schedule. Configure M&C Software scheduling functionality to schedule Modbus systems andOPC systems. Configure M&C Software scheduling functionality for LonWorks field control systems which do not use the Simple Scheduler Object. For LonWorks field control systems which do use the Simple Scheduler Object, configure the Simple Scheduler Objects in the field control system. Create and configure Schedule Objects in BACnet Supervisory Controllers or in the field control system.

   Create and configure displays for configuration of M&C Software schedules and Simple Scheduler Objects in the field control system and Schedule Objects in the field control system. Label schedules and scheduled points with full English-language descriptors. Provide a separate configuration capability for each schedule. A single configuration display may be used to configured multiple schedules, provided that each schedule is separately configurable from the display.

d. Create M&C Software trends for required points as shown on the Points Schedule and as specified. Create and configure Trend Objects in BACnet Supervisory Controllers and in the field control system as shown on the Points Schedule and as specified. Trend points at 15 minute intervals.

   Create and configure displays for creation and configuration of trends and for display of all trended points.

e. Configure Demand Limiting as shown on the Demand Limit Schedule and Points Schedule and as specified.

f. Configure M&C Software standard reports.

3.7 START-UP AND START-UP TESTING

Test all equipment and perform all other tests necessary to ensure the system is installed and functioning as specified. Prepare a Start-Up and Start-Up Testing Report documenting all tests performed and their results and certifying that the system meets the requirements specified in the contract documents.

Submit four copies of the Start-Up and Start-Up Testing Report. The Start-Up and Testing report may be submitted as a Technical Data Package.

3.8 PERFORMANCE VERIFICATION TEST (PVT)

3.8.1 PVT Phase I Procedures

Provide PVT Procedures which include:.

a. Network bandwidth usage and available bandwidth (throughput) measurements. Network bandwidth usage must reference the normal usage network Bandwidth Calculations.

b. Test System Reaction during PVT: The total system response time from initiation of a control action command from the workstation, to display of the resulting status change on the workstation must not exceed 20 seconds under system normal heavy load conditions assuming a zero response time for operation of the node's control device.

c. Verification of IP Connectivity.

d. Verification of configuration of M&C Software functionality.

Submit four copies of the PVT Phase I Procedures. The PVT Procedures may be submitted as a Technical Data Package.

3.8.2 PVT Phase I

Demonstrate compliance of the control system with the contract documents. Using test plans and procedures previously approved by the Government, demonstrate all physical and functional requirements of the project. Upon completion of PVT Phase I and as specified, prepare and submit the PVT Phase I Report documenting all tests performed during the PVT and their results. In the PVT report, include all tests in the PVT Procedures and any other testing performed during the PVT. Document failures and repairs with test results.

Submit four copies of the PVT Phase I Report. The PVT Phase I Report may be submitted as a Technical Data Package.

3.8.3 PVT Phase II

Include Basic Training as part of PVT Phase II. Failures or deficiencies of the UMCS during Basic Training are considered PVT failures. Upon completion of PVT Phase II, and as specified, prepare and submit the PVT Phase II Report documenting any failures which occurred and repairs performed during PVT Phase II.

Submit four copies of the PVT Phase II Report. The PVT Phase II Report may be submitted as a Technical Data Package.

3.9 MAINTENANCE AND SERVICE

Perform inspection, testing, cleaning, and part or component replacement as specified and as required to maintain the warranty. Work includes providing necessary preventive and unscheduled maintenance and repairs to keep the UMCS operating as specified, and accepted by the Government, and other services as specified. Perform work in compliance with manufacturer's recommendations and industry standards. Provide technical support via telephone during regular working hours.

3.9.1 Work Coordination

Schedule and arrange work to cause the least interference with the normal Government business and mission. In those cases where some interference may be essentially unavoidable, coordinate with the Government to minimize the impact of the interference, inconvenience, equipment downtime, interrupted service and personnel discomfort.

3.9.2 Work Control

Upon completion of work on a system or piece of equipment, that system or piece of equipment must be free of missing components or defects which would prevent it from functioning as originally intended and designed. Replacements must conform to the same specifications as the original equipment. During and at completion of work, do not allow debris to spread unnecessarily into adjacent areas nor accumulate in the work area itself.

3.9.3 Working Hours

Working hours are from 7:30 A.M. to 4:00 P.M. local time Mondays through Fridays except Federal holidays.

3.9.4 Equipment Repairs

Initiate and complete equipment repairs within the following time periods, where time periods are measured as actual elapsed time from first notification, including working and non-working hours:

a. for non-redundant computer server hardware, initiate within 4 hours and complete within 8 hours.

b. for non-redundant computer workstation hardware, initiate within 4 hours and complete within 8 hours.

c. for redundant computer server hardware, initiate within 36 hours and complete within 5 days.

d. for redundant computer workstation hardware, initiate within 2 days and complete within 5 days.

e. for active (powered) control hardware, initiate within 4 hours and complete within 6 hours.

f. for cabling and other passive network hardware, initiate within 16 hours and complete within 5 days.

Repair is the restoration of a piece of equipment, a system, or a facility to such condition that it may be effectively used for its designated

purposes. Repair may be overhaul, reprocessing, or replacement of nonfunctional parts or materials or replacement of the entire unit or system.

3.9.5 Replacement, Modernization, Renovation

The Government may replace, renovate, or install new equipment as part of the UMCS at Government expense and by means not associated with this contract without voiding the system warranty. Replaced, improved, updated, modernized, or renovated systems and equipment interfaced to the system may be added to the Contractor's maintenance and service effort as a modification.

3.9.6 Access To UMCS Equipment

Access to UMCS equipment must be in accordance with the following:

a. Coordinate access to facilities and arrange that they be opened and closed during and after the accomplishment of the work effort. For access to a controlled facility contact the Government for assistance.

b. The Government may provide keys for access to UMCS equipment where the Government determines such key issuance is appropriate. Establish and implement methods of ensuring that keys issued by the Government are not lost or misplaced, are not used by unauthorized persons, and are not duplicated.

c. The Government may provide passwords or issue Common Access Cards (CAC) for access to UMCS computer equipment where the Government determines such issuance is appropriate. Establish and implement methods of ensuring that passwords and Common Access Cards issued by the Government are not used by unauthorized persons.

3.9.7 Records, Logs, and Progress Reports

Keep records and logs of each task, and organize cumulative chronological records for each major component, and for the complete system. Maintain a continuous log for the UMCS. Keep complete logs and be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the UMCS.

3.9.8 Preventive Maintenance Requirements

Perform maintenance procedures as described below, or more often if required by the equipment manufacturer. Prepare a Preventive Maintenance Work Plan as specified.

3.9.8.1 Preventive Maintenance Work Plan

Prepare a Preventive Maintenance Work Plan to schedule detailing all required preventive maintenance. Obtain Government approval of the Work Plan as specified in paragraph PROJECT SEQUENCING. Strictly adhere to the approved work plan to facilitate Government verification of work. If it is necessary to reschedule maintenance, make a written request to the Government detailing the reasons for the proposed change at least five days prior to the originally scheduled date. Scheduled dates will be changed only with the prior written approval of the Government.

Submit Four copies of the Preventive Maintenance Work Plan. The

Preventive Maintenance Work Plan may be submitted as a Technical Data Package.

3.9.8.2 Semiannual Maintenance

Perform the following Semiannual Maintenance as specified:

a. Perform data backups on all Server Hardware.

b. Run system diagnostics and correct diagnosed problems.

c. Perform fan checks and filter changes for UMCS hardware.

d. Perform all necessary adjustments on printers.

e. Resolve all outstanding problems.

f. Install new ribbons, ink cartridges and toner cartridges into printers, and ensure that there is at least one spare ribbon or cartridge located at each printer.

3.9.8.3 Maintenance Procedures

3.9.8.3.1 Maintenance Coordination

Coordinate any scheduled maintenance event that will may result in component downtime with the Government as follows, where time periods are measured as actual elapsed time from beginning of equipment off-line period, including working and non-working hours:

a. For non-redundant computer server hardware, provide 14 days notice, components must be off-line for no more than 8 hours.

b. For non-redundant computer workstation hardware, provide 7 days notice, components must be off-line for no more than 8 hours.

c. for redundant computer server hardware, provide 7 days notice, components must be off-line for no more than 36 hours.

d. For redundant computer workstation hardware, provide 4 days notice, components must be off-line for no more than 48 hours.

e. For active (powered) control hardware, provide 14 days notice, components must be off-line for no more than 6 hours.

f. For cabling and other passive network hardware, provide 21 days notice, components must be off-line for no more than 12 hours.

3.9.8.3.2 Software/Firmware

Software/firmware maintenance includes operating systems, application programs, and files required for the proper operation of the UMCS regardless of storage medium. User (project site) developed software is not covered by this contract, except that the UMCS software/firmware must be maintained to allow user creation, modification, deletion, and proper execution of such user-developed software as specified. Perform diagnostics and corrective reprogramming as required to maintain total UMCS operations as specified. Back up software before performing any computer hardware and software maintenance. Do not modify any parameters

without approval from the Government. Properly document any approved changes and additions, and update the appropriate manuals.

3.9.8.3.3 Network

Network maintenance includes testing transmission media and equipment to verify signal levels, system data rates, errors and overall system performance.

3.9.9 Service Call Reception

a. A Government representative will advise the Contractor by phone or in person of all maintenance and service requests, as well as the classification of each based on the definitions specified. A description of the problem or requested work, date and time notified, location, classification, and other appropriate information will be placed on a Service Call Work Authorization Form by the Government.

b. Submit procedures for receiving and responding to service calls 24 hours per day, seven days a week, including weekends and holidays during regular working hours. Provide a single telephone number for receipt of service calls during regular working hours; service calls are to be considered received at the time and date the telephone call is placed by the authorized Government representative.

c. Separately record each service call request, as received on the Service Call Work Authorization form and complete the Service Call Work Authorization form for each service call. Include the following information in the completed form: the serial number identifying the component involved, its location, date and time the call was received, nature of trouble, names of the service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials to be used, the time and date work started, and the time and date of completion.

d. Respond to each service call request within two working hours. Provide the status of any item of work within four hours of the inquiry during regular working hours, and within 16 hours after regular working hours or as needed to meet the Equipment Repair requirements as specified.

3.9.10 Service Call Work Warranty

Provide a 1 year unconditional warranty on service call work which includes labor and material necessary to restore the equipment involved in the initial service call to a fully operable condition. In the event that service call work causes damage to additional equipment, restore the system to full operation without cost to the Government. Provide response times for service call warranty work equivalent to the response times required by the initial service call.

3.9.11 System Modifications

Make recommendations for system modification in writing to the Government. Do not make system modifications without prior approval of the Government. Incorporate any modifications made to the system into the Operations and Maintenance Instructions, and any other documentation affected. Make available to the Government software updates for all software furnished under this specification during the life of this

contract. Schedule at least one update near the end of the contract period, at which time make available the latest released version of all software provided under this specification, and install and validate it upon approval by the Government.

3.10 TRAINING

Conduct training courses for designated personnel in the maintenance, service, and operation of the system as specified, including specified hardware and software. The training must be oriented to the specific system provided under this contract. Provide audiovisual equipment and other training material and supplies required for the training. When training is conducted at Government facilities, the Government reserves the right to record the training sessions for later use. A training day is defined as 8 hours of classroom instruction, excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor should assume that attendees will be tradesmen such as electricians or boiler operators. Obtain approval of the training schedule from the Government at least 30 days prior to the first day of training.

3.10.1 Training Documentation

Prepare and submit one set of Training manuals for each of Basic Training Documentation, Advanced Training Documentation, and Refresher Training Documentation, where each set of documentation consists of:

3.10.1.1 Course Attendance List

Course Attendance List developed in coordination with and signed by the Controls HVAC Electrical shop supervisor.

3.10.1.2 Training Manuals

Include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson in the training manuals. Where portions of the course material are presented by audiovisuals, include copies of those audiovisuals as a part of the printed training manuals.

3.10.2 Basic Training

Conduct a Basic Training course at the project site on the installed system for a period of no less than 5 training days during Phase 2 of the PVT. A maximum of ten personnel will attend this course. Design training targeted towards training personnel in the day-to-day operation and basic maintenance of the system. Upon completion of this course, each student, using appropriate documentation, should be able to start the system, operate the system, recover the system after a failure, perform routine maintenance and describe the specific hardware architecture and operation of the system. Include the following topics at a minimum:

a. General system architecture.

b. Functional operation of the system, including workstations and system navigation.

c. System start-up procedures.

d. Failure recovery procedures.

e. Schedule configuration.

f. Trend configuration.

g. Perform point overrides and override release.

h. Reports generation.

i. Alarm reporting and acknowledgements.

j. Diagnostics.

k. Historical files.

l. Maintenance procedures:

(1) Physical layout of each piece of hardware.

(2) Troubleshooting and diagnostic procedures.

(3) Preventive maintenance procedures and schedules.

3.10.2.1 Basic Training Documentation

Submit training manuals for Basic Training delivered for each trainee on the Course Attendance List with two additional copies delivered for archival at the project site. Submit two copies of the Course Attendance List with the archival copies. The Basic Training Documentation may be submitted as a Technical Data Package.

3.10.3 Advanced Training

Conduct an Advanced Operator Training course at the project site off-site or at the project site for a period of not less then five days. A maximum of ten personnel will attend this course. Structure the course to consist of "hands-on" training under the constant monitoring of the instructor. Include training on the M&C Software, and the BACnet Network Browser. Upon completion of this course, the students should be fully proficient in the operation and management of all system operations and must be able to perform all tasks required to integrate a field control system into the UMCS. Report the skill level of each student at the end of this course. Include the following topics at a minimum:

a. A review of all topics in Basic Training

b. Using the the BACnet Network Browser for network discovery

c. M&C Software configuration, including but not limited to: creating and editing system displays, alarms, schedules, trends, demand limiting and calculations.

3.10.3.1 Advanced Training Documentation

Submit one set of training manuals delivered for each trainee on the Course Attendance List with two additional copies delivered for archival at the project site. Submit two copies of the Course Attendance List with

the archival copies. The Advanced Training Documentation may be submitted as a Technical Data Package.

3.10.4 Refresher Training

Conduct a Refresher Training course at the project site for a period of two training days when approved by the Government and as specified in paragraph PROJECT SEQUENCING. A maximum of ten personnel will attend the course. Structure the course to address specific topics that the students need to discuss and to answer questions concerning the operation of the system. Upon completion of the course, the students should be fully proficient in system operation and have no unanswered questions regarding operation of the installed UMCS. Correct any system failures discovered during the Refresher Training at no cost to the Government.

3.10.4.1 Refresher Training Documentation

Submit one set of training manuals delivered for each trainee on the Course Attendance List with two additional copies delivered for archival at the project site. Submit two copies of the Course Attendance List with the archival copies. The Refresher Training Documentation may be submitted as a Technical Data Package.

APPENDIX A

QC CHECKLIST		
This checklist is not all-inclusive of the requirements of this specification and should not be interpreted as such.		
This checklist is for (check one:)		
	Pre-Construction QC Checklist Submittal (Items 1-2)	( )
	Post-Construction QC Checklist Submittal (Items 1-6)	( )
	Close-out QC Checklist Submittal (Items 1-14)	( )
Instructions: Initial each item in the space provided (|____|) verifying that the requirement has been met.		
Verify the following items for Pre-Construction, Post-Construction and Closeout QC Checklist Submittals:		
1	Contractor Design Drawing Riser Diagram includes location and types of all Control Hardware and Computer Hardware.	|____|
2	M&C Software supports , and ASHRAE 135, and MODBUS Protocol/ MODBUS TCP/IP, and OPC DA. M&C Software is BTL Listed as a B-AWS.	|____|
Verify the following items for Post-Construction and Closeout QC Checklist Submittal:		
3	Communication between the M&C Software and ASHRAE 135 field control systems uses only ASHRAE 135. Communication between the M&C Software and CEA-709.1-D field control systems uses only CEA-709.1-D. Communication between the M&C Software and MODBUS Protocol/ MODBUS TCP/IP field control systems uses only MODBUS Protocol/ MODBUS TCP/IP. Communication between the M&C Software and OPC DA field control systems uses only OPC DA.	|____|

QC CHECKLIST			
4	Connections to non-ASHRAE 135, non-CEA-709.1-D, non-Modbus, non-OPC DA field control systems are via a Gateway from the field control system to ASHRAE 135, or to CEA-709.1-D, or to Modbus, or to OPC DA, or via a UMCS supported protocol without the use of a hardware Gateway.		|____|
5	Computer workstations and servers are installed as shown on the UMCS Riser Diagram.		|____|
6	Training schedule and course attendee lists have been developed and coordinated with shops and submitted.		|____|
Verify the following items for Closeout QC Checklists Submittal:			
7	LNS Database is up-to-date and accurately represents the final installed system. All points in field control systems have been discovered and are available at the M&C Software.		|____|
8	All software has been licensed to the Government.		|____|
9	M&C software monitoring displays have been created for all building systems, including all override and display points indicated on Points Schedule drawings.		|____|
10	Final As-built Drawings accurately represent the final installed system.		|____|
11	Default trends have been set up (per Points Schedule drawings).		|____|
12	Scheduling has been configured at the M&C Software (per Occupancy Schedule drawing).		|____|
13	O&M Instructions have been completed and submitted.		|____|

	QC CHECKLIST		
14	Basic Operator and Advanced Training courses have been completed.		|____|
	_____ _____		
	(QC Representative Signature) (Date)		

-- End of Section --

SECTION 31 21 13

RADON MITIGATION
11/18

PART 1 GENERAL

1.1 SUMMARY

Provide all work necessary to reduce and maintain radon concentration levels below 4.0 picoCuries per liter (pCi/L) in various buildings specified herein. Perform mitigation system installation, and perform post-mitigation testing and monitoring for radon.

1.2 REFERENCES

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 210	(2025) Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

AMERICAN ASSOCIATION OF RADON SCIENTISTS AND TECHNOLOGISTS (AARST)

ANSI/AARST MA-MFLB	Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings
ANSI/AARST SGM-MFLB	(2023) Soil Gas Mitigation Standards for Existing Multifamily, School, Commercial and Mixed-Use Buildings

ASTM INTERNATIONAL (ASTM)

ASTM C920	(2018; R 2024) Standard Specification for Elastomeric Joint Sealants
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM E2121	(2013) Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(2019) Standard for Compressed Air for Human Respiration; 6th Edition

INTERNATIONAL CODE COUNCIL (ICC)

ICC IMC	(2024) International Mechanical Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 00001	(2024) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code

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

SMACNA 1378	(1995) Thermoplastic Duct (PVC) Construction Manual, 2nd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. DEPARTMENT OF THE NAVY (DON)

OPNAV M-5090.1	(2014) Environmental Readiness Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 402-R-92-003	(1993) Protocols for Radon and Radon Decay Product Measurements in Homes
EPA 402-R-92-004	(1992) Indoor Radon and Radon Decay Product Measurement Device Protocols
EPA 402-R-92-014	(1993) Radon Measurement in Schools
EPA 402-R-93-078	(1993; R 1994) Radon Mitigation Standards
EPA 625-R-92-016	(1993; Am 1994) Radon Prevention in Design and Construction of Schools and Other Large Buildings

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1096	(2017) Ionizing Radiation
29 CFR 1926.59	Hazard Communication
29 CFR 1926.103	Respiratory Protection
42 CFR 84	Approval of Respiratory Protective Devices

1.3 DEFINITIONS

1.3.1 Active Soil Depressurization (ASD)

A family of radon mitigation systems involving mechanically-driven soil depressurization, including sub-slab depressurization (SSD), sub-membrane depressurization (SMD), block wall depressurization (BWD) and crawl space depressurization (CSD).

1.3.2 Contract Documents

Documents furnished to prospective bidders/proposers containing information and specifying criteria and project requirements for diagnostic testing, design, construction and monitoring of multiple radon mitigation systems. The documents include this specification and the drawings listed in and accompanying this specification.

1.3.3 Long Term Radon Detectors

Alpha track, electret ion chamber, or approved equivalent. Devices capable of sensing and recording the presences of radon during a time period of 91 days to 12 months which when analyzed provide a numeric value, measured in pCi/L, for radon concentrations during the time exposed.

1.3.4 Pressure Field Extension (PFE)

The distance that a pressure change, created by drawing soil-gas through a suction point, extends outward in a sub-slab gas permeable layer, under a membrane, behind a solid wall or in a hollow wall.

1.3.5 Qualified Mitigation Professional

Regardless of team composition, a "Qualified Mitigation Professional" for the purposes of this document is defined as: "An individual that has demonstrated a minimum degree of appropriate technical knowledge and skills specific to radon mitigation of schools and large buildings: a) as established in certification requirements of the National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB); and b) as required by statute, state licensure or certification program, where applicable."

1.3.6 Short Term Radon Detectors

Charcoal, electret ion chamber, or approved equivalent. Devices capable of sensing and recording the presences of radon during a time period of 48-hours to 90 days which when analyzed provide a numeric value, measured in pCi/L, for radon concentrations during the time exposed.

1.3.7 Suction Hole

Location at which vacuum is created for sub-slab communication testing.

1.3.8 Suction Point

Vertical standpipe penetrating into the soil gas environment containing radon and serving as the conduit to exhaust radon gas to the atmosphere.

1.3.9 Test Hole

Location at which pressure readings are taken during sub-slab communication testing. Readings are used to evaluate potential effectiveness of a sub-slab depressurization system.

1.4 SYSTEM DESCRIPTION AND REQUIREMENTS

1.4.1 Performance Requirements

Please provide a complete active radon mitigation system, including an

in-line exhaust fan and associated piping, in full compliance with the requirements of this section. Radon mitigation systems must reduce and maintain radon concentration levels below 4.0 pCi/L in various buildings specified herein. Test and construct radon mitigation systems in accordance with ANSI/AARST SGM-MFLB, ANSI/AARST MA-MFLB, ASTM E2121 OPNAV M-5090.1 EPA 402-R-93-078, EPA 402-R-92-003, EPA 402-R-92-004 and as specified herein. Additional guidance for testing and constructing radon mitigation systems is contained in EPA 625-R-92-016.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Respirators; G

Radon Mitigation Systems Components

Radon Mitigation Systems Enclosure Components

SD-06 Test Reports

Post Mitigation Testing; G

SD-07 Certificates

Worker Protection Plan; G

Medical Certification; G

Worker Notification; G

Respiratory Protection Program; G

Contractor Qualifications; G

Contractor Experience; G

Testing Laboratory Certification; G

Proof Of Current Calibration For Testing Devices; G

Radon Mitigation System Inspection; G

SD-08 Manufacturer's Instructions

Radon Mitigation Systems Components

SD-10 Operation and Maintenance Data

Radon Mitigation Systems, Data Package 2; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Radon Detector Location Log; G

Respirator Program Records; G

1.6 RADON DETECTOR LOCATION LOG

Prepare and provide to the Contracting Officer a Radon Detector Location Log for each building detailing the identity and location of each short term and long term radon detector. Prepare the log using copies of the "Device Placement Log" contained in EPA 402-R-92-014, and provide the appropriate information as line items. In addition to the log, on a copy of the building floor plans, locate and identify each short term and long term detector.

1.7 WORKER HEALTH AND SAFETY

Comply with OSHA, state and local standards or regulations relating to worker safety and occupational radon exposure. Prepare a worker protection plan in accordance with 29 CFR 1910.1096, OPNAV M-5090.1, EM 385-1-1, and EPA 402-R-93-078.

1.7.1 Worker Protection Plan

The worker protection plan must address, at a minimum occupational radon exposure, safe use of all job site equipment including safe practices when using ladders or scaffolding; safe procedures for crawl space work and avoidance of job site hazards; discussion of hantavirus symptoms; fire and life safety issues; confined space access; handling caustic solvents and bonding chemicals; appropriate use of personal protective equipment; respiratory protection program; suspected contaminants such as asbestos, lead paint, mold or other toxins that may exist; safety data sheets (SDS); ventilated work areas as required to reduce occupational radon exposure. Adhere to 29 CFR 1926.59 and provide the Contracting Officer with a copy of the SDS for all materials brought to the site.

1.7.2 Worker Exposure Records

Maintain records of worker exposure to radon sufficient to verify that workers are exposed to less than four working level months (WLM) in any 12-month period.

1.7.3 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1910.1096 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work.

1.7.4 Worker Notification

Train workers exposed to radon about the hazards of exposure to radon and the need to apply protective measures when working in areas with elevated radon concentrations. Training must comply with 29 CFR 1910.1096. Submit a notification signed by each worker acknowledging they have been properly trained regarding the hazards of radon exposure.

1.8 RESPIRATORY PROTECTION PROGRAM

Establish and implement a respirator program as required by 29 CFR 1910.1096, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

1.8.1 Respirator Program Records

Submit records of the respirator program as required by 29 CFR 1926.103, and 29 CFR 1910.1096.

1.8.2 Respirator Fit Testing

Conduct a qualitative or quantitative fit test conforming to 29 CFR 1926.103 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.8.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1910.1096, 29 CFR 1926.103 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing radon. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured or anticipated airborne radon concentrations to be encountered.

1.8.3.1 Respirators

Provide personnel with respiratory protection as indicated in 29 CFR 1926.103. Breathing air must comply with CGA G-7.

1.9 QUALITY ASSURANCE

1.9.1 Contractor Qualifications and Experience

Within 15 days after award, submit written evidence or data demonstrating that the Contractor and one or more subcontractors employed by the Contractor possess the qualifications and experience specified below.

1.9.1.1 Contractor Qualifications

The person responsible for diagnostic testing, construction and on-site supervision, as required by the specifications, must have successfully completed the requirements of and maintaining a current certification issued by either the National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB)as a qualified mitigation professional. Alternatively, in a State with legislation requiring mandatory credentialing for this work, compliance with the State legislation is

acceptable. Evidence showing successful completion of the requirements of the NRPP or the NRSB must include copy of current certification document and documentation issued by the State.

1.9.1.2 Contractor Experience

Submit written evidence demonstrating that the Contractor has successfully designed and installed at least two radon mitigation systems of the same or similar to the type required herein. The Contractor must have 3 years of experience installing radon mitigation systems. Experience proof must include but not be limited to:

a. The contract name and number, completion dates of the project and the total cost of the project;

b. The names, telephone numbers and fax number of the facility or installation for whom the radon mitigation system design, construction and testing were performed;

c. The name, telephone number and fax number of a supervisory level point of contact at each facility or installation who has knowledge of the Contractor's performance.

1.9.1.3 Qualified Mitigation Professional

A Qualified Mitigation Professional must be physically present or ensure a responsible person is present during onsite activities and immediately available to direct, instruct and oversee activities of other individuals, mitigation installers and other professionals engaged in installation activities for the mitigation system(s). The qualified mitigation professional must have 3 years of experience installing radon mitigation systems.

1.9.2 Testing Laboratory

Submit testing laboratory certification as proof that the testing laboratory performing radon detector analysis has successfully completed the requirements of the National Radon Safety Board (NRSB)or the National Radon Proficiency Program, (NRPP) and is qualified and authorized to perform such analysis. Alternatively, in a State with legislation requiring mandatory credentialing for this work, compliance with the State legislation is acceptable.

1.9.3 Diagnostic Testing Equipment

Submit proof of current calibration for testing devices used in performing diagnostic testing.

1.9.4 On-Site Supervision

No work at the site will be permitted without the presence of a person possessing the qualifications specified elsewhere in this section, namely certification issued by either the National Radon Proficiency Program, (NRPP) or the National Radon Safety Board (NRSB)as a qualified mitigation professional, or the State equivalent, where applicable.

1.9.5 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the

Worker Protection Plan, Accident Prevention Plan (APP) including the AHAs required in specification section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The safety preconstruction conference must include the Contractor and their Qualified Mitigation Professional, Designated IH and Project Supervisor and the Contracting Officer. Deficiencies in the APP will be discussed. Onsite work must not begin until the APP has been accepted.

1.10 DELIVERY, STORAGE AND HANDLING

1.10.1 Delivery of Products

Deliver materials to the site in an undamaged condition. Deliver proprietary items in manufacture's original unopened and undamaged containers of packages with manufacture's name and brand and other pertinent data such as specification number, type, and class, date of manufacture. Schedule deliveries of materials to coincide with scheduled installation.

1.10.2 Storage and Handling

Carefully store materials off the ground to provide proper ventilation, drainage and protection against weather and dampness. Protect materials from marring, staining, rust, damage and overload and from contaminants such as grease, oil and dirt. Store materials at temperatures recommended by the manufacturer. Handle material to avoid damage such as chipping and breaking. Replace damaged material.

1.11 PROJECT CONDITIONS

1.11.1 Building Descriptions

See Drawings for building construction.

PART 2 PRODUCTS

2.1 RADON MITIGATION SYSTEMS

2.1.1 System Performance

Radon mitigation systems must reduce and maintain radon concentration levels below 4.0 pCi/L after activation of the mitigation systems.

2.1.1.1 System Piping

Route radon mitigation systems piping so as not to interfere with the daily operations and functions of the building occupants. Keep visibility of the systems to a minimum. Enclose each radon mitigation system in occupied spaces, however, all operating components must be accessible for maintenance and repair. All spaces must be considered to be occupied spaces except for mechanical and electrical rooms, warehouses, storerooms, janitor closets, crawl spaces, and attic spaces. Enclosures are not required for portions of systems installed above suspended acoustical ceilings.

2.1.1.2 System Outlet Location

Mitigation system discharge points must be as specified in ANSI/AARST SGM-MFLB and EPA 402-R-93-078. Prevent foreign objects from

entering the outlet. Maintain water tight seal through all penetrations to the building exterior.

2.1.1.3 System Failure Warning Monitor

Provide a means to detect and announce each radon mitigation system failure. System failure is defined as:

a. System blockage: foreign debris.

b. Mechanical failure: fan or other mechanical failure.

c. System leakage: pipe breakage or crack.

Provide an audio or visual annunciator device to indicate system failure and locate the annunciator device in an occupied space. Conform to the requirements of ANSI/AARST SGM-MFLB and EPA 402-R-93-078.

2.1.1.4 Air Cleaners

Do not use air cleaners as a radon reduction method.

2.1.1.5 Ventilation Devices

Do not use devices that solely increase ventilation as a radon reduction method.

2.1.1.6 Back Drafting

Do not allow radon mitigation systems to cause back drafting of building chimneys.

2.1.2 Radon Mitigation Systems Components

Mechanical and electrical materials, fabrication, construction and installation must conform to the following industry standards:

a. Poly(vinyl chloride) (PVC) Piping: ASTM D2665, Schedule 40.

b. Sealants: ASTM C920, polyurethane, Type S, Grade P for horizontal application, Grade NS for vertical application, Class 25, Use T.

c. In-line Tubular Centrifugal Fans: AMCA 210 and UL listed.

d. Electrical Work: NFPA 70, NEMA MG 00001, ANSI/AARST SGM-MFLB and EPA 402-R-93-078, No. 12 AWG minimum wire size, solid copper installed in EMT or surface metal raceway.

e. Mechanical Work: ICC IMC, SMACNA 1378, ANSI/AARST SGM-MFLB and EPA 402-R-93-078.

f. Sealants: ASTM C920, polyurethane, Type S, Grade P for horizontal application, Grade NS for vertical application, Class 25, Use T.

g. Crawl space soil-gas retarder membrane must be minimum 40 mils thick.

2.2 RADON MITIGATION SYSTEMS ENCLOSURES

Radon mitigation systems enclosure components, materials, fabrication,

construction and installation for concrete, wood studs and furring, metal studs and furring, gypsum wallboard, sealants and painting must conform to the requirements specified in the respective specification sections addressing this work contained in the project specification.

PART 3 EXECUTION

3.1 RADON MITIGATION SYSTEMS INSTALLATION

3.1.1 Installation

a. Provide radon mitigation systems as indicated in the approved design drawings, as specified in ANSI/AARST SGM-MFLB, EPA 402-R-93-078 and as required by the specifications and standards referenced herein for the respective materials using workmen skilled in the trades involved. Install piping plumb and parallel to existing walls, partitions and ceilings as appropriate, slope horizontal runs to drain, and secure in place in a rigid and substantial manner.

b. Seal new and existing floor slab penetrations in accordance with EPA 402-R-93-078 and as specified herein. Prevent entry of soil gas into the building and exhausting of conditioned air via the radon mitigation system. Seal cracks and openings around floor slab penetrations with polyurethane sealant. Provide backer rod or comparable filler material as required. Insure that all penetrations to the building exterior are weathertight.

c. Lay work out in advance. Exercise care where cutting, channeling, chasing or drilling floors, walls, partitions, ceilings or other surfaces as necessary for proper installation, support or anchorage. Patch and repair damage to buildings, piping and equipment using workmen skilled in the trades involved.

d. Coordinate all work with the Contracting Officer.

3.1.2 Supervision

Installation of the radon mitigation systems must be supervised by a qualified mitigation professional.

3.1.3 Electrical Work

NFPA 70, ANSI/AARST SGM-MFLB and EPA 402-R-93-078, No. 12 AWG minimum wire size, solid copper installed in EMT or surface metal raceway. A source of electric power should be available within 50 feet of each fan installation. Base bids on providing 50 feet of wire and conduit or surface metal raceway for each fan.

3.1.4 Mechanical Work

ICC IMC, SMACNA 1378, ANSI/AARST SGM-MFLB, and EPA 402-R-93-078.

3.1.5 System Identification

Label all components of the radon mitigation systems including, but not limited to, piping (every 10 feet), enclosures, fans, electrical conduit (every 10 feet) and circuit breakers. Labels must read:

Radon Reduction System. Do Not Turn Off.

as specified by the Contracting Officer.

3.2 RADON MITIGATION SYSTEM ENCLOSURES INSTALLATION

Provide enclosures as indicated in the approved design drawings and as required by the specifications and standards referenced herein for the respective materials using workmen skilled in the trades involved. Install enclosures plumb, level and parallel to existing walls, partitions and ceilings as appropriate, and secure in place in a rigid and substantial manner.

3.3 POST MITIGATION FUNCTIONAL EVALUATION/INSPECTION

3.3.1 ASD Systems

In conjunction with activating an ASD system, the suction in system piping must be measured and recorded along with at least one PFE measurement that is conducted under closed-building or normal operating conditions. It is recommended that both measurements be made under conditions that reflect normal building operation when significantly occupied and include consideration for worst-case conditions.

3.3.1.1 PFE Measurement

Obtain PFE measurements at more than one point distant from each suction point(s) to verify intended design using a differential pressure gauge capable of reading to 1/1000 in water column. Record PFE test location and close in a nonpermanent fashion to facilitate any future needs (e.g. diagnosing a system when radon tests do not indicate success in achieving mitigation goals).

3.3.1.2 Non-ASD Systems

Measurements of airflow volume, pressure and other system parameters that are applicable to the method chosen must be recorded after installation.

3.4 FIELD QUALITY CONTROL

3.4.1 Radon Mitigation System Inspection

Inspect and approve in writing by a qualified mitigation professional each radon mitigation system. Verify compliance with the design, ANSI/AARST MA-MFLB, ANSI/AARST SGM-MFLB and the presence of fire stops. Provide the Radon Mitigation System inspection to the Contracting Officer. Deficiencies identified in the inspection report must be corrected by the Contractor at no additional cost to the Government.

3.4.2 Post Mitigation Testing and Monitoring

Perform post mitigation radon testing in the buildings as specified in ANSI/AARST SGM-MFLB, EPA 402-R-93-078 and herein.

3.4.2.1 Short Term

Test each radon mitigation system as described below.

a. Test each radon mitigation system for effectiveness no sooner than 24-hours nor later than 15 days after activation of the radon

mitigation system. Perform all testing in accordance with ANSI/AARST MA-MFLB, ANSI/AARST SGM-MFLB and all local, state and Federal requirements. Provide short term radon detectors (charcoal, electret ion chamber or approved equivalent) at the rate of one detector per 2,000 square feet but not less than one detector per enclosed space, except for closets. On copies of the building floor plans, locate and identify each short term detector and provide short term detector data on copies of the "Device Placement Log" contained in EPA 402-R-92-014.

b. At the end of the testing period, collect the detectors and send the detectors to the testing laboratory for analysis. Provide radon test results of the effectiveness of the mitigation systems not later than 30 days after collecting the detectors. Radon test results must be sent from the testing laboratory directly to the Contracting Officer with one copy to the Contractor. Complete the line item information on the "Device Placement Log."

c. Radon test results above 4.0 pCi/L require system redesign and installation modifications as necessary to achieve radon test results below 4.0 pCi/L. Submit design modifications to the Government for review and approval. After approval of the design modifications, provide installation modifications to the radon mitigation system and retest for effectiveness. Repeat this short term test procedure until test results below 4.0 pCi/L are achieved.

d. System modifications (as-built systems installations) must be reflected in the Contractor's design documents (drawings and design narrative).

3.4.2.2 Long Term

After acceptance of the radon mitigation systems, provide for long term testing (8 to 12 months), see below.

a. Perform all testing in accordance with ANSI/AARST MA-MFLB, ANSI/AARST SGM-MFLB and all local, state and Federal requirements. Provide long term radon detectors (alpha track, electret ion chamber or approved equivalent) at the rate of one detector per 2,000 square feet but not less than one detector per enclosed space, except for closets. Locate and identify each detector on copies of the building floor plans and in the Radon Detector Location Log. After installing the detectors, furnish the completed detector documentation and mailers to the Contracting Officer.

b. At the end of the testing period, collect the detectors, request return of the detector documentation and mailers from the Contracting Officer and send the detectors to the testing laboratory for analysis. Radon test results must be sent from the testing laboratory directly to the Contracting Officer with one copy to the Contractor. Complete the line item information in the Radon Detector Location Log.

c. At the end of the testing period, the Contracting Officer will collect and send the detectors to the testing laboratory for analysis. Radon test results must be sent from the testing laboratory directly to the Contracting Officer with one copy to the Contractor.

d. Radon test results above 4.0 pCi/L require system redesign and installation modifications as necessary to achieve radon test results

below 4.0 pCi/L. Submit design modifications to the Government for review and approval. After approval of the design modifications, provide installation modifications to the radon mitigation system and retest for effectiveness. Repeat the short term and long term test procedures specified herein until test results below 4.0 pCi/L are achieved.

e. Payment for work required because long term testing results in readings above 4.0 pCi/L will be made from the funds identified in the "Schedule of Prices" for the work required under this paragraph and defined under the paragraph POST MITIGATION TESTING - SCHEDULE OF PRICES DATA included herein. Payment of these funds will be made only after the Contracting Officer has received the radon testing results from the testing laboratory and the readings for the long term testing are below 4.0 pCi/L.

f. Final system modifications (as-built systems installations) must be reflected in the Contractor's design documents (drawings and design narrative).

-- End of Section --

SECTION 33 52 40

FUEL SYSTEMS PIPING (NON-HYDRANT)
05/25

PART 1 GENERAL

1.1 REFERENCES

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 PETROLEUM INSTITUTE (API)

API 570	(2016; Addendum 1 2017; Addendum 2 2018; ERTA 1 2018) Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API RP 621	(2022; 5th Ed) Reconditioning of Metallic Gate, Globe, and Check Valves
API RP 1110	(2013; R 2018) Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
API RP 1169	(2020; 2nd Ed) Pipeline Construction Inspection
API RP 1595	(2012; R 2019; 2nd Ed) Design, Construction, Operation, Maintenance, and Inspection of Aviation Pre-Airfield Storage Terminals
API RP 2003	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 2009	(2002; R 2007; 7th Ed) Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants
API STD 608	(2025) Metal Ball Valves - Flanged, Threaded, And Welding End
API Spec 5L	(2018; 46th Ed; ERTA 2018) Line Pipe
API Spec 6D	(2021; Addendum 1 2025) Specification for Pipeline and Piping Valves
API Spec 17J	(2016; Errata 2 2017; ADD 1 2017)

	Specification for Unbonded Flexible Pipe
API Std 594	(2017) Check Valves: Flanged, Lug, Wafer and Butt-Welding
API Std 598	(2009) Valve Inspecting and Testing
API Std 607	(2016) Fire Test for Quarter-turn Valves and Valves Equipped with Non-metallic Seats
API Std 609	(2016; ERTA 2017) Butterfly Valves: Double Flanged, Lug-and-Wafer Type
API Std 1163	(2021; 3rd Ed) In-line Inspection Systems Qualification

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(2024) Unified Inch Screw Threads (UN, UNR, and UNJ Thread Form)
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2024) Factory-Made Wrought Buttwelding Fittings
ASME B16.11	(2021) Forged Fittings, Socket-Welding and Threaded
ASME B16.20	(2023) Metallic Gaskets for Pipe Flanges
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B16.48	(2015) Line Blanks
ASME B18.2.1	(2012; R 2021) Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.3	(2024) Process Piping
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC V	(2017) BPVC Section V-Nondestructive

Examination

ASME BPVC SEC VIII D1 (2023) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (2021) Safety in Welding, Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A53/A53M (2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A105/A105M (2023) Standard Specification for Carbon Steel Forgings for Piping Applications

ASTM A123/A123M (2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A182/A182M (2024) Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

ASTM A193/A193M (2025) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications

ASTM A194/A194M (2024) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

ASTM A234/A234M (2024) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A269/A269M (2024) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A276/A276M (2025) Standard Specification for Stainless Steel Bars and Shapes

ASTM A307 (2023) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60

	000 PSI Tensile Strength
ASTM A312/A312M	(2022a) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A358/A358M	(2024a) Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications
ASTM A403/A403M	(2025) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A564/A564M	(2019) Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A653/A653M	(2025) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2022a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B696	(2000; R 2023) Standard Specification for Coatings of Cadmium Mechanically Deposited
ASTM B766	(2023) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM D1418	(2010; R 2016) Standard Practice for Rubber and Rubber Lattices - Nomenclature
ASTM D2487	(2017; R 2025) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3308	(2012; R 2022) Standard Specification for PTFE Resin Skived Tape
ASTM F336	(2002; R 2023) Standard Practice for Design and Construction of Nonmetallic Enveloped Gaskets for Corrosive Service
ASTM F436	(2011) Hardened Steel Washers
ASTM F2329/F2329M	(2015; R 2023) Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book
IEEE 1100	(2005) Emerald Book IEEE Recommended Practice for Powering and Grounding Electronic Equipment
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 1629	(2013) Rubber and Latices - Nomenclature
ISO 9001	(2015) Quality Management Systems-Requirements
ISO ISO/IEC 17025	(2017) General Requirements for the Competence of Testing and Calibration Laboratories

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2025) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

NACE INTERNATIONAL (NACE)

NACE SP0188	(2024) Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA IM 60000	(2021) Industrial Laminating Thermosetting Products
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2024; ERTA 1 2025) Flammable and Combustible Liquids Code
NFPA 30A	(2024; ERTA 1 2023) Code for Motor Fuel Dispensing Facilities and Repair Garages

NFPA 70	(2026) National Electrical Code
NFPA 77	(2024; ERTA 1 2023) Recommended Practice on Static Electricity
NFPA 407	(2022; TIA 24-2) Standard for Aircraft Fuel Servicing
NFPA 780	(2026) Standard for the Installation of Lightning Protection Systems

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 5/NACE No. 1	(2007) White Metal Blast Cleaning
SSPC SP 16	(2010) Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant
SAE J514	(2012) Hydraulic Tube Fittings

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-4556	(1998; Rev F; Am 1 1999; CANC Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-PRF-13789	(1999; Rev E; Notice 1 2008; Notice 2 1016; Notice 3 2021) Strainers, Sediment: Pipeline, Basket Type
MIL-STD-161	(2025; Rev J) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels
UFC 3-460-01	(2019; with Change 3, 2023) Design: Petroleum Fuel Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-59326	(Rev D) General Specification For Coupling Halves, Quick-Disconnect, Cam-Locking Type

1.2 DEFINITIONS

1.2.1 Anomaly

Unexamined deviation from the norm in pipe material, coatings, or welds, which may or may not be a defect.

1.2.2 Defect

A physically examined anomaly with dimensions or characteristics that exceed acceptable limits.

1.2.3 Designer of Record

The professional engineer designated by the prime contractor to be in multidisciplinary responsible charge of all POL service piping design and repair.

1.2.4 Hot Work

For work covered by this Section, drilling, boring, flame heating, welding, torch cutting, brazing, carbon arc gouging, grinding, abrasive blasting, or any work which produces heat, by any means, of 400 degrees F or more; or in the presence of flammable material or flammable atmosphere, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, nonexplosion-proof lights, fixtures, motors or equipment.

1.2.5 Piping Engineer

One or more licensed professional engineers, or an engineering firm, acceptable to the Contracting Officer who are knowledgeable and experienced in the engineering disciplines associated with evaluating hydraulic, mechanical, and material characteristics which affect integrity and reliability of POL service piping systems. The piping engineer is the piping or pipeline subject matter expert. More than one individual can serve in the role as long as one is designated to be in responsible charge.

1.2.6 POL Service Piping

Pipe, piping, pipeline, fittings, components, assemblies, and appurtenances used for petroleum, oil, or lubricant (POL) conveyance service under pressure or force of gravity, including modifications to existing systems.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Hydrostatic Pressure Test Plan; G

Pneumatic Pressure Test Plan; G

Work Plan; G

SD-02 Shop Drawings

Pipe Support; G

SD-03 Product Data

Carbon Steel Piping; G

Steel Reinforced Flexible Pipe; G

Carbon Steel Fitting; G

Ball Valve; G

Swing Check Valve

Thermal Relief Valve; G

Flexible Ball Joint; G

Strainer; G

Thermometer; G

Sample Connection; G

Flexible Hose Connector; G

Automatic Air Vent; G

Surge Suppressor Tank and Valve; G

Buried Utility Warning Tape; G

Pipeline Marker; G

Flange Gasket, Non-Metallic, Non-Electrically Isolating; G

Flange Gasket, Metallic; G

SD-06 Test Reports

Coating Holiday Test Results

Pneumatic Test Results

Piping Dehydration Results

DBB Valve Hydrotest

Hydrostatic Test Report; G

SD-07 Certificates

Water for Hydrotesting; G

Contractor Qualification; G

SD-08 Manufacturer's Instructions

Flexible Ball Joint; G

SD-09 Manufacturer's Field Reports

Valve Reconditioning Report; G

SD-10 Operation and Maintenance Data

Ball Valve; G

Swing Check Valve; G

Thermal Relief Valve; G

Flexible Ball Joint; G

Strainer; G

Thermometer; G

Sample Connection; G

Automatic Air Vent; G

Surge Suppressor Tank and Valve; G

1.4 SAFETY

Adhere to safety precautions in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, EM 385-1-1, API 570, API RP 2009, NFPA 30, NFPA 30A, and NFPA 407. If a pneumatic test is approved to be performed, ensure the test is incorporated into safety plans and activity hazard analysis fully recognizing the hazard of energy stored in compressed gas.

1.4.1 Control of Hazardous Energy

Provide proper lockout and tagout (LOTO) of piping or pipeline and appurtenances to completely isolate work from fuel, vapors, and sources of energy. Isolate using physical means such as blind flange compliant with ASME B16.5 or solid-plate line blank compliant with ASME B16.48 to prevent fuel or vapor transfer into the workspace. Use isolation means of sufficient strength to withstand pressure which might be exerted by liquid, gas, or vapor in an active pipeline, piping, or tank. Use gaskets on both sides if a line blank is inserted between two flanges. Do not use a valve as sole means of isolation. If LOTO isolates a segment of active fuel piping from thermal relief, install temporary relief capability.

Execute in accordance with accepted Accident Prevention Plan, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and EM 385-1-1. Coordinate LOTO installation, maintenance, inspection, and removal with facility fuel system operator.

1.4.2 Hazard of Released Energy

Pneumatic testing involves the hazard of released energy stored in compressed gas. Particular care must be taken to mitigate the hazard. Establish a boundary around the test segment. Restrict access into the

boundary to authorized personnel during pneumatic test. Provide pressure control to prevent test pressure in excess of 25 psig.

1.4.3 Preparation for Hot Work

Develop written procedures in accordance with EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and AWS Z49.1. Test piping for hydrocarbons and purge as necessary. Do not start grinding or welding until vapor-free certification is received from the Marine Chemist and requirements of EM 385-1-1 have been met.

1.4.4 Gas-Free Condition

Degass piping until requirements of Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, the accepted Accident Prevention Plan, and the certified Marine Chemist are met and a gas-free condition is achieved. Obtain gas-free certification from the Marine Chemist. Maintain the gas-free environment. Display the Marine Chemist certificate on-site and available for review at all times during hot work.

1.5 GENERAL REQUIREMENTS

This section defines requirements for pipe, fittings, piping components, and valves related to non-hydrant, non-service station fuel distribution systems. Such systems include, but are not limited to: marine receipt, pipeline receipt, truck off-loading receipt, pump house, pump pad, truck loading, marine loading, transfer pipeline, product recovery, and other miscellaneous piping systems.

Provide fuel distribution as a complete and fully operational system. Size, select, construct, and install components and equipment to operate together as a complete system. Substitution of functions specified herein will not be acceptable. Coordinate the work of the system manufacturer service personnel during construction, testing, calibration, and acceptance.

1.5.1 Contractor Qualification and Experience

Contractors performing fabrication and installation work must be experienced and qualified in performance of POL system piping. Experience must include erection of piping, systems, or components in compliance with requirements of ASME B31.3 and NFPA 30.

Submit a letter listing prior projects, dates of construction, a point of contact for each prior project, brief scope of work for each prior project, and a detailed list of work performed. Provide in the letter evidence of manufacturer training and state licensing. Each contractor providing installation work must have the following minimum level of experience and qualification.

a. Successful completion of at least three projects of similar scope and size (or larger) within the last 6 years

b. Specific installation experience with regard to the piping, system, or component installation work to be performed

c. Successful completion of, if applicable, manufacturer training courses on installation of piping, system, or component work to be performed

d. Meet State licensing requirement, if applicable, for piping, system, or component work to be performed

1.5.2 Protect in Place

Physically verify the location and elevation of existing facilities and utilities prior to starting construction. Protect in place tanks, piping, components, equipment, flanges, gaskets, motors, valves, pumps, impellers, risers, coating, finishes, gauges, alarms, conduit, and conductors. Employ measures to protect people, equipment, and surfaces from damage. Support uncovered pipelines or existing utilities affected by excavation until backfilled.

1.6 DESIGN REQUIREMENTS **- GENERATOR FUEL OIL SYSTEM**

In this Section, the term "as-indicated" is defined as referring to the design or drawings.

Provide complete diesel fuel oil piping system serving a emergency generator.

System includes:

a. **4,000-gallon aboveground diesel storage tank (AST).**

b. **Fuel transfer pump system.**

c. **Generator day tank.**

d. **Supply and return piping between AST, day tank, and generator.**

Fuel Type:

Diesel Fuel

Design Pressure:

Aboveground piping system shall be designed for a minimum working pressure of 150 psig at 100°F.

Design Temperature:

40°F to 120°F ambient.

Piping system shall comply with UFC 3-460-01, ASME B31.3, and NFPA 30.

1.6.1 Code and Criteria Basis

UFC 3-460-01, API 570, and ASME B31.3 are relevant design codes and criteria. ASME B31.3 incorporates by reference other requirements of ASME BPVC SEC V and ASME BPVC SEC IX. API Std 1163 is the basis for ILI work.

1.6.2 Generator Fuel Oil System Requirements

Provide complete operational system including:

a. Supply piping from AST to day tank.

b. Return piping from generator/day tank to AST.

c. Duplex fuel transfer pump system (duty/standby).

d. Duplex fuel oil filters upstream of generator.

e. Thermal relief valves on all trapped liquid sections.

f. Flexible connectors at generator and pump connections.

g. Isolation valves at all major equipment connections.

h. Emergency shutoff valve (ESV) at AST outlet.

i. Leak detection system for piping and tank.

System shall be designed for automatic operation and emergency conditions.

1.6.3 Flexibility

Make provisions for absorbing expansion and contraction without excess stress in any part of the system. Do not use flexible connectors in permanently mounted pump suction and discharge lines as means of compensating for piping misalignment. Provide appropriate means of flexibility to eliminate vibration.

1.6.4 Support for Piping

Support piping at no more than the maximum spacing in Table 1. Provide additional pipe supports at locations of concentrated loads (valves). Provide anchors where required to resist or transmit loads.

Table 1. Maximum Support Spacing

Nominal Pipe Size (Inches)	one-inch and under	1.5-in	2-in	3-in	4-in	6-in	8-in	10-in	12-in
Maximum Support Spacing (ft)	7-ft	9-ft	10-ft	12-ft	14-ft	17-ft	19-ft	22-ft	23-ft

Provide supports near each change of direction. Select support components which do not restrict movement of pipe due to thermal expansion. Space supports uniformly, and arrange symmetrically.

1.6.5 Space and Access

Incorporate efficient operations and maintenance access in design. Design piping, valves, control tubing, and components to be close to structures and columns as an efficient use of space. Ensure adequate maintenance access is provided for system components, valves, and gauges. For heavy components such as isolation valves, ensure there is adequate access for lifting equipment and rigging.

1.6.6 Structural Support

Design supplementary or intermediate members as required to transmit loads to the support structure and foundation. Do not support piping from other piping.

1.6.7 Structural Connections

Design connections to concrete and masonry by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Ensure inserts and anchors have a safety factor not less than 5. Do not connect pipe supports to metal decking. For overhead applications, only use masonry anchors of ferrous material. Do not weld attachment studs to any pressure-containing boundary surface.

1.6.8 Seismic Requirements

Support and brace piping, and attach valves to resist seismic loads as specified under Sections 13 48 73 SEISMIC CONTROL FOR NONSTRUCTURAL COMPONENTS, 23 05 48.19 SEISMIC BRACING FOR MECHANICAL SYSTEMS, and as shown on the drawings. Structural steel required for reinforcement to properly support piping, headers, and system components but not shown must be provided under this section.

1.6.9 Size Change

Make changes in pipe size with reducing fittings. Do not use bushings. Make branch connections with butt-welded tees except where the branch is at least two pipe sizes smaller than the run, in which case the branch connection can be made with a forged or seamless branch outlet fitting. Use insert type branch connection fittings designed to be radiographed.

Branch connection fittings may be non-radiographicable type if the following conditions are met.

a. Branch connection is made to aboveground piping

b. Branch outlet size is 2.5 inches or less in diameter, and

c. Branch outlet is located in a contained pumphouse, a contained truck fill stand, or other area with spill containment

1.6.10 Direction Change

Make changes in direction of pipes with 1.5 D fittings. Where piping is to be piggable, make changes in direction with 1.5 D fittings and or 3 D sweeps as indicated. For piggable pipelines, do not place 1.5 D fittings back to back. Provide special fittings when required. Make odd-angle offsets with pipe bends or elbows cut to the proper angle. Make changes in direction with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees will not be permitted. The centerline radius of bends must not be less than 6 diameters of the pipe if a pipe bender is used.

1.6.11 Pneumatic Pressure Test

A preliminary pneumatic test using air at pressure no greater than 25 psig

may be used, if approved by the Contracting Officer, prior to hydrostatic testing and before underground pipe is buried. The intent of the test is to identify and locate a gross leak. If piping pneumatic test is anticipated, request approval from the Contracting Officer in advance. Incorporate hazard mitigation into the Accident Prevention Plan and Activity Hazard Analysis in accordance with paragraph SAFETY. Prepare a test plan which implements requirements of paragraphs PNEUMATIC TEST and PNEUMATIC TEST PROCEDURE.

Request a pneumatic test and provide a Pneumatic Pressure Test Plan to the Contracting Officer no less than 4 weeks prior to the test date.

1.6.12 Hydrostatic Pressure Test Plan

Submit a detailed site-specific plan covering all aspects of pipeline hydrostatic testing operations, including procedures and sequencing of testing, segments of piping to be tested, fluid to be used during testing, equipment removal and isolation, hydrostatic testing pressures, disposal of test fluid, and safety protocols.

Provide a Hydrostatic Pressure Test Plan which will establish tightness and strength of piping. Testing must be compliant with ASME B31.3, API 570, and consistent with API RP 1110. Plan must include site specific procedure, sequence, segment identification, fill points and volume, air bleed, closure means and material specification, valves, flanges, fittings, and instruments in each segment. Provide pre-test review by the Piping Engineer to ensure pipe support and foundation structures are suitable for hydrostatic load. Use fresh water with less than 50 ppm chloride content as the test medium. Designate a test operator in responsible charge of executing the plan, examining for leaks, and certifying results. Acceptance criteria are the no leak condition and unaccountable error less than one degree of temperature change. Dispose of test water in accordance with paragraph HYDROSTATIC TEST WATER DISPOSAL.

1.6.13 Piping Identification

Provide piping identification in accordance with MIL-STD-161 unless specified otherwise.

1.7 QUALITY ASSURANCE

1.7.1 Construction Inspection

Establish and maintain a program of inspection and testing to control the quality of design and construction. Ensure program and personnel are experienced and qualified to perform inspection and test activities safely and effectively during construction. Perform inspection and examination to ensure contract work conforms to requirements, consistent with principles of API RP 1169, and in accordance with Section 01 45 00 QUALITY CONTROL. Maintain complete records and make them available to the Government.

Contractor is responsible for the quality of all design, layout, fabrication, inspection, examination, testing, records maintenance, and reporting. All materials used in the piping system must be clearly identified and recorded. Inspection, examination, and testing defined in this Section are minimum requirements. Provide additional inspection, examination, and testing when necessary to achieve the required quality of work.

1.7.2 Data Management

Organize underground piping locational data in a non-proprietary management system such as a database or spreadsheet. Establish a piping location identification scheme which uniquely identifies system features, dimensions, location, aboveground markers, and relative position to other facilities. Provide secure, auditable, and organized data. Cloud-based systems are not acceptable. See paragraph PIPE PIGGING VERIFICATION for pig tool data requirements.

1.7.3 Work Plan

Submit a comprehensive Work Plan that provides sufficient detail to demonstrate a thorough understanding of the project. Document that all piping, systems, or components to be provided will function together and produce the result expected by the Government. Include proposed dates for piping system outages. Plan must demonstrate contractor ability to complete the work within the allotted outage period. For work that requires support of Government system operations, provide proposed dates and the nature of support that is required. Include a list of personnel, spare materials and system components that will be on hand for each phase of work. Describe in detail the means to accomplish the following.

a. Coordinating work with Government and third parties.

b. Preparing for safe piping repair work.

c. Pneumatic pressure testing new piping sections.

d. Hydrostatic pressure testing new piping sections.

e. Purging piping.

f. Vapor monitoring.

g. Preparations for containing and disposing of residual fuel.

h. Cutting, sealing, and welding into existing piping systems.

i. Welding tie-ins in place.

j. Examining repair section tie-in welds.

k. Collecting, storing and disposing of waste fuel generated during work.

l. Dehydrating lines after water was introduced for hydrotesting

1.7.4 Water for Hydrotesting

Submit results of water testing and amount of water required.

1.8 DELIVERY, STORAGE, AND HANDLING

1.8.1 Material Control

Protect system components and materials to prevent damage before, during, and after installation in accordance with this Section and manufacturer instructions.

a. Inspect material and components for damage upon arrival. Reject materials which are mechanically damaged.

b. Inspect the condition of shop-applied coating upon arrival. Identify damage to the protective costing system. Notify the Contracting Officer of material with damaged shop-applied coating. Provide corrective action plan by which the damage will be repaired.

c. Store and handle material in method and environment compliant with manufacturer instructions.

d. Replace damaged or defective components and material.

e. Clean surfaces of all dirt, debris, or foreign substances. Verify condition and cleanliness of material prior to handling for installation.

1.8.2 Proper Storage

a. Store all valves, tubing, accessories, and components with protective covering to prevent internal contamination by any substance or liquid. Protect from damage by plant or animal. Store elevated from the ground surface and covered with secured tarps. Store in a manner and location which protects material from damage.

b. Store pipe or piping on blocks or dunnage racks at least 18 inches above the ground and adequately supported to prevent sagging. Use padded blocks or dunnage racks for coated pipe. The method, environment, and height of storing coated pipe must be in accordance with the coating manufacturer's instructions. Pipe ends must be protected and capped at all times, except to accommodate immediate installation.

c. Use plugs, covers or other methods to secure the cleanliness of piping materials during storage. Maintain secure covers at all times during storage and prior to installation.

d. For material, components, or equipment which are received with factory-applied shrink preservation wrap, maintain the covering intact during storage to prevent ingress. Repair minor damage to shrink wrap with manufacturer-supplied preservation tape.

e. For piping and materials which are stored without protective coating, provide means to ensure external surfaces are protected from precipitation and rust.

f. When work is not in progress, close and secure coverings on stored materials so that water, contamination, or other foreign substances can not enter.

g. See paragraph CLEANING OF PIPING for storage and cleanliness requirements during and after installation.

PART 2 PRODUCTS

2.1 MATERIALS

All piping shall be carbon steel, Schedule 40 minimum, ASTM A53/A53M Grade

B or API 5L Grade B.

All aboveground piping shall be externally coated with high-performance coating system suitable for marine/coastal environment.

Uncoated carbon steel is not permitted.

Stainless steel piping may be used at connections, flexible sections, or where enhanced corrosion resistance is required.

Copper, brass, bronze, and galvanized materials are prohibited for fuel service.

2.1.1 Carbon Steel Piping

Subject each length of pipe to factory hydrostatic testing and ultrasonic testing in accordance with the respective pipe specification.

a. Piping 2-inches and Smaller: Schedule 80, API Spec 5L Product Specification Level (PSL) 1, Grade B, seamless seamless or electric welded submerged-arc welded or gas metal-arc welded Grade B; or Seamless, Schedule 80 ASTM A53/A53M Grade B.

2.1.2 Stainless Steel Piping

a. Piping:

(1) ASTM A358/A358M, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A312/A312M Type 304L, seamless (only). Any agreements between the purchaser and the manufacturer or supplier as referenced in the applicable ASTM standard must include the Contracting Officer as a party to the agreement. All longitudinal piping welds must receive 100 percent radiographic examination, 100 percent liquid penetrant examination, 100 percent visual inspection and all tests as required by the applicable ASTM standard. ASTM A312/A312M seamless piping must be provided with minimum schedule 40S for pipe smaller than 8 inches (except for threaded pipe which must be minimum Schedule 80S).

(2) Pipe Ends: All piping must be provided with beveled ends per Chapter V, ASME B31.3, and must be shipped with the ends capped.

(3) Factory Testing and Inspection Records: Per Table K341.3.2 of Chapter IX of ASME B31.3, visual, radiographic and liquid penetrant tests must be performed for each section of piping provided as all sections are subjected to cyclic conditions. All testing and inspections records must be submitted to the Contracting Officer and must indicate the pipe mark and installed location of each piping section on the project site. Observation by the Contracting Officer of the manufacturers and the fields testing and inspection procedures must be allowed under this contract. Pipe certification along with pipe markings must be submitted before the pipe arrives on the job site.

(4) Quality Assurance Plan: Submit Quality Assurance Plan for the welding, inspecting and testing of the welded seam pipe.

b. Stainless Steel Control Tubing: Seamless, fully annealed tubing conforming to ASTM A269/A269M, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be a minimum of 0.049-inch.

2.1.3 Steel Reinforced Flexible Pipe

Steel Reinforced High Density Polyethylene (HDPE) flexible piping must be manufactured in accordance with API Spec 17J and consist of an inner layer of HDPE material, a steel reinforcing layer and an outer HDPE protective layer. Provide hydrostatic test plan.

2.1.4 External Protective Coating for Aboveground Piping

Provide exterior coating of aboveground piping and fittings, piping in pits, pipe supports, filter separators, and miscellaneous metal and system components. Color of finish coat must be white. Do not coat aboveground stainless steel or aluminum surfaces.

2.1.5 Fittings

2.1.5.1 General

Welding elbows, caps, tees, reducers, must be of materials compatible for welding to the pipeline in which they are installed, and wall thickness, pressure and temperature ratings of the fittings must be not less than the adjoining pipeline. Unless otherwise specified herein or required by the conditions of installation, all elbows must be the 1.5 diameter (D) type. Miter joints are not acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Butt weld fittings must be factory-made wrought fittings manufactured by forging or shaping. Fabricated fittings will not be permitted. Welded branch fittings must be insert type suitable for radiographic inspections specified herein.

See paragraph SIZE CHANGE for conditions under which a non-radiographicable fitting can be used.

2.1.5.2 Carbon Steel Fitting

a. Fittings 2.5 inches and Larger: Butt weld, conforming to ASTM A234/A234M, grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe.

b. Fittings 2 inches and Smaller: Forged, butt weld or socket welded (except flanges, see below). If specifically indicated on drawings, non-flange fittings may be threaded. Socket welded or threaded fittings must be Class 3000, conforming to ASTM A105/A105M, Grade 2 and ASME B16.11. Threaded fittings must only be used for above grade applications. Pipe and fittings of all sizes used underground, in pits, in low point drains, or on waterfront facilities must be butt welded.

c. Flanges: Class 150 weld neck, butt weld, forged flanges conforming to ASTM A105/A105M, and ASME B16.5 except flanges that are to be connected to pumps must match the pump flanges rating. Threaded and slip-on flanges are not allowed. Flanges to be 1/16-inch raised face with modified spiral serrated gasket surface finish, except where required otherwise to match system components furnished. Match flange face to valves or system components furnished. Flange face must be machined to match valves or system components furnished. Use of

spacing rings or gaskets discs are not allowed. Detectable flaws will not be accepted. For flanges 2 inches and smaller located in contained pumphouses, contained truck offloads, contained truck fill stands, and other visibly contained areas the fitting may be forged (socket welded), Class 150, conforming to ASTM A105/A105M, and ASME B16.5. In pits, vaults, on thermal relief valve piping for pipeline routes, and other uncontained locations the flanges must be radiographicable, butt welded, weld neck type.

d. Interior Epoxy Coating System must be applied to the fittings as specified in paragraph CARBON STEEL PIPING.

2.1.5.3 Stainless Steel Fitting

a. Fittings 2.5 inches and Larger: Butt weld stainless steel conforming to ASTM A403/A403M, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same minimum wall thickness as the adjoining pipe. Welded fittings must be tested and inspected the same as the welded seam pipe and meet the same requirements as for the pipe.

b. Fittings 2 inches and Smaller: Forged Type 304 or 304L , butt weld, or socket welded (except flanges, see below). If specifically indicated on drawings, non-flange fittings may be threaded. Socket welded or threaded fittings must be Class 3000 conforming to ASTM A182/A182M and ASME B16.11. Threaded fittings must only be used for above grade applications. Underground and in pits, low point drain pipe, and high point vent pipe must be butt welded.

c. Unions: Conforming to ASTM A182/A182M, Grade 304 or 316.

d. Flanges. Class 150 weld neck, butt weld, forged Type 304 stainless steel flanges conforming to ASTM A182/A182M and ASME B16.5, except flange that are to be connected to pumps must match the pump flanges rating. Threaded and slip-on flanges are not allowed. Flanges to be 1/16-inch raised-face with modified spiral serrated gasket surface finish, except where required otherwise to match system components furnished. Flange face must be machined to match valves or system components furnished. Match flange face to valves or system components furnished. For flanges 2 inches and smaller located in contained pumphouses, contained truck offloads, contained truck fill stands, and other visibly contained areas the fitting may be forged (socket welded), Class 150, conforming to ASTM A182/A182M and ASME B16.5. In pits, vaults, on thermal relief valve piping for pipeline routes, and other uncontained locations the flanges must be radiographicable, butt welded, weld neck type.

e. Stainless Steel Tube Fittings. Flareless, 316 stainless steel fittings conforming to SAE J514.

2.1.5.4 Steel Reinforced Flexible Pipe Fitting

End connections and mid-line connections for steel reinforced high density polyethylene (HDPE) flexible pipe must be of stainless steel swaged onto the pipe ends.

End connections must terminate in either flanged or weld ends as indicated. Mid-line connections must terminate in flanged fittings if they are in a pit or double swage type if they are not.

2.1.6 Insulating Flange Kit (Electrically Isolating)

Material must be resistant to the effects of aviation and non-aviation hydrocarbon fuels. Provide dielectric gaskets that are full face ANSI/NEMA IM 60000 Grade G-10 glass reinforced epoxy, to match pipe flange type and pressure rating, with a Viton seal. Do not use graphite seal elements in dielectric gaskets. Provide ANSI/NEMA IM 60000 Grade G-10 glass reinforced epoxy dielectric bolt sleeves. The dielectric bolt sleeves must be of sufficient length to pass through the flanges, over-voltage protector brackets, both dielectric washers, and both steel backer washers. Provide 0.125-inch thick high-strength ANSI/NEMA IM 60000 Grade G-10 reinforced epoxy insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5-inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Above grade flanges separated by electrically insulating flange kits must be provided with weatherproof lightning surge arrester devices. The surge arrester must bolt across flanges separated by insulating gasket kits per detail on contract drawings. Provide with flange protector as described in this Section. The arrestor must have the following features.

a. Weatherproof NEMA 250 Type 6P enclosure.

b. Bidirectional and bipolar protection.

c. Constructed of solid state components, no lights, fuses or relays and used without required maintenance or replacement.

d. Withstand unlimited number of surges at 50,000 Amperes.

e. Maximum clamping voltage of 700 Volts based on a IEEE C62.41.2 8x20 microsecond wave form at 50,000 Amperes peak measured at the device terminals (zero lead length).

f. A UL listed arrester for installation in Class 1, Division 1 and Division 2, Group D, hazardous areas.

Install the mounting bracket and leads on the flange side of the bolt insulating sleeve and washer, and size in accordance with this schedule:

Line Size	Bolt Size
2 inch	5/8 inch
2.5 inch	5/8 inch
3 inch	5/8 inch
4 inch	5/8 inch
6 inch	3/4 inch
8 inch	3/4 inch
10 inch	7/8 inch
12 inch	7/8 inch
14 inch	1 inch

Line Size	Bolt Size
16 inch	1 inch
Note: Make allowance for the 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.	

2.1.7 Bolts, Nuts and Washers

a. Bolts and nuts for pipe flanges, flanged fittings, valves and accessories must conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified.

b. Bolts must be of sufficient length to obtain full bearing on the nuts and must and must project no more than three full threads beyond the nuts with the bolts tightened to the required torque.

c. Bolts must be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A193/A193M, Class 2, Grade B8, stainless steel, when connections are made where a stainless steel flange is involved, and Grade B7, chromium molybdenum alloy, when only carbon steel flanges are involved. Bolts and nuts chosen must have sufficient strength to seat gasket types chosen. Bolts must be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one-inch and smaller and Eight-Pitch Thread Series for sizes larger than one-inch.

d. Nuts must conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7, chromium molybdenum allow for chromium molybdenum alloy bolts. Nuts must be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one-inch and smaller and Eight-Pitch Thread Series for sizes larger than one-inch.

e. Provide washers under bolt heads and nuts. Use chromium molybdenum alloy washers dimensioned to ASTM F436 flat circular for chromium molybdenum bolts. Stainless steel washer dimensioned similar to ASTM F436 flat circular, use material the same as the bolt.

f. Use torque wrenches to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tighten in the pattern recommended by the gasket manufacturer. Use anti-seize compound on stainless steel bolts.

2.1.8 Flange Gasket, Non-Metallic, Non-Electrically Isolating

ASME B16.21, composition ring, using a Nitrile Rubber such as Buna-N and NBR, polytetrafluoroethylene (PTFE), or a fluoro rubber such as FKM, FPM and Viton©. The gasket must be 0.1250-inch thick. Gaskets must be resistant to the effects of aviation and non-aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets must be used for flat-face flanged joints. Ring gaskets must be used for raised-face flanged joints. Gaskets must be of one piece factory cut. Select a gasket suitable for the working and test pressure of the fluid.

2.1.8.1 Nitrile Butadiene (Buna-N)

Provide Buna-N material that conforms to SAE AMS3275.

2.1.8.2 Acrylonitrile Butadiene Rubber (NBR)

Provide NBR material that conforms to SAE AMS3275.

2.1.8.3 Polytetrafluoroethylene (PTFE)

Provide PTFE material that conforms to ASTM F336.

2.1.8.4 Fluoro Rubber FKM

Provide FKM material that conforms to ASTM D1418.

2.1.8.5 Fluoroelastomer FPM

Provide FPM material that conforms to ISO 1629.

2.1.9 Flange Gasket, Metallic

ASME B16.20, spiral-wound metal gaskets with inner and outer rings. Gaskets must be suitable for use on flat-face and raised-face flanges. The winding material is stainless steel 304 or 316L. The filler material is graphite or PTFE. The gasket must be in accordance with Military Specification MIL-G-24716. Select a gasket suitable for the working and test pressure of the fluid.

2.1.10 Flange Protector

Protectors must protect the bolts, studs, nuts, and gaskets of a flanged end connection from corrosion or damage due to exposure to the environment. Protectors must be weather and ultraviolet (UV) resistant. Protectors must allow for quick and easy removal and re-installation by maintenance personnel. Corrosion inhibitor grease must be non-expansive and designed for the service and ambient temperatures.

2.1.11 Flexible Connectors

Provide stainless steel braided flexible hose connectors at:

a. Generator fuel supply and return connections.

b. Pump suction and discharge connections.

Flexible connectors shall be rated for diesel fuel service and minimum 150 psig working pressure.

2.1.12 Leak Detection System

Provide leak detection system for aboveground fuel oil piping system.

System shall include:

a. Leak detection sensors at AST, pump skid, and day tank.

b. Visual and audible alarm.

c. Interface with building monitoring system (if applicable).

Leak detection system shall be suitable for diesel fuel service.

2.1.13 Emergency Shutoff Valve

Provide emergency shutoff valve (ESV) at AST outlet.

Valve shall be:

a. Normally closed or fail-safe position as required.

b. Electrically or mechanically actuated.

c. Capable of remote shutoff.

Provide manual emergency shutoff station at accessible location near generator or building entrance.

2.2 MANUAL VALVES

All portions of a valve coming in contact with fuel in stainless steel pipelines or epoxy lined carbon steel pipelines must be of noncorrosive material. Valves in stainless steel pipelines or epoxy lined carbon steel pipelines must be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Valves in unlined carbon steel pipelines must have carbon steel body. Stem and trim must be stainless steel for all valves. Manually operated valves 6 inches and larger must be worm-gear operated and valves smaller than 6 inches must be lever operated or handwheel operated. Valves smaller than 2 inches must have lever-type handles. Valves installed more than 8 feet above finished floor standing platform must have chain operators and a position indicators visible from ground (standing) level. Sprocket wheel for chain operator must be aluminum.

2.2.1 Ball Valve

Ball valves must be fire tested and qualified in accordance with the requirements of API Std 607 and API STD 608. Seal material for the fire test must be graphite, seal material for the project must be as indicated below. Ball valves must be nonlubricated valves that operate from fully open to fully closed with 90-degree rotation of the ball. Valves 2 inches and larger must conform to applicable construction and dimension requirements of API Spec 6D, ANSI Class 150 and must have flanged ends. The balls in valves 10 inches and larger full port and 12 inches and larger regular port and larger must have trunnion type support bearings. Except as otherwise specified or indicated, reduced port or full port valves may be provided at the Contractor's option. Balls must be solid, not hollow cavity.

2.2.1.1 Materials

Ball must be stainless steel. Ball valve seats, body seals. and stem seals must be polytetrafluoroethylene (PTFE) or fluoroelastetomer (FKM), commonly referred to as Viton. Valves 4 inches and smaller must have a locking mechanism.

2.2.1.2 V-Port Ball Valve

Valve must conform to requirements as specified for BALL VALVES paragraph in this section. Valve must be provided with characterized linear v-port for flow rate control, and with infinite position lever bracket with locking bolt for set position.

2.2.1.3 Electric Valve Actuator

Electric valve actuator must be as indicated for Plug (Double Block and Bleed) Valves, electric valve actuator.

2.2.2 Swing Check Valve

Swing check valves must conform to ASME B16.34 and API Spec 6D, regular type, ANSI Class 150 with flanged end connections. Discs and seating rings for valve sizes NPS 2 or larger must be renewable without removing the valve from the line. The disc must be guided and controlled to contact the entire seating surface.

2.2.3 Silent Check Valve

Spring assisted, wafer/tapped lug pattern, butterfly check with or globe type FKM or PTFE seat ring, designed to prevent flow reversal slamming of valve, dual plate, and must conform to ASME B16.34, API Std 594, except face to face dimensions may deviate from standard. Valves must be suitable for installation in any orientation. Valve body and trim material must be as previously indicated herein.

2.2.4 Butterfly Valve with Fusible Link Operator

Valve must conform to API Std 609. Valve must meet the fire test requirements of API Std 607. Valve must be designed for bubble tight bidirectional shutoff service at operating conditions. Disc must be Type 304L or Type 316, stainless steel. Stem must be ASTM A276/A276M Type 416 or ASTM A564/A564M Type 630 stainless steel. Seal ring must be Teflon with metal backup. Stem seals must be capable of withstanding the rated pressure and temperature of the valve seat. Provide valves 6 inches and larger and valves at pump discharge with weatherproof gear operators with handwheel; other valves must have minimum 10 position throttling handles. Valve must have a fusible link type valve operator. The fusible link and spring assembly must close the valve automatically when the link material melts at 165 degrees F and lock the valve in the closed position. Spring assembly must be fully enclosed to ensure safety. Provide valve with flanged end connections independent of other flanged end connections provided on items such as system components, piping, piping components, or valves.

2.2.5 Globe Valve

Valve must conform to ASME B16.34, Class 150.

2.3 THERMAL RELIEF VALVE

2.3.1 Valve Material

Valves must have carbon steel bodies (stainless steel on stainless steel pipelines) and bonnets with stainless steel springs and trim. Valves must be Class 150 flanged end connections.

2.3.2 Thermal Relief Valve (ASME Type)

Thermal relief valves must be the fully enclosed, spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and must be labeled in accordance with ASME BPVC SEC VIII D1. Valve stems must be fully guided between the closed and fully opened positions. The valves must be factory-set to open at pressures indicated on the drawings. Operating pressure must be adjustable by means of an enclosed adjusting screw. The valves must have a minimum capacity of 20 GPM at 10 percent overpressure. Valves must have a replaceable seat. Relief valves that do not relieve to a zone of atmospheric pressure or tank must be a balanced type relief valve.

2.3.3 Thermal Relief Valve (Balanced Type)

Thermal relief valves that do not relieve to a zone of atmospheric pressure or atmospheric tank must be a balanced type relief or regulator valve.

Thermal relief valves must be the fully enclosed, spring loaded, angle pattern, single port, fully balanced type (back pressure must not affect relief pressure) back pressure regulator/relief valve. Set valve at pressure indicated on drawings. Valve body must have one-inch (minimum) raised face flange connections unless otherwise indicated. Orifice must have a minimum orifice size of 0.500-inch in diameter. Valve must have bubble-tight piston and seat design with stainless steel piston and Viton seat. Valve must be selected for the nominal flow condition of: pass a minimum of 5 gallons per minute, at a differential pressure of 55 psig, with a nominal set pressure of 50 psig. Valve must be factory configured to open at required set pressure but must be field adjustable by means of an enclosed adjusting screw.

2.4 PIPING ACCESSORIES

2.4.1 Flexible Ball Joint

Flexible ball joints must be stainless steel carbon steel with electroless nickel-plating to a minimum of 3 mils thickness, capable of 360-degree rotation plus 15-degree angular flex movement, ASME B16.5, Class 150 flanged end connections. Provide pressure molded composition gaskets designed for continuous operation temperature of 275 degrees F. Joints must be designed for minimum working pressure of ANSI Class 150. Injectable packing will not be allowed.

2.4.2 Mechanically Adjustable Segmented Elastomeric Seal

Mechanically adjustable segmented elastomeric seals must be constructed of fuel resistant Buna-N elastomers and Type 316 stainless steel fasteners and hardware.

2.4.3 Pipe Sleeve

Install pipe sleeves where indicated on design and at all points where piping passes through concrete construction. Sleeves must be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2-inch. Sleeves through concrete pits or slabs must be standard weight carbon steel pipe with a protective coating. Each sleeve must extend through the respective pit wall or slab and must be

provided with a wrap around Buna-N (Viton when exposed to sunlight) end seal (boot) and secured to the pipe sleeve and piping with adjustable stainless steel hose clamps. Sleeves where piping passes under roads or piping indicated to be double walled must be standard weight carbon steel pipe with a protective coating. Alignment of the sleeve and piping must be such that the pipe is accurately centered within the sleeve by a nonconductive positioning element. The sleeve must be securely anchored to prevent dislocation. Close the space between the pipe and sleeve with a mechanically adjustable segmented elastomeric seal. The seal must be installed so as to be flush.

2.4.4 Strainer

2.4.4.1 Basket Type

Strainer must be single basket type arranged in a simplex configuration in compliance with MIL-PRF-13789. Strainer end connections must be designed in accordance with ASME B16.5, Class 150. Strainer body material must be the same as the material specified for manual valves. Strainers must have removable baskets of 7 mesh wire screen with larger wire mesh reinforcement; wire must be stainless steel, Type 316. Pressure drop for clean strainer must not exceed 3 psig at maximum design flow rate. The ratio of net effective strainer area to the area of the connecting pipe must be not less than three to one. Each strainer must be provided with a suitable drain at the bottom, equipped with a ball valve. The strainer must be equipped with a direct-reading, piston type differential pressure gauge that measures the differential pressure across the basket.

2.4.4.2 Cone Type

Strainer must be stainless steel type 304 or 316, 7 100 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe must be not less than three to one at the pump suction. Pump suction strainer must have a 7 100 mesh screen with not less than 300 percent open area (ratio of the strainer open area to the cross section of pipe).

2.4.5 Thermometer

Analog, dial-type bimetallic actuated type that conforms to ASME B40.200. Thermometer must have a 5 inches diameter dial, a hermetically sealed stainless steel case, a stainless steel stem, a safety glass face, a fixed threaded connection, and a scale range as indicated. Thermometer accuracy must be within one percent of the scale range.

2.4.6 Pipe Support

2.4.6.1 General

Pipe supports must conform to MSS SP-58. Design pipe supports to meet the applicable requirements of ANSI/ASME B31.3 or ANSI/ASME B31.4. Provide hot-dip galvanized finish on rods, nuts, bolts, washers, and supports. Provide Type 316 stainless steel nuts, bolts, washers, and screws when located at a pier. Provide miscellaneous metal that conforms to ASTM A36/A36M, standard mill finished structural steel shapes, hot-dipped galvanized. Provide galvanizing in accordance with ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, Z275 G90.

2.4.6.2 Adjustable Type

Adjustable types consist of a bearing surface such as a saddle or low friction half-round and u-bolt supported by a threaded nipple connected to a carbon steel pipe by means of a special reducer conforming to MSS SP-58. The supports must be provided with PTFE insulation strips.

2.4.6.3 Low Friction Type

Supports must have self-lubricating anti-friction bearing elements composed of 100 percent virgin tetrafluoroethylene polymer and reinforcing aggregates, prebonded to appropriate backing steel members. The coefficient of static friction between bearing elements must be 0.06 from initial installation for both vertical and horizontal loads and deformation must not exceed 0.002-inch under allowable static loads. Bonds between material and steel must be heat cured, high temperature epoxy. Design pipe support elements for the loads applied. Provide anti-friction material with a minimum of 0.09-inch thick. Provide hot-dipped galvanized steel supports. Provide supports that are factory designed and manufactured.

2.4.6.4 U-bolt Half Round Type

Supports must have anti-friction bearing half-round in contact with the bottom of the pipe. Provide polytetrafluoroethylene or like hydrophobic, anti-corrosive material half-round with a minimum compressive strength of 10 ksi or greater as indicated. U-bolts must be installed in either a loose or limited guide configuration. Provide hot-dip galvanized u-bolts with seamless non-metallic low friction coating. U-bolt connection must be double nutted on the bottom and single bolted on top.

2.4.6.5 Concrete and Grout

Concrete and grout for anchors, baseplates, and supports must comply with Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.4.7 Sample Connection

a. Sample connections must be factory assembled units specifically designed for obtaining representative samples from fuel pipelines. Each connection must include a 1/4-inch sampling probe where the probe faces upstream, ball valve and 1/4-inch quick disconnect coupling with dust plug, all assembled into a unit that is suitable for installation in a pipe nipple. The sampling probe must extend not less than one-inch into the fuel pipe. All materials in the sample connections must be stainless steel or aluminum.

b. Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly must consist of a 6-foot length of 1/4-inch clear plastic tubing with internal bonding/grounding wire. One end of the tubing will contain a male connector that actuates flow when inserted into the quick disconnect coupler. Each end of the bonding/grounding wire must be equipped with clips for attaching to the pipe and metal sample container.

2.4.8 Sight Flow Indicators

Sight flow indicators must be ANSI Class 150 and must have flanged end connections. Sight flow indicators must consist of a housing containing a

rotating propeller that is visible through a glass observation port. The housing must be stainless steel when installed in stainless steel lines and carbon steel when installed in carbon steel lines. The glass in the indicator must also meet the Class 150 rating.

2.4.9 Quick Disconnect Coupler and Adapter

Couplers and adapters must be quick disconnect, cam type, that conforms to CID A-A-59326. Provide coupler with a stainless steel dust plug and a stainless steel hanging eye for truck offloading systems.

2.5 FLEXIBLE HOSE CONNECTOR

a. Flexible hoses connectors for fueling pumps must have ANSI Class 300 or 150 flanges to mate directly to the pump and Class 150 flanges to the system flanges. Flanges must be stainless steel and must conform to ASME B16.5. These units must have an inner stainless steel or Inconel, corrugated tube with external stainless steel braid, and all components must be rated for not less than 275 psig at 100 degrees F. Face to Face dimension must be as recommended by the manufacturer. Use Inconel 625 inner bellows in coastal environments or where chlorides are present in the atmosphere.

b. For sizes larger than 6 inches, connectors must incorporate the use of Lo-corr, multi-ply bellows, without external braid, with bellows rating of 300 psig and overall rating consistent with the flange ANSI class. Flanges must be plate type, Vanstone design, with axial movement control rods.

c. Fabricate piping to measurements established on the project site and position into place without springing or forcing. Make provisions for absorbing expansion and contraction without undue stress in any part of the system. The use of flexible connectors in permanently mounted pump suction and discharge lines as a method of compensating for piping misalignment is not acceptable.

2.6 AUTOMATIC AIR VENT

Unit must have one-inch connections and automatically vent air under pressure, and prevent a vacuum when pressure drops below positive. As fuel fills the vent, a float must rise and form a drip-tight closure. The unit pressure rating must be a minimum of 275 psi. The float must be stainless steel. Body and cover be carbon steel or ductile iron and be internally epoxy coated.

2.7 SURGE SUPPRESSOR TANK AND VALVE

The unit must be fabricated from carbon steel, internally coated pressure vessel with a rubber bladder or a stainless steel diaphragm separating the fuel from the gas charge. The epoxy coating must be in accordance with MIL-PRF-4556. The rubber bladder must be molded synthetic nitrile rubber (Buna-N). The unit must be constructed and labeled in accordance with ASME BPVC SEC VIII D1. The housing must be designed for a working pressure of 275 PSIG. The gas precharge must be dry nitrogen and must have a pressure gauge, gas valve, and an adapter for field charging. Bladder precharge pressure must be 80 PSIG. The connection to the piping system must be Class 150 ANSI flange, size as indicated on the drawings. The connection must have a check valve to provide unrestricted flow into the vessel and restricted flow from the vessel. The flange must have a

1/2-inch NPT connection with a valve and adapter to relieve fluid pressure during gas recharging and to drain the vessel during removal. A charging assembly must be provided. The surge suppressor supplier must furnish a service person trained to provide installation check-out assistance and to supervise operation and testing necessary to place the surge control system into service and to provide training on charging, recharging, and checking the surge suppressor.

2.8 MISCELLANEOUS ACCESSORIES

2.8.1 Concrete Anchor Bolt

Concrete anchors must conform to ASTM A307, Grade C, hot-dipped galvanized.

2.8.2 Coating for Bolts, Studs, Nuts, and Washers

Carbon steel bolts, studs, nuts, and washers must be provided with a factory applied cadmium coating that conforms to ASTM B696 or ASTM B766 hot-dipped zinc coating that conforms to ASTM F2329/F2329M.

2.8.3 Polytetrafluoroethylene (PTFE) Tape

Tape must conform to ASTM D3308.

2.8.4 Pipe Sleeve

Provided sleeves constructed of hot-dipped galvanized steel, ductile iron, or cast-iron pipe conforming to ASTM A53/A53M, Standard weight.

2.8.5 Escutcheon

Escutcheon must be the chrome plated, stamped steel, hinged, split ring type. Inside diameter must closely fit pipe outside diameter. Outside diameter must completely cover the corresponding floor, wall, or ceiling opening. Provided each escutcheon with necessary set screws.

2.8.6 Pipe Casing

Provide carbon steel casings in accordance with paragraph MATERIALS. Alignment of the casing and piping must be such that the pipe is accurately centered within the sleeve by a nonconductive centering device specifically manufactured for the purpose. Closure of space between the pipe and the casing must be by means of a mechanically adjustable segmented elastomeric seal. The casing must be provided with a wraparound Buna-N end seal (boot), (Viton when exposed to sunlight) and be secured to the piping with adjustable stainless steel hose clamps. Sleeves where piping passes under roads must be not less than standard weight carbon steel pipe with a protective coating. Provide cathodic test station, leads and bonding to the pipe and casing such that the isolation between the casing and piping CP system can be verified.

2.8.7 Buried Utility Warning Tape

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape, acid and alkali resistant, polyethylene plastic warning tape for warning and identification of buried piping. Tape must be detectable by an electronic detection instrument and manufactured for the purpose of early warning and identification of buried utilities.

Tape must be at least 3 inches in width with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with maximum 350 percent elongation. Provide printed warning and identification lettering at least one-inch in height, imprinted with bold black letters continuous over the entire length of tape. Warning and identification to read "CAUTION, BURIED (intended service) LINE BELOW" or similar. Provide permanent color and printing, unaffected by moisture or soil.

2.8.8 Sand Bedding

Clean, coarse-grained well-graded sand classified as SW in accordance with ASTM D2487 and suitable for for bedding.

2.8.9 Pipeline Marker

Provide pipeline aboveground markers constructed of 6 inches diameter, one-half inch thick bronze disk with a 3-inch long bronze headed bolt welded to the back of the disk. Engrave the front of the disk with the words "UNDERGROUND FUEL LINE" in the case of one line and "UNDERGROUND FUEL LINES" in the case of multiple fuel lines.

2.9 FINISHES

2.9.1 Factory Applied

2.9.1.1 Valves

Valve surfaces must be blasted clean according to SSPC SP 5/NACE No. 1. Valve surfaces must be primed and coated as required in the Statement of Work or Project Program.

2.9.1.2 Equipment and Components

Unless otherwise specified, provide equipment and components fabricated from ferrous metal with the manufacturer's standard factory finish. Each factory finish must withstand 125 hours exposure to the salt spray test specified in ASTM B117. For test acceptance, the test specimen must show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8-inch on either side of the scratch mark immediately after completion of the test. For equipment and component surfaces subject to temperatures above 120 degrees F, the factory coating must be appropriately designed for the temperature service.

PART 3 EXECUTION

3.1 GENERAL

Provide installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing in accordance with ASME B31.3 and NFPA 30 except as modified herein. Strictly observe safety rules as specified in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, EM 385-1-1, NFPA 30, and NFPA 407. Never direct bury threaded connections, socket welded connections, unions, flanges, valves, air vents, or drains. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible.

3.2 VERIFICATION OF DIMENSIONS

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.3 CLEANLINESS OF PIPING

Inspect the cleanliness of piping, fittings, and components before placing into position. Clean the interior of each length of pipe, fitting, and component before and after installation to ensure surfaces are free of water, slag, debris, particulates, or foreign material. See paragraph PROPER STORAGE OF MATERIAL for pre-installation storage requirements.

Keep the interior and ends of all piping, fittings, or components which are part of or affected by construction thoroughly cleaned of foreign material and water before and after installation. Use plugs, covers or other approved methods to keep piping systems clean. When work is not in progress, close and secure openings in pipe, piping systems, fittings, and components to prevent ingress of water, contamination, or foreign substances. See paragraph PIPE PIGGING - CLEANING for post-installation cleanliness requirements.

3.3.1 Dehydration of Piping

For piping containing water, remove all water and open all low point drains to confirm water removed. Provide mechanical dehydration with either dehumidification equipment, forced air, or vacuum extraction. Verify that dehydration is complete by measuring dew point of exhausted air. Dry and dehumidify piping using air with a dew point less than minus 20 degrees F, until no residual water accumulates in low points and the dew point of the air at the outlet is less than minus 10 degrees F. Do not allow water to remain in piping for more than 48 hours. Submit Piping Dehydration Results prior to filling pipelines with fuel.

3.4 ELECTRICAL

3.4.1 General

Provide wiring for motors, manual or automatic motor control system components (except where installed in a motor control center), and protective or signal devices required for operation specified in this Section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide wiring required for operation specified in this Section but not shown on electrical drawings in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.4.2 Grounding and Bonding

Ground and bond as indicated on the drawings and in accordance with NFPA 70, NFPA 77, NFPA 407, NFPA 780, API RP 540, API RP 2003, IEEE 142, and IEEE 1100. Provide jumpers to overcome the insulating effects of gaskets, paints, or nonmetallic components.

3.5 EXCAVATION, TRENCHING, AND BACKFILL

Overexcavate trench to ensure sufficient space for material required in paragraph INSTALLATION OF UNDERGROUND PIPE. Conform excavation, trenching, filling, compaction, and backfill to EM 385-1-1, Section

31 00 00 EARTHWORK, and the following requirements.

a. Excavate for the full length of each section of pipe which does not have protective coating in order to allow access to install protective coating.

b. Pipe that has the grade or joint disturbed after laying, must be taken up and relaid.

c. Dewater trench to remove standing or intruding liquid.

d. See paragraph PIPE BEDDING for haunching and bedding requirements. See paragraphs BURIED WARNING AND IDENTIFICATION TAPE for pipeline location warning tape requirements.

e. Place and compact backfill material in accordance with Section 31 00 00 EARTHWORK.

3.6 PIPING LAYOUT REQUIREMENTS

Determine and provide an efficient pipe routing. Use offsets, fittings, and accessories required to eliminate interference, efficiently match existing system configuration, optimize operability and maintenance access, and minimize alignment stress.

3.6.1 Service and Maintenance Access

Place unions on each side of equipment. Do not place unions in locations that will be inaccessible after the completion of the work.

3.6.2 Pipe Fabrication

a. Fabricate piping to measurements established on the project site and within design tolerances.

b. Position piping into place without cold spring, bending, or forcing. Do not use heat to obtain alignment.

c. Distortion of piping to correct misalignment for joint assembly is prohibited.

d. Prepare pipe or component ends to be smooth and true.

e. Remove slag from surfaces cut by oxygen or thermal arc means.

f. Inside surfaces of components at ends to be joined in girth or miter groove welds must be aligned within the dimensional tolerance in the WPS and the design.

g. Do not tack welded alignment lugs to pipe for fit-up or fabrication.

3.6.3 Interference and Measurement

Verify dimensions before commencing work. Submit discrepancies for clarification to the Contracting Officer before proceeding with installations.

3.6.4 Structural Attachment

Provide structural steel attachments and connections required to support piping system, headers, accessories, and components. This includes elements not shown on design drawings.

3.6.5 Grade Tolerance

Where profiles of piping lines are shown on the drawings, grade the line uniformly between changes in slope or direction. Maintain gradient to within 1/4-inch over the entire length of pipe.

3.6.6 Grade Survey

When backfilling has been completed to top of pipe, perform a relative positional survey of the horizontal and vertical alignment and elevation at each joint or change in direction. Record measurements with an associated odometer reading. See paragraph DATA MANAGEMENT for database requirements. Before backfilling can continue, submit Grade Survey to the Contracting Officer.

3.6.7 Threaded End Connections

Provide threaded end connections only on piping 2 inches in nominal size or smaller, and only where indicated on the drawings. Provide threaded connections with PTFE tape or equivalent thread-joint compound applied to the male threads only. Not more than three threads must show after the joint is tightened.

3.6.8 Bolted Connection

For each bolted connection of stainless steel components (pipes, piping components, valves, system components) use stainless steel bolts or studs, nuts, and washers. For each bolted connection of carbon steel components, use carbon steel bolts or studs, nuts, and washers. See paragraph BOLTS, NUTS AND WASHERS for fastener requirements. Prior to installing nuts, apply a compatible anti-seize compound to the male threads.

3.6.9 Flange and Union

Except where threaded end connections and or unions are indicated, provide flanged joints in each line immediately preceding the connection to system components or material requiring maintenance such as pumps, general valves, control valves, strainers, and other similar items and as indicated. Assemble flanged joints square and tight with matched flanges, gaskets, and bolts.

3.6.10 Flange Protection

Provide flange protectors on each electrically insulating flange connection on each flanged end connection, including valves and system components where indicated on the drawings. Provide protectors that allow visual inspection of flange gasket without removal. Fill flange cavity of electrically insulating flange connections with a corrosion inhibitor type grease. Provide grease filled bolt caps.

3.6.11 Manual Valve

Install isolation plug or ball valve on each side of system equipment, at

the midpoint of a looped main, and at other points indicated or required to be drained, isolated, or sectionalized. Install valve with stem in the vertical position unless otherwise indicated. Provide individual support and anchor for each valve.

3.6.12 Air Vent

Provide 1-1/2 inches air vent at all high points and where indicated to ensure adequate venting of the piping system.

3.6.13 Drain

Provide 2 inches drain at all low points and where indicated to ensure complete piping can completely drain.

3.6.14 Bellows Expansion Joint

Cold set joint to compensate for the temperature at the time of installation. Provide initial alignment guides on the connecting piping no more than four pipe diameters from the expansion joint. Provide additional alignment guides on the connecting piping no more than 14 pipe diameters from the first guide.

3.6.15 Thermometer

Provide thermometer with separable socket. Install separable socket in pipeline in a manner to sense the temperature of flowing fluid and minimize obstruction to flow.

3.6.16 Pipe Sleeve

Provide a pipe sleeve around any pipe that penetrates a wall, floor, or slab. Do not install sleeves in structural members except where indicated or approved. Install pipe sleeve in masonry structures at the time of the masonry construction. Sleeve must be of such size as to provide a minimum of 1/2-inch all-around clearance between bare pipe and the sleeve. Align sleeve and piping such that the pipe is accurately centered within the sleeve by a nonconductive centering element. Securely anchor the sleeve to prevent dislocation. Close the space between the pipe and the pipe sleeve with a mechanically adjustable segmented elastomeric seal. Install seal to be flush. For wall or floor penetration, extend each sleeve through the respective wall or floor and cut flush with each surface. Seal around sleeves that penetrate through valve or fuel related pits with a Buna-N casing seal. Seal around sleeves that penetrate through non-fire-rated walls and floors in accordance with Section 07 92 00 JOINT SEALANTS. Seal around sleeves that penetrate through fire-rated walls and floors as specified in Section 07 84 00 FIRESTOPPING.

3.6.17 Escutcheon

Except for utility or equipment rooms, provide finished surfaces where exposed piping pass through floors, walls, or ceilings with escutcheons. Secure escutcheon to pipe or pipe covering.

3.7 WELDING

3.7.1 General

All joints, unless indicated otherwise, in carbon steel and stainless

steel piping systems must be welded. Do not weld carbon steel to stainless steel. Ad-hoc or field-determined closure welds are not allowed.

3.8 VALVE REFURBISHMENT

a. Provide professional valve reconditioning services in accordance with API Std 598 and API RP 621. Provide services from an independent reconditioning facility with a documented and established quality assurance program which includes essential elements described in the ISO 9001 standard, and has written procedures compliant with API RP 621.

b. Disassemble, clean, and inspect all components for dimensional accuracy, surface condition, mating fit, and mechanical integrity. Use PT examination procedures in accordance with this Section and API RP 621. Provide supplementary PT examination of castings or forgings in accordance with Part 8 of ASME B16.34. Replace slips, soft seats, bonnet and cover fasteners, packing, gaskets, and grease fittings. Recondition valves to manufacturer standards and API RP 621. Pressure test each assembled valve compliant with API Std 598. Recoat exterior valve surfaces in accordance with Project Program.

c. Provide Valve Reconditioning Report and DBB Valve Hydrotest Report for each valve in accordance with paragraph SUBMITTALS. Reinstall valves with new fasteners and gaskets. Commission valves back into service. Verify proper operation through the entire range. Ensure plug rotation towards open lifts the plug without wiping the seals and retracts the sealing slips so clearance is maintained between the slips and valve body. Verify full range of operation.

3.8.1 Valve Operation

Adjust motor operator limit switches and torque settings to provide proper operation. Verify operation through its entire range and demonstrate to Government proper operation prior to requesting return to service.

3.9 COATING

All materials, coatings, and components shall be suitable for coastal/marine environment with high humidity and salt-laden air typical of Guam.

Provide enhanced corrosion protection for all exposed components.

3.9.1 Field Applied

Painting required for surfaces not otherwise specified must be field painted as specified in Section 09 90 00 PAINTS AND COATINGS, the Project Program, or Statement of Work. Do not paint aboveground stainless steel and aluminum surfaces. Do not coat equipment or components provided with a complete factory coating. Prior to any field painting, clean surfaces to remove dust, dirt, rust, oil, and grease.

For field repairs to hot dip galvanized steel, omit application of the zinc-rich epoxy primer. Apply only the epoxy intermediate coat and polyurethane topcoat to these surfaces.

3.9.2 Pipe Supports

When hot dip galvanized pipe support steel must be field coated, prepare

surfaces to SSPC SP 16 Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals. Once the steel is prepared, apply only the epoxy intermediate coat and polyurethane topcoat.

3.9.3 Buried Piping Including Stainless Steel

3.9.3.1 Coating System Application

The condition of coated piping is the responsibility of the Contractor. Damage to protective coating during transit or handling must be repaired at no additional cost to the Government. Take every precaution during lowering and backfilling to prevent damage to the protective coating.

3.9.3.2 Inspection and Testing

Following coating installation, test the exterior coating of direct buried piping for holidays using high-voltage spark testing in accordance with NACE SP0188. Repair holidays and retest to confirm holiday-free coating. Test must include all existing underground piping exposed for the project. Submit Coating Holiday Test Results. Perform holiday test on the entire length of pipe immediately prior to lowering pipe into the trench.

Perform tests with an approved silicone rubber electric wire brush or an approved electric spring coil flaw tester. Tester must be equipped with an operating bell, buzzer, or other audible signal which will sound when a holiday is detected at minimum testing voltage equal to 6,275 times the square root of the average coating thickness in mils. Tester must be a type so fixed that field adjustment cannot be made. Calibration by tester manufacturer must be required at 6-month intervals or at such time as crest voltage is questionable. Certify in writing the calibration date and crest voltage setting. Maintain the battery at ample charge to produce the crest voltage during tests. Areas where arcing occurs must be repaired by using material identical to original coating or coating used for field joints. After installation, retest the exterior surfaces, including field joints, for holidays. Promptly repair holidays.

3.9.4 Interior Epoxy

When internally epoxy lined pipe is cut, the lining must be ground back from the end a minimum of one-inch but not more than 1-1/2 inches.

3.9.5 Damage Repair

When the protective coating on pipe is damaged, notify the Contracting Officer and inspect the pipe before coating is patched. Repair and inspect damaged areas of coating pursuant to all requirements in this Section for coating application.

3.10 INSTALLATION OF UNDERGROUND PIPE

Pitch underground fuel pipelines to grades shown on the drawings. Where not indicated, pitch the installation a minimum of 2 inches per 100 feet. Two-inch pipe size valved drain connections must be provided at all low points and 1-1/2-inch pipe size valved outlet vent connections must be provided at all high points. Vent and drain lines must terminate in male cam-type locking end connectors with matching female dust covers and installed in pits. The pipe must have cover as shown on the drawings.

Drain lines must be installed at the slopes indicated.

3.10.1 Precautions

Take special care to ensure that the protective coating on buried pipe is not damaged during handling or installation. Ensure the completed system is not contaminated by dirt, sand, rocks, water, weld slag, or foreign material such as construction debris. Take the following steps.

a. Handle or rig coated pipe only with fabric or nylon slings or padded clamps. Repair coating damaged by improper handling or storage.

b. Review bedding and haunching material before installation to ensure no foreign or deleterious objects are present.

c. Make visual inspection of the inside of each length of pipe to ensure that it is not fouled and is clean prior to installation.

d. Close any open ends of the pipe system at the end of each work day, or when work is not in progress. Use expansion plugs or fitted covers. Do not open until work resumes.

e. Pull through each length of pipe a swab with a leather, canvas, or foam disc that fits the inside diameter, after welding into place. Remove foreign objects and material with the swab.

f. Obstruction or foreign material remaining in the pipe after completion of the system must be removed at the expense of Contractor.

g. Do not use plasma cutters or torches to make penetrations in pipe or to cut pipe.

h. See paragraph PIPE PIGGING - CLEANING.

3.10.2 Pipe Assembly

Pipe must be strung parallel and adjacent to or above a trench. The pipe must be supported on padded skids during welding and inspection of joints. Protective coating must be inspected and repaired prior to lowering the pipe into the trench. The pipe must be lowered using only canvas or nylon slings. The sling must be dug from underneath the pipe after placements and must not be pulled from underneath the pipe while in contact with it.

Take care to prevent damage to the pipe, weld joints, or coating. Inspect the installation prior to burial. Ensure the gross leak test (pneumatic) occurs early in order to perform rework (if necessary) outside of a trench. See paragraph TIMING. Report any damage to the Contracting Officer. Repair damage pursuant to applicable provisions of this Section.

3.10.3 Clearances

Install pipe to be clear of contact with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, rocks, or other metallic structures. Where pipes cross other pipes or structures with a separation of less than 12 inches, install an insulating separator mat. Center insulating mat at the point of intersection. Insulating mat must be neoprene or butyl rubber, not less than 36 inch in any length dimension, and at least 1/8 inch thick.

3.10.4 Buried Warning and Identification Tape

In order to identify buried pipe during future underground utility locator work, provide continuous identification tape in the backfill of excavated trenches. Install tape in accordance with manufacturer recommendations as modified herein. Bury tape at depth no less than 12 inches below finish grade but no closer to pipe than 12 inches from top.

3.10.5 Pipe Bedding

Embed piping in compacted sand material. Provide sand bedding on the subgrade, below the pipe invert, in the haunch, and above the pipe. Fully encircle piping with sand bedding material. Conform bedding to Section 31 00 00 EARTHWORK and the following requirements.

a. Provide testing and application of protective coating to joints before starting side bedding or backfill.

b. Haunch the pipe in sand bedding to the springline at least 6 inches thick, compacted in accordance with Section 31 00 00 EARTHWORK, paragraph "FILLING AND COMPACTION". Exercise care and do not come into contact with protective coating if rodding or shovel slicing is used to move and compact sand into the haunch area.

c. Material requirements of sand bedding material are those of Section 31 00 00 EARTHWORK, paragraph SELECT GRANULAR MATERIAL.

d. Pipe that has its grade or joint disturbed after laying, must be taken up and relaid.

e. Do not place pipe in standing water or when the trench or weather conditions are unsuitable for such work.

f. Place and compact sand bedding above springline to a thickness at least one foot above top of pipe.

3.10.6 Damage To Buried Pipe

Repair damage to pipe or coating in accordance with paragraphs CORRECTION AND REWORK and WELDING. If pipe is dented or out of round past the new material tolerance, or damaged more than welding can repair, the length of pipe must be rejected.

3.10.7 Pipeline Markers

Provide aboveground markers over buried fuel piping spaced every 300 feet, at tees, and at changes in direction. For sections of underground piping less than 300 feet long, place at midpoint. Provide directly above pipe for single lines and between pipes where pipes run in pairs. Provide additional marker over each mid-line fitting connections for steel reinforced flexible pipe. Cast marker into 18-inch diameter, 12-inch thick concrete plug unless it is set in an area with concrete paving in which case it must be cast into the concrete paving.

3.10.8 Steel Reinforced Flexible Pipe

Connections between steel pipe and steel reinforced flexible pipe and between separate lengths of steel reinforced flexible pipe must not be

made aboveground but must be made either inside a pit or vault, or direct bury them. Where practicable, end-line and mid-line connections must be located inside pit type enclosures of an appropriate size. Where it is not practicable to locate mid-line connections inside pit type enclosures, mid-line connections may be wrapped with a suitable waterproof protective substance and direct buried underground. The location of direct buried mid-line connections must be indicated on the final drawings and provided with a pipeline marker and monitoring well. Record GPS coordinates of all installed direct buried joints on as-built drawings.

3.11 CORRECTION AND REWORK

Defects in work, disqualifying or rejectable inspection findings or examination results, and installation damage must be completely removed and repaired as specified in ASME B31.3, unless stated otherwise in this Section.

3.12 TESTING

Piping must be tested by hydrostatic and pneumatic pressure. Testing must comply with applicable requirements of ASME B31.3, NFPA 30 and requirements specified herein. Perform hydrostatic test using fuel water as the liquid with Service Headquarters approval. Do not perform pressure testing until weld inspection and NDE have been successfully completed. Furnish labor, material, equipment, electricity, repair, and retesting necessary to achieve successful results. Schedule work so tests are in accordance with paragraph TIMING.

a. Provide means to brace piping and prevent displacement during testing.

b. Keep personnel clear of piping during testing. Control access to only permit authorized personnel in the area during testing.

c. Isolate system components such as pumps, strainers, instruments, tanks, filter separators, and meters from test pressure.

d. Do not exceed the pressure rating of any component in the piping system during testing.

e. Following satisfactory completion of each test, relieve pressure and seal the pipe immediately. When water is authorized for hydrostatic testing of fuel piping, ensure that all water is removed from the piping by mechanical dehydration. See paragraph DEHYDRATION OF PIPING. Do not allow water to remain in piping for more than 48 hours after test.

3.12.1 Timing

Plan work to properly time pipe assembly, inspection, NDE, joint coating, and test activities. Use caution when timing the gross leak test, placing pipe into the trench, and coating joints. Avoid rework performed inside a trench.

Do not leave fuel piping in trench with exposed welds for longer than 30 days. Do not backfill piping before completing weld inspection, weld NDE, pneumatic test, coating (of welds) application and testing, and other quality control work have been successfully completed. For piping that will be pneumatically tested, do not apply protective coating on welds until successful test results are achieved. Schedule hydrotest such that

the pipeline can be filled with fuel as soon as possible after test is complete. Fill line with fuel no more than two weeks following draining of water and dehydration of piping.

3.12.2 Pneumatic Test

Test must be in accordance with an approved plan required in paragraph PNEUMATIC TEST PLAN. Furnish all equipment necessary for a safe and successful test. Do not begin pneumatic test until permission is granted by the Contracting Officer. Only authorized personnel are permitted in the area during pneumatic test.

a. Isolate piping into segments and conduct separate tests.

b. Isolate using physical means such as blind flange compliant with ASME B16.5 or solid-plate line blank compliant with ASME B16.48. Use means of sufficient strength to withstand test pressure. Do not use a valve as means of isolation.

c. Provide pressure gauges with current calibration certificate.

d. Furnish tapped flange or blank that will permit a direct connection between the test segment and the compressed air source. Do not install a tap in the permanent piping.

e. Air used for pneumatic testing must have a dew point of no more than 41 degrees F.

f. Provide dehumidifying equipment on the discharge side of the compressor used to provide test air.

g. Pressurizing pump must not exceed 10 cfm.

h. Provide a pressure relief device with set pressure above the test pressure but no more than 30 psig.

i. Provide mechanical means to isolate test segment from source of pressure. Provide means to slowly relieve excess pressure during test period.

3.12.2.1 Pneumatic Test Procedure

Pneumatic test must contain, at minimum, the following elements.

a. Special safety measures to include wearing personnel face protection in accordance with ANSI/ISEA Z87.1 during test.

b. Designate a competent test operator who is in responsible charge of the test. Test operator must control or direct application and release of pressure, verify connections are secure, ensure test segment and area is safe and clear of unauthorized personnel, and remain in constant communication with observers.

c. Stage observers at appropriate locations from which a major leak can be safely detected and reported to the test operator.

d. Apply pressure to test segment in increments. Gradually increase pressure to 0.5 test pressure and stop. Verify conditions with observers. Slowly increase pressure at approximately 1/10 increments

until 25 psig is reached. Isolate segment from source of pressure.

e. Monitor pressure gauge while applying a bubble forming solution on welds and any area of suspect integrity. While applying the solution, visually inspect the entire segment of piping for leaks (bubble formation).

f. If leaks are discovered, discontinue the test and repair the piping. Inspect and perform NDE on the repair. Restart the test on the repaired segment. Repeat process until system is leak-free. See paragraph CORRECTION AND REWORK.

g. Monitor pressure for a 2 hour test period during which there must be no drop. Pressure can rise due to ambient temperature change. Carefully relieve excess pressure as-needed to maintain test. Ensure segment remains isolated from pressure source during test period.

h. Acceptable results are the no leak condition with no appreciable pressure drop during the test period.

i. Report Pneumatic Test Results through the Quality Control program.

3.12.3 Hydrostatic Test

Upon successful completion of pneumatic testing and after backfilling, hydrostatically test piping system with fuel water at 275 psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure. Furnish electricity, instruments, connecting devices, and personnel for test. In cases where it is not specified, water must be potable and treated and must meet all requirements of water used for hydrostatic testing in API 570. Defects in work must be corrected at the Contractor's expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

a. Duration of the test must be a minimum of 4 hours.

b. Designate a competent test operator who is in responsible charge of the test. Test operator must control or direct application and release of pressure, verify connections are secure, ensure test segment and area is safe and clear of unauthorized personnel, and remain in constant communication with observers.

c. Upon successful completion of hydrostatic testing, perform Soak Testing of the piping systems per API RP 1595.

d. Only authorized personnel are permitted in the area during hydrostatic testing.

e. If leaks are discovered, discontinue the test and repair the piping. Inspect and perform NDE on the repair. Restart the test on the repaired segment. Repeat process until system is leak-free. See paragraph CORRECTION AND REWORK.

3.12.3.1 Instruments

a. Instruments must be clean, in good working order, and within the calibration interval. Instruments without a calibration certificate must not be used.

b. Calibrate all test instruments against a standard by a laboratory A2LA accredited to ISO ISO/IEC 17025. Calibration must have taken place no more than 6 months prior to the hydrostatic testing. Calibration certificates must include the Model, Serial Number, date of certification and must be signed by the testing company. Provide current Instrument Calibration Certificate for measurement instruments.

c. Provide indicating pressure test gauge connected directly to the segment and readily visible to the operator controlling pressure for the duration of the test. Analog type gauges must be compliant with ASME B40.100 Grade 3A, accurate to plus or minus 0.25 percent full scale, graduated over a range not less than 1-1/2 times nor more than 4 times the test pressure, and incremented no greater than 0.5 psi.

d. Digital type pressure gauge must be integral transducer type, compliant with ASME B40.100 Grade 3A, and accurate to plus or minus 0.25 percent full scale.

e. Provide digital contact thermometer incremented to 0.1 degree F or less. Memorialize pressure data with analog chart recorder. Transducers must have a range not less than 1.5 times and not greater than 4 times the pressure being tested.

f. Use calibrated continuous recorders (dataloggers) with adequate storage capacity to record temperature and pressure data. Synchronize the time interval for both measurements.

g. Measure the volume of test medium with a calibrated meter.

3.12.3.2 Procedure

a. For inaccessible segments, account for the volume of any test medium added or removed by measuring with a calibrated meter.

b. After filling has been completed, allow the test section to stabilize at 25 percent of the test pressure for 24 hours or until a temperature-time plot is asymptotic to ground temperature. Start pressure and temperature recorders prior to pressurization and run throughout the stabilization period to ensure proper stabilization has taken place before starting the hydrotest.

c. Maintain segment at a steady test pressure condition for a minimum of 15 minutes prior to initiation of examination for leakage. Examine piping, joints, and connections of accessible piping for leaks while maintaining test pressure. Leakage of temporary gaskets and seals, installed for the purpose of conducting the hydrostatic test and which will be replaced later, is permitted unless the leakage rate precludes maintenance of system test pressure for the required duration. Personnel performing the examination for leaks must be qualified for visual examination. Extend the test interval as needed to ensure positive reconciliation of test data. Monitor temperature and pressure. Analyze consistent error, inconsistent error, the magnitude of any lost volume, and pressure versus temperature data trends.

3.12.3.3 Hydrostatic Test Water Disposal

Remove test water from segment upon completion of test. For large volume tests, apply for coverage under a State permit authorizing discharge of hydrotest water. Sample, test, and characterize the water pursuant to the

permit. Provide Test Water Characterization results to the Contracting Officer. If test results exceed allowable discharge limits in the permit, dispose of the water off Installation in an appropriate manner. If discharge is allowed under the permit, provide a Test Water Disposal Plan to the Contracting Officer for approval. Water discharged on the surface must be in a slow and controlled manner which will not result in erosion or migration outside the disposal area.

3.12.3.4 Test Report

Provide certification from the hydrostatic test examiner the piping segments are either pass or fail. Inconclusive results are not acceptable. Prepare a pressure test report consistent with API RP 1110 to serve as the permanent qualification record, demonstrate the operating pressure limit and includes test drawings and logs of recorded test data. Provide written Hydrostatic Test Report.

3.12.4 Soak Testing

Upon completion of hydrostatic testing with fuel, perform Soak Testing of the piping systems per API RP 1595. Duration of the test must be a minimum of 4 days and maximum of 7 days.

3.12.5 System Integrity Check

After system installation, inspection, NDE, and pressure testing are complete, check flanges, valves, fittings, joints, gaskets, connections, and components for visible weep, leak, or any area wetted with fuel. Replace, repair, or tighten to establish integrity. Re-check system to verify.

3.12.6 Performance Testing

After fuel system testing is completed (including integrity check), flush, clean, and performance-test. Verify proper operation of all valves, pumps, controls, and motors. After start-up is complete, re-check the system for leaks and proper operation. Repair or replace to correct any defects.

-- End of Section --

SECTION 33 56 10

FACTORY-FABRICATED FUEL STORAGE TANKS
05/25

PART 1 GENERAL

1.1 SUMMARY

This section defines the requirements for factory-fabricated fuel storage tanks.

1.1.1 Related Sections

1.1.1.1 Earthwork

Excavation and backfilling for tanks must be in accordance with Section 31 00 00 EARTHWORK.

1.1.1.2 Cathodic Protection

Provide buried metallic components including pipe, anchors, conduit, etc., with a cathodic protection system in accordance with. Cathodic protection for metal components that attach to a tank must be coordinated and compatible with the tank corrosion control system.

1.2 REFERENCES

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN PETROLEUM INSTITUTE (API)

API MPMS 2.2A	(1995; R 2017) Manual of Petroleum Measurement Standards Chapter 2-Tank Calibration Section 2A-Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank Strapping Method
API MPMS 2.2E	(2004; Errata 2009; R 2009) Petroleum and Liquid Petroleum Products - Calibration of Horizontal Cylindrical Tanks - Part 1: Manual Methods
API RP 540	(1999; R 2004) Electrical Installations in Petroleum Processing Plants
API RP 2003	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M	(2020) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A48/A48M	(2022) Standard Specification for Gray Iron Castings
ASTM A193/A193M	(2025) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2024) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A307	(2023) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM D3308	(2012; R 2022) Standard Specification for PTFE Resin Skived Tape
ASTM F436	(2011) Hardened Steel Washers
ASTM F844	(2019; R 2024) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 142	(2007; Errata 2014) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book
IEEE 1100	(2005) Emerald Book IEEE Recommended Practice for Powering and Grounding Electronic Equipment

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2024; ERTA 1 2025) Flammable and Combustible Liquids Code

NFPA 30A	(2024; ERTA 1 2023) Code for Motor Fuel Dispensing Facilities and Repair Garages
NFPA 31	(2024; TIA 23-1) Standard for the Installation of Oil-Burning Equipment
NFPA 70	(2026) National Electrical Code
NFPA 77	(2024; ERTA 1 2023) Recommended Practice on Static Electricity
NFPA 407	(2022; TIA 24-2) Standard for Aircraft Fuel Servicing
NFPA 704	(2022) Standard System for the Identification of the Hazards of Materials for Emergency Response
NFPA 780	(2026) Standard for the Installation of Lightning Protection Systems

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC QP 3	(2010) Standard Procedure for Evaluating Qualifications of Shop Painting Applicators
SSPC QS 1	(2015) Standard Procedure for Evaluating a Contractor's Advanced Quality Management System

STEEL TANK INSTITUTE (STI)

STI 700-50-5007	(2010) Installation Instructions for Shop Fabricated Aboveground Tanks for Flammable, Combustible Liquids
STI SP001	(2018, 6th Ed) SP001 Standard for The Inspection of Aboveground Storage Tanks

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-161	(2025; Rev J) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

UL SOLUTIONS (UL)

UL 142	(2019; Reprint Jan 2021) UL Standard for Safety Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 2085	(1997; Reprint Sep 2010) UL Standard for Safety Protected Aboveground Tanks for Flammable and Combustible Liquids

1.3 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality

Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Grounding and Bonding

SD-03 Product Data

Aboveground Storage Tank (Double Wall, Concrete Encased); G

Tank Protective Coatings; G

Atmospheric Vent; G

Pressure Vacuum Vent; G

Emergency Vent; G

Independent Level Alarm System; G

Tank Gauges; G

Tank Mounted Fuel Dispensing Unit; G

Tank Anchorage System Materials; G

SD-05 Design Data

Tank Anchorage Calculations; G

SD-06 Test Reports

Aboveground Storage Tank Tightness Tests; G

Tank Manufacturer's Tests

Tank Fill Tests

Tank Inspection Reports; G

SD-07 Certificates

Contractor Qualifications; G

Manufacturer's Certification; G

State Certification; G

Pollution Liability Insurance

Permitting

Registration

Licensed Personnel

Demonstrations

STI SP001 Inspector's Certification; G

SD-08 Manufacturer's Instructions

Aboveground Storage Tank

Independent Level Alarm System

Tank Gauges

SD-10 Operation and Maintenance Data

Aboveground Storage Tank; G

Independent Level Alarm System; G

Tank Gauges; G

1.4 QUALITY ASSURANCE

1.4.1 Contractor Qualifications

Each installation Contractor must have successfully completed at least 5 projects of the same scope, and the same size or larger within the last 3 years and demonstrated specific installation experience in regard to the specific system installation to be performed. Each installation Contractor must have taken, if applicable, manufacturer's training courses on the installation of storage tanks and must meet all applicable licensing requirements in the state. If applicable, state certified installers must be provided by the Contractor. Installers must also be trained and certified by the manufacturer to install the equipment and materials being installed and must be STI certified. Installers must submit certification from the manufacturer and State. If installing underground storage tanks and piping systems, installation Contractor must have Pollution Liability Insurance. Submit a letter listing prior projects, the date of construction, a point of contact for each prior project, the scope of work of each prior project, and a detailed list of work performed. The letter must also provide evidence of prior manufacturer's training, state licensing, and other related information.

1.4.2 Regulatory Requirements

1.4.2.1 Permitting

Obtain necessary permits in conjunction with the installation of storage tanks as required by federal, state, or local authority.

1.4.2.2 Registration

Obtain and complete all tank registration forms required by federal, state, and local authorities. Submit all completed tank registration forms within 30 days after contract award to the Contracting Officer. The Contracting Officer will ensure the Base Environmental staff for the DoD Installation submits the forms to the proper regulatory agencies.

1.4.2.3 Licensed Personnel

Tank installers must be licensed by the state when the state requires licensed installers.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect system components and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer, upon recommendation by Base Environmental for the DoD Installation. Replace damaged or defective items.

1.6 PROJECT SITE CONDITIONS

Exposed moving parts, parts that produce high operating temperatures and pressures, parts that may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Install safety devices so that proper operation of equipment is not impaired.

1.7 WARRANTY

All factory-fabricated storage tanks must come with a manufacturer's warranty of a minimum period of 30 years. All warranty paperwork will be completed and submitted by Contractor to both the tank and system component manufacturers, the Contracting Officer, and the Base Environmental for the DoD Installation. This includes all applicable completed manufacturers' equipment installation checklists.

PART 2 PRODUCTS

2.1 ELECTRICAL WORK

Provide controllers, integral disconnects, contactors, controls, and control wiring with their respective pieces of system components. Provide electrical system components, including motors and wiring, in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Any wiring required for the operation specified herein, but not shown on the electrical plans, must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.1.1 Grounding and Bonding

Grounding and bonding must be in accordance with NFPA 70, NFPA 77, NFPA 407, NFPA 780, API RP 540, API RP 2003, IEEE 142, and IEEE 1100. Provide jumpers to overcome the insulating effects of gaskets, paints, or nonmetallic components.

2.2 MATERIALS AND SYSTEM COMPONENTS

Provide materials and system components that are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship. Provide materials and system components that have been in satisfactory commercial or industrial use for a minimum 3 years prior to bid opening. The 3 year period must include applications of the system components and materials under similar circumstances and of similar size. Provide materials and system components that have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 3 year period.

Internal parts and components of system components, piping, piping components, and valves that could be exposed to fuel during system operation must not be constructed of zinc coated (galvanized) metal, brass, bronze, or other copper alloys. Do not install cast iron bodied valves in piping systems that could be exposed to fuel during system operation.

2.3 NAMEPLATES

Attach nameplates to all specified system components defined herein. List on each nameplate the manufacturer's name, address, contract number, acceptance date, component type or style, model or serial number, catalog number, capacity or size, and the system that is controlled. Construct plates of stainless steel, 0.125 inch thick, UV resistance, black with white center core, matte finish surface and square corners. Install nameplates in prominent locations with nonferrous screws, nonferrous bolts, or permanent adhesive. Minimum size of nameplates must be one by 2.5 inches. Provide manufacturer's storage tank nameplates as required. On concrete-encased tanks, provide a minimum smooth flat mounting surface of 12 by 12 inches for attaching nameplates. Lettering must be the normal block style with a minimum 0.25 inch height. Accurately align all lettering on nameplates. Key the nameplates to a chart and schedule for each system. Frame charts and schedule under glass, and locate where directed near each system. Provide two copies of each chart and schedule. Each nameplate description must identify its function.

2.4 ABOVEGROUND STORAGE TANK

2.4.1 Aboveground Storage Tank (Double Wall, Concrete Encased)

The primary (inner) storage tank must be a factory-fabricated stainless steel tank and must be in accordance with UL 142. The primary storage tank must be insulated. The secondary containment must be a minimum of 30 mil thick high density polyethylene (HDPE) liner encased in concrete that fully-encloses the primary storage tank. Concrete must have a minimum 4000 psi strength, be monolithically poured, and be properly reinforced for the application. The primary storage tank and insulation must be isolated from the exterior concrete encasement. The interstitial space between the primary tank and the containment reservoir must be verifiable for leaks. The entire tank assembly must be in accordance with UL 2085 and bear the UL 2085 label.

2.5 TANK PROTECTIVE COATINGS

For tanks coated in California and where required by the State or local regulations, provide tank coating system in accordance with California Air Resources Board (CARB).

2.5.1 Interior Surfaces

Coat 100 percent of a metal tank's interior surfaces including all metal piping and metal appurtenances the manufacturer's standard coating system as modified herein.

2.5.1.1 Certifications of Coating Contractors

All Contractors and Subcontractors that perform surface preparation or coating application must be certified to SSPC QP 3 and SSPC QS 1 prior to contract award, and must remain certified while accomplishing any surface

preparation or coating application. Painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor or subcontractor certification expires, the firm is not allowed to perform any work until the certification is reissued. Requests for extension of time due to delay as a result of an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in certification status. Notify the Contracting Officer of all scheduled or unannounced on site audits from SSPC and provide a copy of all audit reports.

2.5.2 Exterior Surfaces, Aboveground Tanks

Protect the exterior surfaces of each aboveground tank with the manufacturer's standard coating system as modified herein in accordance with Section 09 90 00 PAINTS AND COATINGS as modified herein.

2.5.2.1 Certifications of Coating Contractors

All Contractors and Subcontractors that perform surface preparation or coating application must be certified to SSPC QP 3 and SSPC QS 1 prior to contract award, and must remain certified while accomplishing any surface preparation or coating application. Painting contractors and painting subcontractors must remain so certified for the duration of the project. If a contractor or subcontractor certification expires, the firm is not allowed to perform any work until the certification is reissued. Requests for extension of time due to delay as a result of an inactive certification will not be considered and liquidated damages will apply. Notify the Contracting Officer of any change in certification status. Notify the Contracting Officer of all scheduled or unannounced on site audits from SSPC and provide a copy of all audit reports.

2.5.3 Tank Labeling

Tank must be labelled with the following information at a minimum:

a. Product Stored and Tank Capacity (Per MIL-STD-161).

b. Tank Number and Facility Number.

c. NFPA 704 Diamond Hazmat Label.

d. "No Smoking" on Class 1 tanks.

e. "Confined Space" on tanks with manhole/ladder hatch.

2.6 TANK COMPONENTS

2.6.1 Tank Manhole

Tank manholes must have an internal diameter of 30 inches. Provide each manhole with a matching flanged watertight manhole cover. Manhole covers must be UL listed, be constructed of pressed or mild steel, and include a UL listed gasket. Frame and cover assembly must be rated to withstand H-20 highway loading in accordance with AASHTO HB-17.

2.6.2 Tank Piping Penetrations

Provide a welded-in-place double tapered National Pipe Thread (NPT) coupling flanged pipe nozzle for each tank piping connection. All unused

or spare tank piping penetrations must be sealed with malleable iron plugs steel plugs steel flanges.

2.6.3 Tank Striker Impact Plates

Provide an interior striker impact plate under each tank manhole and pipe connection. Each plate must be a minimum of 1/4 inch in thickness, be larger in diameter than the tank penetration, fit the curvature of the tank bottom, and be completely coated in the same fashion as the interior tank bottom coating. Each plate must be welded to the tank bottom at the factory (full circumference connection). The welds must be non-destructive tested using the appropriate means.

2.6.4 Manual Gauging/Sampling Hatch

Provide a combination gauging and sampling hatch assembly. The assembly must include a bronze top-seal type adapter with a corresponding locking type cap (adapter and cap both externally-mounted to the top of the tank) steel stilling well pipe. The stilling well pipe must be a minimum 4 inches in size and extend downward through the top of the tank to within 3 inches of the tank bottom. Provide the entire length of pipe inside the tank with 1/2 inch wide by 12 inches long slots at alternate locations. Coat the pipe in the same fashion as the interior tank bottom coating.

2.6.5 Tank Ladder

Provide interior tank ladders constructed of either fiberglass or steel. If steel, coat the ladder in the same fashion as the tank interior. The two stringers must be a minimum 3/8 inch thick and a minimum 2 inches wide. The rungs must be a minimum 3/4 inch rod on 12 inches centers. Members of the ladder must be securely affixed. Ladder must be of sufficient length to extend from the bottom of the tank to the top surface of the tank. Ladder must be rigidly connected to the tank bottom in accordance with the tank manufacturer's standard. Ladder must be connected to the top of the tank with pipe guides or slip bars to accommodate expansion of the two stringers.

2.6.6 Tank Venting

2.6.6.1 Atmospheric Vent

Provide atmospheric, updraft type cap. Cap must be constructed of aluminum or carbon steel. Cap must have an internal brass or bronze insect screen, minimum 40-mesh. Cap must prevent rain, snow, or ice from entering the vent piping.

2.6.6.2 Pressure Vacuum Vent

Tank vent outlet must be equipped with pressure-vacuum breather vent, aluminum construction with weather hood and with fluoroelastomer (FKM, Viton) pallet seat inserts, high density screens, stainless steel internals, with pressure relief setting, vacuum relief setting, and venting vacuum capacity per tank manufacturer.

2.6.6.3 Emergency Vent

Vent must be the normally-closed, UL listed type that vents outward and upward. Vent must conform with NFPA 30 and UL 142 and must be sized by the tank manufacturer. Provide vent with the cubic feet per minute (cfm)

rating permanently labeled on the vent's exterior. For double wall or protected type tanks, provide a second emergency vent to protect the interstitial space. This second emergency vent is not to be provided on concrete encased tanks.

2.7 INDEPENDENT LEVEL ALARM SYSTEM

Provide an independent level alarm system that will monitor 4 programmable liquid level setpoints. The system must delineate between each individual setpoint. The system must produce an audible and visible alarm in the event of monitoring an alarm condition. Mechanically-actuated float assemblies must be field adjustable. The system must be totally independent of the tank gauging system.

2.7.1 Setpoints

Configure the alarm system's 4 setpoints in accordance with the following:

a. High Level Setpoint. Produce an alarm condition when a tank's liquid level rises above 90 percent capacity.

b. High-High Level Setpoint. Produce an alarm condition when a tank's liquid level rises above 95 percent capacity.

c. Low Level Setpoint. Produce an alarm condition when a tank's liquid level drops below 15 percent capacity.

d. Low-Low Level Setpoint. Produce an alarm condition when a tank's liquid level drops below the minimum pump submergence level at percent capacity.

2.7.2 Independent Level Alarm Control Panel

Install the control panel for the alarm system in a NEMA 4 rated enclosure in accordance with NEMA 250 standard industrial enclosure. Panel doors must swing left or right.

2.7.2.1 Audible Alarm

Panel must have internal speakers that produce a buzzer sound of 70 decibels or greater in the event of a detected alarm condition.

2.7.2.2 Visual Alarm

Panel must have a visual alarm that illuminates in the event of a detected alarm condition. The visual alarm must include either individual lights for each alarm condition or must include a single light and a liquid crystal display (LCD) panel that displaces information regarding each alarm condition.

2.7.2.3 Acknowledge Switch

Panel must have a manual acknowledge switch that will deactivate the audible alarm. The acknowledge switch must not deactivate subsequent audible alarms unless depressed manually again for each occurrence. Under no circumstance must this acknowledgement switch extinguish the visual alarms until the alarm condition has been corrected. The acknowledge switch must be an integral component located on the front of the control panel. The switch must be either a key switch or push button.

2.7.2.4 Test Pushbutton

Panel must have a manual test pushbutton that will enable operators to verify that the panel is powered, and the visual and audible alarms are working properly.

2.8 TANK GAUGES

2.8.1 Stick Gauge

For each tank, provide 2 wooden stick gauges. Gauge length must allow the measurement of the entire level of fuel in the corresponding tank. Gauges must be compatible with the fuel to be measured (no swelling or damage from fuel contact). Provide gauge with non-sparking caps on each end. Mark gauges in feet and inches. The smallest unit of measure on the gauge must be 1/16 inch.

2.8.2 Tank Strapping Table

Provide 2 API MPMS 2.2E API MPMS 2.2A tank manufacturer certified strapping tables (calibration charts) for each tank. One of the tables must indicate the liquid contents in gallons for each 1/16 inch of tank depth. Strapping table volumes for all tanks 5,000 gallons and larger must be determined using physical measurements and not calculated values. For each tank, provide an electronic media file of each strapping table.

2.8.3 Mechanical Clock Gauge

Gauge must be the level sensing, mechanically actuated type that provides the tank level readout in a sealed glass cap contained in a gauge box. Gauge must be accurate to plus or minus 1/4 inch and must measure the liquid level over the full range of a tank's height. Gauge must have vapor tight seals to prevent condensation from fogging the viewing glass.

2.8.4 Automatic Tank Gauge System (ATG)

Gauge system must be the mechanically or electronically actuated type that can continuously monitor a tank's usable liquid level storage capacity. The system must provide a digital readout of a tank's liquid level in terms of inches and gallons. The system must be accurate to plus or minus 0.05 inch. The system must measure water accumulation in inches from 3/4 to 5 inches off the bottom of a storage tank. Construct system components to be chemically compatible with the fuel to be handled. For each tank monitored, provide a sending unit that transmits the digital readout from a tank to an electronic display panel. Panel must be a NEMA 4 enclosure as defined by NEMA 250 standard industrial enclosure. Panel doors must swing left or right. The panel must display the digital readout of each monitored tank on an LCD mounted exterior to the panel. The panel must also have external controls to allow operators to toggle between information on the LCD without having to open the panel.

2.9 TANK MOUNTED FUEL DISPENSING UNIT

Provide fuel dispensing unit with integral UL labeled suction pump as supplied by the tank manufacturer. Unit must include all necessary appurtenances for operation. Unit must include a visible register to indicate individual deliveries up to 99.9 gallons with a reset meter. Pump must have a delivery capacity of 15 gpm. Hose must be a minimum 3/4

inch inside diameter, 15 ft long, and fuel resistant. The dispensing nozzle must be of the automatic shutoff type with graduated notches for various delivery speeds. Dispensing unit must provide a means for locking of the nozzle to the pump when the pump is shutoff. Diesel fuel dispensing unit cabinet must be painted yellow from the manufacturer. Gasoline dispensing unit must be painted red from the manufacturer. Units must be clearly marked for the fuel they are dispensing.

2.10 ACCESSORIES

2.10.1 Concrete Anchor Bolts

Concrete anchors must be in accordance with ASTM F1554, hot-dipped galvanized.

2.10.2 Bolts and Studs

Carbon steel bolts and studs must be in accordance with ASTM A307, Grade B, hot-dipped galvanized. Stainless steel bolts and studs that be in accordance with ASTM A193/A193M, Grade 8.

2.10.3 Nuts

Carbon steel nuts must be in accordance with ASTM A563, Grade A, hex style, hot-dipped galvanized. Stainless steel nuts must be in accordance with ASTM A194/A194M, Grade 8.

2.10.4 Washers

Provide flat circular washers under each bolt head and each nut. Washer materials must be the same as the connecting bolt and nut. For ASTM F1554 concrete anchors, use ASTM F436, Type 1, hot-dipped galvanized washers. For ASTM A307 bolts and studs, carbon steel washers must be in accordance with ASTM F844, hot-dipped galvanized. Stainless steel washers must be in accordance with ASTM A194/A194M, Grade 8.

2.10.5 Polytetrafluoroethylene (PTFE) Tape

Tape must be in accordance with ASTM D3308.

2.10.6 Street Manhole Assembly

Round street manhole frames and covers must be the straight traffic type. Frames and covers must be constructed of cast steel in accordance with ASTM A27/A27M, grade 60-30 as a minimum cast iron in accordance with ASTM A48/A48M. Covers must be the solid plate type with a checker pattern. Covers must form a watertight seal with the manhole frame to prevent surface water inflow. Frame and cover assembly must be rated to withstand H-20 highway loading in accordance with AASHTO HB-17.

PART 3 EXECUTION

3.1 INSTALLATION

Install work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Handle storage tanks with extreme care to prevent damage during placement and install in accordance with the manufacturer's installation instructions and NFPA 30, NFPA 30A, or NFPA 31 as applicable. Inspect the exterior surface of each tank for

obvious visual damage prior to and during the placement of each storage tank. Repair surface damage to a storage tank according to manufacturer's requirements before proceeding with the system installation. Provide the termination of fill lines within a tank with an antisplash deflector. Provide nylon dielectric bushings on pipe connections to a steel tank.

Where anchors are required (either aboveground or underground), provide submittals for tank anchorage system materials and tank anchorage calculations.

3.1.1 Aboveground Storage Tank

Install aboveground storage tanks in accordance with STI 700-50-5007 (STI R912) except as modified herein. Place tank that is less than 5,000 gallons on a level surface.

3.1.1.1 Steel Aboveground Storage Tank Handling

3.1.1.1.1 Concrete Encased Aboveground Storage Tank Handling

Store, handle, and place concrete encased aboveground storage tanks with care and in a manner that will minimize damage to the tank. Place tanks in position carefully and with a minimum of handling. Do not move the tank unless it is empty.

3.1.1.2 Steel Aboveground Tank Installation Procedures

Tanks should be secured to the associated tank pad per tank manufacturer's recommendations using fasteners installed through the tank saddle base plate.

3.1.1.2.1 Concrete Encased Aboveground Storage Tank Installation Procedures

Concrete encased tanks do not need to be secured.

3.1.2 System Components

Properly level, align, and secure system components in place in accordance with manufacturer's instructions. Provide supports for system components, appurtenances, and pipe as required. Install anchors, bolts, nuts, washers, and screws where required for securing the work in place. Sizes, types, and spacings of anchors and bolts not indicated or specified must be as required for proper installation.

3.2 FIELD QUALITY CONTROL

3.2.1 Aboveground Storage Tank Tightness Tests

Perform tightness tests on each aboveground storage tank prior to making piping connections. Perform testing in accordance with STI 700-50-5007 (STI R912) except as modified herein. Gauges used to monitor the tests must have a scale with a maximum limit of 15 psig. Repair leaks discovered during the tightness tests in accordance with tank manufacturer's instructions. Following any repair, re-test the tank until the tank successfully passes the testing requirements of this paragraph.

3.2.2 Tank Manufacturer's Tests

In addition to the tests required herein, perform any additional tests

(i.e., leak tests, cathodic protection verification tests, etc.) on each storage test that is required by the tank manufacturer's written test procedures. Manufacturer's tests that are redundant to tests already required by this specification will only be performed once per tank. Repair all leaks discovered during the tests in accordance with manufacturer's instructions. Following tank repairs, re-test the tank until the tank successfully passes the manufacturer's testing requirements.

3.2.3 Tank Inspection Reports

Prior to system commissioning, a STI SP001 certified inspector must perform a Formal External Inspection on the completed aboveground tank in accordance with STI SP001 and deliver a full report to the Contracting Officer. The report must include a record of ultrasonic thickness measurements (UTMs), exclusive of the coating, of each single wall aboveground tank shell. The report must include the tank dataplate information and photograph of the tank data plate. Provide electronic copies of the tank inspection reports to Service Headquarters, Service Control Points, and DLA-Energy. The paper and electronic copies of the report and UTMs must be provided to the Contracting Officer for filing with the tank's "as-built drawings." Refer to Section 01 45 00 QUALITY CONTROL for STI SP001 Inspector's Certification requirements.

3.3 DEMONSTRATIONS

Conduct a training session for designated Government personnel in the operation and maintenance procedures related to the system components and systems specified herein. Include pertinent safety operational procedures in the session as well as physical demonstrations of the routine maintenance operations. Provide instructors who are familiar with the installation system components and systems, both operational and practical theories, and associated routine maintenance procedures. The training session must consist of a total of 8 hours of normal working time and must start after the system is functionally completed, but prior to final system acceptance. Submit a letter, at least 14 working days prior to the proposed training date, scheduling a proposed date for conducting the onsite training.

3.4 Tank Fill Tests

Tank fill tests must not be performed until after the flushing, cleaning, and adjusting requirements. For the tank fill tests, initially fill each storage tank with fuel in order to verify the tank level alarm system operates properly and the tank overfill protection device functions as designed. Stop filling each tank immediately once the overfill devices operates. Do not overfill any storage tank more than the 98 percent level. Drain the system below the low liquid level setpoint to verify operation of the low level alarm. Correct and retest any problems with the level alarm system or the overfill device until each operate as specified herein. During the tests, verify that all tank gauges are calibrated and operating appropriately.

3.5 FIELD PAINTING

Painting required for surfaces not otherwise specified must be field painted Section 09 90 00 PAINTING, GENERAL. Do not paint stainless steel and aluminum surfaces. Do not coat system components or components provided with a complete factory coating. Prior to any field painting, clean surfaces to remove dust, dirt, rust, oil, and grease.

-- End of Section --

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)
04/06

PART 1 GENERAL

1.1 REFERENCES

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.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials
ASTM D1557	(2021) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2023) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-84-608	(2017) Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements
ICEA S-87-640	(2016) Optical Fiber Outside Plant Communications Cable; 4th Edition
ICEA S-98-688	(2012) Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-78-B	(2020c) FOTP-78 Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation
TIA-455-107	(1999a) FOTP-107 Determination of Component Reflectance or Link/System Return Loss using a Loss Test Set
TIA-472D000	(2007b) Fiber Optic Communications Cable for Outside Plant Use
TIA-492CAAA	(1998; R 2002) Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers
TIA-526-7	(2015a; R 2022) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fibre-Optic Communications Subsystem Test Procedures - Part 4-2: Installed Cable Plant - Single-Mode Attenuation and Optical Return Loss Measurement
TIA-526-14	(2015c) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
TIA-568.2	(2018d) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568.3	(2016d; Add 1 2019) Optical Fiber Cabling Components Standard
TIA-569	(2019e; Add 1 2022) Telecommunications Pathways and Spaces
TIA-590	(1997a) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
TIA-606	(2021d) Administration Standard for Telecommunications Infrastructure
TIA-607	(2024e) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard
TIA/EIA-455	(1998b) Standard Test Procedure for Fiber

	Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
TIA/EIA-455-204	(2000) Standard for Measurement of Bandwidth on Multimode Fiber
TIA/EIA-598	(2014D; Add 2 2018) Optical Fiber Cable Color Coding

U.S. ARMY INFORMATION SYSTEMS ENGINEERING COMMAND

21-010	**(2021) Telecommunications Outside Plant Planning and Design Criteria**

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755	Telecommunications Standards and Specifications for Materials, Equipment and Construction
RUS Bull 345-65	(1985) Shield Bonding Connectors (PE-65)
RUS Bull 345-72	(1985) Filled Splice Closures (PE-74)
RUS Bull 1751F-630	(1996) Design of Aerial Plant
RUS Bull 1751F-643	(2002) Underground Plant Design
RUS Bull 1751F-815	(1979) Electrical Protection of Outside Plant
RUS Bull 1753F-201	(1997) Acceptance Tests of Telecommunications Plant (PC-4)
RUS Bull 1753F-401	(1995) Splicing Copper and Fiber Optic Cables (PC-2)

UL SOLUTIONS (UL)

UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 497	(2001; Reprint Jul 2022) UL Standard for Safety Protectors for Paired Conductor Communication Circuits
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

1.2 RELATED REQUIREMENTS

Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM and Section 33 71 02, UNDERGROUND ELECTRICAL DISTRIBUTION apply to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568.1, TIA-568.2, TIA-568.3, TIA-569, TIA-606, and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).)

1.3.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.3.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)

1.3.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The telecommunications outside plant consists of cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use. The telecommunications contractor must coordinate with NCTS concerning layout and configuration of the EF telecommunications and OSP. The telecommunications contractor may be required to coordinate work effort for access to the EF telecommunications and OSP with NCTS.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. **When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "NN" designation identifies that NAVSEA and NCTS will review the submittal.** Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Outside Plant; **G NN**

Telecommunications Entrance Facility Drawings; **G NN**

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Wire and Cable; **G NN**

Cable Splices, and Connectors; **G NN**

Closures; **G NN**

Building Protector Assemblies; **G NN**

Protector Modules; **G NN**

SD-06 Test Reports

Pre-installation Tests; **G NN**

Acceptance Tests; **G NN**

Outside Plant Test Plan; **G NN**

SD-07 Certificates

Telecommunications Contractor Qualifications; **G NN**

Key Personnel Qualifications; **G NN**

Minimum Manufacturer's Qualifications; **G NN**

SD-08 Manufacturer's Instructions

Building Protector Assembly Installation; **G NN**

Cable Tensions; **G NN**

Fiber Optic Splices; **G NN**

Submit instructions prior to installation.

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; **G NN**

SD-10 Operation and Maintenance Data

Telecommunications Outside Plant (OSP), Data Package 5; **G NN**

Commercial off-the-shelf manuals shall be provided for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications outside plant (OSP). Submit operations and maintenance data in accordance with Section 01 78 23,

OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS OUTSIDE PLANT SHOP DRAWINGS and TELECOMMUNICATIONS ENTRANCE FACILITY DRAWINGS.

SD-11 Closeout Submittals

Record Documentation; **G NN**

In addition to other requirements, provide in accordance with paragraph RECORD DOCUMENTATION.

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with TIA-758, RUS Bull 1751F-630 for aerial system design, and RUS Bull 1751F-643 for underground system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with TIA-606. Drawings shall include fold out (butterfly) diagrams of all maintenance holes and hand holes wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gauge and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant. The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

Provide T3 drawings for EF Telecommunications as specified in the paragraph TELECOMMUNICATIONS SPACE DRAWINGS of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS. The telecommunications entrance facility shop drawings shall be included in the operation and maintenance manuals.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be

provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor Qualifications

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems in accordance with TIA-758 within the past 3 years.

1.6.2.2 Key Personnel Qualifications

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Cable splicing and terminating personnel assigned to the installation of this system or any of its components shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

Supervisors and installers assigned to the installation of this system or any of its components shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband cabling, and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced

project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer's Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with, TIA-568.1, TIA-568.2 and TIA-568.3. In addition, cabling manufacturers shall have a minimum of 3 years experience in the manufacturing and factory testing of cabling which comply with ICEA S-87-640, ICEA S-98-688, and ICEA S-84-608.

1.6.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the copper conductor and optical fiber cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least 30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with TIA-568.1 and RUS Bull 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.6.4 Standard Products

Provide materials and equipment that are standard products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and shall be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is provided.

1.6.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5.1 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.7 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels as needed with a minimum overage of 10 percent. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.8 MAINTENANCE

1.8.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project including fold out (butterfly) diagrams of all maintenance holes and hand holes.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Building Protector Assemblies

Provide self-contained 5 pin unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for outside cable. Building protector assembly shall have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.2.2 Protector Modules

Provide in accordance with UL 497 solid state type 5 pin rated for the application. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.2.3 Fiber Optic Terminations

Provide fiber optic cable terminations as specified in 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Cable Closures

a. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. Closure shall be stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure. Provide filled splice cases in accordance with RUS Bull 345-72.

2.3.2 Fiber Optic Closures

2.3.2.1 In Vault or Manhole

Provide underground closure suitable to house splice organizer in a protective housing. Closure shall be stainless steel material supplying

structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall **not be used**.

2.4 CABLE SPLICES, AND CONNECTORS

2.4.1 Copper Cable Splices

Provide multipair, splices of a moisture resistant, two-wire insulation displacement connector held rigidly in place to assure maximum continuity in accordance with RUS Bull 1753F-401. Cables greater than 25 pairs shall be spliced using multipair splicing connectors, which accommodate 25 pairs of conductors at a time. Provide correct connector size to accommodate the cable gauge of the supplied cable.

2.4.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector shall accommodate 22 to 26 AWG solid wire with a maximum insulation diameter of 0.065 inch. Fill connector with sealant grease to make a moisture resistant connection, in accordance with RUS Bull 1753F-401.

2.4.3 Copper Cable Spare Cap

Caps for spare copper pairs shall be moisture resistant, accept two conductors, and conductors shall be held in place with a plastic blade. Spare copper pairs shall not be capped with metallic type connectors.

2.4.4 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion methods as required. The splice insertion loss shall be 0.3 dB maximum when measured in accordance with TIA-455-78-B using an Optical Time Domain Reflectometer (OTDR). Splices shall be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with TIA-455-107. Physically protect each fiber optic splice by a splice kit specially designed for the splice.

2.4.5 Fiber Optic Splice Organizer

Provide splice organizer suitable for housing fiber optic splices in a neat and orderly fashion. Splice organizer shall allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer shall accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

2.4.6 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bull 345-65.

2.5 CONDUIT

Provide conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL

DISTRIBUTION.

2.6 PLASTIC INSULATING TAPE

UL 510.

2.7 WIRE AND CABLE

2.7.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor shall determine the range of numbers of pairs specified; 24 gauge (6 to 2100 pairs). Copper conductor shall conform to the following:

2.7.1.1 Underground

Provide filled cable meeting the requirements of ICEA S-84-608 and RUS 1755.890.

2.7.1.2 Screen

Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-84-608 and RUS 1755.390.

2.7.2 Fiber Optic Cable

Provide single-mode, OS2, 8/125-um, 0.10 aperture 1310 nm fully water blocked, gel free, **single** armored, fiber optic cable in accordance with TIA-492CAAA, TIA-472D000, and ICEA S-87-640 including any special requirements made necessary by a specialized design. Provide optical fibers as indicated. Fiber optic cable shall be specifically designed for outside use with loose buffer construction. Provide fiber optic color code in accordance with TIA/EIA-598

2.7.2.1 Strength Members

Provide central, non-metallic strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and shall not serve as a pulling strength member.

2.7.2.2 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

2.7.3 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA-607, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B1 for sizes No. 8 AWG and smaller and stranded bare

copper wire meeting the requirements of ASTM B8, for sizes No. 6 AWG and larger. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.8 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags shall be stainless steel and labeled in accordance with TIA-606. Handwritten labeling is unacceptable.

2.8.1 Stainless Steel

Provide stainless steel, cable tags 1 5/8 inches in diameter 1/16 inch thick minimum, and circular in shape. Tags shall be die stamped with numbers, letters, and symbols not less than 0.25 inch high and approximately 0.015 inch deep in normal block style.

2.9 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with TIA-590.

2.10 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid shall be made from flat tin-plated copper.

2.11 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.12 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with ASTM D709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.13 TESTS, INSPECTIONS, AND VERIFICATIONS

2.13.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with TIA-568.1 and TIA-568.3. Use TIA-526-7 for single mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), shall meet the requirements of ICEA S-84-608. Enhanced performance air core OSP copper cables shall meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, NFPA 70, **21-010**, and as indicated. Provide all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system.

3.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable shall be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps shall remain intact on the reel until the cable is ready for placement.

3.1.3 Cable Protection

3.1.3.1 Cable End Caps

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.4 Underground Duct

Provide underground duct and connections to existing manholes, handholes, concrete pads, and existing ducts as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.5 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.6 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.7 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.7.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension **and breakaway swivel rated for manufacturers maximum cable pulling tension**. This tension shall not be exceeded.

3.1.7.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.7.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.8 Cable Splicing

3.1.8.1 Copper Conductor Splices

Perform splicing in accordance with requirements of RUS Bull 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.8.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with manufacturer's recommendation and shall exhibit an insertion loss not greater than 0.2 dB for fusion splices.

3.1.9 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meet the requirements of RUS Bull 1751F-815.

3.1.10 Grounding

Provide grounding and bonding in accordance with RUS 1755.200, TIA-607, IEEE C2, and NFPA 70. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.10.1 Primary Bonding Busbar (PBB)

The PPB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a PBB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.10.2 Incoming Cable Shields

Shields shall not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the PBB.

3.1.10.3 Campus Distributor Grounding

a. Protection assemblies: Mount CD protector assemblies directly on the telecommunications backboard. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to PBB.

b. PBB connection: Connect PBB to Secondary Bonding Busbar (SBB) with copper conductor with a total resistance of less than 0.01 ohms.

3.1.11 Cut-Over

All necessary transfers and cut-overs, shall be accomplished by the telecommunications contractor in coorddination with NCTS.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with TIA-606 and NCTS requirements. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using thermal ink transfer process.

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of telecommunications cable tag identifiers shall be in accordance with TIA-606 and NCTS requirements. Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with TIA-606 and NCTS requirements.

3.3 FIELD APPLIED PAINTING

Provide ferrous metallic enclosure finishes in accordance with the following procedures. Ensure that surfaces are dry and clean when the coating is applied. Coat joints and crevices. Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Apply primer and finish coat in accordance with the manufacturer's recommendations.

3.3.1 Cleaning

Clean surfaces in accordance with SSPC SP 6/NACE No.3.

3.3.2 Priming

Prime with a two component polyamide epoxy primer which has a bisphenol-A base, a minimum of 60 percent solids by volume, and an ability to build up a minimum dry film thickness on a vertical surface of 5.0 mils. Apply in two coats to a total dry film thickness of 5 to 8 mils.

3.3.3 Finish Coat

Finish with a two component urethane consisting of saturated polyester polyol resin mixed with aliphatic isocyanate which has a minimum of 50 percent solids by volume. Apply to a minimum dry film thickness of 2 to 3 mils. Color shall be the manufacturer's standard.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.5.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

3.5.1.1 Cable Capacitance

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

3.5.1.2 Loop Resistance

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.5.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least 5 working days before installation is to start. Results shall indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

3.5.2 Acceptance Tests

Perform acceptance testing in accordance with RUS Bull 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

3.5.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with TIA-758 OSP copper testing shall be conducted from the respective J-875 PET to the

respective ADN.:

a. Wire map (pin to pin continuity)

b. Continuity to remote end

c. Crossed pairs

d. Reversed pairs

e. Split pairs

f. Shorts between two or more conductors

3.5.2.2 Fiber Optic Cable

Test fiber optic cable in accordance with TIA/EIA-455 and as further specified in this section. OSP fiber testing shall be conducted from the respective J-875 OSP fiber optic patch panel to the respective ADN. Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multimode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

a. OTDR Test: The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 66 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with TIA-526-7 for single-mode fiber and TIA-526-14 for multimode fiber. Splice losses shall not exceed 0.3 db.

b. Attenuation Test: End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1310 and 1550 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with TIA-526-7 for single-mode fiber optic cables. The measurement method shall be in accordance with TIA-455-78-B.

c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with TIA/EIA-455-204.

3.5.3 Soil Density Tests

a. Determine soil-density relationships for compaction of backfill material in accordance with ASTM D1557, Method D.

3.5.4 Final Verification Test

All strands of fiber optic cabling and all pairs of copper cabling installed by this contract shall be tested and found to be complete and useable. If any of the strands or copper pairs are found not to be complete and useable the entire cable shall be replaced at no cost to the government.

-- End of Section --