



eProjects
Work Order Number(s):
1564839
Appropriation:

F-35B Lift System Repair Facilities

At the

MARINE CORPS AIR STATION CHERRY POINT, NC

DESIGNED BY:

MBF ARCHITECTS, PA
317-C POLLOCK STREET
NEW BERN, NC 28560

SPECIFICATION PREPARED BY:

Architectural: MBF Architects, Darden J. Eure, III
Civil: Avolis Engineerings, PA, Kevin Avolis
Structural: Kaydos-Daniels Engineering, PLLC, Lucas Gelo
Mechanical/Plumbing/Electrical: Crenshaw Consulting Eng., Jeff Roseman
Fire Prot.: Jensen Hughes, Alison Wakelin
Specification: Robert T. Belangia, MBF Architects

Date: 1 May 2018 **100% Final**

SPECIFICATION APPROVED BY:

For Commander, NAVFAC MID-ATLANTIC:
Date:

This page is intentionally left blank.

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	SUMMARY OF WORK
01 14 00	WORK RESTRICTIONS
01 20 00.00 20	PRICE AND PAYMENT PROCEDURES
01 30 00	ADMINISTRATIVE REQUIREMENTS
01 32 17.00 20	NETWORK ANALYSIS SCHEDULES (NAS)
01 33 00	SUBMITTAL PROCEDURES
01 33 29	SUSTAINABILITY REPORTING
01 35 26	GOVERNMENTAL SAFETY REQUIREMENTS
01 45 00.00 20	QUALITY CONTROL
01 50 00	TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
01 57 13.00 22	EROSION AND SEDIMENT CONTROL
01 57 19.00 20	TEMPORARY ENVIRONMENTAL CONTROLS
01 57 19.01 20	SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS
01 58 00	PROJECT IDENTIFICATION
01 60 00.00 22	REQUIREMENTS FOR PESTICIDE AND HERBICIDE COORDINATION
01 74 19	CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT
01 78 00	CLOSEOUT SUBMITTALS
01 78 23	OPERATION AND MAINTENANCE DATA
01 78 24.00 20	FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI)
01 78 30.00 22	GIS DATA DELIVERABLES

DIVISION 02 - EXISTING CONDITIONS

02 41 00	DEMOLITION
02 51 00	SURFACE CLEANING DECONTAMINATION

DIVISION 03 - CONCRETE

03 30 00	CAST-IN-PLACE CONCRETE
----------	------------------------

DIVISION 05 - METALS

05 30 00	STEEL DECKS
05 40 00	COLD-FORMED METAL FRAMING
05 50 13	MISCELLANEOUS METAL FABRICATIONS
05 52 00	METAL RAILINGS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 41 16.00 10	PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
06 61 16	SOLID SURFACING FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 21 16	MINERAL FIBER BLANKET INSULATION
07 84 00	FIRESTOPPING
07 92 00	JOINT SEALANTS

DIVISION 08 - OPENINGS

08 11 13	STEEL DOORS AND FRAMES
08 33 23	OVERHEAD COILING DOORS
08 71 00	DOOR HARDWARE
08 81 00	GLAZING

08 91 00 METAL WALL LOUVERS

DIVISION 09 - FINISHES

09 22 00 SUPPORTS FOR PLASTER AND GYPSUM BOARD
09 29 00 GYPSUM BOARD
09 65 00 RESILIENT FLOORING
09 90 00 PAINTS AND COATINGS

DIVISION 10 - SPECIALTIES

10 14 00.20 INTERIOR SIGNAGE
10 21 13 TOILET COMPARTMENTS
10 22 13 WIRE MESH PARTITIONS
10 26 00 WALL AND DOOR PROTECTION
10 28 13 TOILET ACCESSORIES
10 44 16 FIRE EXTINGUISHER CABINETS
10 56 13 STEEL SHELVING

DIVISION 13 - SPECIAL CONSTRUCTION

13 34 19 METAL BUILDING SYSTEMS

DIVISION 21 - FIRE SUPPRESSION

21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
21 13 16.00 20 DRY-PIPE FIRE SPRINKLER SYSTEMS

DIVISION 22 - PLUMBING

22 00 00 PLUMBING, GENERAL PURPOSE

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

23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS
23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND
EQUIPMENT
23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS
23 09 23.13 22 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
23 11 25 FACILITY GAS PIPING
23 23 00 REFRIGERANT PIPING
23 81 00.00 20 UNITARY AIR CONDITIONING EQUIPMENT

DIVISION 26 - ELECTRICAL

26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS
26 08 00 APPARATUS INSPECTION AND TESTING
26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS
26 20 00 INTERIOR DISTRIBUTION SYSTEM
26 27 14.00 20 ELECTRICITY METERING
26 51 00.00 22 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING

DIVISION 27 - COMMUNICATIONS

27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM

DIVISION 31 - EARTHWORK

31 23 00.00 20 EXCAVATION AND FILL
31 66 13 HELICAL PILES AND HELICAL ANCHORS

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 11 23 AGGREGATE BASE COURSES
32 11 26.16 BITUMINOUS CONCRETE BASE COURSE

DIVISION 33 - UTILITIES

33 11 00 WATER UTILITY DISTRIBUTION PIPING
33 30 00 SANITARY SEWERS
33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION
33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

-- End of Project Table of Contents --

This page is intentionally left blank.

SECTION 01 11 00

SUMMARY OF WORK
07/16

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.

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-01 (2013, with Change 3) General Building Requirements

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1.3.1 Project Description

The work includes P 766 F-35B Lift Sytem Repair Facility and incidental related work.

1.3.2 Location

The work is located at the Marine Corps Air Station, Cherry Point, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.4 BUILDING CODE

Except as indicated otherwise, or as modified by UFC 1-200-01, use ICC IBC as the building code for this project.

1.5 OCCUPANCY OF PREMISES

Building(s) will be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area.

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.6 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.7 LOCATION OF UNDERGROUND UTILITIES

Contact local utility locating service a minimum of 48 hours prior to excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract drawings, within area of work.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground or encased obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.7.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 days prior to starting excavation work.

1.8 GOVERNMENT TELECOMMUNICATIONS CONTRACTOR COORDINATION REQUIREMENTS

1.8.1 Government Telecommunications Contractor Access

Allow the Government Telecommunications Contractor access to the facility towards the end of construction (finishes 90 percent complete, rough-in 100 percent complete, Inside Plant (ISP)/Outside Plant (OSP) infrastructure in place) to provide equipment in the telecommunications rooms and make final connections. Coordinate efforts with the Government Telecommunications Contractor to facilitate joint use of building spaces during the final phases of construction. After the Contracting Officer has facilitated coordination meetings between the two contractors, within one week, incorporate the effort of additional coordination with the Government Telecommunications Contractor into the construction schedule to demonstrate a plan for maintaining the contract duration.

1.9 PHASED CONSTRUCTION SCHEDULE

Within the overall project schedule, commence and complete the work in phases. Complete each phase of the work within the number of calendar days stated in the following schedule.

- a. Scheduled start day: The day designated as the beginning of a particular phase; the number listed is the number of calendar days from the award of contract.
- b. Completion day: The day designated as the end of a given phase and the day the work in that phase must be completed; the number listed is the number of calendar days from the award of contract.
- c. Schedule:

PHASE	DESCRIPTION	SCHEDULED START DAY	COMPLETION DAY
I	Building 4630	0	180
IIA	Building 4224 Corridor and North Rooms	181	271
IIB	Building 4224 High Bay and Mezzanine	285	450

- d. Construction of Phase "I" must be complete and accepted by the Contracting Officer before the Contractor begins Phase "IIA". Construction of Phase "IIA" must be complete and accepted by the Contracting Officer before the Contractor begins Phase "IIB".

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

This page is intentionally left blank.

SECTION 01 14 00

WORK RESTRICTIONS

07/16

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-01 Preconstruction Submittals

List of Contact Personnel; G

1.2 SPECIAL SCHEDULING REQUIREMENTS

- a. The nearby buildings and utilities will remain in operation during the entire construction period. The Contractor must conduct his operations so as to cause the least possible interference with normal operations of the activity.
- b. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 21 calendar days prior to the desired date of interruption, as required by FRCE.
- c. Government Telecommunications Contractor Access: The Government Telecommunications Contractor must be allowed access to the facility towards the end of construction (finishes 90 percent complete, rough-in 100 percent complete, Inside Plant (ISP)/Outside Plant (OSP) infrastructure in place) to provide equipment in the telecommunications rooms and make final connections. The Contractor will be required to coordinate their efforts with the Government Telecommunications contractor to facilitate joint use of building spaces during the final phases of construction and work the coordination effort into the construction schedule. Requirements for Government Telecommunications are specified in the contract documents.
- d. The work under this contract requires special attention to the scheduling and conduct of the work in connection with existing operations. Identify on the construction schedule each factor which constitutes a potential interruption to operations.

1.3 CONTRACTOR ACCESS AND USE OF PREMISES

1.3.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Mark Contractor equipment for identification.

1.3.1.1 Subcontractors and Personnel Contacts

Provide a [list of contact personnel](#) of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.1.2 Identification Badges and Installation Access

Application for and use of badges will be as directed. Obtain access to the installation by participating in the Navy Commercial Access Control System (NCACS), [also referred to as RAPIDGATE](#), or by obtaining passes each day from the Base Pass and Identification Office. Costs for obtaining passes through the NCACS are the responsibility of the Contractor. One-day passes, issued through the Base Pass and Identification Office, will be furnished without charge. Furnish a completed EMPLOYMENT ELIGIBILITY VERIFICATION (DHS FORM I-9) form for all personnel requesting badges. This form is available at <http://www.uscis.gov/portal/site/uscis> by searching or selecting Employment Verification (Form I-9). Immediately report instances of lost or stolen badges to the Contracting Officer.

- a. NCACS Program: NCACS is a voluntary program in which Contractor personnel who enroll, and are approved, are subsequently granted access to the installation for a period up to one year, or the length of the contract, whichever is less, and are not required to obtain a new pass from the Base Pass and Identification Office for each visit. The Government performs background screening and credentialing. Throughout the year the Contractor employee must continue to meet background screening standards. Periodic background screenings are conducted to verify continued NCACS participation and installation access privileges. Under the NCACS program, no commercial vehicle inspection is required, other than for Random Anti-Terrorism Measures (RAM) or in the case of an elevation of Force Protection Conditions (FPCON). Information on costs and requirements to participate and enroll in NCACS is available at <http://www.rapidgate.com> or by calling 1-877-727-4342. Contractors should be aware that the costs incurred to obtain NCACS credentials, or costs related to any means of access to a Navy Installation, are not reimbursable. Any time invested, or price(s) paid, for obtaining NCACS credentials will not be compensated in any way or approved as a direct cost of any contract with the Department of the Navy.
- b. One-Day Passes: Participation in the NCACS is not mandatory, and if the Contractor chooses to not participate, the Contractor's personnel will have to obtain daily passes, be subject to daily mandatory vehicle inspection, and will have limited access to the installation. The Government will not be responsible for any cost or lost time associated with obtaining daily passes or added vehicle inspections incurred by non-participants in the NCACS.

1.3.1.3 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.3.2 Working Hours

Regular working hours must consist of an 8 1/2 hour period established by the Contractor Officer, Monday through Friday, excluding Government holidays.

1.3.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays and Sundays.

1.3.4 Occupied Buildings

The Contractor shall be working in an existing building and around existing buildings which are occupied. Do not enter the buildings without prior approval of the Contracting Officer.

The existing buildings and their contents must be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the buildings during the construction period.

Relocate movable furniture approximately 6 feet away from the Contractor's working areas required to perform the work, protect the furniture, and replace the furniture in its original locations upon completion of the work.

The Government will remove and relocate other Government property in the areas of the buildings scheduled to receive work.

1.3.5 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required paragraph WORK OUTSIDE REGULAR HOURS.
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS.
- d. Operation of Station Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the

work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

- e. Connection to Existing Sanitary Sewer Line: Provide positive verification that the existing line conveys sanitary sewer; verify line is not incorrectly connected to a storm drain. Obtain Installation's Sanitary Sewer Connection Permit 2 weeks prior to connection and in accordance with Section 33 30 00 SANITARY SEWERS.

1.4 SECURITY REQUIREMENTS

Contract Clause "FAR 52.204-2, Security Requirements and Alternate II," "FAC 5252.236-9301, Special Working Conditions and Entry to Work Area," and the following apply:

1.4.1 Contractor Access to MCAS Cherry Point and Outlying Areas

No employee or representative of the Contractor will be admitted to the work site without an Identification Badge unless specifically authorized admittance to the worksite by the Contracting Officer.

Documentation requirements for granting access to MCAS Cherry Point for commercial and contract and employers and employees. This document is an aid in meeting ASO 5500.14_ requirements and is not a substitute for the order.

- a. Provide a list of employees (prime and/or sub-contractor) that require Station access on company letterhead and include the contract number and a copy of the "base access table" outlined in your contract. NOTE: This list should include employee names ONLY. Do NOT include other personally identifiable information (PII) such as Social Security Number, Date of Birth, etc.. Contractors who are hired for a period more than 30 days will be issued a contractor's badge after the conditions outlined in this document are met. The badge must be carried in plain view or readily accessible at all times while on Station. All badges will be issued for a period **NOT TO EXCEED ONE YEAR** regardless of the length of the contract. Upon the expiration of the badge, the company/employee will provide a new 50 state/national criminal records check and LRC prior to being re-badged.

For any access from 1 day to less than 30 days, employers will provide the same documentation as stated above. In place of a badge a copy of this letter with the worker's name highlighted, stamped with the "Pass & ID" stamp, "Criminal Records Check (CRC) Sighted", and we will also annotate below the stamps the following statement: "Valid until (expiration date) then date and initial it." This document will be issued to each worker and IS their authorization to be aboard the installation. This letter must be carried on their person or readily accessible at all times while on Station.

- b. Contractor personnel requesting access to MCAS Cherry Point must complete and sign the attached Local Records Check (LRC) Form.
- c. Contractor personnel requesting access to MCAS Cherry Point can personally deliver the (original) LRC and the national background check to MCAS Pass & ID 2 full work days prior to requiring a badge or you may send the completed LRC (original) form to include the national background check in via **U.S. Mail only** to arrive 2 to 5 days prior to your arrival. Address: Provost Marshal, Attn: Pass & ID Office,

Marine Corps Air Station, Cherry Point, NC 28533-0035 or Provost Marshal's Office, Postal Service Center Box 8035, Marine Corps Air Station, Cherry Point, North Carolina 28533-0035. SSN and photo ID will be verified at this time. NOTE: Due to the sensitivity of the personal information contained in the LRC Release, these documents CAN NOT be faxed or e-mailed to MCAS Pass & ID per Air Station Order 5500.14.

In order to get a badge, you must be present, as it is photo badge.

If the vetting process works correctly, we should have your approved paperwork on hand pending your arrival.

- d. MCAS Pass & ID will complete the local records check prior to contractor arriving for badging. If negative results are found, the sponsoring company (prime contractor) will be notified. NOTE: LRC's are only valid for 15 days, therefore the contractor must receive their badge within 15 days or they will have to resubmit the paperwork.
- e. Individual Contractor Personnel report to Pass & ID for badging according to the following schedule:

LRC & Background Check Submitted: Earliest Badging Opportunity:

Monday	Thursday
Tuesday	Friday
Wednesday	Monday (the following week)
Thursday	Tuesday (the following week)
Friday	Wednesday (the following week)

- f. Individual Contractor Personnel MUST bring the following documents when reporting to Pass & ID for badging:

- Copy of LRC release previously submitted above.
- Picture ID (typically a driver's license).
- Social Security Card or official document listing SSN.
- Birth Certificate or Passport to verify citizenship.
- If NOT US citizen, provide proof of immigration status.
- Copy of 50-State Background Check (must be less than 30-days old).

IMPORTANT NOTE:

FEAD personnel (Construction Managers, Engineering Techs, or Contract Specialists) and FSC personnel (Contract Surveillance Reps) will not receive, process, re-transmit or otherwise handle in any way PII information related to the badging process. Do NOT forward any of this information to **FEAD** or FSC.

- g. All employers/employees must provide a CRC from any Internet investigative service or any other investigative service company that provides a 50 state/national criminal records check and a check of the Sexual Offenders List. (Local county/state checks are not authorized and will not be accepted.) This records check must be a "complete" check covering the period from at the minimum their 18th birthday to present. The CRC must also have a statement in the records check that this is a "national records check" or the terminology the agency uses to indicate such. Please be sure of what you are requesting. If it is anything less than a national check, it will be rejected. The CRC can not be more than 30 days old at the time it is presented to Pass & ID personnel. CRCs may be obtained from, but not limited to the following

sources (*):

1. www.sentrylink.com
2. www.integrascan.com
3. www.criminalwatchdog.com
4. www.intellicorp.net
5. www.castlebranch.com
6. www.peoplescanner.com
7. www.krollbackgroundscreening.com
8. www.backgroundchecks.com
9. www.instantpeoplecheck.com
10. www.americanbackground.com
11. www.lexisnexis.com

Cost of a background check can vary anywhere from \$19 to \$60 based on the type or amount of services requested. Minimum information required for a background check is the individual's last name, first name, middle name (optional) and date of birth, which must match exactly with your name and DOB on your driver's license or state ID. A social security number verification is also available at an additional cost.

- h. In accordance with ASO 5500.14_ (not an all inclusive list), access will be denied if the individual:
 1. Is on the National Terrorist Watch List.
 2. Is illegally present in the United States.
 3. Is currently debarred or banned from military installations.
 4. Is a registered sex offender or been convicted of any child abuse or related offense(s).
 5. Is a convicted felon within the past 5 years.
 6. Convicted of any drug offense within the past 5 years.
 7. Is subject to an outstanding warrant or is currently pending trial.
 8. Has knowingly submitted a false/fraudulent employment questionnaire.
 9. Any reason the Installation Commander deems reasonable for good order & discipline.
 10. Individuals convicted of a DUI/DWI within the past year will be allowed aboard but not be permitted to drive.
- i. Picture ID from a state or federal agency (i.e., valid driver's license or state identification card).
- j. **Social Security Card** or any official document listing the SSN (letter from Social Security Administration listing the SSN, W-2 (tax form), DD-214, pay stub listing complete SSN). An additional source may be through the Internet with E-Verify.
- k. Birth certificates and passports are used when necessary to verify citizenship and are never used as a means to verify social security numbers.
- l. If the employee is not a U.S. Citizen, **PROOF OF IMMIGRATION STATUS** must be provided and carried on their person or be readily accessible at all times while on station. Proof must also be provided if an individual is a naturalized U.S. citizen.
- m. Due to recent changes with Privacy laws, please do not include social security numbers in the company letters being sent to this office. Additionally, all criminal record checks must be hand carried by the

individual worker or brought in by the supervisor.

- n. As of 19 December 2007 security clearances are no longer valid as a means for requesting access to the installation. All personnel hired as commercial or contractor employees to work for a company aboard the installation will be required to provide a 50 state/national criminal check.
- o. The changes in this document are effective as of 29 February 2012.

Note: Until further notice, ID cards and vehicle passes issued to contractors at Camp Lejeune and New River are not valid at Cherry Point without a 50 state/national CRC in their possession at the time they are requesting access at MCAS Cherry Point.

(*) The United States Government and the United States Marine Corps does not endorse nor are they affiliated with any of the screening services mentioned above. We must be able to verify/validate the information contained in the CRC via telephone. If we are unable to validate the CRC the clearance information will not be accepted.

(**) Due to recent developments concerning the screening services of **Criminal CBS** (also DBA **US Criminal Checks, INC**), **Net Detective**, and **ABI (Accurate Background Investigations)**, they are no longer authorized as a means for entry at MCAS Cherry Point.

Questions on these revised procedures should be addressed directly with Pass & ID personnel at CHPT_PASS-ID_OMB@USMC.MIL or 252-466-4683/5921.

1.4.1.1 Motor Vehicle Operation

Ingress and egress of personnel will be subject to the security regulations of the Station.

- a. All personnel must be made aware of the base speed limits:
 - Housing areas 5 mph
 - Parking areas 10 mph
 - All other areas 25 mph (unless otherwise posted)
- b. Parking is in designed areas only, between two white lines. No parking is permitted in fire lanes, on grass or planted areas, in parking slots reserved for general officers and handicapped personnel.
- c. Traffic accidents should be reported immediately to the Station Security Department by calling 252-466-4366.
- d. All personnel entering the installation are subject to random vehicle inspections. The purpose of these inspections is to detect the theft of Government and private property, and to detect weapons, contraband or illegal drugs.
- e. Vehicle Passes/Required Information on Privately Owned Vehicles - Advise company employees who desire to use their privately owned vehicles to personally bring the vehicle, vehicle registration, copy of vehicle insurance policy, valid state inspection documentation, and driver's license to the Main Gate Vehicle Pass Office, Building B-250, telephone 252-466-5921.

- f. Access to Restricted Areas - Base entry passes allow access to designated areas on the installation only. Entry into off limits areas is prohibited unless the contract requires it.
- g. Current Information - Contractors will be responsible for keeping the vehicle and employee lists current, and for securing and returning identification cards belonging to terminated employees to the Contracting Officer.
- h. Station Entry/Visitor Passes - Contractor station entry passes will be valid for each entry aboard Marine Corps Air Station, Cherry Point from 6:00 a.m. to 6:00 p.m., Monday through Friday only, unless prior arrangements have been made with the Facilities Engineering and Acquisition Division (FEAD) Cherry Point, and the Provost Marshall Officer (PMO), Marine Corps Air Station, Cherry Point, has been notified. The passes are the property of the station and are to be returned to Visitors Control at the Main (East) Gate upon completion of the contract or termination of employment. Replacement passes must be requested in writing and be accomplished by written authorization from the Contracting Officer. Visitor Passes will be issued from the Main Gate Visitor Pass Office, Building B-250, telephone 252-466-3330.
- i. Providing Information to Subcontractors - Prime Contractors are responsible for ensuring that subcontractors receive security information. Failure to comply with the specified requirements will result in prime contractors and subcontractors being denied access to the construction site.

1.4.1.2 Security Of Contractor-Owned Equipment And Materials

The Contractor is responsible for control and security of Contractor-owned equipment and materials at the work site. Report immediately, missing/lost/stolen property to the Station Security Department as each case occurs.

1.4.2 Fleet Readiness Center East (FRC East), Cherry Point, North Carolina

Contractor personnel are required to obtain personnel identification badges. Submit, in triplicate, a list of his subcontractors and the work each is to perform. On this listing shall appear the names of the key personnel of the Contractor and subcontractors. A copy of the list of key personnel shall be forwarded to the Fleet Readiness Center East (FRC East) Cherry Point Security Department and MCAS Cherry Point Provost Marshall Officer (PMO) by the Contracting Officer. The key personnel shall be responsible for identifying other Contractor and subcontractor personnel for the purpose of obtaining identification badges. Contractors working in restricted work areas shall also be required to obtain special identification badges for personnel requiring access to the restricted work areas. Immediately after award, the submit a letter to the Contracting Officer with the following information for each employee: Company name, employee's name, birthplace (city/state/country), birth date, Social Security number, height, and weight. Also, indicate the names of persons authorized to vouch for additional employees requiring badges.

All Contractor and subcontractor personnel are required to be legal resident citizens of the United States of America in order to gain access into the secure Fleet Readiness Center East (FRC East) compound, and proof of citizenship may be required for persons whose submitted personal data contains any discrepancies. Legal resident alien (non-citizens) personnel

may be permitted access inside the secure Fleet Readiness Center East (FRC East) compound if, in addition to aforementioned personal data, legal documentation (work visas, green card) are furnished for prior Fleet Readiness Center East (FRC East) Cherry Point Security Department review. Such persons may be barred from entering the secure Fleet Readiness Center East (FRC East) compound for any reason at the discretion of the Fleet Readiness Center East (FRC East) Cherry Point Security Department.

Additional requirements include:

- a. Contractor responsibility for employees. The Contractor is responsible for employees under his employment. Ensure that employees are familiar with and obey station traffic, safety, and security regulations, as well as all security and area access procedures inside the Fleet Readiness Center East (FRC East) Complex. Special security measures to be obeyed inside the Fleet Readiness Center East (FRC East) complex are available from:

Fleet Readiness Center East (FRC East) Security Department
Attention: Security Chief
PSC Box 8021
Cherry Point, NC 28533-0021

Tel. (252) 464-8018
Fax: (252) 464-7843

- b. Motor Vehicle Operation - Ingress and egress of personnel will be subject to the security regulations of the Station.
- c. Foreign Object Damage (FOD) Control: Demolition, alteration and construction operations under this contract will be performed in proximity to the Cherry Point airstrip, access runways, and airstrip access streets. Exercise due care at all times for entire duration of this contract to prevent materials, debris, trash or other items from creating hazards to aircraft and vehicles. Inspect all exterior grade surfaces areas and streets accessible to the airstrip and access runways within the security perimeter of this project.
- d. Safety glasses with side-shields and safety shoes are the minimum personal protective equipment (PPE) required in all industrial shops unless it is specifically exempted on the Shop Hazard Assessment available on the Safety Intranet web page. Sunglasses, even if ANSI approved, are not to be worn inside. The requirement for safety shoes and glasses is "at all times" not just when employees are doing hazardous processes. Hearing protection is required at all times in the shops designated 100 percent hearing protection and whenever noise hazards are encountered. These requirements apply to all personnel entering the industrial shops. The only exempted areas are the main transportation aisles in buildings 133 and 137 that non-industrial workers must travel through to get to their work stations, payroll, and the eatery. Aisles that cut through industrial shops are included in the PPE requirement. These safety requirements are applicable only to the extent that they exceed requirements specified elsewhere in this specification. The most stringent requirement shall prevail.

1.4.2.1 Additional Security Requirements

- a. The Contractor is hereby notified that several areas of MCAS Cherry Point are designated hazardous, dangerous, or secure due to ongoing

military and aircraft operations. These areas are clearly identified by security fencing, warning signs or other means. The Contractor will bear full responsibility for Contractor's and subcontractors' personnel remaining clear of, and not entering, such areas at all times.

- b. Photography is prohibited on-board the Marine Corps Air Station Cherry Point, and is illegal (a serious, punishable offense) inside the secure Fleet Readiness Center East (FRC East) Cherry Point Compound. Cameras, video recording devices, and cell phones of any kind are strictly prohibited within the secure Fleet Readiness Center East (FRC East) compound at all times. Radios of certain type may be permitted within certain areas of the secure Fleet Readiness Center East (FRC East) compound, but only for use on specific frequencies approved by Fleet Readiness Center East (FRC East) and MCAS Cherry Point. Radio use within electronically sensitive areas of the secure Fleet Readiness Center East (FRC East) compound shall be prohibited at all times.
- c. When operationally required, submit a written request containing specific justification and details to the Contracting Officer for review by the Fleet Readiness Center East (FRC East) Security Officer at least three working days prior to needed photography. Photography, when justified, shall be performed only by the official Fleet Readiness Center East (FRC East) Cherry Point photographer during regular business hours.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --



UNITED STATES MARINE CORPS

PROVOST MARSHAL'S OFFICE
POSTAL SERVICE CENTER BOX 8035
MARINE CORPS AIR STATION
CHERRY POINT, NORTH CAROLINA 28533-0035

IN REPLY REFER TO:
5512
PMO

From: Pass & Identification Office
To: (1) PMO Records Manager
(2) Criminal Investigation Division Office

Subj: Request for Local Records check for the below named individual.

Ref: ASO 5500.14

Attach: (1) Individual 50 State Criminal History Report
(2) Authorization to Release of Information (back of this page)

1. The following information is provided for pending access aboard MCAS, Cherry Point, NC

FULL NAME: _____

FULL SSN: _____

COMPANY/SPONOR'S NAME: _____

DATE OF BIRTH: _____

CURRENT ADDRESS: _____

CONTACT PHONE NUMBER: _____

SIGNATURE: _____

PMO / CID USE ONLY

Provost Marshal's Office

Date: _____

Time: _____

Results: _____

Name of Processor _____

PMO RECORDS

TLO VERIFIED (DATE/TIME/INITIALS) _____

Provost Marshal's Office

Date: _____

Time: _____

Results: _____

Name of Processor _____

Criminal Investigation Division

INDIVIDUAL CONTACTED (DATE/TIME/INITIALS): _____

☐

APPROVED

☐

DENIED

APPROVAL OFFICIAL SIGNATURE

Authorization for Release of Information

Carefully read this authorization to release information about you, then sign and date it in ink.

I Authorize any investigator, special agent, or other duly accredited representative of the OPM, the Federal Bureau of Investigation, the Department of Defense, the Department of State, and any other authorized Federal agency, to request criminal record information about me from criminal justice agencies for the purpose of determining my eligibility for requesting access to the facilities aboard Marine Corps Air Station Cherry Point N.C.

I Authorize custodians of records and other sources of information pertaining to me to release such information upon request of the investigator, special agent, or other duly accredited representative of any Federal agency authorized above regardless of any previous agreement to the contrary.

I Understand that, for some sources of information, a separate specific release will be needed, and I may be contacted for such a release at a later date.

I Understand that the information released by records custodians and sources of information is for official use by the Federal Government only for the purpose provided above, and it may be disclosed by the Government only as authorized by law.

Photocopies of this authorization that show my signature are NOT VALID

Signature(sign in ink)	Full Name (First, Middle, Last)	Date Signed (mm/dd/yyyy)
Other Names Used	Date of Birth	Social Security Number
Current Street Address	City, State, Zip Code	Contact Telephone Number

SECTION 01 20 00.00 20

PRICE AND PAYMENT PROCEDURES

09/15

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)

EP-1110-1-8

(2009) Construction Equipment Ownership
and Operating Expense Schedule

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 Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

EARNED VALUE REPORT; G

1.3 EARNED VALUE REPORT

1.3.1 Data Required

This contract requires the use of a cost-loaded Network Analysis Schedule (NAS). The information required for the Schedule of Prices will be entered as an integral part of the Network Analysis Schedule. Within 15 calendar days of notice of award, prepare and deliver to the Contracting Officer an Earned Value Report (construction contract) as directed by the Contracting Officer. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices. Costs shall be summarized and totals provided for each construction category.

1.3.2 Schedule Instructions

Payments will not be made until the Earned Value Report from the cost-loaded NAS has been submitted to and accepted by the Contracting Officer. Identify the cost for site work, and include incidental work to the 5 ft line. Identify costs for the building(s), and include work out to the 5 ft line. Work out to the 5 ft line shall include construction encompassed within a theoretical line 5 ft from the face of exterior walls and shall include attendant construction, such as pad mounted HVAC cooling equipment, cooling towers, and transformers placed beyond the 5 ft line.

1.3.3 Real Property Assets

Real Property Assets identified in Section 01 78 00 CLOSEOUT SUBMITTALS, Paragraph "REAL PROPERTY RECORD" apply to work covered by this

specification.

Cost data accumulated under this section are required in the preparation of DD Form 1354. Coordinate with Section 01 78 00 CLOSEOUT SUBMITTALS, Paragraph "REAL PROPERTY RECORD".

NOTE: Real Property Unique Identifiers (RPUID's) will be provided by the Government but may not be available until later in the project schedule. Coordinate receipt of the RPUID's with the Contracting Officer and the Real Property Accounting Officer. Temporary RPUID's may be required until the actual RPUID's can be provided.

The Government will provide the Draft DD Form 1354, Transfer and Acceptance of Military Real Property filled in with the appropriate **construction Category Codes** to summarize the designed real property assets that apply to this contract. The Contractor shall meet with the Contracting Officer and the Real Property Accounting Officer during the Pre Construction Meeting and the Project Closeout Meetings to modify and include any necessary changes to the DD Form 1354. **The Contractor shall obtain related Real Property Unique Identifiers (RPUID's) from the Real Property Accounting Officer during or following the Pre Construction Meeting.** The Contractor shall provide the Interim DD Form 1354 that uses the appropriate division of the **RPUID's/ Category Codes** to represent the final constructed facility and include all associated cost. Coordinate the Contractor's Price and Payment structure with the structure of the **RPUID's/ Category Codes**.

Divide detailed asset breakdown into the **RPUID's** and related construction Category Codes and populate associated costs which represent all aspects of the work. Where assets diverge into multiple **RPUID's/ Category Codes**, divide the asset and provide the proportion of the assets in each **Facility Number/ Category Code**. Assets and related **RPUID's/ Category Codes** may be modified by the Contracting Officer as necessary during course of the work. Coordinate identification and proportion of these assets with the Government Real Property Accounting Officer.

1.3.4 Schedule Requirements for HVAC TAB

The field work Section 23 05 93 **TESTING, ADJUSTING AND BALANCING FOR HVAC** shall be broken down in the **Earned Value Report from the cost-loaded NAS** by separate line items which reflect measurable deliverables. Specific payment percentages for each line item shall be determined on a case by case basis for each contract. The line items shall be as follows:

- a. Approval of Design Review Report: The TABS Agency is required to conduct a review of the project plans and specifications to identify any feature, or the lack thereof, that would preclude successful testing and balancing of the project HVAC systems. The resulting findings shall be submitted to the Government to allow correction of the design. The progress payment shall be issued after review and approval of the report.
- b. Approval of the pre-field engineering report: The TABS Agency submits a report which outlines the scope of field work. The report shall contain details of what systems will be tested, procedures to be used, sample report forms for reporting test results and a quality control checklist of work items that must be completed before TABS field work commences.
- c. Season I field work: Incremental payments are issued as the TABS field

work progresses. The TABS Agency mobilizes to the project site and executes the field work as outlined in the pre-field engineering report. The HVAC water and air systems are balanced and operational data shall be collected for one seasonal condition (either summer or winter depending on project timing).

- d. Approval of Season I report: On completion of the Season I field work, the data is compiled into a report and submitted to the Government. The report is reviewed, and approved, after ensuring compliance with the pre-field engineering report scope of work.
- e. Completion of Season I field QA check: Contract QC and Government representatives meet the TABS Agency at the jobsite to retest portions of the systems reported in the Season I report. The purpose of these tests are to validate the accuracy and completeness of the previously submitted Season I report.
- f. Approval of Season II report: The TABS Agency completes all Season II field work, which is normally comprised mainly of taking heat transfer temperature readings, in the season opposite of that under which Season I performance data was compiled. This data shall be compiled into a report and submitted to the Government. On completion of submittal review to ensure compliance with the pre-field engineering report scope, progress payment is issued. Progress payment is less than that issued for the Season I report since most of the water and air balancing work effort is completed under Season I.

1.4 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause "DFARS 252.236-7000, Modification Proposals-Price Breakdown," and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, equipment use rates shall be based upon the applicable provisions of the [EP-1110-1-8](#).

1.5 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

1.5.1 Content of Invoice

Requests for payment will be processed in accordance with the Contract Clause FAR 52.232-27, Prompt Payment Construction Contracts and FAR 52.232-5, Payments Under Fixed-Price Construction Contracts. The requests for payment shall include the documents listed below.

- a. The Contractor's invoice.
- b. The Earned Value Report from the cost-loaded NAS, showing in detail: the estimated cost, percentage of completion, and value of completed performance for each of the construction categories stated in this contract.
- c. Updated Project NAS and reports required by the contract.
- d. Contractor Safety Self Evaluation Checklist.
- e. Other supporting documents as requested.
- f. Updated copy of submittal register.

- g. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies.
- h. Affidavit to accompany invoice (LANTDIV NORVA Form 4-4235/4 (Rev.5/81)).
- i. Materials on Site.

1.5.2 Submission of Invoices

If NFAS Clause 5252.232-9301 is included in the contract, the listed documents shall be provided as attachments in Wide Area Work Flow (WAWF). The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction it shall be provided as instructed by the Contracting Officer.

Monthly invoices and supporting forms for work performed through the anniversary award date of the contract shall be submitted to the Contracting Officer within 5 calendar days of the date of invoice. For example, contract award date is the 7th of the month, the date of each monthly invoice shall be the 7th and the invoice shall be submitted by the 12th of the month.

1.5.3 Final Invoice

- a. A final invoice shall be accompanied by the Contractor's Final Release. If the Contractor is incorporated, the Final Release shall contain the corporate seal. An officer of the corporation shall sign and the corporate secretary shall certify the Final Release.
- b. For final invoices being submitted via WAWF, the original Contractor's Final Release Form must be provided directly to the respective Contracting Officer prior to submission of the final invoice. Once receipt of the original Final Release Form has been confirmed by the Contracting Officer, the Contractor shall then submit final invoice and attach a copy of the Final Release Form in WAWF.
- c. Final invoices not accompanied by the Contractor's Final Release will be considered incomplete and will be returned to the Contractor.

1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor which comply with the requirements of this section, and will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this contract will, at the discretion of the Contracting Officer, be subject to reductions and/or suspensions permitted under the FAR and agency regulations including the following in accordance with "FAR 32.503-6:

- a. Reasonable deductions due to defects in material or workmanship;
- b. Claims which the Government may have against the Contractor under or in connection with this contract;

- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and
- d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings."

1.6.2 Payment for Onsite and Offsite Materials

Progress payments may be made to the contractor for materials delivered on the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions:

- a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.
- b. Materials delivered on the site but not installed, including completed preparatory work, and off-site materials to be considered for progress payment shall be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the construction site. Examples of materials acceptable for payment consideration include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings, precast/prestressed concrete products, plastic lumber (e.g., fender piles/curbs), and high-voltage electrical cable. Materials not acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.
- c. Materials to be considered for progress payment prior to installation shall be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with **Earned Value Report** requirement of this contract. Requests for progress payment consideration for such items shall be supported by documents establishing their value and that the title requirements of the clause at FAR 52.232-5 have been met.
- d. Materials are adequately insured and protected from theft and exposure.
- e. Provide a written consent from the surety company with each payment request for offsite materials.
- f. Materials to be considered for progress payments prior to installation shall be stored **in the Continental United States**.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

This page is intentionally left blank.

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

02/17

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 (2014) Safety and Health Requirements
Manual

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View Location Map; G

Progress and Completion Pictures; G

1.3 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.

1.4 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 views from points located 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. Cross reference submittals in the appropriate daily report. Photographs provided are for unrestricted use by the Government.

1.5 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 [State](#) law.

1.6 FIRST TIER CONTRACTOR REQUIREMENTS FOR SPACE TEMPERATURE CONTROL, HVAC TAB, AND APPARATUS INSPECTION

All contract requirements of [Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC](#) [Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC](#) and [Section 26 08 00 APPARATUS INSPECTION AND TESTING](#) shall be accomplished directly by a first tier subcontractor. No work required by [Section 23 09 23.13 2023 05 93](#) or [26 08 00](#) shall be accomplished by a second tier subcontractor.

1.7 SUPERVISION

1.7.1 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.

1.7.2 Superintendent Qualifications

The project superintendent must have 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.

For routine projects where the superintendent is permitted to also serve as the Quality Control (QC) Manager as established in [Section 01 45 00.00 20 QUALITY CONTROL](#), the superintendent must have qualifications in accordance with that section.

1.7.2.1 Duties

The project superintendent is primarily responsible for managing and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend [NAVFAC 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.

1.7.3 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 insure 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 for excess costs or damages by the Contractor.

1.8 PRECONSTRUCTION MEETING

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule of prices or earned value report, shop drawings, and other submittals, scheduling programming, prosecution of the work, and clear expectations of the "Interim DD Form 1354" Submittal. Major subcontractors who will engage in the work must also attend.

1.9 FACILITY TURNOVER PLANNING MEETINGS (NAVFAC Red Zone - NRZ)

Meet with the Government to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start the turnover process at the Pre-Construction Conference meeting with a discussion of the NAVFAC Red Zone (NRZ) process and convene at regularly scheduled NRZ Meetings. See attached NAVFAC Red Zone Facility Turnover Planning Meeting AGENDA for typical meeting agenda. Include the following in the facility Turnover effort:

1.9.1 NRZ Checklist

- a. Contracting Officer's Technical Representative (COTR) will provide the Contractor a copy of the NRZ Checklist template prior to 75 percent completion. See attached NRZ Checklist Items.
- b. Prior to 75 percent completion add/delete critical activities to the NRZ Checklist template as necessary to match the project scope, and schedule critical activities and insert planned completion dates in the NRZ checklist for each critical activity. Present the NRZ Checklist to COTR and review during a regularly scheduled QC Meeting.

1.9.2 Meetings

- a. Upon Government acceptance of the NRZ Checklist, the Project Superintendent is required to lead regular NRZ 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 determine the frequency of the meetings, which is expected to increase as the project completion draws nearer.
- c. Using the NRZ 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. Coordinate with the COTR any upcoming activities that require Government involvement.
- e. Maintain the NRZ Checklist by documenting the actual completion dates as work is completed and update the NRZ Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current NRZ Checklist to attendees at each NRZ Meeting.

1.9.3 Facility Turnover Planning Meeting Attendees

The following key personnel are to attend the Facility Turnover Meetings: Contractor QC Manager, Superintendent, Major Subcontractors, Designer-of-Record, Contracting Officer's Representative, Representative(s) of NAVFAC, the Facility Owner, and the Client.

1.10 PARTNERING

To most effectively accomplish this contract, the Government requires the formation of a cohesive partnership within the Project Team whose members are from the Government, the Contractor and their Subcontractors. Key personnel from the Supported Command, the End User (who will occupy the facility), the Government Design and Construction team and Subject Matter Experts, the Installation, the Contractor and Subcontractors, and the Designer of Record will be invited to participate in the Partnering process. The Partnership will draw on the strength of each organization in an effort to achieve a project that is without any safety mishaps, conforms to the Contract, and stays within budget and on schedule.

The Contracting Officer will provide Information on the Partnering Process and a list of key and optional personnel who should attend the Partnering meeting.

1.10.1 Formal Partnering

Provide and host the Partnering sessions with key personnel of the Project Team, including Contractor personnel and Government personnel. Pay all costs associated with the Partnering effort including the Facilitator, the meeting room, and other incidental items. In exception, each participant bears their own costs for meals, lodging, and transportation associated with the Partnering sessions.

Before a Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note paper, pens/pencils, colored flash cards), and have these items available at the Partnering session. Provide copies of documents for distribution to all attendees. Provide a Facilitator experienced in conducting Partnering Workshops, and who is acceptable to both the Government and the Contractor. The Facilitator is responsible for leading the team in a timely manner and making sure that issues are identified and resolved. A list of Partnering Facilitators is available from the Contracting Officer.

- a. Schedule the Initial Partnering Session for a duration of one day minimum. Locate this session at a place off the construction site, as agreed to by the Contracting Officer and the Contractor. It may take place concurrently with the Pre-Construction Meeting.
- b. Schedule follow-on Partnering Session(s) for a maximum of 4 hours. Schedule them at no more than 3 to six month intervals. Participants are encouraged to utilize electronic means to expedite meetings. Meetings may be held at a location off-Base, at the project site, or in a Government Facility on Base. Follow-on meetings may be held concurrently with other scheduled meetings. Attendees need only be those required to resolve current issues. Recommend using the same Facilitator from the Initial Partnering session to achieve best results and for continuity.

1.11 ELECTRONIC MAIL (E-MAIL) ADDRESS

Establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments as text files, pdf files, and other similar formats. Within 10 days after contract award, provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes or terrorist threats. Multiple email addresses are not allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). Promptly notify the Contracting Officer, in writing, of any changes to this email address.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

This page is intentionally left blank.

NAVFAC Red Zone Facility Turnover Planning Meeting

AGENDA

I. Introduction and Overview – Purpose

CM

The purpose of the Facility Turnover Planning Meeting is to address elements within the project team's purview – schedule management, assure completed facility complies with contract requirements, and other contractual issues. Each member of the project delivery team (Client, NAVFAC, and the contractor) has critical responsibilities to ensure timely completion and turnover of the new facility and each member should execute the NRZ process to achieve this end. The NRZ process provides a final re-focusing of attention to details of those key elements critical for a successful construction contract completion. In implementing NRZ processes, the NAVFAC/Contractor/Client team take a collective “snapshot” of contract status, identifying remaining actions to be accomplished, and confirm required resources needed for successful contract completion and turnover to the Client.

The Facility Turnover Planning Meeting is a collaborative effort between the Client, NAVFAC, and the contractor and results in a completed “NRZ Checklist/POAM Items” list that identifies the major items (and their due dates) that must be completed by the Contractor, the Client and the NAVFAC team to ensure timely completion of the contract.

II. Attendees

NAVFAC Echelon IV (PM); NAVFAC FEAD/ROICC Team (AROICC, CM, ET/QA, Contracting Officer); Client Team (Project Manager, Program Coordinator, User/Tenant); Contractor Team (Project Manager, Project Superintendent, CQC Manager)

III. Schedule to Completion (POAM)

Contractor

IV. Schedule of Final Outfitting and Occupancy (POAM)

Client

V. Critical feature(s) of project (POAM)

CM

VI. Transfer of Maintenance Responsibility

CM

VII. Systems training & O&M Manuals (POAM)

CQC Manager

VIII. Other Items to include on NRZ checklists

All

IX. Summary of Required Actions and Responsibility

CM

Guidelines for conducting Facility Turnover Planning Meeting are as follows:

- a. Meeting is held at approximately 75% construction contract completion or three to six months prior to BOD. NAVFAC representatives will include the Project Manager, Construction Manager/AROICC (CM) and Design Manager (DM), as appropriate. The contractor representatives include applicable prime contractor staff and decision-makers from major subcontractors. Design-Build contractors will have A-E representatives attending. The Client should include representatives from Public Works Officer (PWO) staff, a Client scope and financial decision maker, a user tenant representative, a facility start-up person, and others such as SPAWAR, Government Telecommunications Contractor, telephone, and furniture contractor, etc.
- b. The purpose of the meeting is to plan the remaining work, identify critical project features that still need to be completed (such as “soft” construction contract requirements as shown on the NRZ Checklist/POAM Items), and to complete the filling out of the “NRZ Checklist/POAM Items”.
- c. The contractor, client and NAVFAC provide a POC and due date for each item on their checklist. The team fills in the checklists by selecting items applicable to the project, selects due dates on each item, and appoints a person who has responsibility to ensure the item gets completed by the due date. The CM will be responsible to monitor the milestones.

NRZ Checklist/POAM Items

The tables below provide typical NRZ checklist items for contractor, Client, and NAVFAC actions (Tables 1, 2, and 3, respectively). Items listed on the checklists are required to remain on the checklists if they are part of the project/contract or required by construction convention. Items not listed on the checklists, but required in the contract or by construction convention, must be added to the checklists by the contractor, Client and NAVFAC. Checklists are applicable to all contracts no matter what Category of Work.

The Point of Contact and due date shall initially be determined during the Facility Turnover Planning Meeting by the NAVFAC, client and contractor leads. During execution of the NRZ process, for each item on the entire list, the Construction Manager (CM) shall indicate date completed and initial to indicate completion of the item. If a party fails to complete an item by the due date, this should be noted on the checklist and new due date established and indicated. The completed NRZ Checklist/POAM shall be placed in the contract file.

Table 1

Contractor Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
a. Construction Completion Schedule					
b. Facility Delivery Closeout:					
Duct Air Leakage Testing					
HVAC System Test & Balance					
ACATS Controls Testing					
Conduct Second Seasons TAB					
Electrical Systems Testing					
Final utility systems connections (power, water, etc.)					
Superchlorination of potable water systems					
Plumbing / Other Mechanical Testing					
Elevator Certification(s)					
Specialized Equipment & Systems Inspections (Boilers, UPV, etc.)					
Fire Protection Systems Inspections and Performance Verification					
Communications / IT Systems Testing					
Security Systems Testing					
Other Specified Building Performance Requirements					
c. Other Contractor Items:					
Delivery of O&M Manuals					
Delivery of Equipment/Product Warranty List/Tag					
O&M/OMSI Training of Navy Personnel					
Site Restoration, if applicable					

Contractor Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
Landscaping Complete					
Pre-Final Inspection					
Final Inspection and Acceptance					
Delivery of Spare Parts, Extra Stock, Special Tools, etc					
Delivery of As-Built Drawings					
Delivery of Utility Record Drawings (if applicable)					
Delivery of Utility As-Built Drawings (if applicable)					
Beneficial Occupancy Date (BOD)					
Final Demobilization and Clean-up Completed					
Remove Construction Fence & Associated Coordination					
Pre-warranty Conference					
Project Close-out Meeting					
Coordination and Delivery of Facility Signage					
Final Cleaning					
Replace Construction Lock Cores and Re-keying					
Punch List Completion					
Provide DD1354 to Government CM					

Table 2

Client Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
Modification to FSC or BOSC to maintain/service new facility -Telephone service contract -Utilities service contract -Custodial service contract					
Installation of communications for phones and computers					
Government Telecommunications Installations or other networks					
Delivery and installation of client furnished furniture					
Delivery and installation of client furnished equipment					
User move-in					
GFE status/delivery schedule (GFCL, GFGL)					
Coordination of Intrusion Detection Systems and Physical Security Equipment					
Process operating permits					
Recycled/recovered materials report					
Coordination of IT and Communication Infrastructure and Devices (incl. CAT IV)					
Ribbon-cutting ceremony					

Table 3

NAVFAC Checklist Items	Point of Contact	Due Date	Actual Complete Date	CM Initials	Notes
Client walk-thru prior to pre-final inspections, if appropriate					
Schedule client satisfaction post BOD follow-up					
Schedule Government inspections of specialized equipment (e.g., Boiler/pressure vessels, elevators, UPS, Secure Room shielding requirements, medical certifications, generators/switchgear)					
Provide keying plan to contractor					
Confirm utilities availability for final connections by contractor					
Startup utilities					
Mechanical Acceptance					
Resolve contract modifications & requests for equitable adjustment					
Contractor final release					
Return unobligated funds					
Process final payment					
Process recycled/recovered materials report					
Closeout actions on construction permits (e.g., NPDES)					
A-E and Construction Contractor Evaluations (ACASS/CCASS)					
Contractor QC Evaluation					
Complete Installed Property List and DD 1354					
Sign & provide Interim DD1354 to activity Real Property Accountability Officer NLT BOD					

This page is intentionally left blank.

Performance Assessment Plan

MONTHLY EVALUATION

MONTH: _____ **YEAR:** _____

Evaluation Factor	Yes	No	N/A	Comments
<p><i>Experience of Personnel</i></p> <p>1. Did the team identified in the proposal actively participate in the project?</p> <p>2. If personnel substitutions were needed, was the degree of technical competence maintained?</p>				
<p><i>Working Relationships</i></p> <p>1. Did the Construction team participate in the design process (i.e. attend meetings, provide insight, etc.)? Were the coordination meetings between Construction and Design team personnel documented?</p> <p>2. Did the Design team participate in the construction process (i.e. attend CQC meetings, perform field oversight, etc.)? Were coordination meetings between Construction and Design team personnel documented?</p> <p>3. Did the collaboration between the Construction and Design Team deliver a high value innovative facility?</p> <ul style="list-style-type: none"> - Were Total Operating Cost minimized - What LEED points can be obtained - Was energy efficiency optimized, and the energy goals exceeded. <p>4. Was the budget management process clear; was an estimate submitted on time with each design submittal. Was the estimate updated to reflect the changes in the design submittal?</p> <p>5. Did the Contractor's team effectively manage the project budget and the User's requirements to meet the customer's needs? Was project budget and emphasis in cost control exhibited in the estimate? (Contractor to document in comments block</p>				

materials/systems innovations and provision of higher quality than required in the RFP Part 4)				
<i>Additional factors to be developed during Partnering.</i>				
Quality Control 1. Were re-submittals of design deliverables or construction rework required this month? 2. Were as built redlines updated this month? <i>Additional factors to be developed during Partnering.</i>				
Timely Performance 1. Is the Contractor on schedule? 2. Is the Contractor maintaining the schedule? (Can the Government confirm the project is on schedule?) 3. Is the Contractor following his schedule? <i>Additional factors to be developed during Partnering.</i>				
Effectiveness of Management 1. Did the Government need to intercede in resolving a subcontractor issue? <i>Additional factors to be developed during Partnering.</i>				
Compliance with Labor Standards 1. Did payrolls have to be resubmitted this month due to inaccuracies or errors? <i>Additional factors to be developed during Partnering.</i>				
Compliance with Safety Standards 1. Were there any lost time accidents this month?				

<i>Additional factors to be developed during Partnering.</i>				
<u>GENERAL PERFORMANCE COMMENTS THIS MONTH:</u>				

Concurrence:

CM/ROICC Representative _____ Date_____.

Project Manager _____ Date_____.

Contractor Representative _____ Date_____.

NMCARS ANNEX 9 – GOVERNMENT-FURNISHED PROPERTY COMPLIANCE CHECKLIST

ANNEX 9 – GOVERNMENT-FURNISHED PROPERTY COMPLIANCE CHECKLIST

Per NMCARS 5245.103-73(i), the Government-Furnished Property Compliance Checklist is to be completed, signed and retained in the contract file with the Business Clearance Memorandum (BCM). An excel version of this sheet is available at:

<http://www.secnaveavy.mil/rda/Pages/NMCARS.aspx>.

Government-Furnished Property Compliance Checklist		
Instructions		
<p>This checklist is designed to enable pre-award review of compliance with existing GFP requirements as found in FAR, DFARS and DoD Policy. Lines 1-17 shall be validated prior to award and a copy of the checklist with lines 1-19 completed shall be included with the Business Clearance Memorandum retained in the contract file.</p> <p>Lines 1 - 7: Enter information as appropriate.</p> <p>Lines 8-17: Contracting Officer select from the pull-down list after validating that the clause/information is included in the contract.</p> <p>Line 18: Contracting Officer select from the pull-down list after validating that the GFP justification is included in the contract file.</p> <p>Lines 19-20 Sign and enter information as appropriate.</p>		
1	Solicitation/Contract Number	
2	Modification/Delivery Order/Task Order # (if applicable)	
3	Program Name	
4	Contracting Officer (PCO) Name	
5	Program Manager (PM) Name	
6	Period of Performance Start date	
7	Period of Performance End date	
8	FAR clause 52.245-1 Government Property with Alternate for I	
9	FAR clause 52.245-9 Use and Charges	
10	DFARS clause 252.245-7001 Tagging, Labeling and Marking of GFP	
11	DFARS clause 252.245-7002 Reporting Loss of Government Property	
12	DFARS clause 252.245-7003 Contractor Property Management System Administration	
13	DFARS clause 252.245-7004 Reporting, Reutilization and Disposal	
14	DFARS clause 252.211-7007 Reporting of GFP	
15	FAR clause 52.245-2 Government Property Installation Operation Services (if applicable)	
16	DFARS clause 252.245-7000 Government-Furnished Mapping, Charting and Geodesy Property (if applicable)	
17	Validate written justification to provide GFP is included in contract file per FAR 45.102(b) and DFARS PGI 245.103-70 (if GFP is planned or issued)	
18	Validate all known GFP is listed on OSD mandated attachment per PGI 245.103-72 Use the Consolidated GFP Attachment and instructions available at http://dodprocurementtoolbox.com/site-pages/gfp-attachments .	
19	Contracting Officer signature/date	
20	UIC	

Form Instructions: In addition to the instructions at the top of the form, the following instructions apply.

Row 1: Solicitation/Contract #. Insert the solicitation/contract number.

Row 2: Mod/TO/DO. Insert the modification number, delivery order (DO) number or task order (TO) number as appropriate. If the action is a modification of a DO or TO, insert the DO/TO number followed by the modification number.

Row 3: Program Name. A short description of the program name the GFP is supporting.

Row 4: Contracting Officer Name. Insert the contracting officer name.

Row 5: Program Manager (PM) Name. Insert the PM name.

Row 6: Period of Performance (POP) Start Date. Insert the POP start date.

Row 8-16: Indicate if the clause was included in the Row 1 solicitation/contract number reported, as required by FAR and DFARS. Use the pull-downs on the right side of the right-hand column to fill the entries. Only the following phrases are to be used; Included, Not Included, Not Applicable (N/A). When "Not Included" is used, provide an explanation for the contract file as to why the required clause was not included in the solicitation, contract, modification, DO or TO.

Row 17: Indicate that a written justification to provide GFP was provided by the requiring official and is included in the contract file per FAR 45.102(b) and PGI 245.103-70. Use the pull-downs on the right side of the right-hand column to fill the entries. Only use "N/A" if no GFP is planned.

Row 18: Indicate that the OSD form containing the GFP requirements has been completed and validated per PGI 245.103-72. Use the pull-downs on the right side of the right-hand column to fill the entries. Only use "N/A" if no GFP is planned.

Row 19: Contracting officer signature/date. Sign and date form.

Row 20: UIC. Insert UIC of the contracting officer.

This page is intentionally left blank.

SECTION 01 32 17.00 20

NETWORK ANALYSIS SCHEDULES (NAS)

09/15

PART 1 GENERAL

1.1 DESCRIPTION

The Contractor is responsible for scheduling procurement, Contractor quality control and construction, acceptance testing and training. Refer to Specification **Section 01 33 00 SUBMITTAL PROCEDURES** to determine if any items require Government approval prior to construction; If any are required, that submittal review time shall be included in the schedule.

The schedule is a tool to manage the project, both for Contractor and Government activities. It will also be used to report progress and evaluate time extensions. If cost-loaded, it will provide the basis for progress payments.

The Contractor shall use the Critical Path Method (CPM) and the Precedence Diagram Method (PDM) to satisfy time and cost applications. For consistency, when scheduling software terminology is used in this specification, the terms in Primavera's scheduling programs are used.

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. Submit the following in accordance with **Section 01 33 00 SUBMITTAL PROCEDURES**:

SD-01 Preconstruction Submittals

Qualifications; G

Baseline Network Analysis Schedule (NAS); G

SD-07 Certificates

Monthly Network Analysis Schedule Update; G

SD-11 Closeout Submittals

As-Built Schedule; G

1.3 SCHEDULE ACCEPTANCE PRIOR TO START OF WORK

The Contracting Officer and Contractor shall participate in a preliminary meeting(s) to discuss the proposed schedule and requirements of this section prior to the Contractor preparing the Project Baseline Schedule.

Government review comments on the Contractor's schedule(s) shall not relieve the Contractor from compliance with requirements of the Contract Documents.

Only bonds shall be paid prior to acceptance of the Baseline Network Analysis Schedule (NAS).

The acceptance of a Baseline NAS is a condition precedent to:

- a. The Contractor starting work on the demolition or construction stage(s) of the contract.
- b. Processing Contractor's pay request(s) for construction activities/items of work.
- c. Review of any schedule updates.

Submittal of the [Baseline Network Analysis Schedule](#), and subsequent schedule updates, shall be understood to be the Contractor's certification that the submitted schedule meets all of the requirements of the Contract Documents, represents the Contractor's plan on how the work shall be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced (as-built logic).

1.4 SOFTWARE

Project schedules must be prepared and maintained using Primavera P6 or current mandated scheduling program. Save files in Concentric P6 or current mandated scheduling program file format, compatible with the Governments version of the scheduling program. Importing data into P6/current mandated scheduling program using data conversion techniques or third party software will be cause for rejection of the submitted schedule.

1.5 [QUALIFICATIONS](#)

The designated Scheduler for the project shall have prepared and maintained at least 3 previous schedules of similar size and complexity [as this](#) contract using Primavera P3, Primavera SureTrak, or Primavera P6. A resume outlining the qualifications of the Scheduler shall be submitted for acceptance to the Contracting Officer. Payment will not be processed until an acceptable Scheduler is provided.

1.6 NETWORK SYSTEM FORMAT

The system shall include time scaled logic diagrams and specified reports.

1.6.1 Diagrams

Provide Time-scaled Logic Diagram printed in color on ANSI D size sheets. The diagram shall clearly show activities on the critical path. [Critical path items must be red in color.](#) Include the following information for each activity:

- a. Activity ID
- b. Activity Description
- c. Original Duration in Work Days
- d. Remaining duration
- e. Percent Complete
- f. Early Start Date

- g. Early Finish Date
- h. Total Float

1.6.2 Schedule Activity Properties and Level of Detail

The NAS shall identify all Government, Construction Quality Management (CQM), Construction activities planned for the project and all other activities that could impact project completion if delayed. Separate activities shall be created for each Phase, Area, Floor Level and Location the activity is occurring. Activity categories included in the schedule are specified below.

With the exception of the Contract Award and Contract Completion Date (CCD) milestone activities, no activity shall be open-ended; each activity shall have predecessor and successor ties. Once an activity exists on the schedule it may not be deleted or renamed to change the scope of the activity and shall not be removed from the schedule logic without approval from the Contracting Officer. The ID number for a deleted activity shall not be re-used for another activity. No more than 20 percent of the activities shall be critical or near critical. Critical is defined as having zero days of Total Float. "Near Critical" is defined as having Total Float of 1 to 14 days. Contractor activities shall be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days.

1.6.2.1 Activity Categories

- a. Procurement Activities: Examples of procurement activities include, but are not limited to; Material/equipment submittal preparation, submittal and approval of material/equipment; material/equipment fabrication and delivery, and material/equipment on-site. As a minimum, separate procurement activities will be provided for critical items, long lead items, items requiring government approval and material/equipment procurement for which payment will be requested in advance of installation. The Contractor shall show each delivery with relationship tie to the Construction Activity specifically for the delivery.
- b. Government Activities: Government and other agency activities that could impact progress shall be clearly identified. Government activities include, but are not limited to; Government approved submittal reviews, Government conducted inspections/tests, environmental permit approvals by State regulators, utility outages, Design Start, Construction Start, (including Design/Construction Start for each Fast-Track Phase, and delivery of Government Furnished Material/Equipment.
- c. Construction Quality Management (CQM) Activities: CQM Activities shall identify the Preparatory Phase and Initial Phase for each Definable Feature of Work identified in the Contractor's Quality Control Plan. These activities shall be added to each Three-Week Look Ahead Schedule referenced in the paragraph entitled "THREE-WEEK LOOK AHEAD SCHEDULE" and will also be included in each monthly update. The Follow-up Phase will be represented by the Construction Activities in the Baseline Schedule and in the schedule updates.
- d. Construction Activities: No on-site construction activity shall have a duration in excess of 20 working days. Separate construction activities shall be created for each Phase, Area, Floor Level and Location the

activity is occurring. Contractor activities will be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days, unless otherwise defined in this contract.

- e. Turnover and Closeout Activities: Include a separate section with all items on the **Facility Turnover Checklist** that are applicable to this project. The checklist will be provided at the Preconstruction Meeting. As a minimum, this will include all testing, specialized inspection activities, Pre-Final inspection, Punch List Completion, Final Inspection and Acceptance. Add a milestone for the Facility Turnover Planning Meeting at approximately 75 percent construction contract completion or three to six months prior to BOD, whichever is sooner.

1.6.2.2 Contract Milestones and Constraints

- a. Project Start Date Milestones: The Contractor shall include as the first activity on the schedule a start milestone titled "Contract Award", which shall have a Mandatory Start constraint equal to the Contract Award Date.
- b. Projected Completion Milestone: The Contractor shall include an unconstrained finish milestone on the schedule titled "Projected Completion". Projected Completion is defined as the point in time the Government would consider the project complete and ready for its intended use. This milestone shall have the Contract Completion (CCD) milestone as its only successor.
- c. Contract Completion Date (CCD) Milestone: The Contractor shall include as the last activity on the schedule a finish milestone titled "Contract Completion (CCD)", which shall have a Mandatory Finish constraint equal to the current Contract Completion Date. Calculation of schedule updates shall be such that if the finish of the "Projected Completion" milestone falls after the contract completion date, then negative float will be calculated on the longest path and if the finish of the "Projected Completion" milestone falls before the contract completion date, the float calculation shall reflect positive float on the longest path. The only predecessor to the Contract Completion Date Milestone shall be the Projected Completion milestone.

1.6.2.3 Activity Code

At a minimum, the Contractor shall establish activity codes identified in this specification and 3 additional activity codes identified by the Contracting Officer. Once established, activity codes and values cannot be changed without approval by the Contracting Officer.

- a. Phase: All activities shall be assigned a 4-digit code value based on the contract phase it occurs in.
- b. Area Code: All activities shall be assigned an area code value identifying the Area in which the activity occurs. Activities shall not belong to more than one area. Area is defined as a distinct space, function or activity category; such as, separate structure(s), sitework, project summary, construction quality management, material/equipment procurement, etc.
- c. Work Item: All activities in the project schedule shall be assigned a 4-digit Work Item code value. Examples of Work Item code values

include but are not limited to water lines, drain lines, building pad and foundation, slab on grade, walls and columns, suspended slab, roof structure, roofing, exterior finish systems, interior rough-in, and finishes, etc.

- d. Location 1: Assign a 4-digit Location 1 code value to activities associated with multistory structures. Code values are used to identify the floor level where an activity is occurring.
- e. Location 2: Assign a 4-digit Location 2 code value to all activities to identify the location within an Area, Work Item or Building Level that an activity is occurring.
- f. Responsibility Code: All activities in the project schedule shall be identified with the party responsible for completing the task. Activities shall not belong to more than one responsible party.

1.6.2.4 Anticipated Weather Delays

The Contractor shall use the **National Oceanic and Atmospheric Administration's (NOAA) historical monthly averages for the NOAA location closest to the project site** as the basis for establishing a "Weather Calendar" showing the number of anticipated non-workdays for each month due to adverse weather, Saturdays, Sundays and all Federal Holidays as non-work days.

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities critical to contract completion. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity.

1.6.2.5 Cost Loading

- a. Cost Loading Activities: Material and Equipment Costs for which payment will be requested in advance of installation shall be assigned to their respective procurement activity (i.e., the material/equipment on-site activity). All other construction costs shall be assigned to their respective Construction Activities. The value of inspection/testing activities will not be less than 10 percent of the total costs for Procurement and Construction Activities. Evenly disperse overhead and profit to each activity over the duration of the project.
- b. Quantities and Units of Measure: Each cost loaded activity shall have a detailed quantity breakdown and unit of measure.

1.6.3 Schedule Software Settings and Restrictions

- a. Activity Constraints: Date/time constraint(s), other than those required by the contract, will not be allowed unless accepted by the Contracting Officer. Identify any constraints proposed and provide an explanation for the purpose of the constraint in the Narrative Report.

- b. Default Progress Data Disallowed: Actual Start and Actual Finish dates on the CPM schedule shall match the dates on the Contractor Quality Control and Production Reports.
- c. Software Settings: Schedule calculations and Out-of-Sequence progress (if applicable) shall be handled through Retained Logic, not Progress Override. All activity durations and float values will be shown in days. Activity progress will be shown using Remaining Duration. Default activity type will be set to "Task". The project "Must Finish By" date shall be left blank.

1.6.4 Required Tabular Reports

The following reports shall be included with the schedule submittal:

- a. Log Report: Listing of all changes made between the previous schedule and current updated schedule.
- b. Narrative Report: Identify and justify; 1) Progress made in each area of the project; 2) Critical Path; 3) Date/time constraint(s), other than those required by the contract 3) Changes in the following; added or deleted activities, original and remaining durations for activities that have not started, logic, milestones, planned sequence of operations, critical path, and cost loading; 4) Any decrease in previously reported activity Earned Amount; 5) Pending items and status thereof, including permits, changes orders, and time extensions; 6) Status of Contract Completion Date and interim milestones; 7) Current and anticipated delays (describe cause of delay and corrective actions(s)); and 8) Description of current and future schedule problem areas. Each entry in the narrative report will cite the respective Activity ID and Activity Description, the date and reason for the change, and description of the change.
- c. Earned Value Report: Listing all activities having a budget amount cost loaded. Compilation of total earnings on the project from notice to proceed to current progress payment request. Group and sort activities as directed by the Contracting Officer. Show current budget, previous physical percent complete, to-date physical percent complete, previous earned value, to-date earned value and cost to complete on the report for each activity:
- d. Schedule Variance Control (SVC) Diagram: With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates and 2) Earned Value to-date. Revise Cash Flow S-Curves when the contract is modified, or as directed by the Contracting Officer.

1.7 SUBMISSION AND ACCEPTANCE

1.7.1 Monthly Network Analysis Updates

Contractor and Government representatives shall meet at monthly intervals to review and agree on the information presented in the updated project schedule. The submission of an acceptable, updated schedule to the Government is a condition precedent to the processing of the Contractor's pay request. If a Schedule of Prices is the basis for progress payments, it shall be consistent with the logic and activity breakdowns on the progress schedule. If progress payments are based on a cost-loaded

schedule, the Contractor and Government shall agree on percentage of payment for each activity progressed during the update period.

Provide the following with each Schedule submittal:

- a. Time Scaled Logic Diagram.
- b. Reports listed in paragraph entitled "Required Tabular Reports."
- c. Data disks containing the project schedule. Include the back-up native .prx/current mandated schedule program files.

1.7.2 As-Built Schedule

As a condition precedent to the release of retention and making final payment, submit an "As-Built Schedule," as the last schedule update showing all activities at 100 percent completion. This schedule shall reflect the exact manner in which the project was actually constructed.

1.8 CONTRACT MODIFICATION

Submit a Time Impact Analysis with each cost and time proposal for a proposed change. Time Impact Analysis (TIA) shall illustrate the influence of each change or delay on the Contract Completion Date or milestones. No time extensions will be granted nor delay damages paid unless a delay occurs which consumes all available Project Float, and extends the Projected Finish beyond the Contract Completion Date.

- a. Each TIA shall be in both narrative and schedule form demonstrating the delay impact. The TIA shall identify the predecessors to the new activities and demonstrate the impacts to successor activities. The Contractor shall run the schedule calculations and submit the impacted schedule with the proposal or claim.
- b. The TIA schedule submitted with the proposal shall show all activity progress as of the date of the proposal. If the impact to the schedule occurs prior to the proposal submission, the TIA schedule shall be updated to show all activity progress as of the time of the impact. If the proposed change does not impact the CCD, no TIA shall be required.
- c. Submit Data disks containing the TIA schedule. Include the back-up native .prx/current mandated schedule program files.
- d. Unless the Contracting Officer requests otherwise, only conformed contract modifications shall be added into the Project NAS.

1.9 PROJECT FLOAT

Project Float is the length of time between the Contractor's Projected Finish Milestone and the Contract Completion Date Milestone. Project Float available in the schedule, at any time shall not be for the exclusive use of either the Government or the Contractor.

1.10 THREE-WEEK LOOK AHEAD SCHEDULE

The Contractor shall prepare and issue a 3-Week Look Ahead schedule to provide a more detailed day-to-day plan of upcoming work identified on the Project Network Analysis Schedule. The work plans shall be keyed to NAS activity numbers and updated each week to show the planned work for the

current and following two-week period. Additionally, include upcoming outages, closures, preparatory meetings, and initial meetings. Identify critical path activities on the Three-Week Look Ahead Schedule. The detail work plans are to be bar chart type schedules, maintained separately from the Project NAS on an electronic spreadsheet program and printed on 8 ½ by 11 sheets as directed by the Contracting Officer. Activities shall not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work. Three hard copies and one electronic file of the 3-Week Look Ahead Schedule shall be delivered to the Contracting Officer no later than 8 a.m. each Monday and reviewed during the weekly CQC Coordination Meeting.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

11/15

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections.
Submittals are identified by Submittal Description (SD) numbers and titles
as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to **commencing work on site**.

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction Progress Schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices

Health and safety plan

Work plan

Quality control (QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate
some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in
producing the product and as aids to the Contractor for integrating the
product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems
and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts,

instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier,

installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (MSDS) concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

Interim "DD Form 1354" with cost breakout for all assets 30 days prior to facility turnover.

1.1.2 Approving Authority

Office or designated person authorized to approve submittal.

1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor QC approval. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal register; G

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Government Approved G

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled, "Specifications and Drawings for Construction," they are considered to be "shop drawings."

On submittals indicated as G, ID, these submittals shall to be reviewed and approved by NAVFAC MidLant Interior Design.

1.3.1.1 Information Only

Submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.4.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to Architect-Engineer: MBF Architects, submittals required in the technical sections of this specification, including shop drawings, product data and samples. One copy of the transmittal form for all submittals shall be forwarded to the Facilities Engineering and Acquisition Division (FEAD).

The Architect-Engineer for this project will review and approve for the Contracting Officer those submittals reserved for Contracting Officer approval to verify submittals comply with the contract requirements.

1.4.1.1 O&M Data

Marine Corps North Carolina IPT will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

- a. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.4.1.2 Submittals Reserved for Marine Corps North Carolina IPT Approval

As an exception to the standard submittal procedure specified above, submit the following to NAVFAC MID-LANT MCIPT, 9324 Virginia Avenue, Attn: (insert project manager name here), Code OPQC15, Marine Corps North Carolina IPT, Norfolk, Virginia, 23511-3095:

- a. Section 21 13 13.00 20, "WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION": All fire protection system submittals
- b. Section 28 31 63.00 20, "ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM": All fire alarm system submittals
- c. Section 23 09 23.13 20 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC: SD-06 field test report submittals
- d. Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC: All submittals
- e. Section 26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS: All submittals
- f. Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM: All submittals. Provide an information copy of all submittals to Base Telephone through the Contracting Officer. Base Telephone will coordinate their review and approval through the Marine Corps North Carolina IPT.

1.4.1.3 Submittals Not Requiring Government Approval Or Surveillance

Construction submittals not requiring Government approval or surveillance shall be submitted for information.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled, "Identifying Submittals," of this section. Process transmittal forms to record actions regarding sample installations or panels.

1.5.2 Identifying Submittals

When submittals are provided by a subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified

submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Date of the drawings and revisions.
- d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other **subcontractor** associated with **the** submittal.
- e. Section number of the specification section by which submittal is required.
- f. Submittal description (SD) number of each component of submittal.
- g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.
- h. Product identification and location in project.

1.5.3 Electronic Submittals

Construction Submittals for this project shall be made electronically utilizing software provided by the Contractor and approved by the Government and the DOR. Electronic Working and Record Drawings shall be submitted in accordance with specification section **01 78 00 CLOSEOUT SUBMITTALS**. Provide eOMSI submittals in accordance with specification section **01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI)**.

1.5.3.1 Identification and Information

Identify and incorporate information in each electronic submittal file as follows:

- a. Assemble complete submittal package into a single indexed electronic file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
- b. Name file with the project identifier and Specification Section number, and submittal number, including revision identifier if required as follows:

File name shall use project P-number followed by a dash, the six or ten digit Specification Section number followed by a dash, and then a sequential number (e.g., P601-04 20 00-001 or P601-07 21 00.00 20-001). Resubmittals shall include an alphabetic suffix after the sequential number (e.g., P601-04 20 00-001A or P601-07 21 00.00 20-001A).

1.5.3.2 General Electronic Submittal Procedure Requests

Post electronic submittals as PDF electronic files directly to Contractor's project electronic site specifically established for the Project.

- a. DOR will post electronic annotated files.
- b. Contractor shall annotate and retain one copy of file as an electronic Project record document file.
- c. Contractor shall maintain three (3) hard copies of all submittals: one copy to be maintained in the field during construction, one for the Construction Management Engineer (CME) office, and one for the contract files.
- d. Contractor shall provide upon completion of the project, CDs which have all reviewed and marked up submittals for the project.

1.5.4 Format for SD-02 Shop Drawings

- a. Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.
- b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
- c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."
- d. Number drawings in a logical sequence. Contractors may use their own number system. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.
- e. Reserve a blank space, no smaller than 4 inches square on the right hand side of each sheet for the Government disposition stamp.
- f. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.
- g. Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

1.5.5 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

- a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

- b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.
- c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.
- e. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.
- f. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. 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. State on the certificate 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.
- g. Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of construction effort.
- h. Submit manufacturer's instructions prior to installation.

1.5.6 Format of SD-04 Samples

- a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:
 - (1) Sample of Equipment or Device: Full size.
 - (2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
 - (3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
 - (4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
 - (5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

(6) Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

(7) Sample Panel: 4 by 4 feet.

(8) Sample Installation: 100 square feet.

- b. Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.
- c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.
- d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.
- e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.7 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.5.8 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

- a. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.
- b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.9 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA and 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI) for O&M Data format.

1.5.10 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of SD-02 Shop Drawings

Submit **six** copies of submittals of shop drawings requiring review and approval only by QC organization and **seven** copies of shop drawings requiring review and approval by Contracting Officer.

1.6.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of Samples SD-04 Samples

- a. Submit **two** samples, or **two** sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.
- b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials.

1.6.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit **Five** copies of O&M Data to the Contracting Officer for review and approval.

1.6.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit **two** sets of administrative submittals.

1.6.8 Quantity of Submittals for Information

Submit **two** copies of submittals for information to the Contracting Officer.

1.7 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans

and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 VARIATIONS

Variations from contract requirements require both Designer of Record (DOR) and Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.8.1 Considering Variations

Discussion with Contracting Officer prior to submission, after consulting with the DOR, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.8.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government, including the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.8.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor, including its Designer(s) of Record, warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.8.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.9 SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required. The Government will provide the initial submittal register with the following fields completed, to the

extent that will be required by the Government during subsequent usage. The Government provided submittal register will be in the form of a pdf file.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

1.9.1 Use of Submittal Register

Submit submittal register. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.9.2 Contractor Use of Submittal Register

Update the following fields with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.9.3 Approving Authority Use of Submittal Register

Update the following fields.

Column (b) Transmittal Number: Contractor assigned list of

consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p) List Date related to review actions.

Column (q) List date returned to Contractor.

1.9.4 Action Codes

Entries for columns (j) and (o), are to be used are as follows (others may be prescribed by Transmittal Form):

1.9.4.1 Government Review Action Codes

"A" - "Approved as submitted"; "Completed"

"B" - "Approved, except as noted on drawings"; "Completed"

"C" - "Approved, resubmission required"; "Resubmit"

"D" - "Returned by correspondence"; "Completed"

"E" - "Disapproved (See attached)"; "Resubmit"

"F" - "Receipt acknowledged"; "Completed"

"G" - "Other (Specify)"; "Resubmit"

"X" - "Receipt acknowledged, does not comply"; "Resubmit"

1.9.4.2 Contractor Action Codes

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.9.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request.

1.10 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 14 calendar days will be allowed and shown on the register for review and approval of submittals for refrigeration and HVAC control systems.

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

- b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A."
- c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.
- d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."
- e. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization.
- f. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of 30 working days for return of submittal to the Contractor.
- g. Period of review for each resubmittal is the same as for initial submittal.

1.10.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is QC Manager unless otherwise specified for specific submittal. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates Contracting Officer is approving authority for that submittal item.

1.10.2 Constraints

- a. Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.
- b. Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.
- c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.
- d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.10.3 QC Organization Responsibilities

- a. Note date on which submittal was received from Contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.
 - (1) When QC Manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph entitled, "Approved/Accepted Submittals," of the section."
 - (2) When Contracting Officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.
- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.
 - (1) When approving authority is Contracting Officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number (insert contract number here), is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

- (2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with contract Number (insert contract number here), is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Approved by QC Manager _____, Date _____"
(Signature)

- g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.
- h. Update **submittal register** as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.
- i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.11 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

- a. Note date on which submittal was received **from QC Manager**.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph entitled "Review Notations" of this section and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date approved submittals. **Two** copies of the approved submittal will be retained by the Contracting Officer and **remaining** copies of the submittal will be returned to the Contractor.

1.11.1 Review Notations

Contracting Officer review will be completed within **30** calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" "or approved except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
- c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.
- d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals

returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.12 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes," is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED/ACCEPTED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor to assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place

may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the contract.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 14 00	SD-01 Preconstruction Submittals														
			List of Contact Personnel	1.3.1.1	G												
		01 20 00.00 20	SD-01 Preconstruction Submittals														
			EARNED VALUE REPORT	1.3	G												
		01 30 00	SD-01 Preconstruction Submittals														
			View Location Map	1.3	G												
			Progress and Completion	1.4	G												
			Pictures														
		01 32 17.00 20	SD-01 Preconstruction Submittals														
			Qualifications	1.5	G												
			Baseline Network Analysis	1.3	G												
			Schedule														
			SD-07 Certificates														
			Monthly Network Analysis	1.7.1	G												
			SD-11 Closeout Submittals														
			As-Built Schedule	1.7.2	G												
		01 33 00	SD-01 Preconstruction Submittals														
			Submittal register	1.9	G												
		01 33 29	SD-01 Preconstruction Submittals														
			Sustainability Action Plan	1.4.1	G												
			Preliminary Sustainability	1.5.3.1	G												
			eNotebook														
			SD-11 Closeout Submittals														
			Final Sustainability eNotebook	1.5.3.1	G												
			Amended Final Sustainability	1.5.3.1	G												
			eNotebook														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 33 29	Amended Final High Performance and Sustainable Building Checklist	1.5.3.1	G												
		01 35 26	SD-01 Preconstruction Submittals														
			Accident Prevention Plan (APP)	1.7	G A												
			Activity Hazard Analysis (AHA)	1.8	G A												
			Crane Critical Lift Plan	1.7.1	G A												
			Crane Operators	1.6.1.3	G A												
			Traffic Control Plan	1.17.1	G A												
			Standard Hand Signals	1.17.2.1	G A												
			SD-06 Test Reports														
			Notifications and Reports	1.12													
			Accident Reports	1.12.2													
			Crane Reports	1.12.3													
			Arc Flash Risk/Hazard Analysis	3.8.2	G												
			SD-07 Certificates														
			Confined Space Entry Permit	1.9													
			Hot work permit	1.9													
			Arc Flash Risk/Hazard Analysis	3.8.3	G												
			Qualifications														
			Contractor Electrical Energized	3.8.4	G												
			Work Permit														
			Contractor Safety Self-Evaluation	1.4	G A												
			Checklist														
			Certificate of Compliance	1.12.4													
		01 45 00.00 20	SD-01 Preconstruction Submittals														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 45 00.00 20	Construction Quality Control (QC) Plan	1.6.1	G												
			Indoor Air Quality (IAQ) Management Plan	1.17	G												
			SD-06 Test Reports														
			Acceptance Testing of Critical Systems Checklist	1.4.1													
			SD-07 Certificates														
			ICC IBC Special Inspections Certification	1.5.4.1	G												
		01 50 00	SD-01 Preconstruction Submittals														
			Traffic control plan	3.3.1	G												
			Construction site plan	1.4	G												
		01 57 13.00 22	SD-01 Preconstruction Submittals														
			Construction Sequence Schedule	1.4	G												
			SD-03 Product Data														
			Sediment Fence	2.1													
			Dust Suppressors	2.4													
			Erosion Control Matting	2.6													
			Filter Fabric	2.3.1.2													
		01 57 19.00 20	SD-01 Preconstruction Submittals														
			Preconstruction Survey	1.5.1	G												
			Solid Waste Management Plan and Permit	3.4	G												
			Regulatory Notifications	1.5.2	G												
			Environmental Management Plan	3.1	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 57 19.00 20	Air Emissions Source	3.2.3	G												
			Specification Data														
			Dirt and Dust Control Plan	3.14.1													
			Contractor Hazardous Material	3.6	G												
			Inventory Log														
			SD-06 Test Reports														
			Laboratory Analysis	3.13.2.2													
			Disposal Requirements	3.15.2													
			Contractor 40 CFR employee	1.5.5													
			training records														
			Solid Waste Management Report	3.4.1	G												
			SD-11 Closeout Submittals														
			Waste Determination	3.5													
			Documentation														
			Disposal Documentation for	3.6.1													
			Hazardous and Regulated Waste														
			Contractor 40 CFR Employee	1.5.5													
			Training Records														
			Solid Waste Management Permit	3.4													
			Solid Waste Management Report	3.4.1													
			Contractor Hazardous Material	3.6	G												
			Inventory Log														
			Hazardous Waste/Debris	3.13.2													
			Management														
			Regulatory Notifications	1.5.2													
		01 58 00	SD-02 Shop Drawings														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 58 00	preliminary drawing indicating layout and text content	1.3.1	G												
		01 60 00.00 22	SD-07 Certificates														
			Certificate of State Licensed Applicator	1.2.1	G												
			SD-11 Closeout Submittals														
			Field Pesticide/Herbicide Management Record Form	3.2	G												
		01 74 19	SD-01 Preconstruction Submittals														
			Waste Management Plan	1.5	G												
			SD-11 Closeout Submittals														
			Records	1.6													
		01 78 00	SD-03 Product Data														
			As-Built Record of Equipment and Materials	1.3.2													
			Warranty Management Plan	1.7.1													
			Warranty Tags	1.7.4													
			Final Cleaning	1.9													
			Spare Parts Data	1.4													
			SD-08 Manufacturer's Instructions														
			Preventative Maintenance	1.5													
			Condition Monitoring (Predictive Testing)	1.5													
			Inspection	1.5													
			Instructions	1.7.1													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASS SIFIC ATION OR A/ REV WR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 78 00	SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	1.8													
			Manuals														
			SD-11 Closeout Submittals														
			Record Drawings	1.3.1													
			NAVFAC Sustainable & Energy	1.12	G												
			Data Record Card														
			Certification of EPA Designated	1.6	G												
			Items														
			Preliminary Interim DD Form	1.10	G												
			1354														
			Updated Interim DD Form 1354	1.10	G												
		01 78 24.00 20	SD-07 Certificates														
			Qualifications of eOMSI Preparer	1.6	G												
			Qualifications of eOMSI Preparer	1.6	G												
			SD-10 Operation and Maintenance														
			Data														
			Training Plan	3.1.1	G												
			Training Plan	3.1.1	G												
			Training Plan	3.1.1	G												
			Training Outline	3.1.3	G												
			Training Content	3.1.2	G												
			SD-11 Closeout Submittals														
			eOMSI, 100 percent, Prefinal	1.9.1	G												
			Submittal														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 78 24.00 20	eOMSI, Final Submittal	1.9.2	G												
			Training Video Recording	3.1.4	G												
			Validation of Training Completion	3.1.6	G												
		01 78 30.00 22	SD-11 Closeout Submittals														
			GIS Data Deliverables	1.3.7	G												
		02 41 00	SD-01 Preconstruction Submittals														
			Demolition Plan	1.2.1	G												
			Existing Conditions	1.9													
			SD-07 Certificates														
			Notification	1.6	G												
			SD-11 Closeout Submittals														
			Receipts	3.2.4													
		02 51 00	SD-01 Preconstruction Submittals														
			Surface Cleaning	1.3													
			Decontamination Conference														
			SD-02 Shop Drawings														
			Procedures	3.1	G												
		03 30 00	SD-01 Preconstruction Submittals														
			Quality Control Plan	1.6.4	G												
			Quality Control Personnel	1.6.5	G												
			Certifications														
			Quality Control Organizational	1.6.5													
			Chart														
			Laboratory Accreditation	1.6.7	G												
			SD-02 Shop Drawings														
			Reinforcing Steel	1.6.2.1	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03 30 00	SD-03 Product Data														
			Joint Sealants	2.3.8													
			Joint Filler	2.3.7													
			Materials for Forms	2.1													
			Recycled Aggregate Materials	2.3.3.2													
			Cementitious Materials	2.3.1													
			Vapor retarder	2.3.6													
			Concrete Curing Materials	2.2.3													
			Reinforcement	2.4													
			Liquid Chemical Floor Hardener	2.5.1													
			Admixtures	2.3.5													
			Mechanical Reinforcing Bar	2.4.2													
			Connectors														
			Local/Regional Materials	1.8.1													
			Biodegradable Form Release	2.3.9													
			Agent														
			SD-05 Design Data														
			Mix Design	2.2.1	G												
			SD-06 Test Reports														
			Concrete Mix Design	1.6.1.1	G												
			Fly Ash	1.6.3.1													
			Pozzolan	1.6.3.1													
			Ground Granulated	1.6.3.2													
			Blast-Furnace Slag														
			Aggregates	2.3.3													
			Compressive Strength Tests	3.12.2.3	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03 30 00	Unit Weight of Structural Concrete	3.12.2.5													
			Air Content	3.12.2.4													
			Slump Tests	3.12.2.1													
			Water	2.3.2													
			SD-07 Certificates														
			Reinforcing Bars	2.4.1													
			Welder Qualifications	1.9													
			Forest Stewardship Council (FSC) Certification	1.8.2													
			Field Testing Technician and Testing Agency	1.6.5.2													
			SD-08 Manufacturer's Instructions														
			Liquid Chemical Floor Hardener	2.5.1													
			Curing Compound	2.2.3													
		05 30 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.3.4													
			SD-03 Product Data														
			Accessories	2.2													
			Deck Units	2.1													
			Galvanizing Repair Paint	2.1.3													
			Mechanical Fasteners	2.2.10													
			Touch-up Paint	2.1.3													
			Flexible Closure Strips	2.2.3													
			SD-05 Design Data														
			Deck Units	2.1													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05 30 00	SD-07 Certificates														
			Powder-Actuated Tool Operator	1.3.2													
			Wind Storm Resistance	1.3.3.1													
			Manufacturer's Certificate	1.3.1													
			SD-11 Closeout Submittals														
			Recycled Content of Steel	2.1													
			Products														
		05 40 00	SD-02 Shop Drawings														
			Framing Components	1.6.1	G												
			SD-03 Product Data														
			Studs, Joists	2.1													
			SD-05 Design Data														
			Metal Framing Calculations	1.6.2	G												
			SD-07 Certificates														
			Load-Bearing Cold-Formed Metal	1.4													
			Framing														
			Welds	3.1.1													
		05 50 13	SD-02 Shop Drawings														
			Floor Plates, Patterned	2.1.5	G												
			floor box	2.1.5	G												
		05 52 00	SD-02 Shop Drawings														
			Fabrication Drawings	1.2.1	G												
			SD-07 Certificates														
			Welder Qualification	1.4.1	G												
		06 41 16.00 10	SD-02 Shop Drawings														
			Shop Drawings	2.9													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASS OR SPEC ATTN	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		06 41 16.00 10	Installation	3.1													
			SD-03 Product Data														
			Wood Materials	2.1													
			SD-04 Samples														
			Plastic Laminates	2.3													
			Cabinet Hardware	2.6													
			SD-07 Certificates														
			Quality Assurance	1.4													
			Laminate Clad Casework	3.1													
		06 61 16	SD-02 Shop Drawings														
			Detail Drawings	1.4.2	G												
			Installation	3.1	G												
			SD-03 Product Data														
			Solid Polymer Material	2.1													
			Qualifications	1.4.1													
			Fabrications	2.3													
			SD-04 Samples														
			Material	2.1	G												
			Counter and Vanity Tops	2.3.4	G												
			Shower Wall Panel System	2.3.6													
			SD-06 Test Reports														
			Solid Polymer Material	2.1													
			SD-07 Certificates														
			Fabrications	2.3													
			Qualifications	1.4.1													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		06 61 16	SD-10 Operation and Maintenance Data														
			Clean-up	3.2													
		07 21 16	SD-03 Product Data														
			Blanket Insulation and Blanket Insulation - Sound Attenuation	2.2													
			SD-08 Manufacturer's Instructions														
			Insulation	3.3.1													
			SD-11 Closeout Submittals														
			Recycled Content for Insulation Materials	2.1.1													
			Reduce Volatile Organic Compounds (VOC)	2.1.2													
		07 84 00	SD-02 Shop Drawings														
			Firestopping System	2.1	G												
			SD-03 Product Data														
			Firestopping Materials	2.2	G												
			SD-06 Test Reports														
			Inspection	3.3	G												
			SD-07 Certificates														
			Firestopping Materials	2.2													
			Installer Qualifications	1.5.1	G												
		07 92 00	SD-03 Product Data														
			Sealants	2.1	G												
			Primers	2.2	G												
			Bond Breakers	2.3	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		07 92 00	Backstops	2.4	G												
			SD-07 Certificates														
			Indoor Air Quality	1.4.1	G												
			SD-11 Closeout Submittals														
			Indoor Air Quality For Interior	2.1.1													
			Sealants														
			Indoor Air Quality For Interior	2.1.3													
			Floor Joint Sealants														
		08 11 13	SD-02 Shop Drawings														
			Doors	2.1	G												
			Doors	2.1	G												
			Frames	2.4	G												
			Frames	2.4	G												
			Accessories	2.2													
			SD-03 Product Data														
			Doors	2.1	G												
			Frames	2.4	G												
			Accessories	2.2													
		08 33 23	SD-02 Shop Drawings														
			Overhead Coiling Doors	2.2.1	G												
			Counterbalancing Mechanism	2.2.3	G												
			Electric Door Operators	2.2.4	G												
			Bottom Bars	2.2.1.3	G												
			Guides	2.1.1.1	G												
			Mounting Brackets	2.2.3.1	G												
			Overhead Drum	2.2.1.8	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08 33 23	Hood	3.3.2	G												
			Installation Drawings	2.1.1.1	G												
			SD-03 Product Data														
			Overhead Coiling Doors	2.2.1	G												
			Hardware	2.2.2	G												
			Counterbalancing Mechanism	2.2.3	G												
			Electric Door Operators	2.2.4	G												
			SD-05 Design Data														
			Overhead Coiling Doors	2.2.1	G												
			Hardware	2.2.2	G												
			Counterbalancing Mechanism	2.2.3	G												
			Electric Door Operators	2.2.4	G												
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.3.2	G												
			Manuals														
			Materials	3.3.2	G												
			Devices	3.3.2	G												
			Procedures	3.3.2	G												
			Manufacture's Brochures	3.3.2	G												
			Parts Lists	3.3.2													
			SD-11 Closeout Submittals														
			Warranty	3.3.1	G												
		08 71 00	SD-02 Shop Drawings														
			Manufacturer's Detail Drawings	1.3	G												
			Verification of Existing Conditions	1.3	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08 71 00	Hardware Schedule	1.5	G												
			Keying System	2.3.5	G												
			SD-03 Product Data														
			Hardware Items	2.3	G												
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Hardware Schedule	1.5	G												
			SD-11 Closeout Submittals														
			Key Bitting	1.6.1													
		08 81 00	SD-03 Product Data														
			Glazing Accessories	1.3													
			Fire/Safety Rated Glass	2.1.2													
			SD-08 Manufacturer's Instructions														
			Glass Setting	3.2													
		08 91 00	SD-02 Shop Drawings														
			Wall louvers	1.4													
			Wall louvers	1.5													
			SD-03 Product Data														
			Metal Wall Louvers	2.2													
		09 22 00	SD-02 Shop Drawings														
			Metal support systems	2.1	G												
		09 29 00	SD-03 Product Data														
			Cementitious Backer Units	2.1.3													
			Abuse Resistant Gypsum Board	2.1.2													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09 29 00	Accessories	2.1.6													
			Gypsum Board	2.1.1													
			SD-07 Certificates														
			Asbestos Free Materials	2.1	G												
			SD-08 Manufacturer's Instructions														
			Material Safety Data Sheets	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Manufacturer Maintenance	2.1													
			Instructions														
		09 65 00	SD-03 Product Data														
			Wall Base	2.1													
			SD-04 Samples														
			Resilient Flooring and	2.4	G												
			Accessories														
		09 90 00	SD-03 Product Data														
			Materials	2.1													
			Coating	2.1	G												
			Manufacturer's Technical Data	2.1													
			Sheets														
			SD-04 Samples														
			Color	1.6	G												
			SD-07 Certificates														
			Applicator's qualifications	1.3													
			SD-08 Manufacturer's Instructions														
			Application instructions	3.2.1													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASSIFICATION OR REVIEW NUMBER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		09 90 00	Mixing	3.6.2													
			Manufacturer's Material Safety	1.7.2													
			Data Sheets														
			SD-10 Operation and Maintenance														
			Data														
			Coatings	2.1	G												
		10 14 00.20	SD-02 Shop Drawings														
			Detail Drawings	1.3.2	G												
			SD-03 Product Data														
			Installation	3.1	G												
			Warranty	1.5	G												
			SD-04 Samples														
			Interior Signage	1.3.1	G												
			SD-10 Operation and Maintenance														
			Data														
			Approved Manufacturer's	3.1	G												
			Instructions														
			Protection and Cleaning	3.1.2	G												
		10 21 13	SD-02 Shop Drawings														
			Installation Drawings	3.2	G												
			SD-03 Product Data														
			Cleaning and Maintenance	2.1													
			Instructions														
			Colors And Finishes	2.7													
			Galvanized Steel Sheet	2.2.1													
			Sound-Deadening Cores	2.2.2													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		10 21 13	Anchoring Devices and Fasteners	2.2.3													
			Hardware and Fittings	2.2.5													
			Brackets	2.2.4													
			Door Hardware	2.2.6													
			Toilet Enclosures	2.3.1													
			Urinal Screens	2.3.2													
			Pilaster Shoes	2.5													
			SD-04 Samples														
			Colors and Finishes	2.7	G												
			SD-07 Certificates														
			Warranty	1.5													
			SD-10 Operation and Maintenance Data														
			Plastic Identification	2.1.1	G												
		10 22 13	SD-02 Shop Drawings														
			Wire Mesh Partitions	1.4													
			SD-03 Product Data														
			Wire Mesh Partitions	1.4													
		10 26 00	SD-02 Shop Drawings														
			Corner Guards	2.2													
			SD-03 Product Data														
			Corner Guards	2.2													
			SD-04 Samples														
			Finish	2.3													
		10 28 13	SD-03 Product Data														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		10 28 13	Finishes	2.1.2	G												
			Accessory Items	2.2	G												
			SD-07 Certificates														
			Accessory Items	2.2													
		10 44 16	SD-02 Shop Drawings														
			Cabinets	Part 2	G												
			SD-03 Product Data														
			Cabinets	Part 2	G												
		10 56 13	SD-01 Preconstruction Submittals														
			Shelving Units	2.1													
			SD-03 Product Data														
			Shelving Units	2.1													
			Accessories	2.2													
			Installation instructions	3.2													
			SD-04 Samples														
			Finish	2.3													
			SD-06 Test Reports														
			Shelving Units	2.1													
			Finish	2.3													
		13 34 19	SD-01 Preconstruction Submittals														
			Manufacturer's Qualifications	1.6.3	G												
			SD-02 Shop Drawings														
			Detail Drawings	1.2.1.7	G												
			Detail Drawings	1.6.1	G												
			SD-03 Product Data														
			Manufacturer's catalog data	1.6.1	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		13 34 19	SD-04 Samples														
			Flush Profile Metal Panels (Soffit)	2.4.2													
			Manufacturer's color charts and chips	2.4.3	G												
			SD-05 Design Data														
			descriptive and technical literature	1.6.1	G												
			building design analysis	1.6.1	G												
			SD-06 Test Reports														
			test reports	1.6.1	G												
			Coatings and base metals	1.6.1	G												
			Factory Color Finish Performance Requirements	1.6.1	G												
			SD-07 Certificates														
			system components	1.6.1	G												
			Coil Stock	1.6.1	G												
			Coil Stock	2.1.7	G												
			Qualification of Manufacturer	1.6.1	G												
			Qualification of Erector	1.6.1	G												
			SD-08 Manufacturer's Instructions														
			Installation of Roof panels	1.6.2	G												
			SD-11 Closeout Submittals														
			Manufacturer's Warranty	3.10.1	G												
			Contractor's Warranty for Installation	3.10.2	G												
		21 13 13.00 20	SD-02 Shop Drawings														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		21 13 13.00 20	Shop Drawings	1.5.2	G												
			SD-03 Product Data														
			Pipe	2.1.1	G												
			Fittings	2.1.1	G												
			Valves	2.1.4	G												
			Sprinklers	2.1.3	G												
			Pipe hangers and supports	2.1.5	G												
			Sprinkler Alarm Switches	2.2.1													
			Mechanical couplings	2.1.1	G												
			SD-05 Design Data														
			Hydraulic Calculations	1.3	G												
			SD-06 Test Reports														
			request to schedule Preliminary Tests	3.5	G												
			Preliminary Test Report	3.5	G												
			request to schedule Final Acceptance Test	3.6	G												
			Final Acceptance Test Report	3.6	G												
			SD-07 Certificates														
			Fire Protection Engineer	1.5.1	G												
			Sprinkler System Installer	1.5.2	G												
			SD-10 Operation and Maintenance Data														
			Operating and Maintenance Instructions	3.7													
			SD-11 Closeout Submittals														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		21 13 13.00 20	As-built drawings	1.5.2													
			On-site training	3.7													
		21 13 16.00 20	SD-02 Shop Drawings														
			Sprinkler heads and piping system layout	1.3.8	G												
			Electrical wiring diagrams	1.3.8	G												
			SD-03 Product Data														
			Piping	2.1	G												
			Valves	2.1.9	G												
			Sprinkler heads	2.1.2	G												
			Pipe hangers and supports	2.1.8	G												
			Low air pressure supervisory switch	2.1.6	G												
			Dry pipe valves	2.1.4	G												
			Air compressor	2.1.7	G												
			Mechanical couplings	2.1.1	G												
			Pressure Switch	2.1.5	G												
			SD-05 Design Data														
			Sprinkler system design	1.3	G												
			SD-06 Test Reports														
			Preliminary tests	3.2.1	G												
			SD-07 Certificates														
			Qualifications of installer	1.5.1	G												
			SD-10 Operation and Maintenance Data														
			Dry pipe valves	2.1.4	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		21 13 16.00 20	Air compressor	2.1.7	G												
			SD-11 Closeout Submittals														
			As-built drawings of each system	1.3.9	G												
		22 00 00	SD-02 Shop Drawings														
			Plumbing System	3.9.1	G												
			SD-03 Product Data														
			Fixtures	2.5													
			Flush Valve Water Closets	2.5.1	G												
			Flush Valve Urinals	2.5.2	G												
			Countertop Lavatories	2.5.3	G												
			Break Room Sinks	2.5.4	G												
			Mop Sinks	2.5.7	G												
			Drinking-Water Coolers	2.5.5	G												
			Precast Plastic Shower Floors	2.5.6	G												
			Water Heaters	2.10	G												
			Pumps	2.11	G												
			Backflow Prevention Assemblies	3.9.1.1	G												
			Shower Faucets	2.7.2	G												
			Welding	1.5.1													
			Vibration-Absorbing Features	3.4	G												
			Plumbing System	3.9.1													
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.9													
			Test of Backflow Prevention	3.9.1.1	G												
			Assemblies														
			SD-07 Certificates														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		22 00 00	Materials and Equipment	1.3													
			Bolts	2.2.1													
			SD-10 Operation and Maintenance Data														
			Plumbing System	3.9.1	G												
			SD-11 Closeout Submittals														
			Water-Efficient Products	2.1.1	S												
			Energy-Efficient Water Heaters	2.1.2	S												
		23 00 00	SD-02 Shop Drawings														
			Detail Drawings	1.4.4	G												
			SD-03 Product Data														
			Metallic Flexible Duct	2.10.1.1													
			Duct Connectors	2.10.1.2													
			Duct Access Doors	2.10.2	G												
			Manual Balancing Dampers	2.10.3	G												
			Sound Attenuation Equipment	2.10.5													
			Diffusers	2.10.6.1													
			Registers and Grilles	2.10.6.3													
			Louvers	2.10.7													
			Air Vents, Penthouses, and Goosenecks	2.10.8													
			Centrifugal Type Power Roof Ventilators	2.11.1.1													
			Energy Recovery Devices	2.13	G												
			Test Procedures	1.4.5													
			Diagrams	1.2.1.2	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 00 00	Metal Ductwork	2.10.1	G												
			Dedicated Outdoor Air System (DOAS)	2.13.1	G												
			SD-06 Test Reports														
			Performance Tests	3.12	G												
			Damper Acceptance Test	3.10	G												
			SD-07 Certificates														
			Bolts	1.4.1													
			Ozone Depleting Substances	1.4.3													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Installation	3.3													
			Instructions														
			Operation and Maintenance	3.14.2													
			Training														
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.14.1	G												
			Manuals														
			Manual Balancing Dampers	2.10.3	G												
			Centrifugal Type Power Roof	2.11.1.1	G												
			Ventilators														
			Energy Recovery Devices	2.13	G												
			Dedicated Outdoor Air System (DOAS)	2.13.1	G												
			SD-11 Closeout Submittals														
			Energy Efficient Equipment	2.1.1	S												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASS SIFIC ATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 00 00	Reduce Volatile Organic Compounds (VOC)	2.1.2	S												
			Indoor Air Quality During Construction	3.1	S												
			Ozone Depleting Substances for Refrigerants	2.1.3	S												
		23 03 00.00 20	SD-11 Closeout Submittals														
			Energy Efficient Equipment for Motors	2.1.1	S												
		23 05 48.00 40	SD-02 Shop Drawings														
			Installation Drawings	1.2	G												
			Outline Drawings	1.2	G												
			SD-03 Product Data														
			Equipment and Performance Data	1.2	G												
			SD-06 Test Reports														
			Type of Isolator	2.4	G												
		23 05 93	SD-01 Preconstruction Submittals														
			Independent TAB Agency and Personnel Qualifications	1.5.1	G												
			TAB Design Review Report	1.5.3.1	G												
			SD-02 Shop Drawings														
			TAB Schematic Drawings and Report Forms	1.3.2	G												
			SD-03 Product Data														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 05 93	Equipment and Performance Data	1.3	G												
			TAB Related HVAC Submittals	1.5.1.3	G												
			SD-06 Test Reports														
			Completed Pre-Final DALT Report	3.3.5	G												
			Certified Final DALT Report	3.3.8	G												
			Prerequisite HVAC Work Checkout List	1.5.3.2	G												
			Prerequisite HVAC Work Checkout List	1.5.3.2	G												
			Prerequisite HVAC Work Checkout List	1.5.3.2	G												
			Proportional Balancing	3.7	G												
			Season 1	3.7	G												
			Season 2	3.7	G												
			SD-07 Certificates														
			Independent TAB Agency and Personnel Qualifications	1.5.1	G												
			DALT and TAB Submittal and Work Schedule	1.5.3.1	G												
			TAB Pre-Field Engineering Report	1.5.3.2	G												
			Instrument Calibration Certificates	1.5.5	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 05 93	DALT and TAB Procedures	3.7	G												
			Summary														
			Completed Pre-Final DALT Work	3.7	G												
			Checklist														
			Advance Notice of Pre-Final	3.3.2	G												
			DALT Field Work														
			Proportional Balancing	3.7	G												
			Season 1	3.7	G												
			Season 2	3.7	G												
		23 07 00	SD-02 Shop Drawings														
			Pipe Insulation Systems	2.4													
			Pipe Insulation Systems	3.2													
			Duct Insulation Systems	3.3													
			SD-03 Product Data														
			Pipe Insulation Systems	2.4	G												
			Pipe Insulation Systems	3.2	G												
			Duct Insulation Systems	3.3	G												
			SD-08 Manufacturer's Instructions														
			Pipe Insulation Systems	2.4	G												
			Pipe Insulation Systems	3.2	G												
			Duct Insulation Systems	3.3	G												
			SD-11 Closeout Submittals														
			Reduce Volatile Organic	2.1.1	S												
			Compounds (VOC)														
			Recycled Content	2.1.2	S												
		23 09 23.13 22	SD-02 Shop Drawings														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 09 23.13 22	Control system drawings title sheet	1.4.1.1	G												
			List of I/O Points	1.4.1.2	G												
			Control System Components List	1.4.1.3	G												
			Control system schematics	1.4.1.4	G												
			HVAC Equipment Electrical	1.4.1.5	G												
			Ladder diagrams														
			Component wiring diagrams	1.4.1.6	G												
			Terminal strip diagrams	1.4.1.7	G												
			BACnet communication architecture schematic	1.4.1.8	G												
			SD-03 Product Data														
			Direct Digital Controllers	2.1.2	G												
			BACnet Gateways	2.1.2.13	G												
			Notebook Computer	2.1.3	G												
			Sensors and Input Hardware	2.2	G												
			Output Hardware	2.3	G												
			Surge and transient protection	2.4.2	G												
			Duct smoke detectors	2.5.1	G												
			Variable frequency (motor) drives	2.6	G												
			SD-05 Design Data														
			Performance Verification Testing Plan	3.5.2	G												
			Pre-Performance Verification Testing Checklist	3.5.4	G												
			SD-06 Test Reports														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 09 23.13 22	Performance Verification Testing Report	3.5.11	G												
			SD-07 Certificates														
			Contractor's Qualifications	1.6.6	G												
			SD-09 Manufacturer's Field Reports														
			Pre-PVT Checklist	3.5.1	G												
			SD-10 Operation and Maintenance Data														
			BACnet Direct Digital Control Systems	1.4	G												
			Controls System Operators Manuals	3.4	G												
			VFD Service Manuals	2.6.2	G												
			SD-11 Closeout Submittals														
			DDC Software	2.1.5	G												
			Training documentation	3.6.1	G												
		23 11 25	SD-02 Shop Drawings														
			Gas Piping System	1.5.2	G												
			Gas Piping System	2.2	G												
			Gas Piping System	3.3	G												
			SD-03 Product Data														
			Gas Piping System	1.5.2	G												
			Gas Piping System	2.2	G												
			Gas Piping System	3.3	G												
			Pipe Coating Materials	2.1	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 11 25	Pressure Regulators	2.5	G												
			Valves	2.3	G												
			SD-06 Test Reports														
			Testing	3.15	G												
			Pressure Tests	3.15.1	G												
			Pressure Tests for Liquified	3.15.2	G												
			Petroleum Gas														
			Test with Gas	3.15.3	G												
			SD-07 Certificates														
			Welders Procedures and	1.5.1	G												
			Qualifications														
			Assigned Number, Letter, or	1.5.1	G												
			Symbol														
			SD-08 Manufacturer's Instructions														
			Pipe Coating Materials	2.1	G												
			SD-10 Operation and Maintenance														
			Data														
			Gas Facility System and	1.3.1	G												
			Equipment Operation														
			Gas Facility System Maintenance	1.3.2	G												
			Gas Facility Equipment	1.3.3	G												
			Maintenance														
		23 23 00	SD-02 Shop Drawings														
			Refrigerant Piping System	2.3	G												
			SD-03 Product Data														
			Refrigerant Piping System	2.3													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 23 00	Qualifications	1.3.1													
			Refrigerant Piping Tests	3.5													
			Verification of Dimensions	3.1													
			SD-06 Test Reports														
			Refrigerant Piping Tests	3.5													
			SD-07 Certificates														
			Service Organization	2.1													
			SD-10 Operation and Maintenance														
			Data														
			Maintenance	1.5	G												
			Operation and Maintenance	3.4	G												
			Manuals														
			Demonstrations	3.4	G												
		23 81 00.00 20	SD-02 Shop Drawings														
			Field-Assembled Refrigerant	2.7.2													
			Piping														
			Control System Wiring Diagrams	1.4.2													
			SD-03 Product Data														
			Heat Pumps	2.2													
			Ductless Air Conditioners	2.3													
			Filters	2.4													
			Thermostats	2.3.8													
			Refrigerant	1.5													
			Refrigerant Piping and	2.7													
			Accessories														
			Coatings for Finned Tube Coils	2.5													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 81 00.00 20	SD-06 Test Reports														
			Salt-Spray Tests	2.9.1													
			Start-Up and Initial Operational Tests	3.8.3													
			SD-08 Manufacturer's Instructions														
			Heat Pumps	2.2													
			Ductless Air Conditioners	2.3													
			Filters	2.4													
			Thermostats	2.3.8													
			Refrigerant Piping and Accessories	2.7													
			SD-10 Operation and Maintenance Data														
			Heat Pumps	2.2													
			DuctlessAir Conditioners	2.3													
			Filters	2.4													
			Thermostats	2.3.8													
			SD-11 Closeout Submittals														
			Posted Operating Instructions	1.4.4													
			Energy Efficient Equipment for Unitary Air Conditioning Equipment	2.1.1	S												
			Ozone Depleting Substances	2.1.2	S												
			Indoor Air Quality During Construction	3.1.1	S												
		26 08 00	SD-06 Test Reports														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 08 00	Acceptance tests and inspections	3.1	G												
			SD-07 Certificates														
			Qualifications	1.4.1	G												
			Acceptance test and inspections	1.4.3	G												
			procedure														
		26 12 19.10	SD-02 Shop Drawings														
			Pad-mounted transformer	1.4.1	G												
			drawings														
			SD-03 Product Data														
			Pad-mounted transformers	2.2	G												
			SD-06 Test Reports														
			Acceptance checks and tests	3.7.1	G												
			SD-07 Certificates														
			Transformer Efficiencies	2.2.2.1	G												
			SD-09 Manufacturer's Field														
			Reports														
			design tests	2.7.2	G												
			routine and other tests	2.7.3	G												
			SD-10 Operation and Maintenance														
			Data														
			Transformer(s)	1.5.1	G												
			SD-11 Closeout Submittals														
			Transformer test schedule	2.7.1	G												
		26 20 00	SD-02 Shop Drawings														
			Panelboards	2.12	G												
			Transformers	2.14	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 20 00	Cable trays	2.3	G												
			Marking strips	3.1.7.1	G												
			SD-03 Product Data														
			Receptacles	2.11	G												
			Circuit breakers	2.12.3	G												
			Switches	2.9	G												
			Transformers	2.14	G												
			Enclosed circuit breakers	2.13	G												
			Manual motor starters	2.15	G												
			Grounding Busbar	2.18.3	G												
			Surge protective devices	2.23	G												
			SD-06 Test Reports														
			600-volt wiring test	3.5.2	G												
			Grounding system test	3.5.5	G												
			Transformer tests	3.5.3	G												
			Ground-fault receptacle test	3.5.4	G												
			SD-07 Certificates														
			Fuses	2.10	G												
		26 27 14.00 20	SD-02 Shop Drawings														
			Installation Drawings	1.4.1	G												
			SD-03 Product Data														
			Electricity meters	2.1.4	G												
			Current transformer	2.1.3	G												
			Potential transformer	2.1.2	G												
			communications	2.2	G												
			SD-06 Test Reports														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 27 14.00 20	Acceptance checks and tests	3.2.1	G												
			System functional verification	3.2.2	G												
			Building meter installation sheet,	3.2.1	G												
			per building														
			Completed meter installation	3.2.1	G												
			schedule														
			Completed meter data schedule	3.2.1	G												
			Meter configuration template	2.1.1	G												
			Meter configuration report	3.2.1	G												
			SD-10 Operation and Maintenance														
			Data														
			Electricity Meters and	1.5.1	G												
			Accessories														
			SD-11 Closeout Submittals														
			System functional verification	3.2.2	G												
		26 51 00.00 22	SD-02 Shop Drawings														
			Luminaire Drawings	1.5.1	G												
			Occupancy/Vacancy Sensor	1.5.2	G												
			Coverage Layout														
			SD-03 Product Data														
			Luminaires	2.2	G												
			Light Sources	2.4	G												
			Drivers	2.3	G												
			Ballasts	2.3	G												
			LED Luminaire Warranty	1.6.1	G												
			Luminaire Design Data	1.5.4	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 51 00.00 22	Vacancy Sensors	2.5.3.1	G												
			Dimming Switches	2.5.2	G												
			Exit Signs	2.6.1	G												
			Emergency Lighting Unit (EBU)	2.6.2	G												
			LED Emergency Drivers	2.6.3	G												
			Occupancy Sensors	2.5.3.1	G												
			Ambient Light Level Sensor	3.1.8	G												
			Lighting Control Panel	2.5.4	G												
			SD-06 Test Reports														
			LED Luminaire - IES LM-79 Test Report	1.5.5	G												
			LED Light Source - IES LM-80 Test Report	1.5.6	G												
			LED Light Source - IES TM-21 Test Report	1.5.7	G												
			Occupancy/Vacancy Sensor Verification Tests	1.5.8	G												
			Energy Efficiency	1.5.11.3	G												
			SD-07 Certificates														
			Luminaire Useful Life Certificate	1.6.1.1	G												
			LED Driver and Dimming Switch Compatibility Certificate	1.5.3	G												
		26 56 00	SD-01 Preconstruction Submittals														
			LED Luminaire Warranty	1.7.1	G												
			SD-03 Product Data														
			LED Luminaires	2.2	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		26 56 00	Luminaire Light Sources	2.2.2	G												
			Luminaire Power Supply Units	2.2.3	G												
			(Drivers)														
			Lighting contactor	2.3.3	G												
			Time switch	2.3.2	G												
			Lighting Control Relay Panel	2.3.4	G												
			Photocell	2.3.1	G												
			SD-05 Design Data														
			Design Data for luminaires	1.5.1	G												
			SD-06 Test Reports														
			LED Luminaire - IES LM-79 Test	1.5.2	G												
			Report														
			LED Light Source - IES LM-80	1.5.3	G												
			Test Report														
			Operating test	3.2													
			SD-07 Certificates														
			Luminaire Useful Life Certificate	1.7.1	G												
		27 10 00	SD-02 Shop Drawings														
			Telecommunications drawings	1.6.1.1	G												
			Telecommunications Space	1.6.1.2	G												
			Drawings														
			SD-03 Product Data														
			Telecommunications cabling	2.3	G												
			Patch panels	2.4.5	G												
			Telecommunications	2.5	G												
			outlet/connector assemblies														

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		27 10 00	Equipment support frame	2.4.2	G												
			Connector blocks	2.4.3	G												
			SD-06 Test Reports														
			Telecommunications cabling testing	3.5.1	G												
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1	G												
			Key Personnel	1.6.2.2	G												
			Manufacturer Qualifications	1.6.2.3	G												
			Test plan	1.6.3	G												
			SD-09 Manufacturer's Field Reports														
			Factory reel tests	2.10.1	G												
			SD-10 Operation and Maintenance Data														
			Telecommunications cabling and pathway system	1.10.1	G												
			SD-11 Closeout Submittals														
			Record Documentation	1.10.2	G												
		28 31 63.00 20	SD-02 Shop Drawings														
			Battery power calculations	1.5.1													
			SD-03 Product Data														
			Terminal cabinets	2.2.8.2	G												
			Manual stations	2.2.9	G												
			Batteries	2.2.7.1	G												
			Smoke sensors	2.2.6	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		28 31 63.00 20	Wiring	2.2.8.3	G												
			Wiring	2.3	G												
			Notification appliances	2.2.10	G												
			Addressable interface devices	2.2.5	G												
			Waterflow detectors	2.2.12	G												
			Tamper switches	2.2.11	G												
			Smoke sensor testing procedures	2.2.6.2	G												
			SD-07 Certificates														
			Qualifications of installer	1.5.2													
			SD-10 Operation and Maintenance														
			Data														
			INTERIOR FIRE ALARM	2.2	G												
			SYSTEM														
			Record drawing software	1.5.3													
		31 23 00.00 20	SD-06 Test Reports														
			Fill and backfill	3.11.2.1													
			Porous fill	3.11.2.2													
			Density tests	3.11.2.3													
			Moisture Content Tests	3.11.2.4													
		31 66 13	SD-02 Shop Drawings														
			Helical Piles	2.1	G												
		32 11 26.16	SD-05 Design Data														
			job-mix formula	1.6.1													
			SD-06 Test Reports														
			Bituminous mix	3.6.2.2													
			Density	3.6.2.3													

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		32 11 26.16	Thickness	3.6.2.3													
			Smoothness	3.6.2.3													
		33 11 00	SD-03 Product Data														
			Pipe, Fittings, Joints and Couplings	2.2													
			Valves	2.3													
			Valve Boxes	2.3.2	G												
			Pipe Anchorage	2.2.3	G												
			SD-07 Certificates														
			Pipe, Fittings, Joints and Couplings	2.2													
			Valves	2.3													
			Disinfection Procedures	3.2.4													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	3.2.1													
		33 30 00	SD-01 Preconstruction Submittals														
			Existing Conditions	1.6													
			SD-03 Product Data														
			Pipeline Materials	2.1													
			SD-06 Test Reports														
			Reports	2.3													
		33 71 02	SD-03 Product Data														
			Medium voltage cable	2.5	G												
			Medium voltage cable joints	2.7	G												
			Medium voltage cable terminations	2.6	G												

SUBMITTAL REGISTER											CONTRACT NO.						
TITLE AND LOCATION P766 F-35B Lift System Repair Facility						CONTRACTOR											
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION OR REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 71 02	SD-06 Test Reports														
			Medium voltage cable	2.12.2	G												
			qualification and production tests														
			Field Acceptance Checks and	3.15.1	G												
			Tests														
			Arc-proofing test	2.12.1	G												
			SD-07 Certificates														
			Cable splicer/terminator	1.4.1	G												
			Cable Installer Qualifications	1.4.2	G												
		33 82 00	SD-02 Shop Drawings														
			Telecommunications Outside	1.6.1.1	G												
			Plant														
			Telecommunications Entrance	1.6.1.2	G												
			Facility Drawings														
			SD-03 Product Data														
			Wire and cable	2.6	G												
			Cable splices, and connectors	2.3	G												
			Building protector assemblies	2.2.1	G												
			Protector modules	2.2.2	G												
			SD-06 Test Reports														
			Pre-installation tests	3.4.1	G												
			Acceptance tests	3.4.2	G												
			Outside Plant Test Plan	1.6.3	G												
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1	G												
			Key Personnel	1.6.2.2	G												

CONTRACT NO.

TITLE AND LOCATION

P766 F-35B Lift System Repair Facility

CONTRACTOR

[illegible]

This page is intentionally left blank.

SECTION 01 33 29

SUSTAINABILITY REPORTING

02/17

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

ASHRAE 189.1 (2014) Standard for the Design of
High-Performance Green Buildings Except
Low-Rise Residential Buildings

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)

HPSB Guiding Principles (2016) Guiding Principles for Sustainable
Federal Buildings and Determining
Compliance with the Guiding Principles for
Sustainable Federal Buildings

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

ANSI/SMACNA 008 (2007) IAQ Guidelines for Occupied
Buildings Under Construction, 2nd Edition

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy
Efficiency Labeling System (FEMP)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

SNAP (2016) EPA's Significant New Alternatives
Policy Program

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

40 CFR 247 Comprehensive Procurement Guideline for
Products Containing Recovered Materials

1.2 SUMMARY

This specification includes general requirements and procedures for this project to be constructed and documented per the federally mandated High Performance and Sustainable Building or HPSB Guiding Principles (GP), UFC 1-200-02, High Performance and Sustainable Building Requirements, and other requirements identified in this specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to this section. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Sustainability Action Plan; G

Preliminary Sustainability eNotebook; G

SD-11 Closeout Submittals

Final Sustainability eNotebook; G

Amended Final Sustainability eNotebook; G

Amended Final High Performance and Sustainable Building Checklist;
G

1.4 GUIDING PRINCIPLES VALIDATION (GPV)

Provide construction related sustainability documentation to verify achievement of HPSB Guiding Principles Validation (GPV). Provide the following for GPV:

- a. Refer to Attachment 1, HPSB Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require HPSB tracking.)
- b. Obtain approval of any changes to the HPSB Checklist from the Contracting Officer at the Preconstruction Conference. Contracting Officer's approval establishes identified HPSB Guiding Principles Requirements as the project's sustainability goals.

No variations or substitutions to the HPSB Checklist are allowed without written consent from the Contracting Officer. Immediately bring to the attention of the Contracting Officer any changes that impact meeting the approved HPSB Guiding Principles Requirements for this project and demonstrate that change will not incur additional construction cost or increase the life cycle cost.

- c. Provide all work, including "S" submittals, required to incorporate the applicable HPSB Guiding Principles Requirements indicated on the HPSB Checklist and in this contract.
- d. Provide Sustainability Action Plan
- e. Provide construction related documentation for the project Sustainability eNotebook, and keep updated with regularly-scheduled construction meetings. Include construction related documentation containing the following components;

(1) HPSB Checklist

(2) Sustainability Action Plan

- (3) Documentation illustrating HPSB Guiding Principles Requirements compliance (including "S" submittals)

1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

- a. Planned method to achieve each construction related GP requirement.
- b. For each designated construction related **HPSB Guiding Principles** Requirements that is not achieved, provide narrative explaining how mission or activity precludes achieving specific sustainability requirement or goal. Provide analysis of particular requirement and level to which project is able to comply. Final government-approved narrative(s) must be included with the HPSB Checklist submittal.
- c. Name and contact information for: POC responsible for ensuring sustainability goals are accomplished and documentation is assembled.
- d. Include the Indoor Air Quality plan with the Sustainability Action Plan.

1.4.2 Costs

Bear all costs associated with constructing and demonstrating that project complies with approved **HPSB Guiding Principles** Requirements.

1.4.3 Calculations

Provide calculations, product data, labels and certifications required in this section to demonstrate compliance with the **HPSB Guiding Principles** Requirements.

1.5 SUSTAINABILITY SUBMITTALS

Provide HPSB Checklist and other documentation in the Sustainability eNotebook to indicate compliance with the sustainability requirements of the project.

1.5.1 High Performance Sustainable Building (HPSB) Checklist

Provide construction documentation that provides proof of and supports compliance with the completed HPSB Checklist.

1.5.1.1 HPSB Checklist Submittals

Submit updated HPSB Checklist with each Sustainability eNotebook submittal. Attach final HPSB Checklist to draft final DD1354 Real Property Record Submittal.

1.5.2 "S" Submittals for Sustainability Documentation

Submit the GPV compliance data in "S" submittal.

1.5.3 Sustainability eNotebook

Provide and maintain a comprehensive Sustainability eNotebook to document compliance with the sustainability requirements identified in the approved HPSB Checklist. Sustainability eNotebook must contain all required data to support full compliance with the **HPSB Guiding Principles** Requirements, including HPSB checklist, Sustainable Action Plan, calculations, labels, and certifications. Sustainability eNotebook is in the form of an Adobe PDF file; bookmarked at each **HPSB Guiding Principles** Requirement and sub-bookmarked at each document. Match format to **HPSB Guiding Principles** numbering system indicated herein. Maintain up to date information, spreadsheets, templates, and other required documentation with each current submittal.

Contracting Officer may deduct from the monthly progress payment accordingly if Sustainability eNotebook information is not current, until information is updated and on track per project goals.

1.5.3.1 Sustainability eNotebook Submittal Schedule

Provide Sustainability eNotebook Submittals at the following milestones of the project:

a. **Preliminary Sustainability eNotebook**

Submit preliminary Sustainability eNotebook for approval at the Pre-construction conference.

b. Construction Progress Meetings. Update GP documentation in the Sustainability eNotebook for each meeting.

c. **Final Sustainability eNotebook**

Submit updated Sustainability eNotebook at the Beneficial Occupancy Date (BOD). Final progress payment retainage may be held by Contracting Officer until final sustainability documentation is complete.

d. **Amended Final Sustainability eNotebook**

Amend and resubmit the Final Sustainability eNotebook to include post-occupancy corrections, updates, and requirements. Include **Amended Final High Performance and Sustainable Building Checklist**. Final progress payment retainage may be held by Contracting Officer until amended final sustainability documentation is complete. Submit 3 final electronic copies of the Amended Final Sustainability eNotebook Submittal on DVDs to the Government no longer than 30 days after the GP designated data collection period.

1.6 DOCUMENTATION REQUIREMENTS

a. Incorporate each of the following **HPSB Guiding Principles** Requirements into project construction; and provide documentation that proves compliance with each listed requirement. Items below are organized according to the **HPSB Guiding Principles**. For life-cycle cost analysis requirements, one document with all analyses is acceptable, with Contracting Officer approval.

b. For each of the following paragraphs that require the use of products

listed on Government-required websites, provide documentation of the process used to select products, or process used to determine why listed products do not meet project performance requirements.

1.6.1 Energy Efficient Products

Provide only energy-using products that are **Energy Star** rated, or have the Federal Energy Management Program (FEMP) recommended efficiency. Where **Energy Star** or FEMP recommendations have not been established, provide most efficient products that are life-cycle cost effective. Provide only energy using products that meet FEMP requirements for low standby power consumption. Energy efficient products can be found at: <https://energy.gov/eere/femp/federal-energy-management-program> and <https://www.energystar.gov/>. Provide the following documentation:

Proof that products are labeled energy efficient and comply with the cited requirements.

1.6.2 Reduce Volatile Organic Compounds (VOC) (Low Emitting Materials)

Meet the requirements of Table 3-1 at the end of this specification. Provide the following documentation:

Provide certifications or labels that demonstrate compliance with cited requirements.

1.6.3 Indoor Air Quality During Construction

Prior to construction, create indoor air quality (IAQ) plan. Develop and implement the IAQ construction management plan during construction and flush building air before occupancy.

For renovation of occupied existing buildings, comply with **ANSI/SMACNA 008** IAQ Guidelines for Occupied Buildings Under Construction.

Provide documentation showing that after construction ends and prior to occupancy, HVAC filters were replaced and area air was flushed out in accordance with the cited standard.

1.6.4 Recycled Content

Comply with **40 CFR 247**. Refer to <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program> for assistance identifying products cited in **40 CFR 247**. Selected products must comply with non-proprietary requirements of the Federal Acquisition Regulation, and must meet performance requirements. Provide the following documentation:

- a. Manufacturers' documents stating the recycled content by material, or written justification for claiming one of the exceptions allowed on the cited website.
- b. Substitutions: Submit for Government approval, proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. For all such proposed substitutions, submit with the Sustainability Action Plan accompanied by product data demonstrating equivalence.

1.6.5 Ozone Depleting Substances

Meet the requirements of **ASHRAE 189.1** Section 9.3.3 Refrigerants for no CFC-based refrigerants in heating ventilation, air conditioning and refrigeration systems (except for fire suppression system requirements, covered elsewhere in this specification). Where feasible, use products from U.S. EPA Significant New Alternatives Policy (SNAP) (<https://www.epa.gov/snap>) or meet the criteria of **SNAP**. Provide the following documentation:

- a. SDS sheets for all refrigerants.
- b. Provide label for each product meeting the cited standards.

1.6.6 Waste Material Management (Recycling - Construction)

Divert construction debris from landfill disposal where markets or on-site recycling exists, and provide documentation in accordance with Section **01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT**.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 SUSTAINABILITY COORDINATION

3.1.1 Coordinating Sustainability Documentation Progress

Provide sustainability focus and coordination at the following meetings to achieve sustainability goals. The designated sustainability professional responsible for GP documentation must participate in the following meetings to coordinate documentation completion.

- a. Pre-Construction Conference: Discuss the following: HPSB Checklist, Sustainability Action Plan, Construction submittal requirements and schedule, individuals responsible for achieving each Guiding Principle Requirement.
- b. Construction Progress Meetings: Review GP sustainability requirements with project team including contractor and sub-contractor representatives. Demonstrate GP documentation is being collected and updated to the Sustainability eNotebook.
 - (1) Facility Turnover Meetings: Review Sustainability eNotebook for completeness and identify any outstanding issues relating to final documentation requirements.
 - (2) Final Sustainability eNotebook Review

3.2 TABLE 3-1 VOLATILE ORGANIC COMPOUNDS (VOC) (LOW EMITTING MATERIALS) REQUIREMENTS

Refer to following table, based on [ASHRAE 189.1](#) section 8.4.2 (Materials), for compliance criteria.

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications)				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Adhesives and Sealants	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Adhesives (carpet, resilient, wood flooring; panel; primers) Sealants (acoustical; firestop; HVAC Air duct; primers) Caulks	SCAQMD Rule 1168 (Use "other" category for HVAC duct sealant) (for firestop adhesive, UFC 3-600-01 overrides conflicting requirements)
			Aerosol adhesives	Section 3 of Green Seal Standard GS-36 (except: cleaners, solvent cements, and primers used with plastic piping and conduit in plumbing, fire suppression, and electrical systems; HVAC air duct sealants when the application space air temp is less than 40 F (4.5 C)).
Paints and Coatings	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Flat and nonflat topcoats, primers, undercoaters, and anti-corrosive coatings	Green Seal Standard GS-11

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications)				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Paints and Coatings	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Concrete/masonry sealers (waterproofing concrete/masonry sealers), concrete curing compounds, dry fog coatings, faux finishing coatings, fire resistive coatings, floor coatings, graphic arts (sign) coatings, industrial maintenance coatings, mastic texture coatings, metallic pigmented coatings, multicolor coatings, pretreatment wash primers, reactive penetrating sealers, recycled coatings, shellacs (clear and opaque), specialty primers, stains, wood coatings (clear wood finishes), wood preservatives, and zinc primers	California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings or SCAQMD Rule 1113

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications)				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Paints and Coatings	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)	or	Basement specialty coatings, high-temperature coatings, low solids coatings, stone consolidants, swimming-pool coatings, tub- and tile-refining coatings, and waterproofing membranes	California Air Resources Board (CARB) Suggested Control Measure for Architectural Coatings
Floor Covering Materials	For carpet, all locations: CDPH/EHLB/Standard Method V1.1 (California Section 01350) or label for Section 9 of CDPH/EHLB/Standard Method V1.1 (California Section 01350)		none	none

UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications
Only)

MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY

TABLE 3-1 Volatile Organic Compounds (VOC) (Low Emitting Materials) Requirements				
UFGS 01 33 29, Para 1.6.5 Submittal Requirements (Interior Applications)				
MATERIAL CATEGORY	EMISSIONS REQUIREMENT		MATERIALS WITH ADDED VOC REQUIREMENT	MATERIAL CATEGORY
Ceiling and Wall Systems ceiling and wall insulation acoustical ceiling panels tackable wall panels gypsum wall board and panels wall coverings	CDPH/EHLB/Standard method V1.1 (California Section 01350) (Use "office" or "classroom" space limits for all applications)		none	none

-- End of Section --

This page is intentionally left blank.

NAVFAC SUSTAINABILITY AND ENERGY DATA --- NEW CONSTRUCTION & MAJOR RENOVATION

PROJECT INFORMATION

Work Order No.: _____ FY _____ MILCON P No. / Customer Reference No.: _____
 Project Title: _____
 Location/UIC: _____
 NAVFAC Project Manager: _____ Project Dollar Amount \$: _____
 Project Type: _____ Project Design Level: _____
 Facility Area: _____ U/M: _____ Category Code: _____ Facility #: _____
 AE Contract # & T.O. _____ AE Firm Sustainability Coordinator: _____
 AE Firm Name: _____
 Project Phase: _____ Solicitation Documents Complete (Draft) _____ Construction Complete (Final) _____
 Construction Contract & T.O. _____ Award Date (P/A): _____ BOD (P/A): _____
 Construction Contractor: _____
 Contractor's Sustainability Coordinator: _____

SUSTAINABILITY DATA - GUIDING PRINCIPLES for SUSTAINABLE NEW CONSTRUCTION and MAJOR RENOVATION

Use this form to collect design and as-constructed project information to be recorded on the Sustainable and Energy Tab in eProjects

Provide justification for each target missed:

Sustainability Third Party Rating System:	USGBC LEED Not Applicable	GBI Green Globes Other
A Sustainability Certification Level - Target	LEED Silver	2 Globes
Identify "Other" certification system and target level		
B Sustainability Certification Level - Achieved	LEED Certified 1 Globe	LEED Silver 2 Globes
Identify "Other" certification system and level achieved	LEED Gold 3 Globes	LEED Platinum 4 Globes
I. Employ Integrated Design Principles	Included	Not Included
I.a Integrated Assessment, Operation, and Management		
I.b Commissioning (Select one)	Commissioning	No Commissioning
Systems Commissioned:		
II. Optimize Energy Performance		
II.a Energy Efficiency		
i Energy Reduction 30% target		
ii Efficiency Standard	90.1 - 2004	90.1 - 2007
a. Total Design Energy Use Intensity (EUI):	kBTU/Sq Ft/Year	90.1 - 2010
iii New Technology: Provide description		
II.b On-Site Renewable Energy		
i. Solar Hot Water 30% target		
ii. Renewable energy technology types (select all that apply)		
Daylighting	Ground Source Heat Pumps	Solar Photovoltaic
Geothermal	Mechanical (i.e., direct water pumping)	Solar Thermal -domestic hot water
Wind		Solar Thermal -space conditioning
iii. Sustainable Roof Attribute (Select all that apply)		
Cool - white	Cool - reflective	Solar PV
II.c Building-level Metering (Measurement)	Included	Not Included
III. Protect and Conserve Water		
III.a Indoor Water		
i Reduce potable water		
ii Building-level Metering (Measurement)	Included	Not Included
a. Total Design Indoor Water Use Intensity (WUI):	Gallons/Sq Ft/Year	
III.b Outdoor Water		
i Reduce landscape water	50% below conventional	100%
IV. Enhance Indoor Environmental Quality		
IV.a Ventilation and Thermal Comfort		
i Thermal Environmental Conditions	Met	Not Met
ii Ventilation	Met	Not Met
IV.b Moisture Control Plan	Included	Not Included
IV.c Daylighting		
i Minimum Daylight	Met	Not Met
ii Automatic dimming controls	Included	Not Included
IV.d Low-Emitting Materials	Met	Not Met

NAVFAC SUSTAINABILITY AND ENERGY DATA --- NEW CONSTRUCTION & MAJOR RENOVATION

IV.e Protect Indoor Air Quality during Construction	Met	Not Met
V. Reduce Environmental Impact of Materials		
V.a Recycled Content: www.epa.gov/cpg	Met	Not Met
V.b Biobased Products	Met	Not Met
V.c Waste and Materials Management		
i. Waste Diversion (50% target)		
ii. Waste Management	Included	Not Included
V.d Ozone Depleting Compounds	Met	Not Met

To maintain prior project sustainability information, print and upload a copy of the completed worksheet to the Notes tab as Design & Criteria note BEFORE updating the tab.

GUIDANCE ON CALCULATION FOR EUI & WUI

- 1 The EUI must be calculated as the total Design Energy Consumption per year (including savings from renewables) divided by the total Building Area (including unconditioned indoor space).
 - a. The total Design Energy Consumption can be found in the Energy Cost Budget (ECB) Compliance Report. The Design Energy Consumption is in the Energy Summary by End Use Table at the bottom of page 2 of the ECB Report. The value is listed as Total Including Solar for the Proposed Building. It is the first field on the bottom row. (Units in the ECB Report are 10⁶ Btu/yr, so multiply by 1000 to yield kBtu/yr)
 - b. The total Building Area (including unconditioned indoor spaces) can be found in the Energy Cost Budget (ECB) Compliance Report in the Space Summary Table on page 1 of the ECB Report. The value is listed as Total (area) including Conditioned area and Unconditioned area. Insure the units are in square feet

- 2 The WUI must be calculated as the total Design Indoor Potable Water Consumption per year divided by the total Building Area (including unconditioned space).
 - a. The total Design Water Consumption can be found in the LEED WE P1 water consumption calculation or Green Globes 3.4.1.1 Water Consumption calculation. The value is the Design Case – Annual Potable Water Consumption. It is listed in units of Gallons/year
 - b. The total Building Area (including unconditioned spaces) can be found in the Energy Cost Budget (ECB) Compliance Report in the Space Summary Table on page 1 of the ECB Report. The value is listed as Total (area) including Conditioned area and Unconditioned area. Insure the units are in square feet

NAVFAC SUSTAINABILITY AND ENERGY DATA -- RENOVATIONS >\$2.5M &<50% PRV; OR ENERGY

PROJECT INFORMATION

Work Order No.:	_____	Budget FY	_____	Customer Reference No.:	_____
Project Title:	_____				
Location/UIC:	_____				
NAVFAC Project Manager:	_____			Estimated Cost/PA:	_____
Project Type:	_____			Project Design Level:	_____
Facility Area:	_____	U/M:	_____	Category Code:	_____
AE Contract # & T.O.	_____	_____		Facility #:	_____
AE Firm Name:	_____			AE Firm Sustainability Coordinator:	_____
	Project Phase:	Solicitation Documents Complete (Draft)			Construction Complete (Final)
Construction Contract & T.O.	_____			Award Date (P/A):	_____
Construction Contractor:	_____			BOD (P/A):	_____
Contractor's Sustainability Coordinator:	_____				

SUSTAINABILITY DATA - GUIDING PRINCIPLES for SUSTAINABLE EXISTING BUILDINGS

Use this form to collect design and as-constructed project information to be recorded on the Sustainable and Energy Tab in eProjects.

Provide justification for each target missed:

I. Employ Integrated Assessment, Operation, and Management Principles

I.a Integrated Assessment, Operation, and Management	Included	Not Included
I.b Commissioning (Select one)		
Commissioning		
No Commissioning		
Re-Commissioning		
Retro-Commissioning		
Systems Commissioned		

II. Optimize Energy Performance

II.a Energy Efficiency				
i Energy Reduction Below Baseline (20% target)	_____	%		
ii Efficiency Standard (Select one)				
Energy Star 75 or higher			Building Baseline 2003	
ASHRAE 90.1-2007			ASHRAE 90.1-2010	
a. Total Design Energy Use Intensity (EUI):	kBTU/Sq Ft/Year			
iii New Technology: Provide description				
II.b On-Site Renewable Energy				
i. Solar Hot Water Demand (30% target)				
ii. Renewable energy technology types (Select all that apply)				
Daylighting		Ground Source Heat Pumps		Solar Photovoltaic
Geothermal		Mechanical (i.e., direct water pumping)		Solar Thermal -domestic hot water
Wind				Solar Thermal -space conditioning
iii. Sustainable Roof Attribute (Select all that apply)				
Cool - white		Cool - reflective	Solar PV	Solar Thermal
Cool - reflective			Not Included	Vegetated
II.c Building-level Metering (Measurement)				

III. Protect and Conserve Water

III.a Reduce Indoor Water			
i Choose Option (Select one)			
20% below IPC or IBC		20% below bldg baseline 2003	
ii Reduce potable water (percent)	_____	%	
ii Building-level Metering (Measurement)		Included	Not Included
a. Total Design Indoor Water Use Intensity (WUI):	Gallons/Sq Ft/Year		
III.b Reduce landscape water (Select one)		50% below conventional	50% below building baseline 2003
			100%

IV. Enhance Indoor Environmental Quality

IV.a Ventilation and Thermal Comfort			
i Thermal Environmental Conditions	Met	Not Met	
ii Ventilation	Met	Not Met	
IV.b Moisture Control Plan	Included		Not Included
IV.c Daylighting and Lighting Controls			
i Daylighting and lighting controls (Select one)		2% in 50% of occupied spaces	Not Met
		50% occupant control	
ii Automatic lighting controls		Included	Not Included
IV.d Low-Emitting Materials	Met	Not Met	
IV.e Protect Indoor Air Quality during Construction	Met	Not Met	

V. Reduce Environmental Impact of Materials

V.a Recycled Content: www.epa.gov/cpg		Met	Not Met
V.b Biobased Products	Met	Not Met	
V.c Waste and Materials Management			
i Waste Diversion - 50% target	_____	%	
ii Waste Management		Included	Not Included
V.d Ozone Depleting Compounds	Met	Not Met	

To maintain prior project sustainability information, print and upload a copy of the completed worksheet to the Notes tab as Design & Criteria note BEFORE updating the tab.

GUIDANCE ON CALCULATION FOR EUI & WUI

- 1 The **EUI** must be calculated as the total Design Energy Consumption per year (including savings from renewables) divided by the total Building Area (including unconditioned indoor space).
 - a. The total Design Energy Consumption can be found in the Energy Cost Budget (ECB) Compliance Report. The Design Energy Consumption is in the Energy Summary by End Use Table at the bottom of page 2 of the ECB Report. The value is listed as Total Including Solar for the Proposed Building. It is the first field on the bottom row. (Units in the ECB Report are 10⁶ Btu/yr, so multiply by 1000 to yield kBtu/yr)
 - b. The total Building Area (including unconditioned indoor spaces) can be found in the Energy Cost Budget (ECB) Compliance Report in the Space Summary Table on page 1 of the ECB Report. The value is listed as Total (area) including Conditioned area and Unconditioned area. Insure the units are in square feet

- 2 The **WUI** must be calculated as the total Design Indoor Potable Water Consumption per year divided by the total Building Area (including unconditioned space).
 - a. The total Design Water Consumption can be found in the LEED WE P1 water consumption calculation or Green Globes 3.4.1.1 Water Consumption calculation. The value is the Design Case – Annual Potable Water Consumption. It is listed in units of Gallons/year
 - b. The total Building Area (including unconditioned spaces) can be found in the Energy Cost Budget (ECB) Compliance Report in the Space Summary Table on page 1 of the ECB Report. The value is listed as Total (area) including Conditioned area and Unconditioned area. Insure the units are in square feet

SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS
09/15

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 SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

- ASSE/SAFE A10.32 (2012) Fall Protection
- ASSE/SAFE A10.34 (2001; R 2012) Protection of the Public on or Adjacent to Construction Sites
- ASSE/SAFE Z359.1 (2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

ASME INTERNATIONAL (ASME)

- ASME B30.22 (2010) Articulating Boom Cranes
- ASME B30.3 (2012) Tower Cranes
- ASME B30.5 (2014) Mobile and Locomotive Cranes
- ASME B30.8 (2010) Floating Cranes and Floating Derricks

ASTM INTERNATIONAL (ASTM)

- ASTM F855 (2015) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 1048 (2003) Guide for Protective Grounding of Power Lines
- IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

- ANSI/ISEA Z87.1 (2010) Occupational and Educational Personal Eye and Face Protection Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 1 (2015; ERTA 2015) Fire Code

NFPA 10	(2013) Standard for Portable Fire Extinguishers
NFPA 241	(2013; Errata 2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 306	(2014) Standard for Control of Gas Hazards on Vessels
NFPA 51B	(2014) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code
NFPA 70E	(2015; ERTA 1 2015) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual
------------	----------------------------------------------

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009) Manual on Uniform Traffic Control Devices
-------	--------------------------------------------------

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

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.1400	Cranes & Derricks in Construction
29 CFR 1926.16	Rules of Construction
29 CFR 1926.500	Fall Protection
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-307	(2009; Change 1 Mar 2011; Change 2 Aug
--------------	----------------------------------------

2011)Management of Weight Handling
Equipment

ND OPNAVINST 5100.23

(2005; Rev G) Navy Occupational Safety and
Health (NAVOSH) Program Manual

1.2 DEFINITIONS

- a. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.
- b. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- c. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered personnel.
- d. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers and crane walkers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).
- e. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
 - (1) Death, regardless of the time between the injury and death, or the length of the illness;
 - (2) Days away from work (any time lost after day of injury/illness onset);
 - (3) Restricted work;
 - (4) Transfer to another job;
 - (5) Medical treatment beyond first aid;
 - (6) Loss of consciousness; or
 - (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.
- f. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.
- g. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or

injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.) Any mishap meeting the criteria described above shall be documented in both the Contractor Significant Incident Report (CSIR) and using the NAVFAC prescribed Navy Crane Center (NCC) form submitted within five days both as provided by the Contracting Officer. Comply with additional requirements and procedures for accidents in accordance with NAVFAC P-307, Section 12.

- h. Internal Traffic Control Plan (ITCP). Strategies to control the flow of construction workers, vehicles and equipment inside the work zone.

1.3 SUBMITTALS

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

Government acceptance is required for submittals with a "G, A" designation.

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, A

Activity Hazard Analysis (AHA); G, A

Crane Critical Lift Plan; G, A

Proof of qualification for Crane Operators; G, A

Traffic Control Plan; G, A

Standard Hand Signals; G, A

SD-06 Test Reports

Notifications and Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Notifications and Reports."

Accident Reports

Crane Reports

Arc Flash Risk/Hazard Analysis; G

SD-07 Certificates

Confined Space Entry Permit

Hot work permit

Arc Flash Risk/Hazard Analysis Qualifications; G

Contractor Electrical Energized Work Permit; G

Contractor Safety Self-Evaluation Checklist; G, A

Certificate of Compliance (Crane)

Submit one copy of each permit/certificate attached to each
Daily **Quality Control** Report.

1.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. Complete the checklist monthly and submit with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90 may result in retention of up to 10 percent of the voucher. Additionally, provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher. The Contracting Officer will submit a copy of the Contractor Safety Self-Evaluation and Monthly Exposure Report to the local safety and occupational health office.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, NFPA 70E, IEEE C2 and federal, state, and local, laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.6 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

The SSHO must meet the requirements of EM 385-1-1 section 1 and ensure that the requirements of 29 CFR 1926.16 are met for the project. Provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Designated Representative/alternate shall be at the work site at all times to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO's training, experience, and qualifications shall be as required by EM 385-1-1 paragraph 01.A.17, entitled SITE SAFETY AND HEALTH OFFICER (SSHO), and all associated sub-paragraphs.

A Competent Person shall be provided for all of the hazards identified in the Contractor's Safety and Health Program in accordance with the accepted Accident Prevention Plan, and shall be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the Competent Persons(s) to the the Contracting Officer for acceptance in consultation with the Safety

Office.

1.6.1.1.1 Contractor Quality Control (QC) Person

The Contractor Quality Control Person cannot be the SSHO on this project, even though the QC has safety inspection responsibilities as part of the QC duties.

1.6.1.2 Competent Person for Confined Space Entry

Provide a competent person for confined space meeting the definition and requirements of EM 385-1-1. If work involves marine operations that handle combustible or hazardous materials, this person shall have the ability to understand and follow through on the air sampling, PPE, and instructions of a Marine Chemist, Coast Guard authorized persons, or Certified Industrial Hygienist. All confined and enclosed space work shall comply with NFPA 306 or as applicable, 29 CFR 1910.147 for general industry.

1.6.1.3 Crane Operators

Meet the crane operators requirements in USACE EM 385-1-1, Section 16 and Appendix I. In addition, for mobile cranes, designate crane operators as qualified by a source that qualifies crane operators (i.e., union, a government agency, or and organization that tests and qualifies crane operators). Provide proof of current qualification. In addition, the Contractor shall comply with Contractor Operated Crane Requirements included in the latest revision of document NAVFAC P-307 Section 1.7.2 "Contractor Operated Cranes," and Appendix P, Figure P-1 and with 29 CFR 1926, Subpart CC.

1.6.2 Personnel Duties

1.6.2.1 Site Safety and Health Officer (SSHO)

The SSHO shall:

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily quality control report.
- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.
- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. Post a list of unresolved safety and health deficiencies on the safety bulletin board.
- g. Ensure sub-contractor compliance with safety and health requirements.

- h. Ensure an approved "Contractor Electrical Energized Work Permit" prior to starting any activity on energized electrical systems.
- i. Maintain a list of hazardous chemicals on site and their material safety data sheets.

Failure to perform the above duties will result in dismissal of the superintendent, QC Manager, and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

- a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).
- b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.6.3.2 Safety Meetings

Conduct and document meetings as required by EM 385-1-1. Attach minutes showing contract title, signatures of attendees and a list of topics discussed to the Contractors' daily quality control report.

1.7 ACCIDENT PREVENTION PLAN (APP)

Use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan". Specific requirements for some of the APP elements are described below. The APP shall be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and

the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer, the Contractor Quality Control Manager, and any designated CSP or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34,) and the environment.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site. Continuously review and amend the APP, as necessary, throughout the life of the contract. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered.

1.7.1 EM 385-1-1 Contents

In addition to the requirements outlined in Appendix A of USACE EM 385-1-1, the following is required:

- a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. Specify the duties of each position.
- b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.
- c. Confined Space Entry Plan. Develop a confined and/or enclosed space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, OSHA Directive CPL 2.100, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified

person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none will be created.)

- d. **Crane Critical Lift Plan.** Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. Submit 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.H. and the following:

- (1) For lifts of personnel, demonstrate compliance with the requirements of 29 CFR 1926.1400.

- e. **Fall Protection and Prevention (FP&P) Program Documentation.** The program documentation shall be site specific and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 6 feet. A qualified person for fall protection shall prepare and sign the program documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Revise the Fall Protection and Prevention Program Documentation every six months for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Program Documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Program Documentation in the Accident Prevention Plan (APP).

The FP&P Plan shall include a Rescue and Evacuation Plan in accordance with USACE EM 385-1-1, Section 21.M. The plan shall include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan in the Fall Protection and Prevention (FP&P) Plan, and as part of the Accident Prevention Plan (APP).

- f. **Site Demolition Plan.** The safety and health aspects prepared in accordance with Section 02 41 00 DEMOLITION and referenced sources. Include engineering survey as applicable.
- g. **Excavation Plan.** The safety and health aspects prepared in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

1.8 **ACTIVITY HAZARD ANALYSIS (AHA)**

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1, Section 1. NAVFAC Midlant shall follow latest edition authorized by command. Submit the AHA for review at least 7 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure

the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

Develop the activity hazard analyses using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.9 DISPLAY OF SAFETY INFORMATION

Within 1 calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.
- c. Contractor Electrical Energized Work Permit.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 NOTIFICATIONS AND REPORTS

1.12.1 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$2,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

1.12.2 Accident Reports

- a. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, property damage accidents resulting in at least \$20,000 in damages, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the Contractor Incident Report (CIR), and electronically file the report in ESAMS within 5 calendar day(s) of the accident.
- b. Near Misses: Complete the applicable documentation in NAVFAC Contractor Incident Reporting System (CIRS), and electronically submit via the NAVFAC Enterprise Safety Applications Management System (ESAMS).
- c. Conduct an accident investigation for any weight handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

1.12.3 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix I and as specified herein with Daily Reports of Inspections.

1.12.4 Certificate of Compliance

Provide a Certificate of Compliance for each crane entering an activity under this contract (see Contracting Officer for a blank certificate). State within the certificate that the crane and rigging gear meet applicable OSHA regulations (with the Contractor citing which OSHA regulations are applicable, e.g., cranes used in construction, demolition, or maintenance comply with 29 CFR 1926 and USACE EM 385-1-1 Section 16 and Appendix I. Certify on the Certificate of Compliance that the crane operator(s) is qualified and trained in the operation of the crane to be used. Also certify that all of its crane operators working on the DOD activity have been trained in the proper use of all safety devices (e.g., anti-two block devices). Post certifications on the crane.

1.13 HOT WORK (Welding And Cutting, Etc.)

Hot work permits will only be issued to the Prime Contractor. Prime Contractor shall notify FEAD/ROICC office of issuance of hot work permits and all renewals of hot work permits. Copies of all hot work permits and renewals shall be attached to daily quality control reports.

Submit and obtain a written permit prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, from the Fire Division. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. Provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at

this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

1.14 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

1.15 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must:

- a. Secure outside equipment and materials and place materials that could be damaged in protected areas.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- c. Ensure that temporary erosion controls are adequate.

1.16 CONFINED SPACE ENTRY REQUIREMENTS.

Contractors entering and working in confined spaces performing general industry work are required to follow the requirements of OSHA 29 CFR 1910, 29 CFR 1910.146, and EM 385-1-1 Section 34 Confined Space Entry.

NAVFAC personnel entering and working in confined spaces performing non-maritime facility work are required to follow the requirements of ND OPNAVINST 5100.23 Chapter 27.

1.17 TRAFFIC CONTROL

The requirements contained in this paragraph are in addition to the requirements contained in EM 385-1-1. In case of a conflict, the more stringent requirement applies. Traffic Control shall be accomplished in accordance with MUTCD.

1.17.1 Traffic Control Plan

Prior to the commencement of contract operations, the Contractor shall submit for acceptance the complete details of the proposed traffic control plan for the maintenance of traffic and access through the contract work area.

Include traffic control and traffic control signal systems in each Activity Hazard Analysis as applicable.

1.17.2 Signal Systems, Personnel And Procedures

Signal systems, personnel and procedures shall comply with EM 385-1-1 Section 08.B SIGNAL SYSTEMS, PERSONNEL AND PROCEDURES.

1.17.2.1 Standard Hand Signals

Standard hand signals shall be submitted for acceptance and shall be posted at the operator's position, signal control points and other points as necessary to inform those concerned.

1.17.3 Road Closings

Traffic control is extremely important on highways, in residential areas, and at construction sites. When traffic may pose a hazard to operations, public roads will be closed. Road closings shall be coordinated in writing with appropriate local agencies. Traffic controls and signage shall comply with MUTCD.

1.17.4 Operating Precautions

When a road cannot be closed, the following precautions shall be taken:

- a. "FLAGGER" (MUTCD W-20-7) or "WORKERS AHEAD: (W21-1) or similar appropriate signs shall be placed along the roadway, 1,000 ft (304.8m) and 500 ft (30.5 m) before the work zone, on both sides of the work zone".
- b. Sufficient number of flag persons shall be used to control traffic within the work area.
- c. Flag persons shall be used and shall receive instruction in flagging operations before being placed in traffic (training and certification by the National Safety Council (NSC) is recommended).
- d. All flag persons shall wear high-visibility apparel in accordance with EM 385-1-1, paragraph 05.F, safety-toed footwear and hard hats.
- e. "STOP/SLOW" paddles, preferably mounted on a 6 ft staff, will be used for traffic control.
- f. Flag persons shall be able to communicate with each other and with the foreman, and effectively signal/direct the affected public.
- g. Two-way radios shall be used whenever visual contact between flaggers is not maintained.

1.17.5 Construction Vehicles

All construction vehicles and all vehicles exceeding 1-1/2 tons (1360.8 kg) shall have a signal person to assist in backing and maneuvering in residential and construction areas.

1.17.6 Internal Traffic Control Plans (ITCP)

Internal traffic control plans (ITCP) (written plans which address separation and safety of personnel and moving equipment) will be attached to all AHA's when interaction between personnel and moving equipment will occur or physical changes occur onsite which could affect personnel or moving equipment.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

Provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording:
"DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of **one inch** in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from **5 feet**.

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

Comply with USACE EM 385-1-1, NFPA 1, NFPA 70, NFPA 70E, NFPA 241, IEEE C2, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is required at all times, in accordance with EM 385-1-1, for all personnel who enters a construction site area. In addition to the requirements of EM 385-1-1, Safety Glasses ANSI/ISEA Z87.1 will be worn at all times on construction sites, unless the competent person identifies in the Contractor's accepted activity hazard analysis that an equal or greater hazard is presented in the mandatory wearing of safety glasses. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

Mandatory PPE on all construction sites includes:

- a. Hard Hat
- b. Safety Glasses
- c. Safety-Toed Shoes or Boots

3.1.1 Hazardous Material Use

Each hazardous material must receive approval from the Contracting Officer or their designated representative prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of

radioactive material and devices being brought on base.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos, and other OSHA regulated chemicals (i.e. 29 CFR Part 1910.1000). If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist. For electrical work positive cable/circuit identification must be made prior to submitting any outage request. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Following the application of lockout/tag out devices to all hazardous energy sources, applicable AHA should outline equipment restart methods to ensure "zero energy" state has been accomplished.

3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Ensure that each employee is familiar with and complies with these procedures and USACE EM 385-1-1, Section 12, Control of Hazardous Energy.

3.4 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

Establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

3.4.1 Training

Institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with USACE EM 385-1-1, Section 21.B.

3.4.2 Fall Protection Equipment and Systems

Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, Paragraphs 21.N through 21.N.04. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSE/SAFE A10.32.

3.4.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 6 feet. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

3.4.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

- (1) For work within 6 feet of an edge, on low-slope roofs, protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system used by itself as the only form of fall protection system is not adequate fall protection and is not authorized.
- (2) For work greater than 6 feet from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep-Sloped Roofs: Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

3.4.4 Horizontal Lifelines

Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.4.5 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

3.4.6 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.5 SCAFFOLDING

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access scaffold platforms greater than 20 feet maximum in height by use of a scaffold stair system. Do not use vertical ladders commonly provided by scaffold system manufacturers for accessing scaffold platforms greater than 20 feet maximum in height. The use of an adequate gate is required. Ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Give special care to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Place work platforms on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.6 EQUIPMENT

3.6.1 Material Handling Equipment

- a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions. Additionally, when material handling equipment is used as a crane it must meet NAVFAC P-307 requirements in Sections 1.7.2, "Contractor Operated Cranes," and 12, "Investigation and Reporting of Crane and Rigging Gear Accidents."
- c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA. Proof of qualifications for operator shall be kept on the project site and addressed as part of the AHA.

3.6.2 Weight Handling Equipment

- a. Equip cranes and derricks as specified in EM 385-1-1, section 16.
- b. Notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. Acopy of the permitting process will be provided at the Preconstruction Conference. Contractor's operator shall remain with the crane during the spot check.
- c. Comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.
- d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.
- e. Under no circumstance shall a Contractor make a lift at or above 90 percent of the crane's rated capacity in any configuration.
- f. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and follow the requirements of USACE EM 385-1-1 Section 11, NAVFAC P-307 Figure 10-3 and ASME B30.5 or ASME B30.22 as applicable.
- g. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane.
- h. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- i. All employees must keep clear of loads about to be lifted and of suspended loads.
- j. Use cribbing when performing lifts on outriggers.
- k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- l. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

- m. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.
- n. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.
- o. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).
- p. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. Prior to conducting lifting operations set a maximum wind speed at which a crane can be safely operated based on the equipment being used, the load being lifted, experience of operators and riggers, and hazards on the work site. This maximum wind speed determination shall be included as part of the activity hazard analysis plan for that operation.

3.6.3 Machinery and Mechanized Equipment

- a. Proof of qualifications for operator shall be kept on the project site for review.
- b. Manufacturer specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.
- c. Machinery & Mechanized Equipment are subject to additional Navy proof of certification. A certification form for acceptance by the Contracting Officer prior to being placed into use may be required.

3.6.4 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval shall not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, shall be only where directed and in approved storage facilities. These facilities shall be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.7 EXCAVATIONS

Soil classification must be performed by a competent person in accordance with 29 CFR 1926 and EM 385-1-1. A competent person for excavation must be on site during all excavation work.

3.7.1 Utility Locations

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility

department. Any markings made during the utility investigation must be maintained throughout the contract.

3.7.2 Utility Location Verification

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system.

3.7.3 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.7.4 Location of Underground Utilities

Location and Protection of underground utilities shall be the responsibility of the Contractor. Where existing-to-remain piping, utilities, and underground obstructions of any type are indicated in locations to be traversed by new piping, ducts, and other evacuations, the elevations of the existing utilities and obstructions shall be determined before the new work is completed.

- a. In addition, the Contractor shall be responsible for obtaining the services of a professional utility locator prior to digging. Contractor shall provide documentation that the site has been surveyed and checked for underground utilities. All utilities shall be located, including but not limited to power, water, sewer, storm drains, steam condensate, fuel lines, gas lines, electrical ducts, direct buried conductors, fiber optics, commercial T.V. cable, Base instructional cable TV, commercial telephone, Base telephone, EMCS, fire alarm, and intrusion detection wiring. A set of known utility drawings will be available in the OICC office for review to assist the locator.
- b. It is mandatory that the Contractor also contact the North Carolina One-Call Center to coordinate the location of underground natural gas infrastructure. North Carolina 811, Inc. can be reached at 811 on a touch-tone phone in the state of North Carolina or toll-free at 1-800-632-4949 if calling from out of state. Work request may also be submitted online at www.nc811.org.

3.7.4.1 The Locations of Underground Utilities

The locations of underground utilities shown are only approximate and the information provided may be incomplete. Contractor shall attempt to

ascertain locations of existing underground utilities prior to and during digging operations.

3.7.4.2 Damage to Underground Utilities

Immediate notice shall be delivered to the Contracting Officer of any damage. The Contractor shall make temporary repairs immediately and shall provide permanent repairs as soon as practicable.

3.8 ELECTRICAL

3.8.1 Conduct of Electrical Work

As delineated in EM 385-1-1 electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases an energized work permit shall be obtained from the contracting officer. The energized work permit application shall be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attachment of temporary grounds shall be in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Contractor shall ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147.

3.8.2 Arc Flash Risk/Hazard Analysis

Contractor shall provide an Arc Flash Risk/Hazard Analysis in accordance with NFPA 70E for all locations where workers may be exposed to arc flash hazard (work on energized electrical equipment). The Arc Flash Risk/Hazard Analysis shall be sealed and signed by a qualified professional engineer.

In addition to Arc Flash Risk/Hazard Analysis required for safety during construction, provide an Arc Flash Risk/Hazard Analysis for the entire electrical distribution system as constructed. Provide equipment labels as required by NFPA 70E.

3.8.3 Arc Flash Risk/Hazard Analysis Qualifications

Contractor shall engage the services of a qualified organization to provide Arc Flash Risk/Hazard Analysis of the electrical distribution system. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. This work shall not be performed by a second tier subcontractor.

- a. Submit name and qualifications of organization. Organization shall have been regularly engaged in providing Arc Flash Risk/Hazard Analysis for a minimum of 5 years.
- b. Submit name and qualifications of the professional engineer performing the analysis. Include a list of three comparable jobs performed by the engineer with specific names and telephone numbers for reference.

3.8.4 Contractor Electrical Energized Work Permit

All work on energized electrical systems must have an approved/signed Contractor Electrical Energized Work Permit. The results of the Arc Flash Risk/Hazard Analysis shall be included in the "Contractor Electrical Energized Work Permit" request. Flame-resistant (FR) clothing and personal protective equipment (PPE) shall be rated for a minimum of 8 calories per square centimeter even if the flash hazard analysis indicates a lower value. A blank copy of the permit request is attached. An editable version may be obtained from the Contracting Officer.

3.8.5 Portable Extension Cords

Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. **Immediately remove** from service all damaged extension cords. Portable extension cords shall meet the requirements of **EM 385-1-1**, **NFPA 70E** and OSHA electrical standards.

3.9 WORK IN CONFINED SPACES

Comply with the requirements in Section 34 of USACE **EM 385-1-1**, OSHA **29 CFR 1910**, OSHA **29 CFR 1910.146**, OSHA Directive **CPL 2.100** and OSHA **29 CFR 1926**. Any potential for a hazard in the confined space requires a permit system to be used.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 34 of USACE **EM 385-1-1** for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
- c. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection **in addition to continuous forced air ventilation regardless of space classification.**

-- End of Section --

CONTRACTOR ELECTRICAL ENERGIZED WORK PERMIT

PART I: TO BE COMPLETED BY THE REQUESTER: CONTRACT NUMBER: _____

JO/DO NUMBER _____

DATE OF REQUEST: _____

ANTICIPATED DATE WORK IS TO BE PERFORMED: _____

(1) Description of circuit/equipment/job location: _____

(2) Description of work to be done: _____

(3) Justification of why the circuit/equipment cannot be de-energized or the work deferred until the next scheduled outage: _____

NOTE: ATTACHED COPY OF OUTAGE REQUESTS INCLUDING REASONS FOR DENIAL

Requester/Title

Date

PART II: TO BE COMPLETED BY THE ELECTRICALLY QUALIFIED PERSONS DOING THE WORK:

**Check when
Complete**

(1) Detailed job description procedure to be used in performing the above detailed work: _____

☐

(2) Description of the Safe Work Practices to be employed: _____

☐

(3) Results of the Shock Hazard Analysis: _____

☐

(4) Determination of the Shock Protection Boundaries: _____

☐

(5) Results of the Arc Flash Hazard Analysis: _____

☐

Determination of the Arc Flash Protection Boundary: _____

☐

(6) Necessary personnel protective equipment to safely perform the assigned task: _____

☐

(7) Means employed to restrict the access of unqualified persons from the work area: _____

☐

(8) Evidence of completion of a Job Briefing including discussion of any job – related hazards: _____

☐

(10) Do you agree the above described work can be done safely?

☐ Yes☐ No

(If no, return to requester)

PART III: RECOMMEND APPROVAL(S) TO PERFORM THE WORK WHILE ELECTRICALLY ENERGIZED:

OICC SIGNATURE

CI SIGNATURE

OPS SIGNATURE

NAVFAC MIDLANT CONTRUCTION SAFETY MANAGER

PART IV: FINAL APPROVAL:

NAVFAC MILANT COMMANDING OFFICER

NOTE: COMPLETED FORM WILL BE KEPT ON FILE BY MIDLANT CONSTRUCTION SAFETY MANAGER

[illegible]

- CONTRACTOR ELECTRICAL ENERGIZED WORK PERMIT
1. Detailed job description procedure to be used in performing the above detailed work:
2. Description of the Safe Work Practices to be employed

SECTION 01 45 00.00 20

QUALITY CONTROL
09/15

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.

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

ASHRAE 52.2 (2017) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

ASTM INTERNATIONAL (ASTM)

ASTM D6245 (2012) Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation

ASTM D6345 (2010) Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

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

ANSI/SMACNA 008 (2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Quality Control (QC) Plan; G

Submit a Construction QC Plan prior to start of construction.

Indoor Air Quality (IAQ) Management Plan; G

SD-06 Test Reports

Acceptance Testing of Critical Systems Checklist

SD-07 Certificates

ICC IBC Special Inspections Certification; G

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the Contracting Officer. The report forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control (CQC) Report, (CQC) Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log.

Deliver the following to the Contracting Officer during Construction:

- a. CQC Report: Mail or hand-carry the original (wet signatures) and one copy by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work.
- b. Contractor Production Report: Mail or hand-carry the original (wet signatures) and one copy by 10:00 AM the next working day after each day that work is performed and for every seven consecutive calendar days of no-work, attached to the CQC Report.
- c. Preparatory Phase Checklist: Original attached to the original CQC Report and one copy attached to each QC Report copy.
- d. Initial Phase Checklist: Original attached to the original CQC Report and one copy attached to each QC Report copy.
- e. Field Test Reports: Mail or hand-carry the original within two working days after the test is performed, attached to the original CQC Report and one copy attached to each QC Report copy.
- f. Monthly Summary Report of Tests: Mail or hand-carry the original attached to the last QCReport of the month.
- g. Testing Plan and Log: Mail or hand-carry the original attached to the last CQC Report of each month and one copy attached to each CQC Report copy. A copy of the final Testing Plan and Log shall be provided to the OMSI preparer for inclusion into the OMSI documentation.
- h. Rework Items List: Mail or hand-carry the original attached to the last CQC Report of each month and one copy attached to each CQC Report copy.
- i. CQC Meeting Minutes: Mail or hand-carry the original within two working days after the meeting is held, attached to the original CQC Report and one copy attached to each CQC Report copy.
- j. QC Certifications: As required by the paragraph entitled "QC Certifications."

1.4 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 NAVFAC Commissioning. 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, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which 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**.

1.4.1 Commissioning

Commissioning (Cx) is a systematic process of ensuring that all building systems meet the requirements and perform interactively according to the Contract. The QC Program is a key to this process by coordinating, verifying and documenting measures to achieve the following objectives:

- a. Verify and document that the applicable equipment and systems are installed in accordance with the design intent as expressed through the Contract and according to the manufacturer's recommendations and industry accepted minimum standards.
- b. Verify and document that equipment and systems receive complete operational checkout by the installing contractors.
- c. Verify and document proper performance of equipment and systems.
- d. Verify that Operation and Maintenance (O&M) documentation is complete.
- e. Verify the Training Plan and training materials are accurate and provide correct instruction and documentation on the critical elements of the products, materials, and systems in the constructed facility. Verify that all identified Government operating personnel are trained.
- f. **Provide acceptance testing for critical systems as identified by NAVFAC Engineering & Construction Bulletin ECB issue 2008-03 dated 9/25/2008, attached. Provide the requirements identified under the "Ktr" column for all applicable project elements. The requirements identified are minimum requirements and do not reduce the requirements contained in the technical sections. Provide Acceptance Testing of Critical Systems Checklist showing compliance for all applicable elements for approval by the Contracting Officer.**

1.4.2 Acceptance of the Construction Quality Control (QC) Plan

Acceptance of the QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right

to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel are subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

1.4.3 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.

1.4.4 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel, a minimum of 10 work days prior to a proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 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, *however, the QC manager can serve as the SSHO*. The QC Manager is required to attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, 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 testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.5.1.2 Qualifications

An individual with a minimum of 10 years combined experience in the following positions: 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 two 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.

1.5.2 Construction Quality Management Training

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

1.5.3 Alternate 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 two 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.

1.5.4 QC Specialists Duties and Qualifications

Provide a separate QC Specialist at the work site for each of the areas of responsibilities, specified in Part 3, Execution, of the technical sections, who shall assist and report to the QC Manager and who will have no duties other than their assigned quality control duties. QC Specialists are required to attend the Coordination and Mutual Understanding Meeting, QC meetings and be physically present at the construction site to perform the three phases of control and prepare documentation for each definable feature of work in their area of responsibility at the frequency specified below.

1.5.4.1 Electrical Systems QC Specialists

Provide ICC IBC Special Inspections Certification from the following specialist(s):

<u>Qualification/Experience in Area of Responsibility</u>	<u>Area of Responsibility</u>	<u>Frequency</u>
Electrical Inspector Crew supervision for 10 years minimum Master Electrician licensed in North Carolina	Electrical Systems, All Division 26 Sections, and Division 33 Elec. Sections	Full time during installation and testing all systems

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Construction Quality Control (QC) Plan

1.6.1.1 Requirements

Provide, for acceptance by the Contracting Officer, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs, with pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing commissioning activities during the construction of the project:

- a. QC ORGANIZATION: A chart showing the QC organizational structure.
- b. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, for each person in the QC organization. Include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "Construction Quality Management Training" and "Alternate QC Manager Duties and Qualifications".
- c. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

- d. 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.
- e. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager 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 which is not in compliance with the Contract.
- f. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving, and managing submittals. 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.
- g. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.
- h. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test. Use Government forms to log and track tests.
- i. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, and complete rework items. Use Government forms to record and track rework items.
- j. DOCUMENTATION PROCEDURES: Use Government form.
- k. 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 and is an item or activity on the construction schedule. Include in the list of DFOWs, but not be limited to, all critical path activities on the NAS. Include all activities for which this specification requires QC Specialists or specialty inspection personnel. Provide separate DFOWs in the Network Analysis Schedule for each design development stage and submittal package.
- l. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each 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.
- m. PERSONNEL MATRIX: Not Applicable
- n. PROCEDURES FOR COMPLETION INSPECTION: Not Applicable 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.

- o. TRAINING PROCEDURES AND TRAINING LOG: Procedures for coordinating and documenting the training of personnel required by the Contract.
- p. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. 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.

1.7 QC PLAN MEETINGS

Prior to submission of the QC Plan, the QC Manager will meet 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 DFOWs.

1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, and prior to the start of construction, the QC Manager will meet with the Contracting Officer to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1.8.1 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, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to 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. IAQ Management Plan.
- c. Procedures for noise and acoustics management.
- d. Environmental Protection Plan.
- e. Environmental regulatory requirements.
- f. Cx Plan.

1.8.2 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 prefunctional tests and startup testing with Cx.

1.8.3 Attendees

As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, CA, Environmental Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities shall have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Contracting Officer. Provide a copy of the signed minutes to all attendees and shall be included in the QC Plan.

1.9 QC MEETINGS

After the start of construction, conduct QC meetings once every two weeks by the QC Manager at the work site with the Project Superintendent, the CA, and the foremen who are performing the work of the DFOWs. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within two 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 rework.
- c. Review the status of submittals.
- d. Review the work to be accomplished in the next two weeks and documentation required.
- e. Resolve QC and production problems (RFI, etc.).
- f. Address items that may require revising the QC Plan.
- g. Review Accident Prevention Plan (APP).
- h. Review environmental requirements and procedures.
- i. Review Waste Management Plan.
- j. Review IAQ Management Plan.
- k. Review Environmental Management Plan.
- l. Review the status of training completion.
- m. Review Cx Plan and progress.

1.10 THREE PHASES OF CONTROL

Adequately cover both on-site and off-site work with the Three Phases of Control and include the following for each DFOW.

1.10.1 Preparatory Phase

Notify the Contracting Officer at least two work days in advance of each preparatory phase meeting. The meeting will be conducted by the QC Manager and attended by the Project Superintendent, the CA, and the foreman responsible for the DFOW. When the DFOW will be accomplished by a

subcontractor, that subcontractor's foreman shall attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFOW:

- a. Review each paragraph of the applicable specification sections.
- b. Review the Contract drawings.
- c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders, in order 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.
- g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- h. Arrange for the return of shipping/packaging materials, such as wood pallets, where economically feasible.
- i. 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.
- j. Discuss specific controls used and 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.
- k. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.
- l. Review the Cx Plan and ensure all preliminary work items have been completed and documented.

1.10.2 Initial Phase

Notify the Contracting Officer at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the Project Superintendent, 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, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

- a. Establish the quality of workmanship required.

- b. Resolve conflicts.
- c. Ensure that testing is performed by the approved laboratory.
- d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.
- e. Review the Cx Plan and ensure all preparatory work items have been completed and documented.

1.10.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

- a. Ensure the work is in compliance with Contract requirements.
- b. Maintain the quality of workmanship required.
- c. Ensure that testing is performed by the approved laboratory.
- d. Ensure that rework items are being corrected.
- e. Assure manufacturers representatives have performed necessary inspections if required and perform safety inspections.
- f. Review the Cx Plan and ensure all work items, testing, and documentation has been completed.

1.10.4 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 is resumed after substantial period of inactivity, or if other problems develop.

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

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

1.11 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES.

1.12 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.12.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The

laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.12.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at <http://ts.nist.gov/ts/htdocs/210/214/214.htm>, the American Association of State Highway and Transportation Officials (AASHTO) program at <http://www.transportation.org/aashto/home.nsf/frontpage>, International Accreditation Services, Inc. (IAS) at <http://www.iasonline.org>, U. S. Army Corps of Engineers Materials Testing Center (MTC) at <http://www.wes.army.mil/SL/MTC/>, the American Association for Laboratory Accreditation (A2LA) program at <http://www.a2la.org/>, the Washington Association of Building Officials (WABO) at <http://www.wabo.org/> (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) at <http://www.wacel.org/labaccred.html> (Approval authority by WACEL is limited to projects within Facilities Engineering Command (FEC) Washington geographical area).

1.12.3 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.

1.12.4 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, per the paragraph entitled "INFORMATION FOR THE CONTRACTING OFFICER".

1.12.5 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 Contractor Quality Control Report of each month. Provide a copy of the signed test reports and certifications to the OMSI preparer for inclusion into the OMSI documentation.

1.13 QC CERTIFICATIONS

1.13.1 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."

1.13.2 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, is in compliance with Contract requirements.

1.13.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall 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 OMSI preparer for inclusion into the OMSI documentation.

1.14 COMPLETION INSPECTIONS

1.14.1 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 and the CA 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 "Rework Items List", which were not corrected prior to the Punch-Out Inspection. 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. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.14.2 Pre-Final Inspection

The Government and QCM 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 QCM as a result of this inspection. The QC Manager will ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection must be corrected in a timely manner and be accomplished before the contract completion date for the work, or any particular increment thereof, if the project is divided into increments by separate completion dates.

1.14.3 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, the CA, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other FEAD/ROICC 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."

1.15 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.15.1 Construction Documentation

Reports are required for each day that work is performed and must be attached 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. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER" will be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. 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 and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.15.2 Quality Control Validation

Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders must be readily available to the Contracting Officer during all business hours.

- a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.
- b. All milestone inspections, arranged by Activity Number.
- c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.
- d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
- e. An up-to-date copy of the Rework Items List.
- f. Maintain up-to-date copies of all punch lists issued by the QC staff to

the Contractor and Sub-Contractors and all punch lists issued by the Government.

- g. Commissioning documentation including Cx checklists, schedules, tests, and reports.

1.15.3 Testing Plan and Log

As tests are performed, the CA 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, per the paragraph "INFORMATION FOR THE CONTRACTING OFFICER". Provide a copy of the final "Testing Plan and Log" to the OMSI preparer for inclusion into the OMSI documentation.

1.15.4 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 reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to the last daily CQC Report of each month. The Contractor is responsible for including those items identified by the Contracting Officer.

1.15.5 As-Built Drawings

The QC Manager is required to 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. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. PC No., Modification No., Request for Information No., etc.). The QC Manager 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.

1.16 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, shall be 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 claim for extension of time for excess costs or damages by the Contractor.

1.17 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

Submit an IAQ Management Plan within 15 days after Contract award and not less than 10 days before the preconstruction meeting. Revise and resubmit Plan as required by the Contracting Officer. Make copies of the final plan available to all workers on site. Include provisions in the Plan to meet the requirements specified below and to ensure safe, healthy air for construction workers and building occupants.

1.17.1 Requirements During Construction

Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with [ASTM D6245](#). Provide for evaluation of volatile organic compounds (VOCs) in indoor air in accordance with [ASTM D6345](#). Use filters with a Minimum Efficiency Reporting Value (MERV) of 8 in permanently installed air handlers during construction.

1.17.1.1 Control Measures

Meet or exceed the requirements of [ANSI/SMACNA 008](#), Chapter 3, to help minimize contamination of the building from construction activities. The five requirements of this manual which must be adhered to are described below:

- a. HVAC protection: Isolate return side of HVAC system from surrounding environment to prevent construction dust and debris from entering the duct work and spaces.
- b. Source control: Use low emitting paints and other finishes, sealants, adhesives, and other materials as specified. When available, cleaning products shall have a low VOC content and be non-toxic to minimize building contamination. Utilize cleaning techniques that minimize dust generation. Cycle equipment off when not needed. Prohibit idling motor vehicles where emissions could be drawn into building. Designate receiving/storage areas for incoming material that minimize IAQ impacts.
- c. Pathway interruption: When pollutants are generated use strategies such as 100 percent outside air ventilation or erection of physical barriers between work and non-work areas to prevent contamination.
- d. Housekeeping: Clean frequently to remove construction dust and debris. Promptly clean up spills. Remove accumulated water and keep work areas dry to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved.
- e. Scheduling: Control the sequence of construction to minimize the absorption of VOCs by other building materials.

1.17.1.2 Moisture Contamination

- a. Remove accumulated water and keep work dry.
- b. Use dehumidification to remove moist, humid air from a work area.
- c. Do not use combustion heaters or generators inside the building.
- d. Protect porous materials from exposure to moisture.
- e. Remove and replace items which remain damp for more than a few hours.

1.17.2 Requirements after Construction

After construction ends and prior to occupancy, conduct a building flush-out or test the indoor air contaminant levels. Flush-out must be a minimum two-weeks with MERV-13 filtration media as determined by [ASHRAE 52.2](#) at 100 percent outside air. Air contamination testing must be consistent with EPA's current Compendium of Methods for the Determination of Air Pollutants in Indoor Air. After building flush-out or testing and prior to

occupancy, replace filtration media. Filtration media must have a MERV of 13 as determined by [ASHRAE 52.2](#).

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

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.

-- End of Section --

ENGINEERING & CONSTRUCTION Bulletin

Issue No. 2008-03

25 September 2008

Type: Policy

Subject: **Acceptance Testing of Critical Systems**

Reference: (a) ECB 2007-01 Proper use of Military Construction Funds, 13 October 2006

Enclosure: (1) Roles and Responsibilities (R&R) Matrices

Cancelled: NAVFAC Instruction 12271.1: NAVFAC Total Building Commissioning Policy, dated 23 October 2003

1. Purpose.

To focus NAVFAC's technical oversight of acceptance testing during construction on five critical areas (electrical, fire and life safety, mechanical, roofing, and underwater structures) to ensure the constructed facility performs as intended and meets the needs of the supported commands; to define the use of Post Construction Award Services (PCAS) funding as it applies to the Capital Improvements Business Line (CIBL) in-house acceptance testing and technical support efforts.

2. Background.

NAVFAC has identified five critical areas that have consistently caused problems in facilities delivered to its supported commands. These areas are electrical, fire and life safety, mechanical, roofing systems, and underwater structures. These five critical areas were identified as requiring ongoing, thorough construction technical oversight in support of acceptance testing. A NAVFAC Team of technical experts determined how to apply responsible oversight to these five critical areas using one-half of PCAS funds. Each Team compiled all systems / sub-systems and developed R&R matrices (enclosure (1)). Each matrix identifies responsibilities of each of the contributors to the quality and functionality of the completed project, including the contractor, Facilities Engineering Command's (FEC) Integrated Product Team (IPT) and Facilities Engineering and Acquisition Division (FEAD) technical staff. The matrices served as the basis for determining the level of effort (man hours) to perform the technical support for acceptance testing. The following table shows the format in the R&R matrices. Each heading is provided with a description of each column's intent:

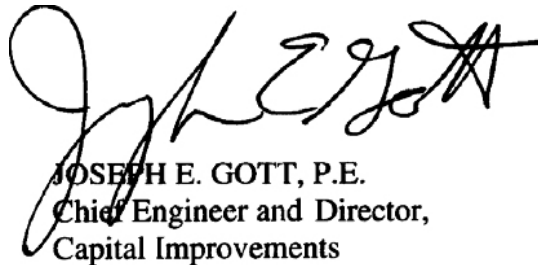
System	Sub-System	Phase	Element	Ktr QC-DOR (Project Req'ts)	FEAD (SIOH)	FEC (PCAS)
Major system grouping	Specific system	Phase of the project where it will occur	The item or task to be accomplished	What actions, if any, need to be taken by the appropriate party? (Indicates funding method)		

The contractor is still responsible for delivering a high quality and properly functioning facility via the Contractor Quality Control (CQC) program and commissioning process (including documentation and training).

3. Policy and Implementation.

The following will apply to the performance of acceptance testing for the five critical areas:

- a. This applies to Military Construction (MILCON) and all Special Projects with costs over \$750,000 for design-build and design-bid-build contracts.
- b. The Project Manager (PM) shall manage, in coordination with the Construction Manager (CM), the project PCAS funds. The PM shall ensure that PCAS funding is used in accordance with reference (a).
- c. The average funds available to support the CIBL acceptance testing in-house effort will be one-half the total PCAS funds.
- d. Enclosure (1) defines the roles and responsibilities of the contractor, FEC's IPT and FEAD technical staff.
- e. While the FEAD will be responsible for managing the overall construction project, the FEC's IPT will be responsible for the technical support for the acceptance testing effort associated with the five critical areas. Technical support from the FEAD can be leveraged as capabilities and resources allow, and must be coordinated between the FEC IPT and FEAD. The support for the five critical areas will be provided by engineers that have been trained and are experienced in that area.
- f. The CM will manage the day-to-day coordination with the contractor and coordinate the necessary reach back to the FEC IPT for technical support for acceptance testing.
- g. PCAS must be budgeted and included in the project costs. The PCAS costs must be shown in the budget estimate summary sheets (BESS) on the DD 1391.
- h. The Public Works Business Line (PWBL) has agreed to designate representatives who are responsible for facility maintenance and sustainment to perform the following:
 - i. Participate in the submittal review process by providing comments on submittals for the critical areas.
 - ii. Be present for the final inspections and tests.
 - iii. Be present for all system training.
 - iv. Provide feedback and lessons learned to the FEC CI4.
- i. It is recommended that the designated representatives, who are responsible for maintenance and sustainment visit the site during construction to become familiar with the building systems.
- j. The efforts in paragraph 3.h above will not be funded using PCAS or supervision, inspection and overhead (SIOH).



JOSEPH E. GOTT, P.E.
Chief Engineer and Director,
Capital Improvements

Note: This ECB has been coordinated with Headquarters, U.S. Marine Corps (Code LFF).

ELECTRICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	EE QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
All Systems	Submittals & Plans	Pre-Construction	Qualifications of Installer, Shop Drawings, Data Sheets, and Calculations (as applicable)	A	C	S
			QC Plan		A	S
			Performance Verification Plan		A	S
	Certificates & Reports	Construction	Functional Acceptance Test Procedure	A	C	S
			Preliminary Test Reports	A	RA	S
			Final Acceptance Test Reports	A	C	S
Power Generators	Single Operation Generator Sets	Test Preparation	Perform fuel oil piping tests	V	C	-
			Perform acceptance checks and tests	V	W	C
			Perform preliminary operations	V	W	C
		Final Test	Test all engine protective shutdown devices	V	—	W
			Test all pre-shutdown alarm devices	V	—	W
			Test crank cycle/terminate relay	V	—	W
			Test automatic and manual operations in all possible scenarios involving loss of utility, return of utility, manual starting, and emergency stop	V	—	W
			Perform load test	V	—	W
	Automatic Transfer Switches	Test Preparation	Perform acceptance checks and tests	V	W	C
		Final Test	Simulate loss of normal power	—	—	W
			Simulate return of normal power	V	—	W
			Simulate loss of emergency power	V	—	W
			Simulate all forms of single-phase conditions	V	—	W
			Verify operation of normal power voltage-sensing relays	V	—	W
			Verify engine start sequence	V	—	W
			Verify time delay upon transfer	V	—	W
			Verify operation of alternate power voltage-sensing relays	V	—	W
			Verify automatic transfer operation	V	—	W
			Verify interlocks and limit switch operation	V	—	W
			Verify time delay and retransfer upon normal power	V	—	W
400-Hertz Solid State Frequency Converter	All	Test Preparation	Perform acceptance checks and tests	V	W	C
			Verify equipment nameplate information with specifications and approved shop drawings	V	W	—
			Inspect physical and mechanical condition	V	W	—
			Verify correct equipment grounding	V	W	—
			Perform resistance measurements through all bolted connections	V	W	—
			Perform preliminary operations	V	W	C
		Final Test	Test all control devices	V	—	W
			Test all protective shutdown devices	V	—	W
			Perform load test	V	—	W
			Perform transient tests	V	—	W
			Perform harmonic distortion tests	V	—	W
			Perform automatic line drop compensation test	V	—	W

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

ELECTRICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	EE QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Uninterruptible Power Supply (UPS)	All	Test Preparation	Verify ventilation equipment in UPS and battery rooms are operational	V	W	—
			Verify battery cells are filled with electrolyte	V	W	—
			Verify polarity of DC connections and phase rotation of AC connections	V	W	—
			Verify AC power to all equipment	V	W	—
			Verify remote monitors and control wiring	V	W	—
			Verify UPS system and battery system is properly grounded	V	W	—
			Verify operation of emergency shower and eye wash	V	W	—
			Verify control connections between UPS and emergency engine generator signal contacts	V	W	—
			Verify control connections between UPS module and UPS maintenance bypass cabinet	V	W	—
			Perform acceptance checks and tests	V	W	C
		Final Test	Perform load tests	V	—	W
			Perform full-load burn in test	V	—	W
			Perform battery discharge test	V	—	W
			Perform battery performance test	V	—	W
			Perform UPS in conjunction with emergency generator service (if applicable)	V	—	W
Lighting	Interior Lighting	Final Test	Verify electronic dimming ballasts operation over full range of dimming capability without any visually detectable flicker	V	W	—
			Verify occupancy sensors operation	V	W	—
			Verify lighting controls operation	V	W	—
			Verify lighting output levels	V	W	—
	Exterior Lighting	Final Test	Verify photocell aiming and operation	V	W	—
			Verify lighting controls operation	V	W	—
Transformers	Single-Phase Pad-Mounted Transformers	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, dielectric, leak (liquid-filled), and dissolved gas analysis (liquid-filled) tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C
	Three-Phase Pad-Mounted Transformers	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, dielectric, leak (liquid-filled), and dissolved gas analysis (liquid-filled) tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C
	Secondary Unit Substations	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, and dielectric tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C
	Primary Unit Substations	Factory Routine Tests	Perform resistance measurements, polarity, ratio, no-load losses and excitation current, load losses and impedance voltage, dielectric, leak (liquid-filled), and dissolved gas analysis (liquid-filled) tests	—	—	W
		Field Tests	Perform acceptance checks and tests	V	W	C

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

ELECTRICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	EE QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Switchgear/ Switchboards	Metal-Clad Switchgear / Switchboards and Busway	Factory Production Tests	60 Hz dielectric, mechanical operation, electrical operation and control wiring, and ground fault sensing equipment tests	—	—	W
		Test Preparation	Perform acceptance checks and tests	V	W	C
Cable	Medium-Voltage Cable, Terminations, and Splices	Test Preparation	Perform acceptance checks and tests	V	W	—
		Field Tests	Perform shield continuity and very low frequency (VLF) tests	V	W	—
SF6 Switch - Padmount	Medium Voltage Pad-mounted Switches	Factory Production Tests	60 Hz dielectric, mechanical operation, electrical operation and control wiring, and ground fault sensing equipment tests	—	—	W
		Test Preparation	Perform acceptance checks and tests	V	W	C
Airfield Lighting	Airfield Lighting Circuits	Field Tests	Airfield lighting circuits low voltage continuity and high voltage insulation resistance tests	V	W	—
		Field Tests	Airfield lighting circuit operating test	V	W	—
	Counterpoise	Field Tests	Counterpoise system test	V	W	—
	Constant	Field Tests	Perform open circuit protector and load tests	V	W	—
	All	Field Tests	Perform airfield lighting system operation test	V	W	—
Cathodic Protection	Cathodic Protection by Galvanic Anodes	Field Tests	Perform non-destructive testing of anodes	V	W	—
			Perform destructive testing of anodes	V	W	—
			Perform base potential tests, insulation joint testing, electrical continuity testing, pipe casing testing, anode-to-soil potential tests, anode output tests, protected potential measurement tests, and interference testing.	V	W	—
			Perform field operation tests.	V	—	W
	Cathodic Protection by Impressed Current	Field Tests	Perform non-destructive testing of anodes	V	W	—
			Perform destructive testing of anodes	V	W	—
			Perform base potential tests, permanent reference electrode calibration, insulation joint testing, electrical continuity testing, rectifier system testing, pipe casing testing, protected potential measurement tests, and interference testing.	V	W	—
			Perform field operation tests.	V	—	W

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
All Systems	Required Submittals	Test Prep & Preliminary Certifications	QC Plan	—	A	S
			Performance Verification Plan	—	A	S
			Field Visit/Construction Surveillance Reports	—	S	QA
			Final Acceptance Test Reports	A	S	QA or A
			Final Life Safety/Fire Protection Certification	—	S	A
Sprinkler Systems	Wet Pipe Sprinkler Systems	Test Preparation	Process/review system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Process/review Preliminary Test Reports & Certifications	—	RA	S
			Witness hydrostatic test.	A	C	—
			Witness flush test.	V	W	—
			Visually inspect system for adherence to plan, completeness, and adequacy of installation.	A	QA	QA
			Visually inspect pipe penetrations	A	QA	QA
			Visually inspect sprinklers for location and that they are not painted / taped.	A	QA	QA
			Visually inspect seismic bracing	A	C	QA
			Operate control valves {Other than main service entrance riser}	A	C	QA
			Visually inspect check valve installation	A	C	QA
			Visually inspect test/drain discharge locations	A	C	QA
			Witness backflow preventer forward-flow test (NFPA 13, §16.2.5).	V	W	W
			Inspect/test alarm valve assembly and water service entrance(pipe sleeves, thrust rods, etc.), including valves, flow switch & tamper switches)	V	C	W
			Inspect/test flow control valve assembly	V	C	W
	Additional requirements for Dry Pipe, Preaction - Deluge	Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Witness hydrostatic test.	A	C	—
			Witness flush test.	V	W	—
			Verify Low-point drains are provided	V	—	QA
			Visually inspect air supply and piping	A	S	QA
			Witness backflow preventer test.	V	W	W
			Test high-low pressure air switch operation	V	—	W
			Inspect/Test deluge or dry valve riser assembly (including control valves, alarm switch & tamper switches), and functional operation	A	S	W
			Inspect/test detection and releasing system	See Fire Alarm System		

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Water Distribution	Fire hydrants, distribution piping, & control valves	Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	—
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect all thrust blocks.	A	QA	—
			Witness hydrostatic test.	A	C	—
			Witness flush testing of hydrant	A	C	QA
			Operate all control/isolation valves (each)	V	S	QA
			Operate fire hydrants and check for proper drainage (each)	V	S	QA
	Water storage	Construction	Preliminary Test Reports & Certifications	—	RA	S
			Verify suction piping w/in tank is installed in accordance with design	A	C	S
Pumps for Fire Protection (Water & Foam)	Pumps & Controllers	Test Preparation	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
		Test Preparation	Visually inspect system for adherence to plan, completeness, and adequacy of installation.	A	QA	QA
			Witness pump controller functional tests (including automatic transfer switch operation & battery transfer as applicable).	A	QA	W
		Final Test	Witness flow test to generate performance curve (pressure vs discharge, rpms, amps, shaft alignment)	V	QA	W
			Witness automatic and manual starts & stops	V	QA	W
			Verify that controller supervisory signals are received by the fire alarm control panel	V	C	W

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Fire Alarm Systems	Evacuation / Notification Detection & Releasing Systems.	Test Preparation & Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect system for adherence to plan, completeness, and adequacy of installation. (30,000 SQ. FT.)	A	QA	QA
			Test initiating devices for proper operation. (Activate 15% of smoke or heat detectors with no failures {30,000 sq. ft.}/(625 sq. ft/ detector)(0.15)=7}	A	QA	QA
			Test initiating circuits for shorts, ground faults, and general operation	A	C	QA
			Test signaling circuits for shorts, ground faults, and general operation	A	C	QA
			Verify audible and visual devices operate properly and audible devices can be heard throughout the facility	A	C	QA
			Test peripheral devices (door hold opens, etc)	A	C	QA
			Witness functional test of the main control panel	V	C	W
			Test interface with other systems (i.e., preaction, gaseous, etc.)	V	C	W
			Test that correct signals are being sent to the base receiving station	V	C	W
			Test recall for elevators - See "Others - Elevators" {Bldg 2 stories or more}	V	S	W
			Test AHU shut down - See "Others - HVAC"	V	S	W
			Test power shut down - See "Others - {Elevators} Electrical"	V	C	W
	Control Panels used for Releasing Service		Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Test releasing circuits for shorts, ground faults, and general operation	V	C	W
			Test power shut down - See "Others - Electrical"	V	S	QA
			Test automatic closing of dampers/doors	V	S	W
	Base-Wide Fire Reporting System		Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Test transmitting devices to ensure the signals are received at the main console {per bldg}	V	C	W
			Test the main console for redundancy requirements	V	S	W

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Miscellaneous Extinguishing Systems	Gaseous Systems	Final Test	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Visually inspect system for adherence to plan, completeness, and adequacy of installation.	A	S	QA
			Verify correct nozzles were installed	A	S	W
			Witness room pressurization test	V	S	W
			Witness full functional test to verify cylinder head functions properly and all control/interface functions operate accordingly.	V	S	W
			Inspect/test detection and releasing system	See Fire Alarm System		
	Wet Chemical & Dry Chemical Systems	Test Prep	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Verify piping and nozzles are installed in accordance with manufacturer's listing requirements	A	S	W
			Witness discharge test - ensure nozzles are bagged if discharging water in a wet chemical system	V	S	W
		Final Test	Verify alarm and supervisory signals are sent to the FACP	V	S	W
			Verify power and gas are disconnect when system activates (if applicable)	V	S	W
			Verify exhaust system either continues to run or shuts down depending on listing (if applicable)	V	S	W
			Inspect/test detection and releasing system	See Fire Alarm System		
	Foam Systems (All types)	Test Preparation	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Review test plan	—	C	QA
			Review the contractor's test plan for environmental and other compliance	—	S	QA
			Inspect/test detection and releasing system	See Fire Alarm System		
			Visually inspect system for adherence to plan, completeness, and adequacy of installation. Conduct functional test of entire system. Submit report.	A	QA	QA
			Verify correct foam generators / discharge devices are installed and properly piped	A	—	QA
			Verify correct size pipe and installed properly	A	—	QA
			Verify riser assembly (deluge valve) is installed properly	A	—	QA
		Final Test	Verify strainer has proper mesh	V	QA	W
		Final Test	Conduct performance test to ensure proper setting and operation of foam control valves and discharge devices. <i>(multiply by the number of risers)</i>	V	QA	W
			Conduct functional test of each generator, ratio controller, or proportioner. <i>(multiply by the number of risers)</i>	—	QA	W

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

FIRE PROTECTION ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	FP QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Passive	Fire / Smoke Barriers IBC Inspections (Section 109)	Preliminary and Final Inspections	Process system submittal (Qualifications of Installer, Shop Drawings, Data Sheets & Calcs)	A	C	S
			Preliminary Test Reports & Certifications	—	RA	S
			Inspect Lath & gypsum board installation	A	QA	QA
			Inspect fire-rated / smoke wall and/or floor penetrations	A	S	QA
			Inspect wall/ceiling/roof joint	A	S	QA
			Inspect/test fire & smoke damper installation and performance	A	S	QA
			Inspect fire doors and frames	A	QA	QA
Life Safety Features	Exit Signs and Emergency Lighting	Preliminary	Verify installed locations of exit signs.	A	S	QA
			Verify installed locations of emergency lighting	A	S	QA
		Final Test	Check performance of emergency lighting systems and battery back-up.	A	S	QA
	Emergency Generators		Check to ensure all life safety features on the emergency generator are provide with power in the required amount of time	A	S	QA
Other Systems	Elevators	Test	Verify elevator re-call to primary floor	A	S	QA
			Verify elevator re-call to alternate floor	A	S	QA
			Test power disconnect upon water flow	V	S	QA
			Verify signal in elevator cab activates	V	S	QA
	Smoke Control / Exhaust Systems	Preliminary Test	Verify smoke exhaust / smoke control system activates via appropriate initiating devices (IBC §1704)	A	S	QA
			Verify location of duct detectors and for proper installation	A	S	QA
		Final Test	Perform operational test to show smoke exhaust / smoke control system functions as designed	V	S	QA
			Special Inspections for smoke control (IBC §1704) (See NFPA 92A & 92B, Chap. 8.)	A	W	W
			Perform operational test to verify detector functions properly and shuts down the correct AHU	V	S	QA
	Electrical	Pre-Test	Verify each detector associated with the electrical equipment disconnects power	A	S	QA
		Final Test	Test power disconnect for associated electronic equipment	V	S	QA

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems	Fuel Oil - ALL	Field Visit	Complete System - Verify contractor provided complete fuel oil system to the facility, including applications and permits	A	QA	—
			Piping - Verify fuel oil piping meets requirements of International Mechanical Code.	A	QA	—
			Testing - Verify oil system testing meets requirements of NFPA 31.	V	W	—
	Fuel Oil - Exterior	Submittal Process	Piping - Verify fuel piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel; or ASTM A 53 Type S (seamless, Grade A or B) black steel; or API SPEC 5L, seamless, submerged-arc weld or gas metal-arc weld, Grade B, black ste	A	RA	—
			Fuel Pumps - Verify fuel pumps comply with NEMA MG 1, NFPA 70, and are designed for use with hydrocarbon fuels.	A	RA	—
			Fuel Pumps - Verify fuel pumps have a working pressure of 1896 kilopascals (275 psig) at 38 degrees C (100 degrees F).	A	RA	—
			Fuel Meters - Verify fuel meters are continuous duty, positive displacement type, with electronic thermal compensation capability, suitable for outdoor installation.	A	RA	—
			Fuel Meters - Verify fuel meters are designed for use with hydrocarbon fuels and have a working pressure of 1896 kilopascals (275 psig) at 38 degrees C (100 degrees F).	A	RA	—
		Submittal Process/ Field Visit	Storage Tanks - Verify aboveground liquid fuel storage tanks are concrete encased or double wall in accordance with UL 142 and UL 2085 with secondary containment and leak monitoring of a capacity to meet the system requirements. Verify overflow/spill con	A	RA/ QA	S
			Dispensing Tanks - Verify Liquid fuel dispensing tanks are concrete encased or double wall in accordance with UL 142 and UL 2085 with secondary containment and leak monitoring of a capacity to meet the system requirements. Verify overflow/spill containme	A	RA/ QA	S
	Fuel Oil - Interior	Submittal Process	Pumps - Verify pumps that are not part of the burner assembly are positive displacement type	A	RA	—
		Field Visit	Oil Filter - Verify an oil filter is provided prior to oil entering appliance or pump.	A	QA	QA
		Field Visit	Drip Legs - Verify drip legs are provided and properly installed prior to oil entering appliance or pump.	A	QA	—
		Submittal Process	Storage Tanks - Verify all storage tanks meet NFPA 31 requirements.	A	RA	—
	Natural Gas - ALL	Field Visit	Complete System - Verify contractor provided complete natural gas system to the facility, including applications and permits	A	QA	—
		Field Visit	Testing - Verify system was tested at 1.5 times maximum working pressure, but not less than 350 kPa (50 PSI) per NFPA 54	V	W	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)	Natural Gas - Exterior (Contractor installed piping)	Field Visit	Piping - Verify exterior gas piping meets requirements of local natural gas utility	A	QA	—
		Submittal Process	Piping - Verify piping meets requirements of ASME B31.8, Gas Transmission and Distribution Piping Systems	A	RA	—
		Submittal Process	Piping - Verify the natural gas piping is either ASTM A 53, Type E (electric-resistance welded, Grade A or B) black steel piping or ASTM A 53 Type S (seamless, Grade A or B) black steel piping or ASTM D 2513, Grade PE2406 or PE3408 polyethylene piping an	A	RA	—
		Field Visit	Meter and Pressure Regulator - Verify meter and pressure regulator are provided in accordance with local utility requirements.	A	QA	—
		Field Visit	Piping Identification - Verify polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines are provided for non-metallic underground piping systems	A	QA	—
	Natural Gas - Interior	Submittal Process	Piping - Verify interior gas piping meets requirements of NFPA 54, National Fuel Gas Code	A	RA	—
	Propane - ALL	Field Visit	Complete System - Verify contractor provided complete propane system to the facility, including appropriate applications and permits.	A	QA	—
	Propane - Exterior	Submittal Process	Piping - If piping is not provided by propane supplier, verify the propane piping is either ASTM A 53, Type E (electric-resistance welded, Grade A or B) black steel piping or ASTM A 53 Type S (seamless, Grade A or B) black steel piping or ASTM D 2513, Gr	A	RA	—
		Submittal Process	Fittings - Confirm Polyethylene fittings meet ASTM D 2683 for socket fittings or ASTM D 2513 for molded butt-fusion fittings	A	RA	—
		Field Visit	Tank - Verify propane tank capacity conforms to tank capacity submitted in shop drawings.	A	QA	—
		Submittal Process	Tank - If tank is not provided by propane supplier, verify propane tank material and installation comply with NFPA 58.	A	RA	—
		Submittal Process	Tank - If tank is not provided by propane supplier, verify propane tank is ASME labeled.	A	QA	—
		Field Visit	Piping Identification - Verify polyethylene plastic tape manufactured specifically for warning and identifying buried utility lines are provided for non-metallic underground piping systems	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)	Propane - Interior	Field Visit	Verify the propane installation meets the requirements specified in NFPA 58.	A	QA	—
		Submittal Process	Piping - Verify standard pipe dimension ratio is not more than 11.5	A	RA	—
	Steam - Exterior Underground	Submittal Process	Confirm the submission of a Certificate of Satisfactory Operation certifying that at least 3 systems installed by the piping system manufacturer within the previous 10 years have and are operating satisfactorily for not less than 5 years.	A	RA	S
		Submittal Process	Confirm the submission of a written certification by the piping system manufacturer that the distribution system installer is technically qualified and experienced in the installation of the system.	A	RA	S
		Submittal Process/ Field Visit	Verify underground steam and condensate piping in separate conduits is direct buried, factory pre-fabricated, pre-insulated, and consist of a steel service pipe with polyurethane insulation and a high-density polyethylene (HDPE) jacket.	A	RA/ QA	—
		Submittal Process/ Field Visit	Confirm piping system fittings and components are factory fabricated and no field insulated fittings are provided.	A	RA/ QA	—
		Field Visit	Verify asbestos cement or plastic conduit piping is not provided.	A	QA	—
		Field Visit	Piping Insulation - Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Submittal Process	Isolation Valves - Verify ASME class 150 isolation valves are provided in manholes for system supply and return lines at take-offs for service to each building .	A	QA	—
		Submittal Process/ Field Visit	Expansion Loops - Verify expansion loops are utilized to compensate for piping expansion.	A	RA/ QA	S
		Submittal Process/ Field Visit	Expansion Anchors - Verify piping expansion anchors are located outside manholes.	A	RA/ QA	—
		Field Visit	Manholes - Verify system manholes are constructed of reinforced, 206.8 bar (3000 psi) concrete. Verify manhole floor and sides are watertight and were made in one monolithic pour. Verify manhole top extends a minimum of 300 mm (6 inches) above grade. V	A	QA	—
		Submittal Process	Verify a sump pit and a vertical sump pump designed for an operating temperature design of 93 degrees C (195 degrees F) minimum are provided in each system manhole.	A	RA	—
		Submittal Process	Sump Pump - Float Control - Verify a 2-pole float control is provided for each manhole sump pump.	A	RA	—
		Submittal Process/ Field Visit	Valves - For system valves located outside of manholes, verify a cast-iron or ductile-iron valve box and cover of a suitable size are provided. Verify the box cover has the word(s) describing the utility cast on the cover.	A	RA/ QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)	Steam - Exterior Aboveground	Submittal Process	Piping - Verify steam piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel pipe or ASTM A 53 Type S (seamless, Grade A or B) black steel pipe or, for pipe sizes through 250 mm (9 inches), ASTM A 106 (Grade A or B) black	A	RA	—
		Submittal Process	Piping - Verify condensate piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 53 Type S (seamless, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 106, G	A	RA	—
		Field Visit	Piping Insulation - Verify piping insulation is either fibrous glass, calcium silicate, or cellular glass as indicated in submitted shop drawings. Verify pipe insulation matches existing or surrounding insulation if applicable.	A	QA	—
		Field Visit	Piping Insulation - Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Field Visit	Insulation - Verify insulation is covered with an with aluminum jacket painted to conform with the Base Architectural Plan.	A	QA	—
		Submittal Process/ Field Visit	Verify the use of either MSS SP-58 or MSS SP-69 adjustable supports with insulation protection saddles. Verify roller supports utilize stainless steel axles.	A	RA/ QA	—
		Field Visit	Support Poles - Verify support poles are installed with guy wires and necessary hardware.	A	QA	—
		Submittal Process/ Field Visit	Pipe Expansion - Verify pipe expansion is compensated by utilizing either expansion loops, guided sliexpansion joints, or flexible ball type expansion joints.	A	RA/ QA	S
	Steam - Interior	Submittal Process	Steam piping - Verify is ASTM A106 or A53, Grade B, Schedule 40, black steel, electric-resistance welded or seamless	A	RA	—
		Submittal Process/ Field Visit	Steam piping - Verify insulated with mineral fiber or cellular glass insulation with all-purpose jacket	A	RA/ QA	—
		Submittal Process	Condensate return piping - Verify is ASTM A106 or ASTM A53, Grade B, Schedule 80, black steel, electric-resistance welded or seamless	A	RA	—
		Submittal Process/ Field Visit	Condensate return piping - Verify insulated with mineral fiber or cellular glass insulation with all-purpose jacket	A	RA/ QA	—
		Submittal Process	Steel pipe fittings - For piping 50 mm (2 inch) and smaller, verify is ANSI/ASME B16.3 malleable iron screwed fittings or ASME B16.11 socket welding (Class 3000) or ASME B16.11 threaded type (Class 2000)	A	RA	—
		Submittal Process	Steel pipe fittings - For piping 63 mm (2-1/2 inch) and larger, verify is ANSI/ASME B16.9 butt-welding fittings or ANSI/ASME B16.5 flanged type	A	RA	—
		Field Visit	Steam pressure reducing station - Verify provided for each building	A	QA	—

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)		Submittal Process/ Field Visit	Steam traps - Verify steam traps and accessories are in accordance with UFC 3-400-10N	A	RA/ QA	—
		Field Visit	Verify all valves, traps, and PRV's are accessible for service & maintenance	A	QA	—
	Hot Water - Exterior Underground	Submittal Process/ Field Visit	Piping - Verify underground hot water supply & return piping in separate conduits is direct buried, factory pre-fabricated, pre-insulated, and consist of a steel service pipe with polyurethane insulation and a high-density polyethylene (HDPE) jacket.	A	RA/ QA	—
		Submittal Process/ Field Visit	Confirm piping system fittings and components are factory fabricated and no field insulated fittings are provided.	A	RA/ QA	—
		Field Visit	Verify asbestos cement or plastic conduit piping is not provided.	A	QA	—
		Submittal Process	The UHDS representative shall be certified in writing by the UHDS manufacturer to be technically qualified and experienced in the installation of the system. Provide a Certificate of Satisfactory Operation certifying that at least 3 systems installed by	A	QA	S
		Field Visit	Piping Insulation - Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Submittal Process/ Field Visit	Isolation Valves - Verify ASME class 150 isolation valves are provided in manholes for system supply and return lines at take-offs for service to each building .	A	RA/ QA	—
		Submittal Process/ Field Visit	Expansion Loops - Verify expansion loops are utilized to compensate for piping expansion.	A	RA/ QA	S
		Submittal Process/ Field Visit	Manholes - Verify system manholes are constructed of reinforced, 206.8 bar (3000 psi) concrete. Verify manhole floor and sides are watertight and were made in one monolithic pour. Verify manhole top extends a minimum of 300 mm (6 inches) above grade. V	A	RA/ QA	—
		Submittal Process	Verify a sump pit and a vertical sump pump designed for an operating temperature design of 93 degrees C (195 degrees F) minimum are provided in each system manhole.	A	RA	—
		Submittal Process	Sump Pump - Float Control - Verify a 2-pole float control is provided for each manhole sump pump.	A	RA	—
		Submittal Process/ Field Visit	Valves - For system valves located outside of manholes, verify a cast-iron or ductile-iron valve box and cover of a suitable size are provided. Verify the box cover has the word(s) describing the utility cast on the cover.	A	RA/ QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Er	Hot Water - Exterior Aboveground	Submittal Process	Piping - Verify hot water piping is either ASTM A 53 Type E (electric-resistance welded, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 53 Type S (seamless, Grade A or B) black steel, Weight Class XS (Extra Strong); or ASTM A 106, Gr	A	RA	—
		Field Visit	Piping Insulation - Verify piping insulation is either fibrous glass, calcium silicate, or cellular glass as indicated in submitted shop drawings.	A	QA	—
		Field Visit	Piping Insulation - Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Field Visit	Insulation - Verify insulation is covered with an with aluminum jacket painted to conform with the Base Architectural Plan.	A	QA	—
		Submittal Process/ Field Visit	Pipe Expansion - Verify pipe expansion is compensated by utilizing either expansion loops, guided slip expansion joints, or flexible ball type expansion joints.	A	RA/ QA	S
		Submittal Process/ Field Visit	Verify the use of either MSS SP-58 or MSS SP-69 adjustable supports with insulation protection saddles. Verify roller supports utilize stainless steel axles.	A	RA/ QA	—
		Field Visit	Support Poles - Verify support poles are installed with guy wires and necessary hardware.	A	QA	—
	Hot Water - Interior	Submittal Process	Piping - Verify hot water piping is electric resistance, welded or seamless, schedule 40, black steel pipe conforming to ASTM A53. Piping 100mm (4 inch) and smaller may be ASTM B 88 Type K or L copper.	A	RA	—
		Submittal Process	Steel fittings - For piping 50mm (2 inch) and smaller, verify provided ANSI/ASME B16.3 malleable iron screwed fittings OR ASME B16.11 socket welding (Class 3000) fittings OR ASME B16.11 threaded type (Class 2000)	A	RA	—
		Submittal Process	Steel fittings - For piping 63 mm (2-1/2 inch) and larger, verify provided ANSI/ASME B16.9 butt-welding fittings OR ANSI/ASME B16.5 flanged type	A	RA	—
		Submittal Process	Copper fittings - Verify ANSI B16.18 cast bronze solder joint type or ASME/ANSI B16.22 wrought copper solder joint type	A	RA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)		Submittal Process/ Field Visit	Insulation - Verify hot water piping insulated with mineral fiber insulation with factory-applied all-purpose jacket	A	RA/ QA	—
		Field Visit	Isolation valves - Verify equipment provided with isolation valves for service and repairs	A	QA	—
		Submittal Process/ Field Visit	Valves - Verify appropriately sized	A	RA/ QA	—
		Submittal Process/ Field Visit	Balancing valves - Verify provided and appropriately sized to balance water flow	A	RA/ QA	QA
		Field Visit	Appurtenances - Verify provided (such as air separators, expansion tanks, suction diffusers, strainers, etc)	A	QA	—
		Field Visit	Test ports - Verify provided in piping at inlet and outlet of all major system components including boilers, pumps, etc)	A	QA	QA
		Field Visit	Verify all valves and test ports are accessible for service and maintenance	A	QA	—
	Chilled Water & Condenser Water - Exterior Underground	Submittal Process	Verify system provided is direct buried, factory-prefabricated, pre-insulated, chilled water piping systems. Verify all fittings and accessories are designed and factory-fabricated to prevent moisture from entering into the system by manufacturer.	A	RA	S
		Field Visit	Verify backfill and overall installation meets the requirements of the piping system manufacturer.	A	QA	—
		Field Visit	Isolation Valves - Verify supply and return line isolation valves are provided at take-offs for service to each building in valve boxes.	A	QA	—
		Submittal Process/ Field Visit	Verify expansion loops are provided to compensate for piping expansion. Verify anchors are provided outside manholes.	A	RA/ QA	S
	Chilled Water & Condenser Water - Exterior Aboveground	Submittal Process	Piping - Verify chilled and condenser water piping are either electric resistance welded or seamless Schedule 40 black steel pipe conforming to ASTM A 53 or, for piping 100 mm (4 inch) and smaller, ASTM B 88 Type K or L copper.	A	RA	—
		Submittal Process	If steel piping is used, verify for piping 50 mm (2 inch) and smaller, ANSI/ASME B16.3 malleable iron screwed fittings or ASME B16.11 socket welding (Class 3000) or threaded type (Class 2000) fittings are provided. For piping 63 mm (2-1/2 inch) and large	A	RA	—
		Submittal Process	If copper piping is used, verify ANSI B16.18 cast bronze solder joint fittings or ASME/ANSI B16.22 wrought copper solder joint fittings are provided.	A	RA	—
		Submittal Process/ Field Visit	Piping Insulation - Verify piping insulation is either Mineral fiber, Urethane, cellular glass, Faced Phenolic Foam, or Flexible Cellular pipe insulation as indicated in submitted shop drawings.	A	RA/ QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (continued)		Field Visit	Piping Insulation - Verify the piping system insulation thickness is in accordance with contract requirements.	A	QA	—
		Field Visit	Piping Insulation - Verify piping insulation is covered with an aluminum jacket.	A	QA	—
		Submittal Process/ Field Visit	Verify the use of either MSS SP-58 or MSS SP-69 adjustable supports with insulation protection saddles. Verify roller supports utilize stainless steel axles.	A	RA/ QA	—
		Field Visit	Support Poles - Verify support poles are installed with guy wires and necessary hardware.	A	QA	—
		Submittal Process/ Field Visit	Pipe Expansion - Verify pipe expansion is compensated by utilizing either expansion loops, guided slip expansion joints, or flexible ball type expansion joints.	A	RA/ QA	S
	Chilled Water & Condenser Water - Interior	Submittal Process	Aboveground chilled & condenser water piping - Verify aboveground chilled water piping is electric resistance welded or seamless schedule 40 black steel pipe conforming to ASTM A 53. Piping 100mm (4 inch) and smaller may be ASTM B 88 Type K or L copper.	A	RA	—
		Submittal Process	Steel pipe fittings - For piping 50mm (2 inch) and smaller - Verify provided ANSI/ASME B16.3 malleable iron screwed fittings or ASME B16.11 socket welding (Class 3000) or threaded type (Class 2000).	A	RA	—
		Submittal Process	Steel pipe fittings - For piping 63mm (2-1/2 inch) and larger - Verify provided ASME/ANSI B16.9 butt-welding fittings or ASME/ANSI B16.5 flanged type.	A	RA	—
		Submittal Process	Steel pipe fittings - Grooved joint pipe coupling systems of appropriate pressure rating are acceptable in lieu of welded or screwed fittings	A	RA	—
		Submittal Process	Copper fittings - Verify provided ANSI B16.18 cast bronze solder joint type or ASME/ANSI B16.22 wrought copper solder joint type	A	RA	—
		Field Visit	Isolation valves - Verify isolation valves provided on supply and return lines at take-offs for service to each building	A	QA	—
		Field Visit	Isolation valves - Verify isolation valves located in valve boxes	A	QA	—
		Submittal Process/ Field Visit	Insulation - Verify above-ground chilled water piping insulated with cellular glass insulation. Flexible unicellular insulation may be used on small piping runouts.	A	RA/ QA	—
		Submittal Process/ Field Visit	Insulation - Verify above-ground condenser water piping insulated with mineral fiber insulation	A	RA/ QA	—
		Submittal Process/ Field Visit	Insulation - Verify all-purpose jacket with vapor retarder provided for above-ground chilled water and condenser piping	A	RA/ QA	—
		Submittal Process/ Field Visit	Valves - Verify appropriately sized	A	RA/ QA	—

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Energy Supply Systems (cont)		Submittal Process/ Field Visit	Balancing valves - Verify provided and appropriately sized to balance water flow	A	RA/ QA	QA
		Submittal Process/ Field Visit	Relief valves - Verify provided and appropriately sized	A	RA/ QA	—
		Field Visit	Test ports - Verify test ports provided in piping at inlet and outlet of all major system components including chillers, pumps, etc	A	QA	QA
		Field Visit	Verify all valves and test ports are accessible for service and maintenance	A	QA	—
	AHU's - ALL	Field Visit	DDC Sensors - Confirm location of DDC sensors (temp, SP, Freeze, High pressure SP, AFM), if required	A	QA	QA
		Field Visit	Smoke Detectors - Confirm location of smoke detectors (if over 2000 cfm)	A	QA	QA
		Field Visit	Testing - Filters - Confirm filters are clean prior to testing	A	QA	QA
		Field Visit	Filters - Confirm filters are installed	—	—	—
		Field Visit	Belts - Confirm belt tightness and alignment	A	QA	QA
		Field Visit	Coils - Confirm all coils are clean	A	QA	QA
		Field Visit	Vibration Isolators - Confirm vibration isolators installed according to contract docs and unit secured	A	QA	QA
		Field Visit	Damper - Confirm damper operation and assembly tightness	A	QA	QA
		Field Visit	Motor - Confirm motor size (HP), voltage, amperage, and rpm	A	QA	QA
		Submittal Process	Fans - Verify provided have AMCA 210 certified fans with AMCA seal	A	QA	—
		Field Visit	Fans - Confirm fan rpm and rotation direction	A	QA	QA
		Field Visit	OA Intake Plenum - Confirm OA intake plenum configuration provides for drainage	A	QA	QA
		Field Visit	AFM - Confirm air flow monitoring station location in conformance with manufacturer requirements	A	QA	QA
		Field Visit	Size - Confirm unit matches schedule req	A	QA	QA
		Submittal Process/ Field Visit	Fan bearings - Verify fan bearings were greased (if req) and have min average life of 200,000 hours at design operating conditions	A	RA/ QA	—
		Field Visit	Birdscreens - Verify birdscreens provided for outdoor inlets and outlets	A	QA	QA
		Field Visit	Verify all filter and access doors are accessible for service and maintenance	A	QA	—
		Field Visit	Verify provided are modular construction, double wall AHU's with min of 25mm (1 inch) casing insulation	A	QA	—
		Submittal Process	Verify provided have ARI 430 certified fans and ARI certified coils	A	RA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	Drain pan - Verify provided has stainless steel, positive draining condensate drain pan	A	RA/ QA	—
		Submittal Process	For 100% OA units - Verify capability provided for cooling, heating, dehumidification, and reheat	A	RA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - Verify central station ahu's provided with an ultraviolet c-band (UVC) disinfection system for mold, bacteria, and odor control in each air handler that has a chilled water or DX cooling coil	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - Verify irradiation emitters and fixtures installed in sufficient quantity and in such an arrangement so as to provide an equal distribution of UVC energy on the coil and in the drain pan	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - Verify the UVC energy produced has the lowest possible reflected and shadowed losses (To maintain energy efficiency)	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - For energy efficiency, verify power supplies are of the high efficiency electronic type and matched to the emitter	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - For intensity, verify the minimal UVC energy striking the leading edge (if installed upstream) or trailing edge (if installed downstream) of all the coil fins is not less than 820 uW/cm2 at the closest point and through pl	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - Verify equal amounts strike the drain pan, either directly or indirectly through reflection	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - For installation, verify emitters and fixtures are installed at right angles to the conforming lines of the coil fins, such that through incident angle reflection, UVC energy bathes all surfaces of the coil and drain pan	A	RA/ QA	—
		Submittal Process/ Field Visit	Ultraviolet disinfection system - Verify one complete set of spare bulbs supplied	A	RA/ QA	—
	AHU's - Split System	Submittal Process	Verify provided is factory assembled, packaged AHU rated in accordance with ARI 210/240 or ARI 340/360	A	RA	—
		Field Visit	Verify matching components provided are from the same manufacturer	A	QA	—
	AHU's - Rooftop	Submittal Process/ Field Visit	Verify provided is factory packaged unit in accordance with ARI 430 and suitable for outdoor installation	A	RA/ QA	—
		Field Visit	Roof Curb - Verify provided with manufacturer's roof curb	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
ment & Components (continued)	Roof Curbs	Field Visit	Mounting Surface - Confirm fan or unit mounting surface is parallel to the horizon, not the roof deck if sloped	A	QA	—
		Field Visit	Waterproofing - Confirm curb has been flashed properly and seal to the roofing material (no leaks) (waterproofing)	A	QA	—
		Field Visit	Lightning Rods - Confirm lightning rods have been attached to units and run to ground	A	QA	—
		Field Visit	Insulation - Confirm roof curb is insulated	A	QA	—
		Field Visit	Size - Confirm curb is the same size or smaller as the unit being placed on it (tight fit)	A	QA	—
	Fans - ALL	Submittal Process/ Field Visit	Verify fans are AMCA 210 certified with AMCA seal	A	RA/ QA	—
		Submittal Process	Fan bearings - Verify fan bearings have min average life of 200,000 hours at design operating conditions	A	RA	—
		Field Visit	Rotation - Confirm rotation and alignment	A	QA	QA
		Field Visit	Belts - Confirm belt tightness (if provided)	A	QA	QA
		Field Visit	Motor - Confirm HP, voltage, amperage	A	QA	QA
		Field Visit	Size - Confirm size matches schedule req	A	QA	QA
		Field Visit	Verify fans are accessible for service and maintenance	A	QA	
		Field Visit	Birdscreens - Verify bird screens provided for outdoor inlets and outlets	A	QA	QA
		Field Visit	DDC - Verify fans provided with means for verifying operation via DDC system	A	QA	QA
	Exhaust Fans (Roof)	Field Visit	Roof Curb - Confirm lag bolted to roof curb	A	QA	QA
		Field Visit	Dome Top - Confirm dome top is secured	A	QA	QA
		Field Visit	Type - Verify centrifugal fans provided	A	QA	
	In-line Fans	Field Visit	Vibration Isolators - Confirm hangers & isolation devices	A	QA	QA
		Field Visit	Flex Connection - Confirm flexible connection to ductwork	A	QA	QA
		Field Visit	Speed Controller - Confirm speed controller installation (if provided)	A	QA	QA
		Field Visit	Access Panel - Confirm access panel located properly	A	QA	QA
		Field Visit	Type - Verify centrifugal fans provided	A	QA	—
	Wall Fans	Field Visit	Type - Verify wall fans provided are propeller fans with fan guards	A	QA	—
		Field Visit	Type - Verify wall fans provided are centrifugal fans with backdraft dampers and wall bracket	A	QA	—
	Bathroom Fan	Submittal Process/ Field Visit	Verify provided are UL 507 and UL-Listed, Home Ventilating Institute (HVI) certified, and with AMCA seal for ceiling installation	A	RA/ QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment	Range Hoods	Submittal Process/ Field Visit	Verify provided are UL 507 and UL-Listed, with AMCA seal	A	RA/ QA	—
		Submittal Process/ Field Visit	Light - Verify provided with light over stove	A	RA/ QA	—
		Submittal Process	Verify min fan capacity is 160 cfm with max sound level of 5.6 sones	A	RA	—
	Louvers & Hoods - ALL	Submittal Process	Louver rating - Verify louvers bear AMCA ratings seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511	A	RA	—
		Submittal Process/ Field Visit	Construction - Verify hoods and louvers constructed of anodized aluminum alloy or stainless steel	A	RA/ QA	
		Submittal Process/ Field Visit	Birdscreens - Verify provided for louvers and hoods	A	RA/ QA	QA
	Intake Hood (Roof)	Submittal Process/ Field Visit	Type - Confirm type as specified	A	RA/ QA	QA
		Field Visit	Confirm top is secured	A	QA	QA
		Submittal Process/ Field Visit	Size - Confirm size matches schedule req (free area)	A	RA/ QA	QA
	OA Intake Louvers (Wall)	Submittal Process/ Field Visit	Type - Confirm type as specified	A	RA/ QA	QA
		Submittal Process/ Field Visit	Size - Confirm size matches schedule req (free area)	A	RA/ QA	QA
		Submittal Process/ Field Visit	Confirm waterproof (when req) and velocity when water carry-over occurs	A	RA/ QA	QA
		Field Visit	Intake Plenum - Confirm intake plenum is sloped back to louver or drain has been provided	A	QA	QA
		Field Visit	Damper - Confirm opposed blade damper with actuator has been provided	A	QA	QA
		Field Visit	AFM - Confirm air flow monitoring type louver has been provided, if req	A	QA	QA

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)	Ductwork	Field Visit	Construction - Except as specified herein, verify ductwork constructed, braced, reinforced, installed, supported, and sealed per SMACNA standards	A	QA	QA
		Field Visit	Verify all dampers are accessible for service and maintenance	A	QA	—
		Field Visit	Confirm general construction conforms to contract documents	A	QA	QA
		Field Visit	Confirm correct pressure rating of ductwork has been conformed to SMACNA	A	QA	QA
		Field Visit	Confirm ductwork has been sealed in accordance with specified seal class	A	QA	QA
		Field Visit	VAV inlet - Confirm minimum straight duct is 6 duct diameters and same size as VAV terminal inlet	A	QA	QA
		Field Visit	Confirm DALT allowables are met	A	QA	QA
		Submittal Process/ Field Visit	Access Doors - Confirm access doors have been provided before every elbow with turning vanes	A	RA/ QA	QA
		Submittal Process/ Field Visit	Access Doors - Confirm access doors provided at appropriate locations	A	RA/ QA	QA
		Field Visit	Flexible duct - Verify insulated flexible duct used only to adapt to minor offsets for connections to air distribution devices	A	QA	QA
		Submittal Process	Flexible duct - Verify is UL 181 listed and per SMACNA DCS with minimum R value of 4	A	RA	—
		Field Visit	Flexible duct - Verify maximum length is 2 meters (6 feet)	A	QA	QA
		Field Visit	Flexible Duct - Confirm, where flexible ductwork is specified, that the length of flex ductwork is provided to the max req length or less and is supported properly with no abrupt turns (ie: as straight as possible)	A	QA	QA
		Field Visit	Flexible connectors - Verify provided between fans and ducts	A	QA	QA
		Submittal Process/ Field Visit	Damper - Confirm balancing damper at branch take-off's, not at diffuser neck	A	RA/ QA	QA
		Submittal Process/ Field Visit	Damper - Confirm balancing damper construction conforms to the specified seal class	A	RA/ QA	QA
		Submittal Process/ Field Visit	Damper - Confirm discharge damper installed on VAV terminal discharge, if req	A	RA/ QA	QA
		Field Visit	Damper - Confirm control damper type and location along with actuator type	A	QA	QA
		Submittal Process	Dampers - Verify conforms to SMACNA DCS	A	RA	—
		Submittal Process	Fire dampers - Verify are rated per UL 555	A	RA	—
		Submittal Process	Fire dampers - Verify are dynamic type rated for closure against a moving airstream	A	RA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
ent & Components (continued)		Submittal Process/ Field Visit	Fire dampers - Verify do not intrude into air stream when in open position	A	RA/ QA	—
		Submittal Process	Smoke dampers - Verify are rated per UL 555S	A	RA	—
		Submittal Process/ Field Visit	Elbows - Confirm correct elbow type (ie: double wall turning vane, 1.5 radius curved, etc)	A	RA/ QA	QA
		Field Visit	Bracing - Confirm proper bracing of high pressure ductwork in accordance with SMACNA	A	QA	QA
		Field Visit	Filters - Confirm access to filter rack for ease of filter change out in duct mounted assemblies	A	QA	QA
		Submittal Process/ Field Visit	Insulation - Confirm ductwork insulated properly (ext batt, hard, int lined, double wall insulated, etc)	A	RA/ QA	QA
		Field Visit	Insulation - Inspect vapor barrier of insulation	A	QA	—
		Field Visit	Hangers - Confirm proper duct hangers have been utilized in accordance with spec req	A	QA	QA
		Field Visit	Vibration Isolators - Confirm the use of vibration isolation material at unit connection to ductwork free of holes (no leakage)	A	QA	QA
		Submittal Process	Sound attenuators - Verify fabricated sound attenuators reduces the rated sound pressure level of the fan down to at least 65 decibels in the 250 Hz (third octave band) center frequency by using a reference sound source calibrated in decibels of sound pow	A	RA	—
		Submittal Process/ Field Visit	Sound attenuators - Verify pressure drop does not exceed 157 Pa (0.63 inch of water)	A	RA/ QA	QA
	VAV Boxes - ALL	Submittal Process	Verify units are pressure-independent type and rated per ARI 880	A	QA	—
		Field Visit	Primary air valve - Verify not allowed to fully shut-off	A	QA	QA
		Field Visit	Heating coil - Verify each box provided with heating coil unless not required by space reheat or heating	A	QA	—
		Field Visit	Verify all VAV box control panels are accessible	A	QA	
		Field Visit	Electronic controls - Verify are provided	A	QA	QA
	VAV Terminal Box (Fan-Powered)	Submittal Process	Type - Verify units are pressure-independent, fan powered, rated per ARI 880, and UL listed	A	QA	—
		Field Visit	Filters - Confirm filter installed and clean	A	QA	QA
		Field Visit	Confirm ductwork on primary inlet is installed with 6 straight duct diameters the same size as the inlet	A	QA	QA
		Submittal Process/ Field Visit	Dampers - Confirm discharge damper has been provided and/or coordinated with sheet metal contractor	A	QA	QA
		Field Visit	Confirm fan size & primary inlet sized in accordance with contract documents	A	QA	—
		Field Visit	Primary Air Valve - Confirm max/min setting of primary air valve	A	QA	QA
		Field Visit	Primary air valve - Verify not allowed to fully shut-off	A	QA	QA

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment		Field Visit	Size - Confirm size matches schedule req	A	QA	QA
		Field Visit	Motor - Confirm HP, voltage, and amperage of fan motor	A	QA	QA
		Field Visit	Heating coil - Verify each box provided with heating coil, if required	A	QA	—
		Field Visit	Reheat Coils - Confirm reheat coil size, if req	A	QA	—
		Field Visit	Reheat Coils - Confirm reheat coil is piped properly	A	QA	QA
		Field Visit	Sensors - Confirm discharge temp sensor provided, if req	A	QA	QA
		Field Visit	Confirm hangers have provisions for vibration isolation	A	QA	QA
		Field Visit	Electronic controls - Verify provided with speed controller, discharge volume control damper(s), and return/recirculation air frame and filter	A	QA	QA
		Submittal Process	Insulation - Verify in accordance with ASHRAE 90.1	A	RA	—
	VAV Terminal Box (Shut Off)	Field Visit	Confirm ductwork on primary inlet is installed with 6 straight duct diameters the same size as the inlet	A	QA	QA
		Field Visit	Primary Air Valve - Confirm max and min setting of primary air valve	A	QA	QA
		Field Visit	Reheat Coils - Confirm reheat coil size, if req	A	QA	—
		Field Visit	Reheat Coils - Confirm reheat coil in piping properly	A	QA	QA
		Field Visit	Sensors - Confirm discharge temp sensor provided, if req	A	QA	QA
		Field Visit	Confirm hangers have provisions for vibration isolation	A	QA	QA
		Field Visit	Size - Confirm box size matches schedule req	A	QA	QA
	DX VAV Units	Submittal Process	Finish - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	QA	—
		Submittal Process/ Field Visit	Direct expansion equipment - Verify is specifically designed and manufactured for VAV applications	A	RA/ QA	—
		Submittal Process/ Field Visit	Equipment - Verify from the same manufacturer (central air handling units, VAV boxes/ zone dampers, and zone controls)	A	RA/ QA	—
		Field Visit	Evaporator coils - Verify airflow through evaporator coils is not modulated	A	QA	—
		Field Visit	Zone control damper units - Verify duct mounted zone control damper units provided with integral control box designed for use with DX VAV packaged systems	A	QA	—
		Submittal Process/ Field Visit	Air diffusers - Verify self-modulating air diffusers are not used	A	RA/ QA	—
	Condensing Units	Submittal Process/ Field Visit	Finish - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	Air conditioner - Verify air-cooled, split system air conditioner provided with ducted air distribution	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

<i>System</i>	<i>Sub-Systems</i>	<i>Phase</i>	<i>Elements</i>	<i>ME QC / DOR (Ktr)</i>	<i>FEAD (SIOH)</i>	<i>FEC (PCAS)</i>
<i>Equipment & Components (continued)</i>		Submittal Process	Construction and rating - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 210/ 240 or ARI 340/ 360	A	QA	—
		Submittal Process/ Field Visit	Clearance - Verify manufacturer's minimum recommended clearance around condensing units is provided	A	RA/ QA	QA
		Field Visit	Refrigerant piping size - Verify is per manufacturer's recommendations	A	QA	—
	Heat Pumps - Ground Source	Submittal Process/ Field Visit	Finish - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	Construction and rating - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 330	A	QA	—
		Submittal Process	Heat exchanger - Verify connected to heat exchanger by closed loop ground source vertical well field	A	RA	—
		Submittal Process/ Field Visit	Well field - Verify design and installation of each well field comply with IGSHPA and ASHRAE standards	A	RA/ QA	—
	Heat Pumps - Water Source	Submittal Process/ Field Visit	Finish - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	Construction and rating - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 210/ 240 or ARI 340/ 360	A	QA	—
	Heat Pumps - Air to Air	Submittal Process/ Field Visit	Finish - If indicated in ESR Section D30, verify anti-corrosion coating provided is immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	—
		Submittal Process	Heat pumps - Verify air-cooled, split system heat pumps provided with ducted air distribution	A	RA/ QA	—
		Submittal Process	Construction and rating - Verify units are factory assembled, designed, tested, and rated in accordance with ARI 210/ 240 or ARI 340/ 360	A	QA	QA
		Field Visit	Clearance - Verify manufacturer's minimum recommended clearance around condensing units is provided	A	QA	—
		Field Visit	Refrigerant piping size - Verify is per manufacturer's recommendations	A	QA	QA
		Field Visit	Insulation - Verify provided for refrigerant piping suction lines and condensate drain	A	QA	—
	Condensate Return Units	Submittal Process/ Field Visit	Verify has floor-mounted receiver and duplex pump unit	A	RA/ QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)	Equipment Thermal Insulation	Submittal Process/ Field Visit	Insulation - Verify insulation provided for hot and chilled water pumps and equipment as suitable for the temperature and service fit as closely as possible to equipment. May be rigid block, semi-rigid board, or flexible unicellular insulation.	A	RA/ QA	QA
			Vapor retarder - Verify provided for chilled water applications	A	QA	—
	Auxilliary Equipment	Submittal Process/ Field Visit	Steam-to-hot-water converter - Verify provided as required for application	A	RA/ QA	—
		Submittal Process	Heat exchangers - Verify factory assembled u-tube units provided constructed in accordance with ASME BPVC for steam or hot water. For hot water, plate type heat exchangers may be provided.	A	RA	—
	Furnaces	Submittal Process/ Field Visit	Construction - Confirm provided furnace is UL-listed, factory assembled, self-contained, and forced circulation	A	RA/ QA	QA
		Submittal Process/ Field Visit	Electronic ignition system - Verify provided	A	RA/ QA	—
		Submittal Process/ Field Visit	Gas furnace rating - Confirm unit is design certified by AGA and GAMA efficiency rating certified for gas furnaces.	A	RA/ QA	—
		Submittal Process/ Field Visit	Oil furnace rating - Confirm unit meets requirements for NFPA 31 for oil furnaces.	A	RA/ QA	—
		Submittal Process/ Field Visit	Cooling coil - Verify provided, if necessary	A	RA/ QA	—
	Unit Ventilators	Submittal Process/ Field Visit	Verify unit is a factory assembled unit ventilator capable of up to 100% OA ventilation and UL-Listed	A	RA/ QA	—
	Unit Heaters	Submittal Process/ Field Visit	See D302004 for gas fired unit heaters	A	RA/ QA	—
	Unit Heaters- Steam	Submittal Process/ Field Visit	Verify provided is UL-Listed and factory assembled	A	RA/ QA	—
	Unit Heaters - Hot Water	Submittal Process/ Field Visit	Verify provided is UL-Listed and factory assembled	A	RA/ QA	—
	Unit Heaters - Cabinet	Submittal Process/ Field Visit	Verify provided is UL-Listed and factory assembled	A	RA/ QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
	Fuel-Fired Unit Heaters - Gas	Submittal Process/ Field Visit	Verify meets requirements for ANSI Z83.8 and AGA label	A	RA/ QA	—
		Submittal Process/ Field Visit	Discharge louver - Verify each heater equipped with individually adjustable package discharge louver	A	RA/ QA	QA
		Submittal Process/ Field Visit	Thermostat - Verify provided	A	RA/ QA	QA
	Fuel-Fired Unit Heaters - Infrared	Submittal Process/ Field Visit	Verify meets requirements for ANSI Z83.8 and AGA label	A	RA/ QA	—
	Unit Heaters - Electric	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-1025	A	RA/ QA	—
	Heaters - Baseboard	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-1042	A	RA/ QA	—
	Heaters - Wall	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-1025, cabinet heaters	A	RA/ QA	—
	Heaters - Infrared	Submittal Process/ Field Visit	Verify provided are factory assembled, UL-Listed and labeled heaters	A	RA/ QA	—
	Fin Tube Radiators & Convectors	Submittal Process	Verify fin tube radiators and convectors provided with copper tubes and aluminum fins	A	RA	—
		Submittal Process	Control Valves - Verify control valves provided are normally open, spring return	A	RA/ QA	QA
	Duct Heater	Submittal Process/ Field Visit	Verify provided is factory assembled, UL-Listed heater	A	RA/ QA	—
		Field Visit	Verify adequate duct length is provided per manufacturer's recommendations upstream & downstream	A	QA	—
		Submittal Process/ Field Visit	Verify control cabinet and heating coil provided	A	RA/ QA	—
	Pumps - ALL	Submittal Process/ Field Visit	Verify provided are centrifugal circulating pumps with motor, motor starter, and motor enclosure conforming to the appropriate NEMA standards	A	RA/ QA	—
		Field Visit	Insulation - Verify pumps used for hot service and chilled water service are insulated	A	QA	QA

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)	Pumps - Base-mounted	Field Visit	Confirm size and nameplate data matches schedule req	A	QA	QA
		Field Visit	Verify voltage service matches nameplate	A	QA	QA
		Field Visit	Verify provided are single-stage end suction pumps suitable for chilled, condenser, and hot water heating systems	A	QA	QA
		Field Visit	Isolation Base - Confirm isolation base is provided where req	A	QA	QA
		Field Visit	Insulation - Confirm insulation enclosure is provided where req	A	QA	QA
		Field Visit	Confirm pressure taps, gages, and shutoffs have been provided in the specified locations	A	QA	QA
		Field Visit	Balancing Valves - Confirm the balancing valves have been provided in accordance with manufacturers recommendations and/or in accordance with the appropriate contract document detail	A	QA	QA
		Field Visit	Balancing Valves - Confirm balancing valves provided with proper clearances	A	QA	QA
		Field Visit	Rotation - Verify rotation direction is correct	A	QA	QA
		Field Visit	Suction diffusers - Verify suction diffusers provided on base-mounted pumps	A	QA	QA
	Pumps - In-line	Field Visit	Location - Confirm location is correct(ie: in accordance with the contract documents)	A	QA	QA
		Field Visit	Verify constructed of manufacturer's standard materials suitable for chilled, condenser, and hot water heating systems	A	QA	QA
		Field Visit	Confirm voltage provided is correct	A	QA	QA
		Field Visit	Valve Arrangement - Confirm valve arrangement around the pump is correct	A	QA	QA
		Field Visit	Balancing Valve - Confirm balancing valve has been provided in accordance with the contract documents, if req	A	QA	QA
		Field Visit	Balancing Valve - Confirm balancing valves provided with proper clearances	A	QA	QA
	Diffusers, Registers, & Grilles	Field Visit	Confirm location, size, and type have been provided in accordance with the contract documents	A	QA	QA
		Field Visit	Dampers - Confirm branch balancing dampers have been provided and dampers, if any, provided with the air device are in the wide open position	A	QA	QA
		Field Visit	Finish - Verify are factory-finished	A	QA	—
		Field Visit	Exterior and exposed edges - Verify are rolled, or otherwise stiffened and rounded	A	QA	—
	Pipe Sleeves	Field Visit	Verify pipe sleeves provided at each wall and floor penetration	A	QA	—
		Field Visit	Verify sleeves are of a material suitable to protect the carrier pipe (2 pipe sizes larger) and sealed with an appropriate flexible material	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	Fire Stopping - In fire rated walls, verify fire stopping provided in accordance with IBC	A	RA/ QA	—
	Piping Identification	Field Visit	Verify piping provided with identification labels or stencil names or code letters for piping systems in clearly visible letters and symbols	A	QA	—
		Field Visit	Verify arrow-shaped markings provided to indicate direction of flow	A	QA	QA
	Piping - Condensate Drain	Submittal Process/ Field Visit	Verify condensate drain piping provided is ASTM B 88, Type M or L, hard drawn copper	A	RA/ QA	—
	Piping	Field Visit	Flushing - Confirm/ witness pipe flushing (make sure water is clear prior to putting final chemicals into water system)	V	W	—
		Field Visit	Strainers - Confirm start-up strainer has been removed from all strainers (hang at location)	A	QA	—
		Field Visit	Air Vents - Confirm air vents are at specified locations and are auto type, if req	A	QA	QA
		Submittal Process/ Field Visit	Pressure Relief Valves - Confirm pressure relief valves are sized properly and installed where specified	A	RA/ QA	QA
		Field Visit	Confirm make-up water pressure setting is sufficient for facility (adjust if req for pressure req at highest point)	A	QA	QA
		Field Visit	Expansion Tanks - Where diaphragm expansion tanks are provided, confirm tank pressure is set in accordance with nameplate	A	QA	QA
		Field Visit	Confirm valve arrangements for each unit coil are as specified on the contract documents	A	QA	QA
		Field Visit	Confirm all valve clearance req's, manufacturer, and/or contract have been adhered to	A	QA	QA
		Field Visit	Layout - Confirm piping layout conforms to the contract documents (physically walk all pipe runs to make sure there are no cross connections)	A	QA	QA
		Field Visit	Confirm traps have been provided on condensate lines per the contract documents	A	QA	
		Field Visit	Confirm slope of condensate lines meets spec req	A	QA	
		Field Visit	Supports - Confirm piping supported properly (ie: hangers, saddles, seismic (if req))	A	QA	QA
		Field Visit	Insulation - Confirm pipe insulated with specified insulation and vapor barrier is intact	A	QA	QA
		Submittal Process/ Field Visit	Fittings - Confirm dielectric fittings have been provided where piping of dissimilar metals connect	A	RA/ QA	—
		Field Visit	Confirm condensate piping from equip has been run to floor drains, if req	A	QA	QA
		Field Visit	Identification - Confirm piping is marked properly with water type and direction of flow	A	QA	QA
		Field Visit	Confirm provisions have been made in the piping arrangement at each coil for isolation of flow and ease of coil removal	A	QA	QA

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Components (continued)		Field Visit	Confirm steam piping relief valve has been piped to the exterior of the building in a safe location to personnel	A	QA	QA
		Field Visit	Confirm hazard warning and/or hot surface signage is in place at steam piping, equip. (This also applies to hot water systems)	A	QA	—
		Field Visit	Flow Meters - Confirm location of flow meters meets factory req for straight, unobstructed inlet and outlet piping	A	QA	QA
	Chillers	Field Visit	Leaving Water Temp - Confirm the leaving chilled water temp is below temp specified for terminal equip to compensate for pump heat gain (approx 1.8F/1.0C) (chiller leaving should never be same as temp req at terminal unit)	A	QA	QA
		Submittal Process/ Field Visit	Confirm piping/valve arrangement matches contract documents and balancing valve and flow monitoring device have been provided in accordance with manufacturers req and/or detail	A	RA/ QA	QA
		Submittal Process/ Field Visit	Decoupler - Confirm decoupler leg is tied into chilled return piping before entering chilled water return header (for multiple chillers)	A	RA/ QA	QA
		Field Visit	Confirm piping arrangement has allotment for access to the cooling and condensing bundles	A	QA	QA
		Field Visit	Flow Switch - Confirm flow switch has been provided to protect the chiller from low or lack of flow	A	QA	QA
		Submittal Process/ Field Visit	Confirm BACNET compatible (if req in contract docs) and that the connection has been made to the DDC control system	A	RA/ QA	QA
	Chiller Systems Closed Circuit Coolers	Submittal Process	Construction and rating - Confirm provided is factory assembled conforming to NFPA 214	A	RA	—
		Submittal Process	Fire hazard rating - Verify fire hazard rating for plastic impregnated materials does not exceed 25	A	RA	—
		Submittal Process	Certification - Verify Cooling Technology Institute 201 certification of tower capability and performance is provided	A	RA	—
		Submittal Process	Cooler performance - Verify meets or exceeds that listed in ASHRAE 90.1	A	RA	—
		Submittal Process/ Field Visit	Hardware - Verify stainless steel hardware provided	A	RA/ QA	—
		Submittal Process	Vibration cutout switch - Verify interlocked with fan motor	A	RA	—
		Submittal Process	Fan motors - Verify 2-speed or adjustable frequency drive fan motors provided	A	RA	—
		Field Visit	Safety - Verify OSHA safety requirements for stairs and handrails are met	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Controls	Chiller Systems Water Cooled Chillers	Submittal Process	Construction and rating - Verify self-contained chiller provided meeting requirements of ARI 550/590-98	A	RA	—
		Field Visit	Control panel - Verify provided with manufacturer's standard controls and protection circuits	A	QA	—
		Submittal Process/ Field Visit	DDC system - If DDC system required in project, verify control interface provided for remote monitoring of chiller's operating parameters, functions, and alarms from DDC control system central workstation	A	RA/ QA	QA
		Submittal Process	Automatic capacity-reduction system - Verify provided for stable operation from 100 to 10 percent of full load capacity	A	RA	—
	Chiller Systems Air Cooled	Submittal Process	Construction and rating - Verify provided air-cooled chillers are type indicated in Project Program and meet requirements of ARI 550/590-98	A	RA	—
		Submittal Process	Control panel - Verify provided with manufacturer's standard controls and protection circuits	A	RA	—
		Submittal Process/ Field Visit	DDC System - If DDC system required in project, verify control interface provided for remote monitoring of chiller's operating parameters, functions, and alarms from DDC control system central workstation	A	RA/ QA	QA
		Submittal Process	Reciprocating chillers - Verify minimum of four stages of unloading provided at 25% per stage minimum	A	RA	—
		Submittal Process	Reciprocating chillers - Verify provided with hot gas bypass	A	RA	—
		Submittal Process	Head pressure control - Verify provided for cold temperature operation	A	RA	—
		Submittal Process/ Field Visit	Freeze protection - Verify provided for chiller and piping	A	RA/ QA	QA
		Submittal Process/ Field Visit	Condenser coils - Verify provided are copper tube with aluminum fins unless specified otherwise	A	RA/ QA	QA
		Submittal Process/ Field Visit	Condenser coils - If condenser coil coatings indicated in ESR Section D30, verify provided with copper tube/ copper fin construction or immersion applied, baked phenolic, or other approved coating. Field applied coatings not acceptable.	A	RA/ QA	QA
		Submittal Process/ Field Visit	Condenser coils - Verify condenser coils provided with manufacturer's optional louvered covers or hail guards for protection against vandalism, debris, or hail	A	RA/ QA	—
	Cooling Tower	Field Visit	Confirm tower size HP, voltage per contract docs	A	QA	QA
		Submittal Process/ Field Visit	Confirm tower constructed in accordance with specs (ie: galvanized, stainless steel, fiber-glass)	A	RA/ QA	QA
		Submittal Process/ Field Visit	Sump - Confirm height of cooling tower sump is above intake of condenser water pumps (min of 3 to 4 feet)	A	RA/ QA	QA

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process/ Field Visit	Confirm return line to tower has trap leg below well unless the by-pass is piped directly to cooling tower well	A	RA/ QA	QA
		Field Visit	Overflow - Confirm tower well overflow is low enough to prevent the well from overflowing	A	QA	QA
		Field Visit	Make-up Float - Confirm tower well make-up float setting shuts of prior to water level reaching the top of the overflow	A	QA	QA
		Field Visit	Fan Rotation - Confirm tower fan rotation is correct	A	QA	QA
		Field Visit	Well Heater - Confirm tower well heater is installed, if req	A	QA	QA
		Field Visit	Shut-off Valve - Confirm tower shut-off valve has been installed in proper location, if req	A	QA	QA
		Field Visit	Fan Discharge - Confirm tower fan discharge is unobstructed from above	A	QA	QA
		Field Visit	Heat Trace - Confirm tower piping above grade is heat traced, if req	A	QA	QA
		Submittal Process	Construction and rating - Confirm provided is factory assembled conforming to NFPA 214	A	RA	—
		Submittal Process	Fire hazard rating - Confirm fire hazard rating for plastic impregnated materials does not exceed 25	A	RA	—
		Submittal Process	Certification - Verify Cooling Technology Institute 201 certification of tower capability and performance is provided	A	RA	—
		Submittal Process	Cooling tower performance - Verify meets or exceeds that listed in ASHRAE 90.1	A	RA	—
		Submittal Process/ Field Visit	Construction - Verify construction is as indicated in ESR Section D30 with fill material of PVC formed sheets	A	RA/ QA	—
		Submittal Process/ Field Visit	Hardware - Verify stainless steel hardware provided	A	RA/ QA	—
		Submittal Process	Vibration cutout switch - Verify interlocked with fan motor	A	QA	—
		Submittal Process	Fan motors - Verify 2-speed or adjustable frequency drive fan motors provided	A	QA	—
		Submittal Process/ Field Visit	Work platforms - Verify provided at all locations in tower that require periodic maintenance	A	RA/ QA	—
		Submittal Process/ Field Visit	Isolation valves - For multi-cell installations, verify isolation valves provided on inlets and outlets of each cell	A	RA/ QA	—
	Fan Coil Units	Field Visit	Confirm size and location in accordance with contract docs	A	QA	QA
		Field Visit	Filter Access - Confirm filter accessibility	A	QA	QA
		Field Visit	Confirm vibration isolation provided for on hangers and at ductwork connection	A	QA	QA
		Field Visit	Confirm installation of auxilliary drain pan (if req) along with respective condensate drain piping	A	QA	QA

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Field Visit	Confirm valves arranged properly including the straight pipe diameters req before and after the balancing valve	A	QA	QA
		Submittal Process/ Field Visit	Speed Controller - Confirm speed controller has been provided, if req in contract docs	A	RA/ QA	QA
		Field Visit	Fan Access - Confirm fan access is accessible by maintenance staff	A	QA	QA
		Field Visit	Confirm unit tagging has been provided	A	QA	—
		Field Visit	Confirm operational	A	QA	—
		Submittal Process/ Field Visit	Sensors - Confirm leaving air temp sensor has been provided	A	RA/ QA	QA
		Submittal Process	Verify provided are UL-Listed, factory assembled and tested fan coils, ARI 440, and ARI certified	A	QA	—
	Thru Wall Classroom Terminal Units	Field Visit	Confirm size and location in accordance with contract docs	A	QA	QA
		Field Visit	Confirm operational	A	QA	—
		Field Visit	Confirm piping arrangement meets contract docs req's	A	QA	QA
	Packaged Thru Wall Units	Submittal Process	Verify provided is factory assembled air conditioner or heat pump and rated in accordance with ARI 310 or ARI 380 and ARI certified	A	RA	—
		Submittal Process	Verify provided unit includes heat and operates under the standard unit controls (Not sure if worded correctly, D305006 1.4)	A	RA	—
		Submittal Process	Wall Sleeve - Verify unit designed to allow ease of maintenance by use of a wall sleeve	A	RA	QA
		Submittal Process/ Field Visit	Condensate Removal - Verify provided unit includes internal condensate removal (condensate shall not be externally drained)	A	RA/ QA	QA
	Room Air Conditioners	Submittal Process	Verify provided is factory assembled air conditioner or heat pump and rated in accordance with AHAM RAC-1	A	RA	—
		Submittal Process/ Field Visit	Verify auxiliary electric heat included and operates under the standard unit controls	A	RA/ QA	QA
		Submittal Process	Verify provided unit is AHAM certified or listed in AHAM DCRAC	A	RA	—
	Computer Room Units	Field Visit	Confirm size and location	A	QA	QA
		Field Visit	Confirm all features have been provided	A	QA	QA
		Field Visit	Confirm water connection to humidifier	A	QA	QA
		Field Visit	Fan Rotation - Confirm fan rotation	A	QA	QA
		Submittal Process	If computer room unit req'd, verify DOR utilized UFGS Spec section 23 81 23.00 20 (Computer Room Air Conditioning Units) for the project spec and submitted the edited spec section as part of the design submittal for the project	A	RA	—
	Boilers	Field Visit	Confirm size and location	A	QA	—
		Field Visit	Stack - Confirm stack material and arrangement meet contract doc req's	A	QA	QA

KEY = A - Approve, R - Review, W - Witness, RA - Receipt Acknowledge, S - Surveillance Review, V- Verification and Testing, C - Copy, QA - Quality Assurance

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
		Field Visit	Stack - Confirm stack above roof does not touch roof curb and guy wires have been provided	A	QA	QA
		Field Visit	Stack - Confirm stack type is per contract docs and the height above the parapet and/or building meets code req's	A	QA	QA
		Field Visit	Confirm fuel train meets contract docs and code req's with no leaks	A	QA	QA
		Submittal Process/ Field Visit	Make-up Air - Confirm adequate make-up air for the boiler(s) has been provided under positive pressure to the room	A	RA/ QA	QA
		Field Visit	Relief Valve - Confirm relief valve setting and operation	A	QA	—
		Field Visit	DDC - Confirm boilers have been interfaced with the DDC system	A	QA	QA
		Field Visit	Confirm pump/piping arrangement meets contract docs including circulation pump, if req	A	QA	QA
		Submittal Process/ Field Visit	Confirm boiler sequencing panel has been provided by the boiler manufacturer, if req in the contract docs	A	RA/ QA	QA
	Boilers - Hot Water	Submittal Process	Load capacity - Verify boiler type provided meets building load capacity as indicated in ESR Section D30, if required	A	RA	—
		Submittal Process/ Field Visit	Construction and rating - Verify boiler designed, tested, and installed per ASME CSD-1 (Controls and Safety Devices) and ASME BPVC (Boiler and Pressure Vessel Code)	A	RA/ QA	—
		Submittal Process/ Field Visit	Construction - Verify boiler meets requirements of UL 795, ANSI Z83.3, and ASME CSD	A	RA/ QA	—
		Submittal Process/ Field Visit	Burners - Confirm provided are make, model, and type certified and approved by manufacturer of provided boiler	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify burner controls and flame safety equipment conform to either ASME CSD-1 or NFPA 58 as dictated by input	A	RA/ QA	—
		Submittal Process/ Field Visit	Boiler controls - Verify are mounted on a single control panel mounted on the burner or separate from the burner (includes operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of the control system). If separa	A	RA/ QA	—
		Submittal Process/ Field Visit	Trim - Verify boiler trim complies with ASME BPVC SEC IV, ASME CSD-1, and additional appurtenances as specified herein	A	RA/ QA	—
		Submittal Process/ Field Visit	Pressure gages - Confirm provided have scale equivalent to 1.5 times the outlet water pressure on supply water piping and return water piping	A	RA/ QA	—
		Submittal Process/ Field Visit	Thermometers - Piping - Confirm provided have scale equivalent to 1.5 times the outlet water temperature on supply water piping and return water piping	A	RA/ QA	—
		Field Visit	Drain valve - Verify provided and piped to floor drain	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

<i>System</i>	<i>Sub-Systems</i>	<i>Phase</i>	<i>Elements</i>	<i>ME QC / DOR (Ktr)</i>	<i>FEAD (SIOH)</i>	<i>FEC (PCAS)</i>
<i>Equipment & Components (continued)</i>		Submittal Process/ Field Visit	Air vent valve - Verify provided with screwed connection, stainless steel disk, and stainless steel seats to vent entrapped air	A	RA/ QA	—
		Submittal Process	Boiler stack - Verify provided boiler stack insulated in accordance with manufacturer's recommendations and conform to NFPA 211, or pre-manufactured multi-wall stacks provided complying with NFPA 54 or NFPA 58 and UL-listed	A	RA	—
		Submittal Process/ Field Visit	Thermometer - Flue gas - Verify provided and mounted in flue gas outlet	A	RA/ QA	—
		Field Visit	Cleaning - Verify boiler(s) cleaned in accordance with ASME Boiler and Pressure Vessel Code and manufacturer's recommendations prior to startup	A	QA	—
		Field Visit	Testing - Verify services are furnished of an engineer or technician approved by the boiler manufacturer for installation, startup, and operational and safety testing	V	W	W
		Field Visit	Testing - Verify boiler demonstrates proper operability of combustion control, flame safeguard control, and safety interlocks	V	W	W
	Boilers - Steam		Confirm meets same requirements specified for hot water boilers except as follows:			
		Submittal Process/ Field Visit	Pressure gage - Confirm provided have scale equivalent to 1.5 times the outlet water pressure on boiler feedwater supply piping and condensate return water piping	A	RA/ QA	—
		Submittal Process/ Field Visit	Pressure gage - Confirm provided boiler steam pressure gage has scale equivalent to 1.5 times the boiler rated working pressure	A	RA/ QA	—
		Submittal Process/ Field Visit	Thermometers - Piping - Confirm provided have scale equivalent to 1.5 times the outlet water temperature on boiler feedwater piping and return water piping	A	RA/ QA	—
	Insulation - Condensate Drain	Field Visit	Insulation - Verify condensate drain piping insulated with flexible cellular insulation	A	QA	—
	Insulation	Field Visit	Verify all ductwork provided with external thermal insulation	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Field Visit	Verify all ductwork in concealed spaces insulated with blanket flexible mineral fiber	A	QA	—
		Field Visit	Verify ductwork in mechanical Rooms and exposed locations insulated with rigid mineral fiber insulation	A	QA	—
		Field Visit	Verify insulation provided with factory applied all-purpose jacket with integral vapor retarder	A	QA	—
		Field Visit	In exposed locations, verify jacket provided with white surface suitable for painting	A	QA	—
		Submittal Process/ Field Visit	Verify flame spread/smoke developed rating for all insulation does not exceed 25/ 50	A	RA/ QA	—
		Submittal Process	Verify minimum insulation thickness does not violate minimum required by ASHRAE 90.1	A	RA	—
		Field Visit	Verify the backs of all supply air diffusers insulated with blanket flexible mineral fiber insulation	A	QA	QA
	VFDs	Submittal Process/ Field Visit	Verify are factory-assembled VFD drive control systems for variable speed control	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify all AHU and pump VFD's are from same manufacturer	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify each VFD provided includes motor starter, motor disconnects, and controls as required for a complete system	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify VFD units provided are UL-Listed and comply with the National Electric Code	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify the following accessories were provided: Disconnect switch, Control circuit transformer with primary and secondary fuses, Manual bypass, System hand-off-auto switch with provisions for remote start/stop of the system, System initialized light, Run	A	RA/ QA	QA
	Air Separators	Submittal Process/ Field Visit	For hot and chilled water - Verify provided are ASME rated air separators with tangential inlet and outlet connections and automatic air vent	A	RA/ QA	—
	Solids Separators	Submittal Process/ Field Visit	Verify provided are centrifugal solids separators with automatic drain in open systems.	A	RA/ QA	—
	Expansion Tanks	Submittal Process/ Field Visit	For hot and chilled water - Verify provided are ASME rated expansion tanks with polypropylene or butyl diaphragm or compression tanks as indicated in UFC 3-400-10N.	A	RA/ QA	—
	Make-Up Water Station	Field Visit	Verify station consists of a water pressure-reducing valve, filter, and relief valve in the make-up water line to the chilled and hot water systems to maintain the operating pressure	A	QA	—
		Field Visit	Verify a 20mm (3/4 inch) globe valve by-pass provided around the pressure reducing station	A	QA	—
		Field Visit	Verify a reduced pressure backflow preventer provided upstream of the by-pass	A	QA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Plant & Components (continued)	Glycol Make-Up Station	Submittal Process/ Field Visit	If required, verify a glycol make-up system provided to maintain system proper operating mixture	A	RA/ QA	—
	Chemical Treatment	Submittal Process/ Field Visit	If required, verify chilled and hot water systems provided with automatic chemical treatment system for the control of pH, scale formation, and corrosion inhibition	A	RA/ QA	—
		Field Visit	Verify shot-type feeders provided for manual chemical feed	A	QA	—
		Submittal Process	Verify feeders rated for use with pressures up to 900 kPa (130 PSI) (gage)	A	RA	—
		Submittal Process/ Field Visit	Verify condenser water systems provided with automatic chemical treatment systems that monitor conductivity, pH, etc, and provide for water metering and bleed-off	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify chemicals provided are in accordance with EPA and equipment manufacturer's recommendations	A	RA/ QA	—
	System Flushing	Field Visit	Verify hydronic systems flushed thoroughly prior to system startup	A	QA	—
	Heat Tape	Submittal Process/ Field Visit	Verify heat tape provided is UL-Listed, and self-regulating	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify heat tape provided on piping subject to freezing	A	RA/ QA	QA
	Terminal & package Units	Submittal Process/ Field Visit	Where required in ESR Section D30, verify anti-corrosion coating provided on the casing and both the condenser and evaporator coils to protect against salt air damage	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify anti-corrosion coating is immersion applied, baked phenolic or other approved coating (Field applied coatings are not acceptable)	A	RA/ QA	—
	Seismic Design	Submittal Process	Verify provided in accordance with UFC 3-400-10N, Mechanical Engineering	A	RA	—
	Energy Recovery Wheel (Enthalpy Wheel)	Field Visit	Verify provided is a total energy (enthalpy) type energy recovery wheel (heat wheel)	A	QA	—
		Submittal Process/ Field Visit	Media - Verify media is aluminum or a lightweight polymer coated with a corrosion resistance finish (Etched or oxidized surfaces are not acceptable)	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify heat transfer surfaces are coated with a non-migrating (permanently bonded) absorbent specifically developed for the selective transfer of water vapor	A	RA/ QA	—
		Submittal Process	Verify equal sensible and latent recovery efficiencies are documented through a certification program conducted per ASHRAE 84 and ARI 1060	A	RA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment		Submittal Process/ Field Visit	Verify energy recovery wheel provided with insulating housing of double wall construction, rotor seals specifically designed to limit cross-contamination, and a rotation detector	A	RA/ QA	—
		Field Visit	Verify the rotation detector alarms the HVAC control system if rotation stops	A	QA	—
		Field Visit	Filter Access - Verify filter sections are readily accessible for maintenance	A	QA	QA
	Heat Pipes	Submittal Process	Verify provided are factory fabricated, assembled and tested heat pipes with counter-flow arrangement	A	RA	—
		Submittal Process	Verify are provided with hermitically sealed, seamless aluminum tube cores with extended surfaces	A	RA	—
		Submittal Process	Verify heat exchanger frame constructed of not less than 16-gage galvanized steel and fitted with intermediate tube supports and flange connections	A	RA	—
		Submittal Process	Verify tube end covers and a partition of galvanized steel provided to separate exhaust and supply air streams without cross-contamination	A	RA	—
		Submittal Process	Refrigerant - Verify refrigerant used as the working fluid (Type I refrigerants are not allowed)	A	RA	—
	Exterior Piping Manholes	Submittal Process/ Field Visit	Manholes - Verify system manholes are constructed of reinforced, 206.8 bar (3000 psi) concrete. Verify manhole floor and sides are watertight and were made in one monolithic pour. Verify manhole top extends a minimum of 300 mm (6 inches) above grade. V	A	RA/ QA	—
		Submittal Process	Verify a sump pit and a vertical sump pump designed for an operating temperature design of 93 degrees C (195 degrees F) minimum are provided in each system manhole.	A	RA	—
		Submittal Process	Sump Pump - Float Control - Verify a 2-pole float control is provided for each manhole sump pump.	A	RA	—
	Exterior Piping Cathodic Protection	Field Visit	If underground steel piping is installed, verify a cathodic protection system is provided.	A	QA	—
		Submittal Process	If a cathodic protection system is provided, verify the system was designed by a National Association of Corrosion Engineers (NACE) certified Cathodic Protection Engineer and they supervised, inspected and tested the installation and performance of the ca	A	QA	QA
		Field Visit	Verify the test stations were post mounted and placed at the manhole or nearby building and test stations were provided at each end of each cathodically protected section.	A	QA	—
	DDC		Verify one of the following provided as directed in ESR Section D30			
		Submittal Process	A) Verify Direct Digital Controls (DDC) provided to comply with UFGS Section 23 09 54.00 20, Direct Digital Control Systems	A	RA	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Equipment & Components (continued)		Submittal Process	A) Verify DOR utilized UFGS Spec Section 23 09 54.00 20, Direct Digital Control Systems, for the project spec, and submitted the edited spec section as part of the design submittal for the project	A	RA	—
		Submittal Process/ Field Visit	B) Verify a partial DDC system provided that communicates with the existing DDC system	A	RA/ QA	—
		Submittal Process	B) Notwithstanding any other provisions of this contract, no other product will be acceptable other than that indicated in ESR Section D30	A	RA	—
		Submittal Process/ Field Visit	B) Verify the system has stand alone digital controllers, a communication network, and a workstation computer with control software (Pneumatic controllers and components are not acceptable)	A	RA/ QA	—
		Submittal Process	B) Verify all 120-volt wiring complies with NFPA 70	A	RA	—
		Submittal Process/ Field Visit	B) Verify all 24-volt wiring complies with the IMC and terminal device manufacturer's recommendations	A	RA/ QA	—
	DDC - Equipment Controllers	Submittal Process/ Field Visit	Verify DDC hardware are UL-916 rated	A	RA/ QA	—
		Submittal Process/ Field Visit	Verify controllers used in a distributed control manner	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify controllers are stand alone with an internal clock and modem	A	RA/ QA	QA
		Submittal Process	Verify the total number of I/O hardware points do not exceed 48 in any controller	A	RA	QA
		Submittal Process	Verify sufficient memory provided for each controller to support required control, communication, trends, alarms, and messages	A	RA	QA
		Submittal Process/ Field Visit	Verify communications ports provided for controller to controller, on-site interface, remote workstation interface, and telecommunications interface	A	RA/ QA	QA
	DDC - Electronic Controls	Submittal Process/ Field Visit	If required, verify programmable thermostats provided with built in keypads for scheduling of day and night temps with two setback periods per day	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify independent summer and winter programs provided	A	RA/ QA	QA
		Submittal Process/ Field Visit	Verify thermostats have temporary and manual override of schedule and battery backup	A	RA/ QA	QA
	All Submittals	Submittal Process	All equipment and controls hardware reviewed by A/E	A	RA	RA
	DALTS - Submittals	Submittal Process	TAB contractor qualifications & certification	RA	RA	A
		Submittal Process	DALT test equip with certification	RA	RA	A

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
		Submittal Process	DALT test plan	RA	RA	A
		Submittal Process	DALT tests report including plan drawing of duct to be tested and square foot calc for each section	RA	RA	A
	DALTS - Testing	Submittal Process	Ductwork to be DALT'd	RA	RA	A
		Field Visit	Testing	V	W	W
		Submittal Process	Pre-final DALT report	RA	C	A
		Submittal Process	Certified final DALT report	RA	C	A
	DALTS - Acceptance Testing	Field Visit	Quality assurance - Contracting officer DALT field checks	V	W	W
		Field Visit	Additional field checks	V	W	W
	TABS - Submittals	Submittal Process	TAB contractors qualifications & certification	RA	RA	A
		Submittal Process	Pre-TAB engineering report	RA	RA	A
		Submittal Process	*Discussion on TAB procedure	RA	RA	A
		Submittal Process	*Pre-requisite checklist	RA	RA	A
		Submittal Process	*Design review report	RA	RA	A
		Submittal Process	*Preliminary TAB test report	RA	RA	A
		Submittal Process	Certified TAB test report (Season 1)	RA	RA	A
		Submittal Process	Certified TAB test report (Season 2 (coil data))	RA	RA	A
	TABS - Pre-Test Checklist		1) Variable Air Volume Series Boxes			
			a) General			
		Field Visit	Louvers installed	V	W	—
		Field Visit	Manual dampers open and locked	V	W	—
		Field Visit	Automatic dampers set properly	V	W	—
		Field Visit	Housing construction leakage	V	W	—
		Field Visit	Access doors per plans & specs.	V	W	—
		Field Visit	Condensate drain piping & pan	V	W	—
		Field Visit	Free from dirt & debris	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			b) Filters			
		Field Visit	Type / size / number correct	V	W	—
		Field Visit	Clean	V	W	—
		Field Visit	Blank-off plates installed	V	W	—
		Field Visit	Frame leakage at a minimum	V	W	—
			c) Coils (Hydronic – Water / Steam)			
		Field Visit	Size & rows	V	W	—
		Field Visit	Fin spacing & condition	V	W	—
		Field Visit	Obstructions and/or debris	V	W	—
		Field Visit	Correct air flow direction	V	W	—
		Field Visit	Correct piping connections / flow	V	W	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
		Field Visit	Valves open & set	V	W	—
		Field Visit	Vents / traps installed correctly	V	W	—
		Field Visit	Provisions for TAB measurements	V	W	—
			d) Coils (Electric)			
		Field Visit	Size & construction	V	W	—
		Field Visit	Airflow direction	V	W	—
		Field Visit	Duct connections	V	W	—
		Field Visit	Safety switches	V	W	—
		Field Visit	Obstructions	V	W	—
		Field Visit	Free from debris	V	W	—
		Field Visit	Contractors & disconnect switches	V	W	—
		Field Visit	Electrical service & connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			e) Fans			
		Field Visit	Rotation	V	W	—
		Field Visit	Wheel clearance & balance	V	W	—
		Field Visit	Bearing & motor lubrication	V	W	—
		Field Visit	Drive alignment	V	W	—
		Field Visit	Belt tension	V	W	—
		Field Visit	Drive set screws tight	V	W	—
		Field Visit	Belt guards in place	V	W	—
		Field Visit	Flex duct connector alignment	V	W	—
		Field Visit	Proper unit / duct alignment	V	W	—
		Field Visit	Starters & disconnect switches	V	W	—
		Field Visit	Electrical service & connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			f) Vibration isolation			
		Field Visit	Springs & compression	V	W	—
		Field Visit	Base level & free	V	W	—
			2) DUCT SYSTEMS			
			a) General			
		Field Visit	Manual damper positioned & locked	V	W	—
		Field Visit	Damper adjustments accessible	V	W	—
		Field Visit	Access doors closed & tight	V	W	—
		Field Visit	Fire dampers open & accessible	V	W	—
		Field Visit	Terminal units open & set	V	W	—
		Field Visit	Registers/diffusers wide open & set	V	W	—
		Field Visit	Turning vanes in square elbows	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	System installed per plans & specs.	V	W	—
		Field Visit	All ductwork sealed as required	V	W	—
			b) Architectural			
		Field Visit	Windows installed & closed	V	W	—
		Field Visit	Doors closed as required	V	W	—
		Field Visit	Ceiling plenums installed/sealed	V	W	—
		Field Visit	Access doors closed & tight	V	W	—
		Field Visit	Air shafts/openings as required	V	W	—
			3) PUMPS			
			a) Motors			
		Field Visit	Rotation	V	W	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
System Acceptance (continued)		Field Visit	Lubrication	V	W	—
		Field Visit	Alignment	V	W	—
		Field Visit	Set screws tight	V	W	—
		Field Visit	Guards in place	V	W	—
		Field Visit	Tank level and controls	V	W	—
		Field Visit	Starters & disconnects	V	W	—
		Field Visit	Electrical service & connections	V	W	—
			b) Piping			
		Field Visit	Correct flow	V	W	—
		Field Visit	Correct connections	V	W	—
		Field Visit	Leakage	V	W	—
		Field Visit	Valves positioned & set	V	W	—
		Field Visit	Strainers clean	V	W	—
		Field Visit	Air Vented	V	W	—
		Field Visit	Flexible connectors installed	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	System water clean	V	W	—
			c) Bases			
		Field Visit	Vibration isolation	V	W	—
		Field Visit	Grouting (if required)	V	W	—
		Field Visit	Leveling	V	W	—
			4) HYDRONIC EQUIPMENT			
			a) Boilers			
		Field Visit	Operating controls & devices	V	W	—
		Field Visit	Safety controls & devices	V	W	—
		Field Visit	Lubrication of fans & pumps	V	W	—
		Field Visit	Draft controls & devices	V	W	—
		Field Visit	Piping controls & devices	V	W	—
		Field Visit	Valves set & open	V	W	—
		Field Visit	Water make-up provisions	V	W	—
		Field Visit	Blowdown provisions	V	W	—
		Field Visit	Electrical connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			b) Heat Exchangers			
		Field Visit	Correct flow & connections	V	W	—
		Field Visit	Valves open or set	V	W	—
		Field Visit	Air vents or steam traps	V	W	—
		Field Visit	Leakage	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			c) Cooling Towers/Evaporative Condensers			
		Field Visit	Correct flow & connections	V	W	—
		Field Visit	Valves open or set	V	W	—
		Field Visit	Leakage	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	Sump water level	V	W	—
		Field Visit	Spray nozzles	V	W	—
		Field Visit	Fan/Pump rotation	V	W	—
		Field Visit	Motor/Fan lubrication	V	W	—
		Field Visit	Drives & alignment	V	W	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
System Acceptance (continued)		Field Visit	Guards in place	V	W	—
		Field Visit	Starters & disconnects	V	W	—
		Field Visit	Electrical connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			5) REFRIGERANT EQUIPMENT			
		Field Visit	Crankcase heaters energized	V	W	—
		Field Visit	Operating controls & devices	V	W	—
		Field Visit	Safety controls & devices	V	W	—
		Field Visit	Valves open	V	W	—
		Field Visit	Piping connections & flow	V	W	—
		Field Visit	Flexible connectors	V	W	—
		Field Visit	Oil level & lubrication	V	W	—
		Field Visit	Alignment & drives	V	W	—
		Field Visit	Guards in place	V	W	—
		Field Visit	Vibration isolation	V	W	—
		Field Visit	Starters/Contactors/Disconnects	V	W	—
		Field Visit	Electrical connections	V	W	—
		Field Visit	Nameplate data clearly visible	V	W	—
			6) HYDRONIC PIPING SYSTEM			
		Field Visit	Leak tested	V	W	—
		Field Visit	Fluid levels & make-up	V	W	—
		Field Visit	Relief or safety valves	V	W	—
		Field Visit	Expansion tanks & air vents	V	W	—
		Field Visit	Steam traps & connections	V	W	—
		Field Visit	Strainers clean	V	W	—
		Field Visit	Valves open & set	V	W	—
		Field Visit	Provisions made for TAB tests	V	W	—
		Field Visit	Systems installed per plans & specs.	V	W	—
			7) CONTROLS & CONTROL SYSTEMS			
		Field Visit	Data centers	V	W	—
		Field Visit	Outdoor/return Air/reset	V	W	—
		Field Visit	Economizer set & tested	V	W	—
		Field Visit	AHU Static pressure set	V	W	—
		Field Visit	Room controls calibrated	V	W	—
		Field Visit	VAV box regulators set to design	V	W	—
		Field Visit	VAV box P.E. switches set	V	W	—
		Field Visit	Proper end-of-line static pressure	V	W	—
		Field Visit	VAV box reheats tested	V	W	—
			8) OTHER CHECKS			
		Submittal Process	Appropriate contractors notified of TABS	A	RA	S
		Submittal Process	Preliminary data complete	A	RA	S
		Submittal Process	Test report forms prepared	S	RA	A

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
	TABS - Testing	Field Visit	TAB field work	V	W	
		Submittal Process	Preliminary procedures	RA	C	A
		Field Visit	TAB air distribution systems	V	W	—
		Field Visit	TAB water distribution systems	V	W	—
		Field Visit	Sound measurement work	V	W	—
		Field Visit	TAB work on performance tests without seasonal limitations	V	W	—
		Field Visit	TAB work on performance tests with seasonal limitations	V	W	—
		Field Visit	Marking settings	V	W	—
		Field Visit	Marking of test ports	V	W	—
	TABS - Acceptance Testing	Field Visit	Quality assurance - Contracting officer TAB field checks	V	W	W
		Field Visit	Additional field checks	V	W	W
	ACATS - Submittals	Submittal Process	Controls contractor qualifications	RA	RA	A
		Submittal Process	Manufacturers field report	RA	RA	A
		Submittal Process	Performance verification test plan (PVT)	RA	RA	A
		Submittal Process	Pre-PVT checklist	RA	RA	A
		Submittal Process	Final certified PVT report (with all mods incorporated in as-builts)	RA	RA	A
	ACATS - Pre-PVT Checklist	Field Visit	Prior to conducting the PVT, thoroughly inspect the installed work with the Contractor's QC representative and the mechanical contractor using the following checklist. Submit the checklist with items checked off once verified. Provide a detailed explana	V	W	—
		Field Visit	a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).	V	W	—
		Field Visit	b. Verify HVAC motors operate below full-load amperage ratings.	V	W	—
		Field Visit	c. Verify all required control system components, wiring, and accessories are installed.	V	W	—
		Field Visit	d. Verify the installed control system architecture matches approved drawings.	V	W	—
		Field Visit	e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.	V	W	—
		Field Visit	f. Verify all required surge protection is installed and functions correctly.	V	W	—
		Field Visit	g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.	V	W	—

MECHANICAL ENGINEERING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	ME QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
System Acceptance (continued)		Field Visit	h. Verify all DDC network communications function properly, including uploading and downloading programming changes.	V	W	—
		Field Visit	i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.	V	W	—
		Field Visit	j. Verify each digital controller's programming is backed up.	V	W	—
		Field Visit	k. Verify all wiring, components, and panels are properly labeled.	V	W	—
		Field Visit	l. Verify all required points are programmed into devices.	V	W	—
		Field Visit	m. Verify all TAB work affecting controls is complete.	V	W	—
		Field Visit	n. Verify all valve and actuator zero and span adjustments are set properly.	V	W	—
		Field Visit	o. Verify all sensor readings are accurate and calibrated.	V	W	—
		Field Visit	p. Verify each control valve and actuator goes to normal position upon loss of power.	V	W	—
		Field Visit	q. Verify all control loops are tuned for smooth and stable operation. View trend data where applicable.	V	W	—
		Field Visit	r. Verify each controller works properly in stand-alone mode.	V	W	—
		Field Visit	s. Verify all safety controls and devices function properly, including interfaces with building fire alarm systems.	V	W	—
		Field Visit	t. Verify all electrical interlocks work properly.	V	W	—
		Field Visit	u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook. Notify the Government when phone lines or netw	V	W	—
		Field Visit	v. Verify the as-built (shop) control drawings are completed.	V	W	—
	ACATS - Testing	Field Visit	Field testing of components	V	W	—
		Field Visit	Field testing of programming	V	W	—
		Field Visit	Pre-performance verification testing	V	W	—
	ACATS - Acceptance Testing	Field Visit	Performance verification testing	V	W	W
		Field Visit	Performance verification re-resting	V	W	W

ROOFING ROLES and RESPONSIBILITIES

System	Sub-Systems	Phase	Elements	Roof QC / DOR (Ktr)	FEAD (SIOH)	FEC (PCAS)
Roofing	Low Sloped Roofs	Design Guidance	Post Award Kick Off Meeting		S	A
		Design Guidance	Verify Roof Design Assurance	A	R	S
		Submittal Process	Review Shop Drawings	A	S	S
		Submittal Process	Review Manufacturer's Product Data Sheets	A	S	S
		Submittal Process	Review Design Data (to include wind and fire resistance)	A	S	S
		Submittal Process	Review Test Reports	A	S	S
		Submittal Process	Review Certificates	A	S	S
		Submittal Process	Review Sample Roof Warranty	A	S	C
		Field Visit	Conduct Pre Roofing Conference	V	S	S
		Field Visit	Review Delivery, Storage, and Handling	A	S	S
		Field Visit	Verify Conditions for roof application	A	S	S
		Field Visit	Verify Preparation	A	S	S
		Field Visit	Verify Application	A	S	S
		Field Visit	Verify Protection of Applied Roofing	A	S	S
		Field Visit	Verify Field Quality Control	A	S	S
		Field Visit	Verify Operation Maintenance and Support Information (Roof Warranty and Information Card)	A	S	S
	Steep Sloped Roofs	Design Guidance	Post Award Kick Off Meeting		S	A
		Design Guidance	Verify Roof Design Assurance	A	R	S
		Submittal Process	Review Shop Drawings	A	S	S
		Submittal Process	Review Manufacturer's Product Data Sheets	A	S	S
		Submittal Process	Review Design Data (to include wind and fire resistance)	A	S	S
		Submittal Process	Review Test Reports	A	S	S
		Submittal Process	Review Certificates	A	S	S
		Submittal Process	Review Sample Roof Warranty	A	S	C
		Field Visit	Conduct Pre Roofing Conference	V	S	S
		Field Visit	Review Delivery, Storage, and Handling	A	S	S
		Field Visit	Verify Conditions for roof application	A	S	S
		Field Visit	Verify Preparation	A	S	S
		Field Visit	Verify Application	A	S	S
		Field Visit	Verify Protection of Applied Roofing	A	S	S
		Field Visit	Verify Field Quality Control	A	S	S
		Field Visit	Verify Operation Maintenance and Support Information (Roof Warranty and Information Card)	A	S	S

UNDERWATER STRUCTURES ROLES and RESPONSIBILITIES

<i>System</i>	<i>Sub-Systems</i>	<i>Phase</i>	<i>Elements</i>	<i>UW QC / DOR (Ktr)</i>	<i>FEAD (SIOH)</i>	<i>FEC/NF ESC (PCAS)</i>
Waterfront Structure H10 (Uniform II) - Substructure H1010	Pile Foundations (H101001) Sheet Piles (H101001) Caissons (H101001) Cofferdams (H101001) Wraps and Encasements (H101001) Sheet Pile Bulheads (H101003) Gravity Walls (H101003) Block Walls (H101003) Seawalls (H101006) Boat Ramps (H101007) Cut-Off Walls (H101008) Wave Attenuation Walls (H101009) Fender Piles (H104001) Dolphins (H104004)	Submittal Process	Shop Drawings	A	C	S
		Submittal Process	Manufacturer's Data Sheets	A	C	S
		Submittal Process	Pile driving records	A	C	S
		Submittal Process	Concrete testing: petrographic, chemical, service-life modeling	A	C	S
		Submittal Process	As-built drawings, 3D AUTOCAD format	A	C	S
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Inspect in-water prestressed/precast concrete piles or sheetpiles for alignment, spalls, cracks, damages, defects, lifting hoops cut/area patched, exposed steel ties, penetrations, etc.	A	—	W
		Field Visit	Inspect in-water cast-in-place concrete drilled caissons for alignment, spalls, cracks, damages, defects, concrete quality (hardness), honeycombing, etc.	A	—	W
		Field Visit	Inspect in-water steel piles and/or p/c p/s concrete sheetpiles for alignment, damage/buckling, coating damage, penetrations, gaps, etc.	A	—	W
		Field Visit	Inspect underwater concrete placement for defects such as honeycombing, concrete quality (hardness)	A	—	W
		Field Visit	Inspect underwater slope protection for conformance with RFP requirements such as rock/boulder size, placement gap limits, angle, location (e.g., toe of slope protection), consistency, etc.	A	—	W
		Field Visit	Inspect underwater Cathodic Protection anodes and connections	A	—	W
		Field Visit	Inspect for underwater debris, existing or by construction.	A	—	W
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Validate in-water/underwater structure complies with RFP requirements, e.g., number, location, size, etc.	A	—	W

UNDERWATER STRUCTURES ROLES and RESPONSIBILITIES

<i>System</i>	<i>Sub-Systems</i>	<i>Phase</i>	<i>Elements</i>	<i>UW QC / DOR (Ktr)</i>	<i>FEAD (SIOH)</i>	<i>FEC/NF ESC (PCAS)</i>
Underwater Cables	All	Submittal Process	Shop Drawings	A	C	S
		Submittal Process	Manufacturer's Data Sheets	A	C	S
		Field Visit	Validate in-water/underwater cable complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Inspect underwater cable for defects/damages, kinks, missing anchors, coating damage, etc.	A	—	W
		Field Visit	Inspect for underwater debris, existing or by construction.	A	—	W
Underwater Utility Pipes and Conduits	All	Submittal Process	Shop Drawings	A	C	S
		Submittal Process	Manufacturer's Data Sheets	A	C	S
		Field Visit	Validate in-water/underwater component complies with RFP requirements, e.g., number, location, size, etc.	A	—	W
		Field Visit	Inspect underwater component for defects/damages, cracks, missing anchors, coating damage, etc.	A	—	W
		Field Visit	Inspect for underwater debris, existing or by construction.	A	—	W

DEFINITIONS

A pprove	(A)	Professional or quality control endorsement of the submittal or installed system meets the contract requirements
R everview	(R)	To confirm accuracy of the submittal and that it meets contract requirements
W itness	(W)	Observe demonstration of system performance for acceptance
R eceipt A cknowledge	(RA)	Confirm receipt of submittal with no review necessary
S urveillance Review	(S)	A quality assurance review based on risk, complexity, and workload
Performance V erification and Acceptance Testing	(V)	A demonstration of satisfactory construction and system performance
Receive C opy of Correspondence	(C)	Receive a copy of the transmittal sheet and/or correspondence letter
Q uality A ssurance Inspection	(QA)	Witnessing satisfactory performance without testing all devices or visual inspection of various parts of the system

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

09/15

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 (2013; Errata 2015) Standard for
Safeguarding Construction, Alteration, and
Demolition Operations

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD (2009) Manual on Uniform Traffic Control
Devices

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

Traffic control plan; G

Construction site plan; G

1.4 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Immediately upon beginning of work, provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

2.1.2 Project and Safety Signs

The requirements for the signs, their content, and location are as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2.2 Fencing

- a. Provide fencing along the construction site at all open excavations and tunnels to control access by unauthorized people. Fencing must be installed to be able to restrain a force of at least 250 pounds against it.
- b. In addition, prior to the start of work, enclose the construction site with a temporary safety fence. The safety fence shall be bright orange, shall be made of high density polyethylene grid or approved equal or plastic fence from recovered materials containing 60-100 percent recovered content level plastic, a minimum of 42 inches high, supported and tightly secured to steel posts located on minimum 10 foot centers. Remove the fence from the work site upon completion of the contract.

2.2.3 Temporary Wiring

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Include frequent inspection of all equipment and apparatus.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Utilities at Special Locations

- a. Reasonable amounts of utilities will be made available to the Contractor at the prevailing Government rates. These rates may be obtained upon application to the Commanding Officer, MCB, Cherry Point, by way of the Contracting Officer. The Contractor will be responsible for making connections, providing transformers and meters, and making disconnections; and for providing backflow preventer devices on connections to domestic water lines. Neither potable water nor sanitary facilities will be available at the main Contractor laydown area at Marine Corps Air Station (MCAS), Cherry Point, NC.

3.2.3 Sanitation

- a. Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties and / or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times without nuisance. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.2.4 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.5 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.2.6 Location of Underground Utilities

See specification section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS

paragraph "Location of Underground Utilities".

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

- a. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a [Traffic Control Plan](#) detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the [MUTCD](#), Part VI. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.
- b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.
- c. Provide, erect, and maintain, at contractors expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.3.3 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Treat dust abatement on access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment.

3.4 CONTRACTOR'S TEMPORARY FACILITIES

3.4.1 Safety

Protect the integrity of any installed safety systems or personnel safety devices. If entrance into systems serving safety devices is required, the Contractor must obtain prior approval from the Contracting Officer. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.4.2 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will **not** be available to the Contractor's personnel.

3.4.3 Storage Area

Construct a temporary **6 foot** high chain link fence around trailers and materials. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store Trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.4.4 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor is responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

3.4.5 Appearance of Trailers

- a. Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on installation property.
- b. **Paint using suitable paint materials** and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

3.4.6 Maintenance of Storage Area

- a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

3.4.7 New Building

In the event a new building is constructed for the temporary project field office, it will be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities must be furnished. Screen the windows and doors and provide the doors with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins will be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, furnish air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Any new building erected for a temporary field office must be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work become the property of the Contractor and removed from the site. All charges for telephone service for the temporary field office will be borne by the Contractor, including long distance charges up to a maximum of \$75.00 per month.

3.4.8 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment; in addition, the Contractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

3.4.9 Storage Size and Location

The open site available for storage must be as indicated by the Contracting Officer.

3.4.10 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.4.10.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.4.10.2 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

- a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards. Contact Contracting Officer for Condition of Readiness (COR) updates and completion of required actions.
- b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.
- c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and Condition of Readiness (COR) updates and completion of required actions.
- d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

3.5 GOVERNMENT FIELD OFFICE

3.5.1 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer. Securely anchor the trailer to the ground at all four corners to guard against movement during high winds.

3.6 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor must install a satisfactory means of communication, such as telephone or other suitable devices and made available for use by Government personnel.

3.7 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project

safety fencing at the work site. The safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

3.8 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store within the fenced area described above or at the supplemental storage area any materials resulting from demolition activities which are salvageable. Neatly stacked stored materials not in trailers, whether new or salvaged.

3.9 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletinboard, signs, barricades, haulroads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore to the original or better condition, areas used by the Contractor for the storage of equipment or material, or other use. Gravel used to traverse grassed areas must be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 13.00 22

EROSION AND SEDIMENT CONTROL

09/15

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 D3787	(2007; R 2011) Bursting Strength of Textiles - Constant-Rate-of-Traverse (CRT), Ball Burst Test
ASTM D4533	(2011) Trapezoid Tearing Strength of Geotextiles
ASTM D4632/D4632M	(2015) Grab Breaking Load and Elongation of Geotextiles

NORTH CAROLINA SEDIMENT CONTROL COMMISSION (NCSCC)

NCSCC ESCM	(2006; R 2013) Erosion and Sediment Control Planning and Design Manual
------------	------------------------------------------------------------------------

1.2 DESCRIPTION OF WORK

The work includes the provision of temporary and permanent erosion control measures to prevent the pollution of air, water, and land within the project limits and in areas outside the project limits where work is accomplished in conjunction with the project.

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

Construction Sequence Schedule; G

SD-03 Product Data

Sediment Fence

Dust Suppressors

Erosion Control Matting

Filter Fabric

1.4 CONSTRUCTION SEQUENCE SCHEDULE

Submit a Contractor furnished construction work sequence schedule, a minimum of 30 days prior to start of construction. The work schedule shall coordinate the timing of land disturbing activities with the provision of erosion control measures to reduce on site erosion and off site sedimentation. Installation of temporary erosion control features shall be coordinated with the construction of permanent erosion control features to assure effective and continuous control of erosion and pollution.

1.5 STATE APPROVED PLAN

The erosion control plan indicated has been approved by the State. No additional State review and approval of the erosion control plan is required, unless the Contractor desires to modify the erosion control plan indicated. Should the Contractor desire to modify the State approved plan, a resubmittal to the State, including the State's approval is required prior to the start of construction. The contractor shall be responsible for any additional costs and time incurred as a result of the resubmittal of the previously approved erosion control plan. The contractor shall anticipate a minimum 45 day review period by the State. Provide and maintain erosion control measures in accordance with NCSCC ESCM, and as specified herein.

PART 2 PRODUCTS

2.1 SEDIMENT FENCE

2.1.1 State Standard Sediment Fence

NCSCC ESCM Standard 6.62, sediment fence (maximum height of 18 inches).

2.2 SILT FENCE DROP INLET PROTECTION

2.2.1 State Standard Drop Inlet Protection

NCSCC ESCM Standard 6.51, using silt fencing.

2.3 CONSTRUCTION ENTRANCE

2.3.1 State Standard Construction Entrance

2.3.1.1 Aggregate

NCSCC ESCM, Standard 6.06.

2.3.1.2 Filter Fabric

A woven or nonwoven polypropylene, nylon, or polyester containing stabilizers and/or inhibitors to make the fabric resistant to deterioration from ultraviolet, and with the following properties:

- a. Minimum grab tensile strength (TF 25 #1/ASTM D4632/D4632M) 180 pounds
- b. Minimum Puncture (TF 25 #4/ASTM D3787) 75 psi in the weakest direction
- c. Apparent Opening Size 40-80 (U.S. Sieve Size)
- d. Minimum Trapezoidal tear strength (TF 25 #2/ASTM D4533) 50 pounds

2.4 DUST SUPPRESSORS

Calcium chloride, or other standard manufacturer's spray on adhesives designed for dust suppression.

2.5 TEMPORARY SEEDING

2.5.1 State Standard Temporary Seeding

Provide seed, lime, fertilizer, and mulch in accordance with NCSCC ESCM, Standards 6.10 and 6.14. Provide hay or straw mulch.

2.6 EROSION CONTROL MATTING

Jute, excelsior, or paper matting that has not been bleached or dyed. Provide matting in minimum 4 feet widths. Staples for anchoring the matting shall be minimum 11 gage wire, formed into a "U" shape with a minimum throat width of one inch and minimum length of 6 inches after forming.

2.6.1 Jute Matting

A uniform open plain weave of single jute yarn providing an average weight of 0.9 pounds per square yard of matting. Yarn shall be of a loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. Matting shall have openings between strands length wise of 0.45 to 0.75 inch, and between strands crosswise of 0.67 to 1.13 inch.

2.6.2 Excelsior Matting

A machine produced mat of wood excelsior with a minimum of 80 percent of wood fibers 6 inches in length or longer. The matting shall have an average weight of 0.75 to 0.85 pounds per square yard with an even fiber distribution producing a consistent mat thickness, and shall have on one side a woven fabric. The woven fabric shall be twisted paper cord, cotton cord, or an extruded plastic mesh with a minimum mesh size of one by one inch and a maximum mesh size of 1 1/2 by 3 inch.

2.6.3 Paper Matting

Shall be a knitted polypropylene yarn with uniform openings with biodegradable paper strips continuously interwoven. The matting shall weigh a minimum of 0.09 pounds per square yard with maximum openings of 3/4 inch and minimum openings of 1/2 inch.

2.6.4 Straw Matting

A machine produced straw mat with a minimum thickness of 1/2 inch +/- 1/8 inch. The straw shall be evenly distributed throughout the mat to provide a minimum average dry weight of .70 pounds per square yard. The topside of the mat shall be covered with a 3/8 inch biodegradable plastic mesh, with the mesh attached to the straw by a knitting process using biodegradable thread.

PART 3 EXECUTION

3.1 CONSTRUCTION SEQUENCE SCHEDULE

Stabilize areas for construction access immediately with gravel. Install principal sediment basins and traps before any major site grading takes place. Provide additional sediment traps, and sediment fences as grading progresses. Provide drop inlet protection around existing drainage structures, and inlet and outlet protection at the ends of new drainage systems. Stabilize graded and disturbed areas immediately after grading. Permanent stabilization shall be provided immediately on areas that have been final graded. Temporary seeding and mulching shall be provided on disturbed areas as specified in the paragraph entitled "Temporary Seeding." Installation of temporary erosion control features shall be coordinated with the construction of permanent erosion control features to assure effective and continuous control of erosion and sediment deposition. **Remove temporary erosion control measures at the end of construction and provide permanent seeding.**

3.2 SEDIMENT FENCES

Install posts at the spacing indicated, and at an angle between 2 degrees and 20 degrees towards the potential silt load area. Sediment fence height shall be approximately 18 inches. Do not attach filter fabric to existing trees. Secure filter fabric to the post and wire fabric using staples, tie wire, or hog rings. Imbed the filter fabric into the ground as indicated. Splice filter fabric at support pole using a 6 inch overlap and securely seal.

3.3 DROP INLET PROTECTION

Provide stakes evenly spaced around the perimeter of the drop inlet, a maximum of 3 feet apart. Stakes shall be driven immediately adjacent to the drainage structure, a minimum of 18 inches into the ground. The fabric shall be securely fastened to the outside of the stakes, with the bottom of the fabric placed into a trench and backfilled.

3.4 CURB INLET PROTECTION

Provide wire mesh over the curb inlet opening so at least 12 inches of wire mesh extends across the inlet cover and at least 12 inches of wire mesh extends across the gutter from the inlet opening, as indicated. Place stone on wire mesh against curb inlet.

3.5 CONSTRUCTION ENTRANCE

Provide as indicated, a minimum of 6 inches thick, at points of vehicular ingress and egress on the construction site. Construction entrances shall be cleared and grubbed, and then excavated a minimum of 3 inches prior to placement of the filter fabric and aggregate. The aggregate shall be placed in a manner that will prevent damage and movement of the fabric. Place fabric in one piece, where possible. Overlap fabric joints a minimum of 12 inches.

3.6 DUST SUPPRESSORS

Immediately dampen the surface before calcium chloride application. Apply dust suppressors on unsurfaced base, subbase and other unsurfaced travel ways. Apply calcium chloride at the rate of 1.0 to 1.25 pounds per square

yard of surface for pellets for the initial application. For subsequent applications of calcium chloride, application rates may be approximately 75 percent of initial application rates. Do not apply when raining or the moisture conditions exceed that required for proper application. Apply other dust suppressors in accordance with manufacturer's instructions. Protect treated surfaces from traffic for a minimum of 2 hours after treatment. Repeat application of dust suppressors as required to control dust emissions.

3.7 TEMPORARY SEEDING

3.7.1 Time Restrictions

Within 48 hours after attaining the grading increment specified herein, provide seed, fertilizer, mulch and water on graded areas when any of the following conditions occur:

- a. Grading operations stop for an anticipated duration of 30 days or more.
- b. When it is impossible or impractical to bring an area to finish grade so that permanent seeding operations can be performed without serious disturbance from additional grading.
- c. When an immediate cover is required to minimize erosion, or when erosion has occurred.
- d. Provide on erosion control devices constructed using soil materials.

3.7.2 Seeding Requirements

3.7.2.1 State Standard Seeding Requirements

Provide seed, lime, fertilizer, and mulch in accordance with NCSCC ESCM, Standard 6.10 and 6.14. Provide hay or straw mulch in an air dried condition, and secure mulch in place.

3.7.2.2 Permanent Seeding

Temporary seeding shall be removed, and permanent sod shall be provided during the specified planting season as shown on the project plans.

3.8 EROSION CONTROL MATTING

Place matting in the direction of the flow of water. The up channel matting end shall be toed in a narrow trench a minimum of 5 inches deep. Where one roll of matting ends and a second roll begins, the end of the upper roll shall be brought over the buried end of the second roll, to provide a 6 inch overlap. Where matting widths are laid side by side, the overlap between matting shall be 4 inches. Provide check slots every 50 feet longitudinally in the matting. Construct check slots by providing a narrow trench 5 inches deep and folding the matting down in to the trench, across the bottom of the trench, and then back up the trench to the existing ground. Backfill and compact the trench using the excavated material from the trench. Staple matting ends, junctions, and check slots at 10 inches on center. Staple matting outer edges and overlaps and the center of each matting strip at 3 feet on center. Install excelsior matting with the woven fabric on top.

3.9 MAINTENANCE AND INSPECTION

Inspect erosion control devices after each rainfall and daily during prolonged rainfall. Remove sediment deposits after each rainfall or when sediment reaches approximately one-half the barrier height. Immediately repair damaged erosion control devices and damaged areas around and underneath the devices. Maintain erosion control devices to assure continued performance of their intended function. Modify the erosion control plan as required to control problem areas noticed after each inspection. Modifications shall be approved by the Contracting Officer.

3.10 CLEAN UP

At the completion of the job, or when directed or approved by the Contracting Officer, temporary erosion control devices shall be removed. Erosion control devices and areas immediately adjacent to the device shall be filled (where applicable), shaped to drain and to blend into the surrounding contours, and provided with permanent seeding. Erosion control devices may remain in place after job completion when approved by the Contracting Officer.

-- End of Section --

SECTION 01 57 19.00 20

TEMPORARY ENVIRONMENTAL CONTROLS

09/15

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. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004 (1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)

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

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
40 CFR 112	Oil Pollution Prevention
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 271	Requirements for Authorization of State Hazardous Waste Programs
40 CFR 272	Approved State Hazardous Waste Management Programs
40 CFR 273	Standards For Universal Waste Management
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 355	Emergency Planning and Notification
40 CFR 372-SUBPART D	Specific Toxic Chemical Listings
40 CFR 51	Requirements For Preparation, Adoption, And Submittal Of Implementation Plans
40 CFR 52	Approval And Promulgation Of Implementation Plans
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings

49 CFR 178

Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

- a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.
- b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.
- c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.
- d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.
- e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.
- f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.
- g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company. Paint cans may not be included as recyclable if sold to a scrap metal company.
- h. Hazardous Waste: By definition, to be a hazardous waste a material

must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste. They have additional regulatory controls and must be handled separately. They are thus defined separately in this document.

Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste

Any discarded material, liquid, solid, or gas, which meets the definition of hazardous material or is designated hazardous waste by the Environmental Protection Agency or State Hazardous Control Authority as defined in 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 271, 40 CFR 272, 40 CFR 273, 40 CFR 279, and 40 CFR 280.

1.2.7 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

Hazardous material is any material that:

- a. Is regulated as a hazardous material per 49 CFR 173, or
- b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or
- c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies,

medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material (WHM)

Any waste material which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial hazard to human health or the environment and which has been so designated. Used oil not containing any hazardous waste, as defined above, falls under this definition.

1.2.9 Oily Waste

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

- a. It is not prohibited in other State regulations or local ordinances
- b. The amount generated is "de minimus" (a small amount)
- c. It is the result of minor leaks or spills resulting from normal process operations
- d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

chlorofluorocarbon-11 (CFC-11)
chlorofluorocarbon-12 (CFC-12)
chlorofluorocarbon-13 (CFC-13)
chlorofluorocarbon-111 (CFC-111)
chlorofluorocarbon-112 (CFC-112)
chlorofluorocarbon-113 (CFC-113)

chlorofluorocarbon-114 (CFC-114)
chlorofluorocarbon-115 (CFC-115)
chlorofluorocarbon-211 (CFC-211)
chlorofluorocarbon-212 (CFC-212)
chlorofluorocarbon-213 (CFC-213)
chlorofluorocarbon-214 (CFC-214)
chlorofluorocarbon-215 (CFC-215)
chlorofluorocarbon-216 (CFC-216)
chlorofluorocarbon-217 (CFC-217)
chlorofluorocarbon-500 (CFC-500)
chlorofluorocarbon-502 (CFC-502)
chlorofluorocarbon-503 (CFC-503)
halon-1211
halon-1301
halon-2402
carbon tetrachloride
methyl bromide
methyl chloroform

Class II ODS is defined in Section 602(s) of The Clean Air Act and includes the following chemicals:

hydrochlorofluorocarbon-21 (HCFC-21)
hydrochlorofluorocarbon-22 (HCFC-22)
hydrochlorofluorocarbon-31 (HCFC-31)
hydrochlorofluorocarbon-121 (HCFC-121)
hydrochlorofluorocarbon-122 (HCFC-122)
hydrochlorofluorocarbon-123 (HCFC-123)
hydrochlorofluorocarbon-124 (HCFC-124)
hydrochlorofluorocarbon-131 (HCFC-131)
hydrochlorofluorocarbon-132 (HCFC-132)
hydrochlorofluorocarbon-133 (HCFC-133)
hydrochlorofluorocarbon-141 (HCFC-141)
hydrochlorofluorocarbon-142 (HCFC-142)
hydrochlorofluorocarbon-221 (HCFC-221)
hydrochlorofluorocarbon-222 (HCFC-222)
hydrochlorofluorocarbon-223 (HCFC-223)
hydrochlorofluorocarbon-224 (HCFC-224)
hydrochlorofluorocarbon-225 (HCFC-225)
hydrochlorofluorocarbon-226 (HCFC-226)
hydrochlorofluorocarbon-231 (HCFC-231)
hydrochlorofluorocarbon-232 (HCFC-232)
hydrochlorofluorocarbon-233 (HCFC-233)
hydrochlorofluorocarbon-234 (HCFC-234)
hydrochlorofluorocarbon-235 (HCFC-235)
hydrochlorofluorocarbon-251 (HCFC-251)
hydrochlorofluorocarbon-252 (HCFC-252)
hydrochlorofluorocarbon-253 (HCFC-253)
hydrochlorofluorocarbon-261 (HCFC-261)
hydrochlorofluorocarbon-262 (HCFC-262)
hydrochlorofluorocarbon-271 (HCFC-271)

1.2.11.1 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (e.g., thermostats) and lamps (e.g., fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal

waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 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 Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey; G
Solid Waste Management Plan and Permit; G
Regulatory Notifications; G
Environmental Management Plan; G
Storm Water Pollution Prevention Plan; G
Air Emissions Source Specification Data; G
Dirt and Dust Control Plan
Contractor Hazardous Material Inventory Log; G

SD-06 Test Reports

Laboratory Analysis
Disposal Requirements
Erosion and Sediment Control Inspection Reports
Storm Water Inspection Reports for General Permit
Contractor 40 CFR employee training records
Solid Waste Management Report; G

SD-11 Closeout Submittals

Some of the records listed below are also required as part of other submittals. For the "Records" submittal, maintain on-site a separate three-ring Environmental Records binder and submit at the completion of the project. Make separate parts to the binder corresponding to each of the applicable sub items listed below.

Storm Water Pollution Prevention Plan compliance notebook; G
Waste Determination Documentation
Disposal Documentation for Hazardous and Regulated Waste
Contractor 40 CFR Employee Training Records
Solid Waste Management Permit

Solid Waste Management Report

Contractor Hazardous Material Inventory Log; G

Hazardous Waste/Debris Management

Regulatory Notifications

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

The Contractor may be required to promptly conduct tests and procedures for the purpose of assessing whether construction operations are in compliance with Applicable Environmental Laws. Analytical work shall be done by qualified laboratories; and where required by law, the laboratories shall be certified.

1.4.1 Environmental Compliance Assessment Training and Tracking System (ECATTS)

The QC Manager is responsible for environmental compliance on projects unless an Environmental Manager is named. The QC Manager (and alternative QC Manager) or Environmental Manager shall complete ECATTS training prior to starting respective portions of on-site work under this contract. If personnel changes occur for any of these positions after starting work, replacement personnel shall complete ECATTS training within 14 days of assignment to the project.

Submit an ECATTS certificate of completion for personnel who have completed the required "Environmental Compliance Assessment Training and Tracking System (ECATTS)" training. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

Register for NAVFAC Environmental Compliance Training and Tracking System, by logging on to <http://navfac.ecatts.com/>. Use password "navfac" (in all lower case letters) to gain access to the training site.

This training has been structured to allow contractor personnel to receive credit under this contract and also to carry forward credit to future contracts. Contractors shall ensure that the QC Manager (and alternate QC Manager) or Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work. Some training modules are tailored for specific State regulatory requirements; therefore, Contractors working in multiple states will be required to re-take modules tailored to the state where the contract work is being performed.

ECATTS is available for use by all contractor and subcontractor personnel associated with this project. These other personnel are encouraged (but

not required) to take the training and may do so at their discretion.

1.4.2 Conformance with the Environmental Management System

The Contractor shall perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). The Contractor shall perform work in a manner that conforms to objectives and targets, environmental programs and operational controls identified by the EMS. The Contractor will provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, the Contractor shall take corrective and/or preventative actions. In addition, the Contractor shall ensure that its employees are aware of their roles and responsibilities under the EMS and how these EMS roles and responsibilities affect work performed under the contract.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and keep up to date on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience. Upon contract award, the Contracting Officer's Representative will notify the installation's EMS coordinator to arrange EMS training. Refer to [Section 01 57 19.01 20](#), SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS for additional site specific EMS requirements related to construction. The installation's EMS coordinator shall identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. The Contractor shall provide training documentation to the Contracting Officer. The EMS coordinator shall retain associated records.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a [Preconstruction Survey](#) of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record.

1.5.2 [Regulatory Notifications](#)

The Contractor is responsible for all regulatory notification requirements in accordance with Federal, State and local regulations. In cases where the Navy must also provide public notification (such as stormwater permitting), the Contractor must coordinate with the Contracting Officer. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all inclusive): demolition, renovation, NPDES defined site work, remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of

hazardous materials that will be brought onto the activity; types and quantities of wastes/wastewater that may be generated during the contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and activity environmental staff to discuss the proposed Environmental Management Plan. Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Management Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these training records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 ENVIRONMENTAL MANAGEMENT PLAN

Prior to initiating any work on site, the Contractor will meet with the

Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Contractor's Environmental Plan shall incorporate construction related objectives and targets from the installation's Environmental Management System. The Environmental Management Plan will be submitted in the following format and shall include the elements specified below.

a. Description of the Environmental Management Plan

(1) General overview and purpose

- (a) A brief description of each specific plan required by environmental permit or elsewhere in this contract.
- (b) The duties and level of authority assigned to the person(s) on the job site that oversee environmental compliance.
- (c) A copy of any standard or project specific operating procedures that will be used to effectively manage and protect the environment on the project site.
- (d) Communication and training procedures that will be used to convey environmental management requirements to contractor employees and subcontractors.
- (e) Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

(2) General site information

- (3) A letter signed by an officer of the firm appointing the Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

b. Management of Natural Resources

- (1) Land resources
- (2) Tree protection
- (3) Replacement of damaged landscape features
- (4) Temporary construction
- (5) Stream crossings
- (6) Fish and wildlife resources
- (7) Wetland areas

c. Protection of Historical and Archaeological Resources

- (1) Objectives

- (2) Methods
- d. Storm Water Management and Control
 - (1) Ground cover
 - (2) Erodible soils
 - (3) Temporary measures
 - (a) Mechanical retardation and control of runoff
 - (b) Vegetation and mulch
 - (4) Effective selection, implementation and maintenance of Best Management Practices (BMPs).
- e. Protection of the Environment from Waste Derived from Contractor Operations
 - (1) Control and disposal of solid and sanitary waste. If Section 01 74 19.05 20 is included in the contract, submit the plan required by that section as part of the Environmental Management Plan.
 - (2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

 - (a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;
 - (b) Sampling/analysis plan;
 - (c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);
 - (d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);
 - (e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);
 - (f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;
 - (g) Used oil management procedures in accordance with 40 CFR 279;
 - (h) Pollution prevention\hazardous waste minimization procedures;
 - (i) Plans for the disposal of hazardous waste by permitted

facilities;

(j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

(1) Procedures to prevent releases to the environment

(2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

(1) List what notifications and permit applications must be made. Demonstrate that those permits have been obtained by including copies of all applicable, environmental **permits**.

3.1.1 Environmental Protection Plan Review

Within thirty days after the Contract award date, submit the proposed Environmental Management Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental management plan has been approved.

3.1.2 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause 52.236-7.

Only an air emissions permit will be obtained by the Contracting Officer.

Where required by the State regulatory authority, the inspections and certifications will be **provided** through the services of a Professional Engineer (PE), registered in the State where the work is being performed. As a part of the quality control plan, which is required to be submitted for approval by the quality control section, provide a sub item containing the name, appropriate professional registration or licence number, address, and telephone number of the professionals or other qualified persons who will be performing the inspections and certifications for each permit.

3.2 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. If the work is near streams, lakes, or other waterways, conform to the national permitting requirements of the Clean Water Act.

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be

responsible for any resultant damage.

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

The Contracting Officer's approval is required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

3.2.1 Erosion and Sediment Control Measures

3.2.1.1 Burnoff

Burnoff of the ground cover is not permitted.

3.2.1.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.2.2 Wetlands

Do not enter, disturb, destroy, or allow discharge of contaminants into any wetlands except as authorized herein. The protection of wetlands is the Contractor's responsibility. Authorization to enter specific wetlands identified will not relieve the Contractor from any obligation to protect other wetlands within, adjacent to, or in the vicinity of the construction site and associated boundaries. Contractor shall ensure wetland boundaries are clearly marked prior to any clearing and grubbing operations. The wetland delineation will be conducted on site by the design engineer with assistance as needed from the Army Corps of Engineers and the base Environmental Management Division.

3.2.3 Air Emissions Permit Application - Government Prepared

This contract may include the design and/or construction of regulated air emission sources that require an air quality permit for construction and operation in accordance with North Carolina Department of Environment and Natural Resources (NCDENR) Division of Air Quality (NCDAQ) permitting procedures. The government will prepare a permit application package for all applicable emission sources in the contract, however the contractor is required to coordinate submission of all Air Emissions Source Specification Data necessary for the preparation of the application package a minimum of 180 calendar days prior to any construction or installation of any emission source point associated with this project. Marine Corps Air Station, Cherry Point, has been issued one Clean Air Act Title V Construction and Operation Permit issued by NCDAQ. The facility is considered a major source for both criteria pollutants and federally listed Hazardous Air Pollutant (HAP). The facility is also subject to North Carolina Toxic Air

Pollutant (TAP) regulations to include requirements for facility wide air dispersion modeling and facility fence line emission limits for certain pollutants. Typical emission sources requiring a permit include:

a. Boilers

(1) Boilers less than 10 MMBtu/hr are considered insignificant per NC regulations (15A NCAC 2Q.0503), but may still require analysis & permitting.

b. Storage Tanks

c. Fuel Dispensing

d. Emergency Generators

e. Non-Emergency Generators

f. Engine Testing Stations or Stands (where engine is removed from mobile vehicle/craft for testing)

g. Fire Training Pits

h. Woodworking/Grinding

i. Abrasive Blasting

j. Paint Stripping

k. Parts Cleaners/Ovens

l. Surface Coating (Paint Booths)

m. Epoxy Curing Benches

n. Remediation Systems

o. Welding/Soldering

p. Refrigerant Recovery/Recycling

3.2.3.1 Regulations Applicability

The permit application will require an evaluation of the applicability of the following regulations:

a. New Source Review (NSR) / Prevention of Significant Deterioration (PSD) (40 CFR 51, 40 CFR 52)

b. New Source Performance Standards (NSPS) (40 CFR 60)

(1) Possible source categories include but are not limited to boilers & internal combustion engines/generators

c. National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61, 40 CFR 63)

(1) Possible source categories include but are not limited to Reciprocating Internal Combustion Engines (RICE)

d. North Carolina Air Toxics Program (15A NCAC 2D.1100, 2Q.0700)

- (1) Many new air emission sources may require air dispersion modeling to receive a permit and/or demonstrate compliance. A July 2010 rule change in the North Carolina regulatory process removed the exemption of combustion sources (e.g. boilers, generators) from the air toxics program effective for sources permitted requiring modeling for these types of sources. This imposes additional permitting requirements on the facility. Projects including combustion sources should be coordinated on a case-by-case basis with the NAVFAC IPT and the installation Environmental Management Division.

3.2.3.2 Type Of Permit Required

Based on preliminary review, it is not anticipated that new emission sources will require New Source Review (NSR) permitting; however, potential air emission rates for new emission sources may exceed Prevention of Significant Deterioration (PSD) thresholds, therefore PSD avoidance permit conditions and/or operating limits (e.g. fuel usage or operating hour limits).

3.2.3.3 Permit Application Package

The permit application package will include the following:

- a. Clear, concise, & explanatory supporting documentation & narrative
- b. Required permit application forms (Title V)
- c. Air emissions calculations
- d. Equipment drawings and specifications
- e. Facility diagrams and/or maps

3.2.3.4 Time Allowance For Permit

The contractor should allow for approximately six months from the time of permit application submission to permit issuance. Construction of an air emission source cannot begin without a permit or a waiver, and operation of the source cannot begin without a permit.

3.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Upon discovery, notify the Contracting Officer. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.4 SOLID WASTE MANAGEMENT PLAN and PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable,

submit one copy of a State and local [Solid Waste Management Permit](#) or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

3.4.1 [Solid Waste Management Report](#)

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor will include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.4.2 [Control and Management of Solid Wastes](#)

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including [40 CFR 241](#), [40 CFR 243](#), and [40 CFR 258](#).

Manage spent hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, as per environmental law.

3.5 [WASTE DETERMINATION DOCUMENTATION](#)

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis (Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.6 [CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG](#)

Submit the "Contractor Hazardous Material Inventory Log" (found at:

<http://www.wbdg.org/ccb/NAVGRAPH/graphdoc.pdf>), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.6.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Resource Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved by the Navy before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the Activity environmental office. Refer to **Section 01 57 19.01 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS** for the Activity Point of Contact information.

3.7 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Management Plan. Consult with the activity Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.8 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.9 HAZARDOUS MATERIAL MANAGEMENT

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of hazardous materials have NFPA labels or their equivalent. Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.10 PETROLEUM PRODUCTS AND REFUELING

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.10.1 Oily and Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

3.10.2 Inadvertent Discovery of Petroleum Contaminated Soil or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the Contractor shall immediately notify the Contracting Officer. The Contractor shall not disturb this material until authorized by the Contracting Officer.

3.11 FUEL TANKS

Petroleum products and lubricants required to sustain up to 30 days of construction activity may be kept on site. Storage and refilling practices

shall comply with 40 CFR 112. Secondary containment shall be provided and be no less than 110 percent of the tank volume plus five inches of free-board. If a secondary berm is used for containment then the berm shall be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Drip pans are required and the tanks must be covered during inclement weather.

3.12 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Base or Activity Fire Department, the activity's Command Duty Officer, and the Contracting Officer. If the contractor's response is inadequate, the Navy may respond. If this should occur, the contractor will be required to reimburse the government for spill response assistance and analysis.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Navy Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials, equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

- a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or
- b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.13 CONTROL AND MANAGEMENT OF HAZARDOUS WASTES

3.13.1 Facility Hazardous Waste Generator Status

MCAS Cherry Point is designated as a Large Quantity Generator. All work conducted within the boundaries of this activity must meet the regulatory requirements of this generator designation. The Contractor will comply with all provisions of Federal, State and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of all construction derived wastes.

3.13.2 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268.

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government.

Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Station Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.13.2.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

<u>Contract Number</u>	_____	<u>Contractor</u>	_____
<u>Haz/Waste or Regulated Waste POC</u>	_____	<u>Phone Number</u>	_____
<u>Type of Waste</u>	_____	<u>Source of Waste</u>	_____
<u>Emergency POC</u>	_____	<u>Phone Number</u>	_____
<u>Location of the Site:</u> _____ (Attach Site Plan to the Request)			

Attach a waste determination form. Allow ten working days for processing this request. The designated area where waste is being stored shall be barricaded and a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.13.2.2 Sampling and Analysis of HW

a. Waste Sampling

Sample waste in accordance with EPA 530/F-93/004. Each sampled drum or container will be clearly marked with the Contractor's identification number and cross referenced to the chemical analysis performed.

b. Laboratory Analysis

Follow the analytical procedure and methods in accordance with the 40 CFR 261. The Contractor will provide all analytical results and reports performed to the Contracting Officer.

c. Analysis Type

Identify waste hazardous material/hazardous waste by analyzing for the following properties as a minimum: ignitability, corrosiveness, total chlorides, BTU value, PCBs, TCLP for heavy metals, and cyanide.

3.13.2.3 Asbestos Certification

Items, components, or materials disturbed by or included in work under this contract may involve asbestos. Other materials in the general area around where work will be performed may contain asbestos. All thermal insulation, in all work areas, should be considered to be asbestos unless positively identified by conspicuous tags or previous laboratory analysis certifying them as asbestos free.

Inadvertent discovery of non-disclosed asbestos that will result in an abatement action requires a change in scope before proceeding. Upon discovery of asbestos containing material not identified in the contract documents, the Contractor shall immediately stop all work that would generate further damage to the material, evacuate the asbestos exposed area, and notify the Contracting Officer for resolution of the situation prior to resuming normal work activities in the affected area. The Contractor will not remove or perform work on any asbestos containing materials without the prior approval of the Contracting Officer. The Contractor will not engage in any activity, which would remove or damage such materials or cause the generation of fibers from such materials.

Asbestos containing waste shall be managed and disposed of in accordance with applicable environmental law. Asbestos containing waste shall be manifested and the manifest provided to the Contracting Officer.

3.13.2.4 Hazardous Waste Disposal

No hazardous, toxic, or universal waste shall be disposed or hazardous material abandoned on government property. And unless otherwise noted in this contract, the government is not responsible for disposal of Contractor generated waste material. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive.

The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or water way or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

Control of stored waste, packaging, sampling, analysis, and disposal will be determined by the details in the contract. The requirements for jobs in the following paragraphs will be used as the guidelines for disposal of any hazardous waste generated.

a. Responsibilities for Contractor's Disposal

Contractor responsibilities include any generation of WHM/HW requiring Contractor disposal of solid waste or liquid.

- (1) The Contractor agrees to provide all service necessary for the final treatment/disposal of the hazardous material/waste in accordance with all local, State and Federal laws and regulations, and the terms and conditions of the contract within sixty (60) days after the materials have been generated. These services will include all necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal, and/or transportation, including manifesting or completing waste profile sheets, equipment, and the compilation of all documentation is required).
- (2) Contain all waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, 40 CFR 268, 40 CFR 270, 40 CFR 272, 40 CFR 273, 40 CFR 279, 40 CFR 280, and 40 CFR 761.
- (3) Obtaining a representative sample of the material generated for each job done to provide waste stream determination.
- (4) Analyzing for each sample taken and providing analytical results to the Contracting Officer. Provide two copies of the results.
- (5) Determine the DOT proper shipping names for all waste (each container requiring disposal) and will demonstrate how this determination is developed and supported by the sampling and analysis requirements contained herein to the Contracting Officer.

Contractor Disposal Turn-In Requirements

For any waste hazardous materials or hazardous waste generated which requires the Contractor to dispose of, the following conditions must be complied with in order to be acceptable for disposal:

- a. Drums compatible with waste contents and drums meet DOT requirements for 49 CFR 173 for transportation of materials.
- b. Drums banded to wooden pallets. No more than three (3) 55 gallon drums to a pallet, or two (2) 85 gallon over packs.
- c. Band using 1-1/4 inch minimum band on upper third of drum.
- d. Recovery materials label (provided by Code 106.321) located in middle of drum, filled out to indicate actual volume of material, name of material manufacturer, other vendor information as available.
- e. Always have three (3) to five (5) inches of empty space above volume of material. This space is called 'outage'.

3.13.3 Class I ODS Prohibition

Class I ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.13.3.1 Universal Waste/e-Waste Management

Universal waste including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed in accordance with applicable environmental law and installation instructions.

3.14 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.14.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.15 ABRASIVE BLASTING

3.15.1 Blasting Operations

The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.15.2 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "Hazardous Waste\Debris Management" of this section and with the approved HWMP. Disposal of non-hazardous abrasive blasting debris will be in accordance with paragraph entitled, "Control and Disposal of Solid Wastes".

3.16 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written

permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, exclusive of holidays, unless otherwise specified.

3.17 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

-- End of Section --

This page is intentionally left blank.

SECTION 01 57 19.01 20

SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS
05/16

PART 1 GENERAL

1.1 MID-ATLANTIC

Comply with the following state, regional, and local requirements which supplement Section 01 57 19.00 20 TEMPORARY ENVIRONMENTAL CONTROLS.

1.1.1 North Carolina

1.1.1.1 MCAS Cherry Point

1.1.1.1.1 Removal of Waste

Remove and dispose of rubbish and debris from Government property.

- a. Provide 24-hour advance written notice to the Contracting Office of Contractor's intention to dispose of off base.
- b. Disposal at sites or landfills not holding a valid state of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.
- c. Off-base disposal of construction debris outside the parameters of this paragraph at site without State permits and/or not in accordance with regulatory requirements will require the Contractor at his own expense to remove, transport and relocate the debris to a State approved site. The Contractor will also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

1.1.1.1.2 Recycling Construction Debris

- a. The Contractor shall provide collection bins on site to facilitate effective waste management and recycling. The Contractor shall instruct their sub-contractors and workers that select material is to be separated from other construction debris for recycling. When the site collection bins are full the Contractor shall deliver the material to the Material Recovery Facility, (MRF). Only those materials currently accepted by the Material Recovery Facility shall be left in their collection bins - any material refused by the Recycling Center shall be removed from the base by the General Contractor and legally disposed of in an authorized North Carolina landfill.
- b. The following materials are currently being accepted for recycling at the MRF; (the list of materials being accepted may change, check with the MRF; see item c. below):

PET Plastic, (for example water bottles)
HDPE Plastic, (for example, buckets and milk jugs)
Aluminum cans
Glass
Corrugated Cardboard
Paper

- c. The Material Recovery Facility (MRF) is located at Building 4638, next to EAD on Access Road. Point of Contact: Dave Cooke, (252) 466-2864; dave.l.cooke@usmc.mil
- d. All scrap metal, (other than aluminum cans, which shall be delivered to the MRF as mentioned above), may be recycled at the DLA Disposition Services facility located at Building 154D on Cleveland Street.

1.1.1.1.3 Requirements For Off Site Soil

Do not furnish or transport soils onto MCAS Cherry Point or outlying fields when such act would violate the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or the General Statutes of North Carolina.

The contractor shall provide documentation certifying that all soil furnished under the contract contains no petroleum or hazardous or toxic materials as stated in DoD Instruction 4715.6, which implements 10 U.S.C. 2692. This documentation shall include the Soil Authorization Form (SAF) showing the volume of soil needed, analytical test data to support the environmental condition of the soil, and a copy of the State-issued "mining permit" for the borrow pit source. The MCAS Cherry Point Environmental Affairs Department (EAD) will review these documents before off site soil is considered approved for use.

The following methods shall be used to determine if soil meets the requirements for off site soil (RFOSS).

If the total amount of soil to be brought onto MCAS Cherry Point for a single contract is less than 200 cubic yards, the contractor shall certify the soil meets the RFOSS by inspecting for "apparent contamination" as determined by visual or other indications of contamination including abnormal or unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum. If the soil shows no apparent contamination, the contractor shall provide to EAD a signed SAF certifying the soil contains no apparent contamination. Soil showing apparent contamination shall not be utilized aboard MCAS Cherry Point or outlying fields.

If the total amount of soil to be brought aboard MCAS Cherry Point for a single contract is equal to or greater than 200 cubic yards, the soil shall be analyzed by a North Carolina certified laboratory. The laboratory must be certified by North Carolina in the specific tests to be performed. Sampling must be conducted by qualified personnel following proper field sampling methodology and proper chain-of-custody protocol must be followed. Otherwise, the sampling will be considered invalid. Consult with the selected laboratory about the specific sample handling procedures required by the analytical methods. Sample containers, sample volumes, and timeframes differ depending on the analytical method.

Sampling requirements are summarized below and are for a single soil source only.

- a. One representative sample for soil volumes of 200 cubic yards to 1,000 cubic yards needed.
- b. For soil volumes greater than 1,000 cubic yards, one additional representative sample is required for each additional 2,000 cubic yards or portion thereof.

A representative sample is achieved by collecting multiple samples in a defined area (e.g. soil stockpile or borrow pit) and directing the laboratory to combine them into a "composite sample" for analysis. The composite or representative sample is intended to represent the soil source as a whole.

Samples shall be collected by qualified personnel following proper field sampling methodology. For each representative sample, 3 "primary samples" from each of 2 soil borings (or excavation pits) shall be obtained for a total of 6 primary samples. The 3 primary samples collected from each boring/pit shall be obtained at even intervals throughout the soil column (i.e. upper, middle, lower) and placed into individual sampling containers. Samples shall not be combined in the field. The 6 primary samples shall be sent to the NC certified laboratory where they will be combined into one "composite sample" for analysis.

Soil sample(s) shall be analyzed for Gasoline Range Organics (GRO), Diesel Range Organics (DRO), Oil and Grease (O&G), and eight Metals (Arsenic; Barium; Cadmium; Chromium; Lead; Mercury; Selenium; and Silver). The laboratory method detection limits must be set below the State action levels or the testing will be considered invalid. All units are to be reported in milligrams per kilograms (mg/kg).

- a. Gasoline Range Organics - use Standard Method 5030
- b. Diesel Range Organics - use Standard Method 5030
- c. Oil & Grease - use EPA Method 9071 with a silica gel wash
- d. Total Metals - use EPA 6010 (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)
- e. Total Metals - use EPA 7471 (Mercury only)

If test results are greater than the allowed detection limits for petroleum constituents (GRO, DRO, O&G) or the standards for the eight metals (as provided by the EPA), the soil from which the sample was taken shall not be approved for use.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

This page is intentionally left blank.

SOIL AUTHORIZATION FORM (SAF)

Based upon Requirements for Off Site Soil (RFOSS)

Project Name: _____

Project Number: _____

Base Contract Officer (e.g. ROICC/FSC): _____

Company Name: _____

Amount of soil required (in cubic yards): _____

--- Check the applicable box below and sign/date in the appropriate section ---

Amount of soil needed for project is:

☐ Up to 200 cubic yards (No analytical data required; Include NC mining permit)

I _____
(print name)
certify the soil contains No apparent contamination
as determined by visual or other indications of contamination including abnormal or
unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum.

Signature

Date (mm/dd/yy)

☐ More than 200 to 1000 cubic yards. (Requires 1 representative sample)

☐ More than 1000 to 3000 cubic yards. (Requires 2 representative samples)

☐ More than 3000 to 5000 cubic yards. (Requires 3 representative samples)

☐ More than 5000 cubic yards. (Requires 4 or more representative samples)

I _____
(print name)
have enclosed analytical testing data, completed
SAF, an NC mining permit as outlined in the RFOSS and followed the guidance for proper
sampling to ensure accurate data collection for the soil.

Signature

Date (mm/dd/yy)

This page is intentionally left blank.

SECTION 01 58 00

PROJECT IDENTIFICATION
09/15

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 WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

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 Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

preliminary drawing indicating layout and text content; G

1.3 PROJECT SIGN

Prior to initiating any work on site, provide one project identification sign at the location designated. Construct the sign in accordance with project sign detail attached at the end of this section. Maintain sign throughout the life of the project. Upon completion of the project, remove the sign from the site.

1.3.1 Project Identification Signboard (Navy)

A project identification signboard shall be provided in accordance with the attached Plates. Provide preliminary drawing indicating layout and text content. The signboard shall be provided at a conspicuous location on the job site where directed by the Contracting Officer.

- a. The field of the sign shall consist of a 4 by 8 foot sheet of grade B-B medium density overlaid exterior plywood.
- b. Lumber shall be B or better Southern pine, pressure-preservative treated in accordance with AWPA C1 and AWPA C2. Nails shall be aluminum or galvanized steel.
- c. The entire signboard and supports shall be given one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint. The lettering and sign work shall be performed by a skilled sign painter

using paint known in the trade as bulletin colors. The colors, lettering sizes, and lettering styles shall be as indicated. Where preservative-treated lumber is required, utilize only cured pressure-treated wood which has had the chemicals leached from the surface of the wood prior to painting.

- d. Use spray applied automotive quality high gloss acrylic white enamel paint as background for the NAVFAC logo. NAVFAC logo shall be an applied 2 millimeter film sticker/decal with either transparent or white background or paint the logo by stencil onto the sign. The weather resistant sticker/decal film shall be rated for a minimum of 2-year exterior vertical exposure. The self-adhering sticker shall be mounted to the sign with pressure sensitive, permanent acrylic adhesive. Shop cut sticker/decal to rectangular shape and provide pull-off backing sheet on adhesive side of design sticker for shipping.
- e. Sign paint colors (manufacturer's numbers/types listed below for color identification only)
 - (1) Blue = To match dark blue color in the NAVFAC logo.
 - (2) White = To match Brilliant White color in the NAVFAC logo.
- f. NAVFAC logo must retain proportions and design integrity. NAVFAC logos in electronic format may be obtained from the NAVFAC web portal via the following link:
<http://www.flickr.com/photos/navfac/sets/72157627315803197/with/6045913859/>
Use the following to choose color values for the paint to be used:
 - (1) Dark Blue = equivalent to CMYK values 100, 72, 0, 8.
 - (2) Light Blue = equivalent to CMYK values 69, 34, 0, 0.
 - (3) Cyan = equivalent to CMYK values 100, 9, 0, 6.
 - (4) Yellow = equivalent to CMYK values 0.9, 94, 0.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

VERIFY W/ CONTRACTING OFFICER IF PROJECT IS AN ARRA PROJECT. FOR ARRA PROJECTS, ADD SIGNAGE AT TOP OF SIGN. SEE PLATES 8 AND 9 FOR SIGNAGE AND DETAILS.

MITERED CORNER

4X4 [89mmx89mm]
PRESSURE TREATED POST;
COLOR: 'DARK BLUE', TYP.

11.25" [286mm] DIAMETER
USMC LOGO AVAIL: https://portal.navfac.navy.mil/portal/page?_pageid=181,3465071&_dad=portal&_schema=PORTAL

2" [50mm] LETTERING
CENTERED (ITALICIZED)

PAINTED FIELD; COLOR,
'WHITE'

3" [75mm] LETTERING
CENTERED

2" [50mm] LETTERING
CENTERED

2.5" [64mm] LETTERING
CENTERED (ITALICIZED)

2" [50mm] LETTERING
CENTERED

2" [50mm] LETTERING
CENTERED

PAINTED 3.5" [89mm]
STRIPE; COLOR, 'DARK
BLUE'

NOTES:

1. PAINT ALL OTHER WOOD
SURFACES WITH ONE COAT
EXT. PRIMER AND TWO
COATS GLOSS WHITE
ENAMEL.

2. ALL LETTERING SHALL
BE EVENLY SPACED.

3. LETTER STYLE, 'ARIAL',
COLOR 'DARK BLUE'.
TYPICAL FOR ALL
LETTERING.

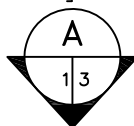
*-ABBREVIATE STATE

**-CONFIRM USE WITH
CONTRACTING OFFICER

***-VERIFY NAME WITH
CONTRACTING OFFICER.

4'-0" [1220mm]

2.5" [64mm] LETTERING CENTERED



9.5"x11.25"[240mm x 286mm]
NAVFAC LOGO AVAIL: https://portal.navfac.navy.mil/portal/page?_pageid=181,3465071&_dad=portal&_schema=PORTAL

USMC
&
NAVFAC



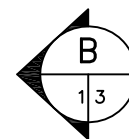
Supporting the Warfighter

2" [50mm] LETTERING
CENTERED

NAME OF PROJECT
2ND LINE

PAINTED 3.5" [89mm]
STRIPE; COLOR, 'DARK
BLUE'

LOCATION (BASE)
CITY AND STATE *



COMING IN SUMMER 2008 **

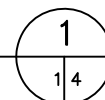
PAINTED 3.5" [89mm]
STRIPE; COLOR, 'DARK
BLUE'

NAVAL FACILITIES ENGINEERING COMMAND
COMPONENT NAME (i.e. MID-ATLANTIC) ***

COST: \$10,000,000 **

PAINTED FIELD; COLOR,
'WHITE'

ARCHITECT
NAME OF A/E FIRM
CITY AND STATE *



CONTRACTOR
CONTRACTOR FIRM
CITY AND STATE *

2.5" [64mm] LETTERING
CENTERED

4x4 [89mmx89mm]
PRESSURE TREATED POST
BEYOND; COLOR: 'WHITE'

GROUND LEVEL

1'-0" [300mm]

3'-0" [915mm]

1'-8" [510mm]

2'-7" [790mm]

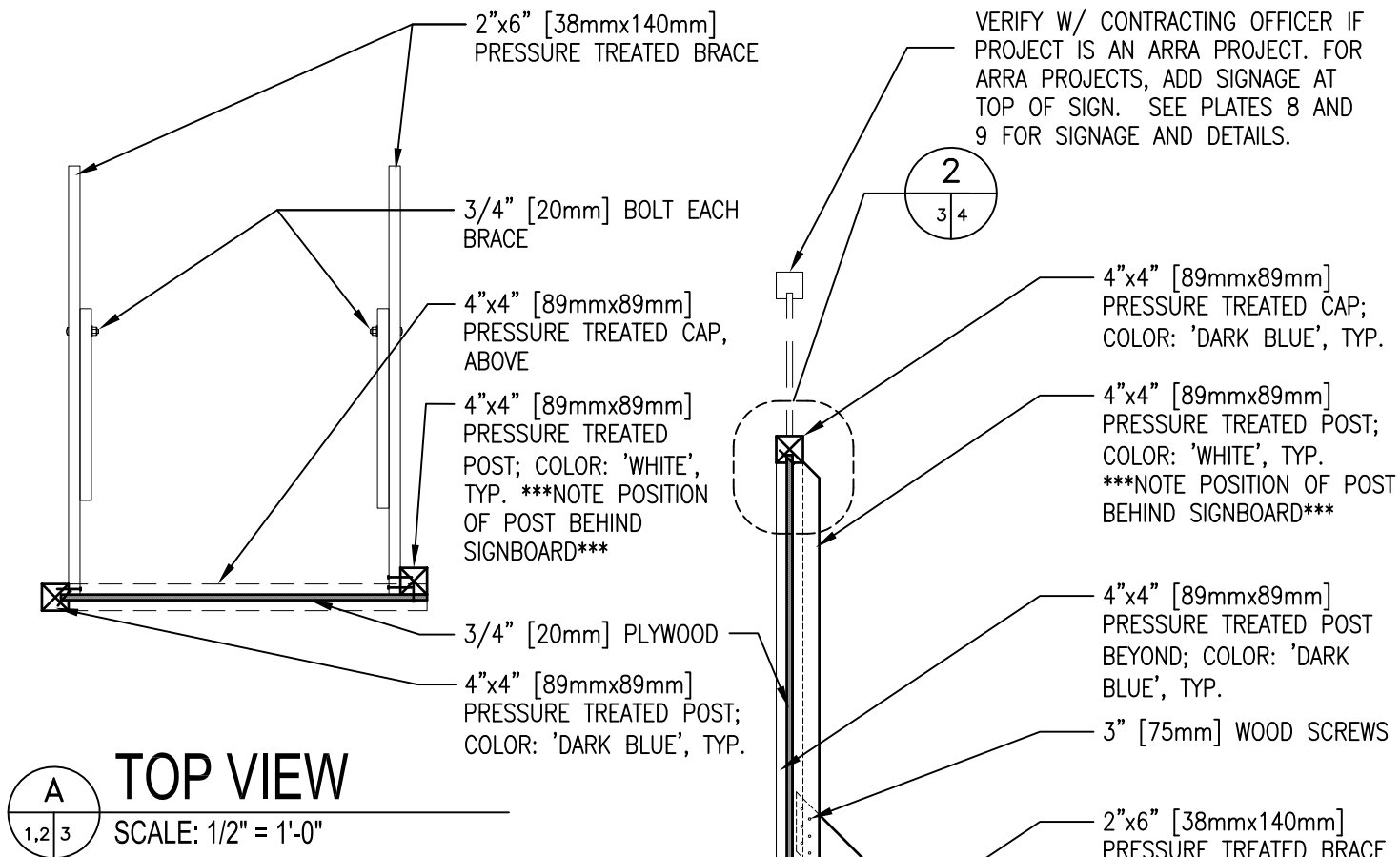
8'-0" [2440mm]

2'-9 1/2" [850mm]

PROJECT IDENTIFICATION SIGNBOARD FOR MARINE CORPS PROJECTS

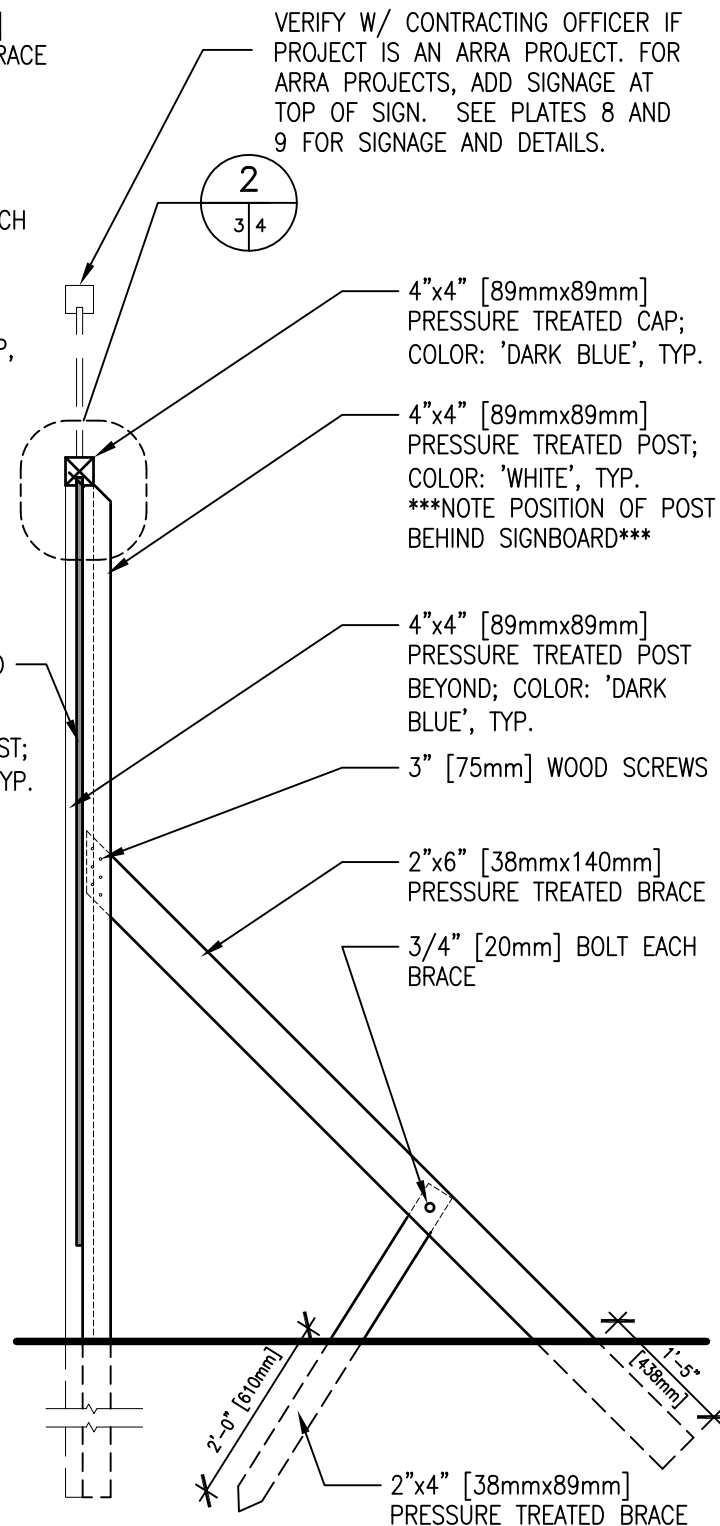
SCALE: 3/4" = 1'-0"

PLATE 1MC



NOTES:

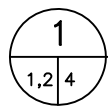
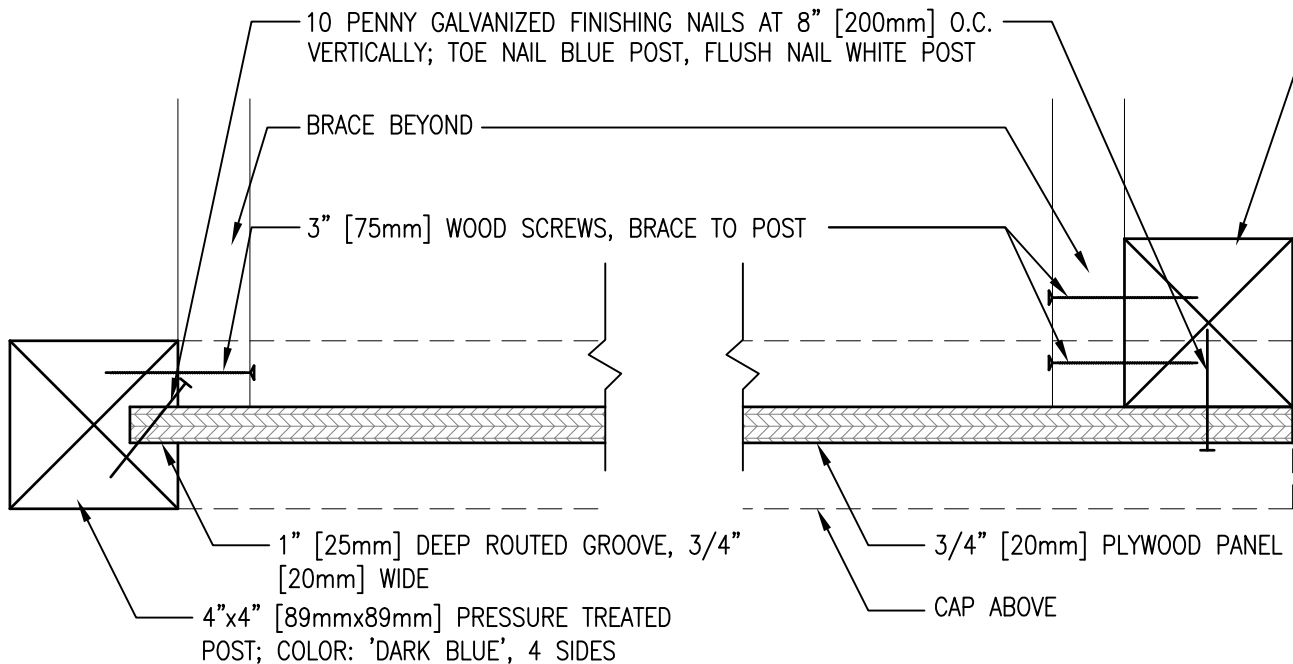
1. POSTS AND BRACES SHALL BE PRESSURE TREATED.
2. ALL FASTENERS SHALL BE ZINC COATED.
3. BRACING IS REQUIRED IN ALL SOIL CONDITIONS AND HIGH WIND ENVIRONMENTS.



PROJECT IDENTIFICATION SIGNBOARD SUPPORT DETAILS

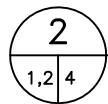
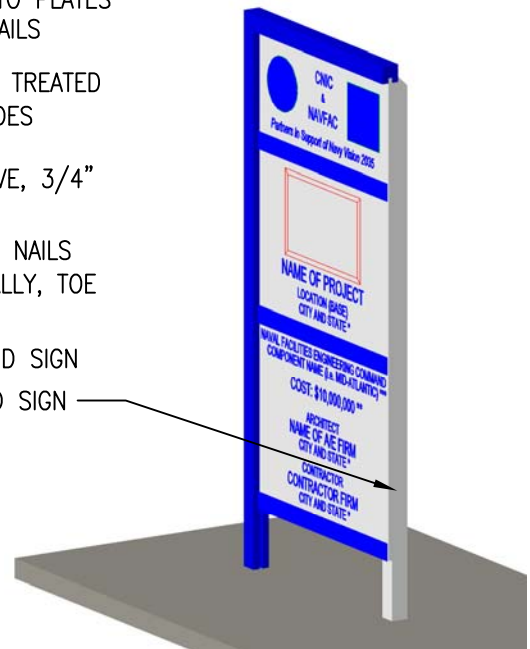
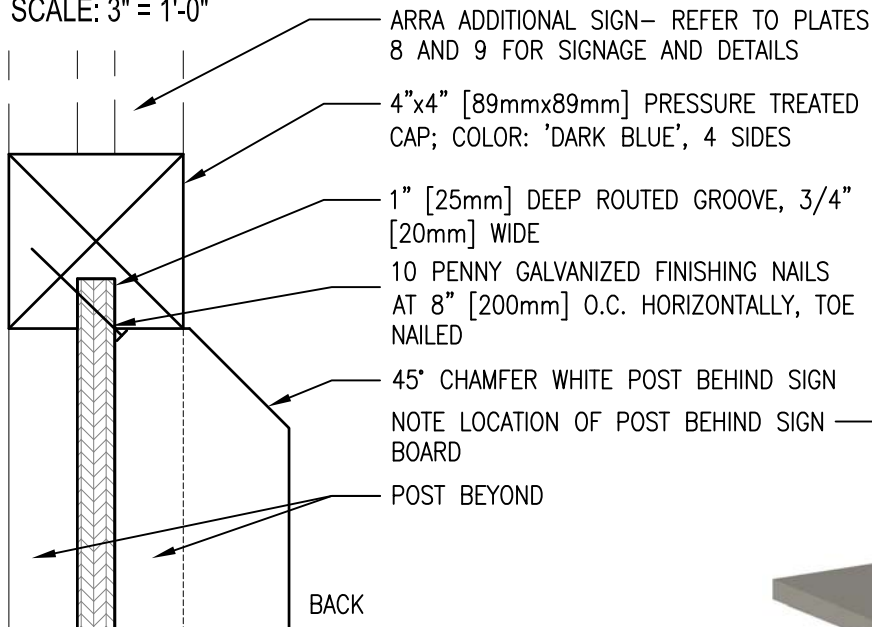
PLATE 3

4"x4" [89mmx89mm] PRESSURE TREATED POST; COLOR: 'WHITE',
TYP. ***NOTE POSITION OF POST BEHIND SIGNBOARD***



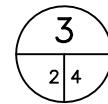
PLAN SECTION

SCALE: 3" = 1'-0"



SECTION AT TOP

SCALE: 3" = 1'-0"



ISO VIEW

SCALE: NONE

PROJECT IDENTIFICATION SIGNBOARD SECTIONS

PLATE 4

This page is intentionally left blank.

SECTION 01 60 00.00 22

REQUIREMENTS FOR PESTICIDE AND HERBICIDE COORDINATION
08/16

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-07 Certificates

Certificate of State Licensed Applicator; G

SD-11 Closeout Submittals

Completed Field Pesticide/Herbicide Management Record Form; G

1.2 QUALITY ASSURANCE

1.2.1 Certificate of State Licensed Applicator

A State licensed applicator is required and must be licensed in the state in which the project is located. Submit a copy of the certificate(s) to the Base Pest Management Coordinator (PMC) through the Contracting Officer.

PART 2 PRODUCTS

2.1 PESTICIDE/HERBICIDE LIST

Comply with Base Regulations and use only approved pesticides/herbicides listed on the current "Base Approved Pesticide/herbicide List". Use the approved list that is current at the time of application. Contact the Contracting Officer to obtain the current approved list.

PART 3 EXECUTION

3.1 COORDINATION WITH BASE PEST MANAGEMENT COORDINATOR (PMC)

Coordinate with the PMC before proceeding with any pesticide/herbicide application. The Point of Contact information for the Base Pest Management Coordinator can be obtained from the Contracting Officer.

3.2 Field Pesticide/Herbicide Management Record Form

Following the pesticide/herbicide application, complete the attached Field Pesticide/Herbicide Management Record Form and submit to the Base Pest Management Coordinator (PMC) through the Contracting Officer. Submit the completed form(s) within 15 days after application.

-- End of Section --

This page is intentionally left blank.

Navy Online Pesticide Reporting System
Pesticides approved for Cherry Point, MCAS
Judah Emory
3/12/2015 17:36

Favorite	Pesticide Type	Formulation	Pesticide Name	Active Ingredient	EPA Number
No	Fungicide	Wettable Powder	PROSTAR 70WP	FLUTOLANIL	432-1223
No	Herbicide	Solution	ACCORD XRT	GLYPHOSATE	62719-517
No	Herbicide	Emulsifiable Concentrate	AMINE 4 2,4-D Weed Killer	2,4-D	34704-120
No	Herbicide	Solution	Aquamaster / RODEO	Glyphosate	524-343
No	Herbicide	Solution	ARSENAL	imazapyr	241-299
No	Herbicide	Suspension Concentrate	Cutrine-Plus	Copper Ethanolamine	8959-10
No	Herbicide	Dust/Granule*	ESCORT HERBICIDE	METSULFURON METHYL	352-439
No	Herbicide	Solution	Finale	Glufosinate	45639-187
No	Herbicide	Solution	GARLON 4	Triclopyr	62719-40
No	Herbicide	Emulsifiable Concentrate	Glyphosate 41% Plus	glyphosate	42750-61
No	Herbicide	Solution	Habitat	Imazapyr	241-426
No	Herbicide	Concentrate	Hyvar X-L	bromacil	352-346
No	Herbicide	Granules/Pellets	OUST HERBICIDE	SULFOMETURON METHYL	352-401
No	Herbicide	Emulsifiable Concentrate	PRAMITOL 25E	PROMETON	66222-22
No	Herbicide	Granules/Pellets	QuikPro	diquat dibromide / glyphosate	524-535
No	Herbicide	Emulsifiable Concentrate	Ranger Pro	Glyphosate	524-517
No	Herbicide	Solution	Reward	Diquat Dibromide	100-1091
No	Herbicide	Emulsifiable Concentrate	ROUNDUP	GLYPHOSATE	524-308
No	Herbicide	Emulsifiable Concentrate	ROUNDUP PRO	GLYPHOSATE	524-475
No	Herbicide	Concentrate	ROUNDUP PROMAX	glyphosate	524-579
No	Herbicide	Dry Flowable	Sencor DF 75	Metribuzin	264-738
No	Herbicide	Liquid*	Transline	Clpyralid	62719-259
No	Insect Growth Regulator	Briquets	ALTOSID BRIQUET	METHOPRENE	20954-13
No	Insect Growth Regulator	Briquets	ALTOSID BRIQUETS	METHOPRENE	2724-375-50809
No	Insect Growth Regulator	Granules/Pellets	ALTOSID PELLETS	METHOPRENE	2724-448
No	Insect Growth Regulator	Briquets	ALTOSID XR	METHOPRENE	2724-421
No	Insect Growth Regulator	Briquets	ALTOSID XR EXTENDED RESIDUAL BRICKETS	METHOPRENE	2724-421-64833
No	Insect Growth Regulator	Emulsifiable Concentrate	ARCHER IGR	Pyriproxyfen	100-1111
No	Insect Growth Regulator	Dust/Granule*	AWARD	FENOXYCARB	100-722
No	Insect Growth Regulator	Solution	GENTROL EC IGR	HYDROPRENE	2724-351
No	Insect Growth Regulator	Aerosol	PRECOR 200 PREMISE SPRAY	Methoprene / Permethrin	2724-483
No	Insect Growth Regulator	Aerosol	PRECOR FOGGER	METHOPRENE / permethrin	2724-291-50809
No	Insecticide	Aerosol	565 Plus XLO	Piperonyl Butoxide / n-Octyl Bicycloheptene Dicarboximide / Pyrethrins	499-290
No	Insecticide	Solution	ACEPHATE PRO 75	ACEPHATE	51036-236
No	Insecticide	Bait Stations	Advance 360A Dual Choice	Abamectin	499-496
No	Insecticide	Gel	Advance Cockroach Gel Bait Reservoir	Dinotefuran	499-507
No	Insecticide	Bait Stations	ADVANCE DUAL CHOICE	N-ETHYL PERFLUOROOCTANESULFONAMIDE	499-459
No	Insecticide	Bait - Solid	Advance Granular Ant Bait	Abamectin B1	499-370
No	Insecticide	Bait Stations	Advion Ant Bait Arena	Indoxacarb	352-664
No	Insecticide	Gel	Advion Ant Gel	Indoxacarb	352-746
No	Insecticide	Bait Stations	ADVION COCKROACH BAIT ARENA	indoxacarb	352-668
No	Insecticide	Gel	Advion Cockroach Gel Bait	Indoxacarb	352-652
No	Insecticide	Gel	Advion Cockroach Gel Bait	Indoxacarb	100-1484
No	Insecticide	Granules/Pellets	Advion Fire Ant Bait	Indoxacarb	100-1481
No	Insecticide	Dust/Granule*	Advion Fire Ant Bait	Indoxacarb	352-627
No	Insecticide	Granules/Pellets	Advion Insect Granule	Indoxacarb	352-651
No	Insecticide	Gel	Alpine Ant Gel Bait	Dinotefuran	499-537
No	Insecticide	Aerosol	Alpine Flea Insecticide	dinotefuran / pyriproxyfen / prallethrin	499-540
No	Insecticide	Bait - Solid	Amdro Fire Ant Bait	Hydramethylnon	73342-1
No	Insecticide	Solution	Anvil 10+10 ULV	SUMITHRIN/PIPERONYL BUTOXIDE / PIPERONYL BUTOXIDE	1021-1688-8329
No	Insecticide	Bait - Solid	Avert Prescription Treatment	Abamectin / Related Compounds	499-294
No	Insecticide	Gel	Avert Prescription Treatment Cockroach Bait Gel Formula 2	Abamectin	499-406
No	Insecticide	Gel	Avert Prescription Treatment TC 93B Bait	Abamectin	499-410
No	Insecticide	Bait - Solid	BAYGON 2% BAIT	PROPOXUR	3125-121
No	Insecticide	Concentrate	Bifenthrin Golf & Nursery 7.9F	Bifenthrin	66222-192
No	Insecticide	Solution	Centerfire 75 WSP	Imidacloprid	432-1332
No	Insecticide	Bait Stations	Combat Large Roach Bait	Fipronil	64240-34
No	Insecticide	Emulsifiable Concentrate	CONQUER	ESFENVALERATE	1021-1641-57056
No	Insecticide	Aerosol	CY-KICK	CYFLUTHRIN	499-470
No	Insecticide	Aerosol	CY-Kick CS	Cyfluthrin	499-303
No	Insecticide	Solution	CY-KICK CS PRESCRIPTION TREATMENT	CYFLUTHRIN	499-304
No	Insecticide	Aerosol	Cykick	Cyflumthrin	499-344
No	Insecticide	Dust	DELTA DUST	Deltamethrin	432-772

No	Insecticide	Tablets	DEMAND PEST TAB	Lambda-cyhalothrin	10182-387
No	Insecticide	Emulsifiable Concentrate	DEMIZE EC	PIPERONYL BUTOXIDE / LINALOOL	4758-161
No	Insecticide	Emulsifiable Concentrate	Demon Max	Cypermethrin	100-1218
No	Insecticide	Emulsifiable Concentrate	DRAGNET FT TERMITICIDE/INSECTICIDE	PERMETHRIN	279-3062
No	Insecticide	Gel	DRAX ANT KILL GEL	ORTHOBORIC ACID	9444-131
No	Insecticide	Dust/Granule*	DRIONE	PYRETHRIN / Pyrethrins	6754-22-5802
No	Insecticide	Dust	DRIONE INSECTICIDE	SILICA GEL, PIPERONYL BUTOXIDE, PYRETHRINS / PIPERONYL BUTOXIDE / PYRETHRINS	4816-353
No	Insecticide	Bait Stations	DUAL CHOICE ANT BAIT	SULFURAMID	11540-20
No	Insecticide	Solution	ExciteR	PIPERONYL BUTOXIDE / Pyrethrins	655-798
No	Insecticide	Aerosol	Hot Shot Bedbug & Flea Fogger	pyrethrins / benzeneacetate / PBO, MGK / pyridine	1021-1674-8845
No	Insecticide	Aerosol	Hot Shot No-Mess Fogger	Tetramethrin	9688-252-8845
No	Insecticide	Granules/Pellets	INTICE 10 PERIMETER BAIT	ORTHOBORIC ACID	73079-6
No	Insecticide	Solution	M-PEDE	Potassium laurate	42697-1-53219
No	Insecticide	Solution	M-pede	Potassium salts of fatty acids	53219-6
No	Insecticide	Bait Stations	MaxAttrax Roach Bait	chlorpyrifos	9688-67-8845
No	Insecticide	Bait Stations	MAXFORCE ANT KILLER BAIT STATION	HYDRAMETHYLNON	64248-2
No	Insecticide	Gel	Maxforce Ant Killer Gel	Fipronil	432-1264
No	Insecticide	Granules/Pellets	Maxforce Complete Granular Bait	HyDRAMETHYLNON	432-1255
No	Insecticide	Gel	MAXFORCE EC BAIT GEL	FIPRONIL	64248-21
No	Insecticide	Gel	MAXFORCE FC	FIPRONIL	64248-14
No	Insecticide	Bait - Solid	Maxforce FC Fire Ant Bait	Fipronil	432-1433
No	Insecticide	Bait Stations	MAXFORCE FC ROACH BAIT STATIONS	FIPRONIL	64248-11
No	Insecticide	Bait - Solid	MAXFORCE FINE GRANULE INSECT BAIT	HYDRAMETHYLNON	64248-19
No	Insecticide	Gel	MAXFORCE ROACH KILLER BAIT GEL	HYDRAMETHYLNON	64248-5
No	Insecticide	Granules/Pellets	NIBAN-FG	ORTHOBORIC ACID	64405-2
No	Insecticide	Fumigant - Solid	NO-PEST STRIP	DICHLORVOS	5481-338-36208
No	Insecticide	Fumigant - Solid	NUVAN PROSTRIPS	DICHLORVOS	5481-553
No	Insecticide	Aerosol	NyGuard Plus	Phenoxybenzyl / Dimethyl / Pyriproxyfen	1021-2580
No	Insecticide	Dust/Granule*	ORTHENE TURF, TREE AND ORNAMENTAL SPRAY 97	ACEPHATE	5481-8978
No	Insecticide	Dust/Granule*	ORTHO ORTHENE FIRE ANT KILLER	ACEPHATE	239-2406
No	Insecticide	Solution	PHANTOM	Chlorfenapyr	241-392
No	Insecticide	Aerosol	Phantom Pressurized	Chlorfenapyr	7969-285
No	Insecticide	Emulsifiable Concentrate	PRECOR IGR CONCENTRATE	METHOPRENE	2724-352
No	Insecticide	Emulsifiable Concentrate	PREVAIL FT TERMITICIDE	CYPERMETHRIN	279-3082
No	Insecticide	Aerosol	PRO-CONTROL FOGGERII	PYRETHRIN/ PIPERONYL BUTOXIDE/N-octyl bicycloheptene dicarboximide / PIPERONYL BUTOXIDE / n-Octyl Bicycloheptene Dicarboximide	11540-27
No	Insecticide	Aerosol	PRO-CONTROL PLUS	PIPERONYL BUTOXIDE/Pyrethrins/Cyfluthrin / PYRETHRINS / Cyfluthrin	499-462
No	Insecticide	Aerosol	Pyrethrin Fogger	Pyrethrins-Piperonyl Butoxide, technical / PIPERONYL BUTOXIDE / N-Octyl Bicycloheptene Dicarboximide	279-3394
No	Insecticide	Gel	SIEGE GEL INSECTICIDE	HYDRAMETHYLNON	241-313
No	Insecticide	Briquets	Summit B.T.I. Briquets	BACILLUS THURINGIENSIS	6218-47
No	Insecticide	Suspension Concentrate	SUSPEND SC	DELTAMETHRIN	432-763
No	Insecticide	Aerosol	Talstar	Bifenthrin / Prallethrin	279-3365
No	Insecticide	Solution	TALSTAR FLOWABLE INSECTICIDE/MITICIDE	BIFENTHRIN	279-3105
No	Insecticide	Granules/Pellets	TALSTAR PL / Talstar EZ	BIFENTHRIN	279-3168
No	Insecticide	Emulsifiable Concentrate	TalstarOne / Talstar P	Bifenthrin	279-3206
No	Insecticide	Wettable Powder	TEMPO 20 WP	CYFLUTHRIN	3125-380
No	Insecticide	Emulsifiable Concentrate	TEMPO SC ULTRA	CYFLUTHRIN	3125-498
No	Insecticide	Aerosol	Temprid Ready Spray	Imidacropid / Cyfluthrin / Other Ingredients	432-1527
No	Insecticide	Granules/Pellets	TERMIDOR 80 WG	FIPRONIL	432-900
No	Insecticide	Solution	TERMIDOR SC	FIPRONIL	432-901
No	Insecticide	Bait - Solid	Uncle Alberts Super Smart Ant Bait	Disodium octaborate tetrahydrate	73340-1
No	Insecticide	Gel	Vendetta Plus	Abamectin B1 / Pyriproxyfen / Other Ingredients	1021-2976
No	Insecticide	Aerosol	Wasp-Freeze	d-trans allethrin / phenothrin	499-362
No	Insecticide	Solution	Web Out	Thyme Oil / Lemongrass Oil / Citronella / Sodium Lauryl Sulfate	25(b) exempt
No	Insecticide	Aerosol	WHITMIRE P. I. CONTACT INSECTICIDE	Piperonyl butoxide / PYRETHRINS	499-444
No	Insecticide	Bait - Solid	WHITMIRE PT 370 ASCEND FIRE ANT STOPPER BAIT	ABAMECTIN	499-370
No	Insecticide	Aerosol	Whitmire PT 515 Wasp Freeze	Pyrethrin / Rotenone	499-153
No	Insecticide	Aerosol	WHITMIRE PT 515 WASP-FREEZE II	PHENOTHHRIN	499-240

No	Insecticide	Aerosol	WHITMIRE PT 565 XLO INSPECTOR CONTACT INSECTICIDE	PYRETHRIN/ PIPERONYL BUTOXIDE/N-octyl bicycloheptene dicarboximide / PIPERONYL BUTOXIDE / n-Octyl Bicycloheptene Dicarboximide	499-417
No	Repellent	Solution	Sawyer Permethrin Tick Repellent	permethrin	50404-3-58188
No	Rodenticide	Bait - Solid	CONTRAC ALL WEATHER BLOX	BROMADIOLONE	12455-79
No	Rodenticide	Bait - Solid	CONTRAC RODENTICIDE PLACE PAC	BROMADIOLONE	12455-76
No	Rodenticide	Granules/Pellets	FINAL Rodenticide RTU Place Pac	Brodifacoum	12455-91
No	Rodenticide	Bait - Solid	GENERATION MINI BLOCKS	DIFETHIALONE	7173-218

This page is intentionally left blank.

FIELD PESTICIDE/HERBICIDE MANAGEMENT RECORD FORM

Revised 24 October 2012

PROJECT / CONTRACT #: _____

Instructions: **A separate form will be filled out for EACH formulation at EACH location or building (if treating inside AND outside of a building, need two separate forms).**

1. Date of Application: _____
2. Location: (Circle One) Inside or Outside
3. Building# and/or Name: _____
4. Type of Pest Control Operation: _____
(i.e. Baiting, Power spray, Manual application of pesticide, ULV, etc.)
5. Site Description: _____
(i.e. Office, Barracks, Housing, Warehouse, Snack Bar, Lawn, Unimproved Grounds, etc.)
6. Pest type: _____
(i.e. Ants, Fire Ants, Cockroaches, Spiders, Termites, etc.)
7. **Contractor/Subcontractor's Company Name:** _____
8. Pesticide Used:
 - 8a. Pesticide Trade Name: _____
 - 8b. Pesticide Active Ingredient: _____
 - 8c. EPA Registration#: _____
 - 8d. Formulation (e.g., Liquid, Granular, Gel, EC, Aerosol, etc.) _____
9. Approximate total area treated: _____
 - 9a. Units: _____ (i.e. SF, LF, AC, CF, EA(for baiting, aerosol cans), etc.)
10. Quantity of **Pesticide Concentrate** applied: _____
 - 10a. Units: _____ (i.e. FLOz, DRoz, LB, Gal, Qt, Pint, Pkt, Bait Block, Bait Stations, Briquet, ML, LT, etc.)
11. **Quantity of Dilutant** Applied (if applicable):
 - 11a. **Type of Dilutant:** _____ (i.e. Water, Oil, etc.)
 - 11b. **Units:** _____ (i.e. Floz, Gal, LT, ML, etc.)
12. Comments: (Survey results, wind conditions, sanitation deficiencies, etc.)

13. Print & Signature of Applicator: _____
14. Certification # of Applicator: _____

This page is intentionally left blank.

SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

09/15

PART 1 GENERAL

1.1 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. A minimum of 50 percent by weight of total project solid waste shall be diverted from the landfill.

1.2 MANAGEMENT

Develop and implement a waste management program. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate **in the effort**. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.3 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 Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Waste Management Plan; G

SD-11 Closeout Submittals

Records

1.4 MEETINGS

Conduct Construction Waste Management meetings. After award of the

Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in **Section 01 45 00.00 20 QUALITY CONTROL**. At a minimum, environmental and waste management goals and issues shall be discussed at the following additional meetings:

- a. Pre-bid meeting.
- b. Preconstruction meeting.
- c. Regular site meetings.
- d. Work safety meetings.

1.5 **WASTE MANAGEMENT PLAN**

A waste management plan shall be submitted within 15 days after contract award and not less than 10 days before the preconstruction meeting. The plan shall demonstrate how the project waste diversion goal shall be met and shall include the following:

- a. Name of individuals on the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the regular meetings to be held to address waste management.
- d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.
- e. Characterization, including estimated types and quantities, of the waste to be generated.
- f. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.
- g. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity. Include the name, location, and phone number for each reuse facility to be used, and provide a copy of the permit or license for each facility.
- h. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Recycling facilities that will be used shall be identified by name, location, and phone number, including a copy of the permit or license for each facility.
- i. Identification of materials that cannot be recycled/reused with an

explanation or justification, to be approved by the Contracting Officer.

- j. Description of the means by which any waste materials identified in item (h) above will be protected from contamination.
- k. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- l. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each subcontractor, the Quality Control Manager, and the Contracting Officer.

1.6 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Quantities may be measured by weight or by volume, but must be consistent throughout. List each type of waste separately noting the disposal or diversion date. Identify the landfill, recycling center, waste processor, or other organization used to process or receive the solid waste. Provide explanations for any waste not recycled or reused. With each application for payment, submit updated documentation for solid waste disposal and diversion, and submit manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

1.7 COLLECTION

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvagability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations. Separate materials by one of the following methods:

1.7.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the following category types as appropriate to the project waste and to the available recycling and reuse programs in the project area:

- a. Land clearing debris.
- b. Asphalt.
- c. Concrete and masonry.
- d. Metal (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, lead brass, bronze).
 - (1) Ferrous.
 - (2) Non-ferrous.
- e. Wood (nails and staples allowed).
- f. Debris.
- g. Glass (colored glass allowed).
- h. Paper.
 - (1) Bond.
 - (2) Newsprint.
 - (3) Cardboard and paper packaging materials.
- i. Plastic.
 - (1) Type 1: Polyethylene Terephthalate (PET, PETE).
 - (2) Type 2: High Density Polyethylene (HDPE).
 - (3) Type 3: Vinyl (Polyvinyl Chloride or PVC).
 - (4) Type 4: Low Density Polyethylene (LDPE).
 - (5) Type 5: Polypropylene (PP).
 - (6) Type 6: Polystyrene (PS).
 - (7) Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

- j. Gypsum.
- k. Non-hazardous paint and paint cans.
- l. Carpet.
- m. Ceiling tiles.
- n. Insulation.
- o. Beverage containers.

1.7.2 Co-Mingled Method.

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.7.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.8 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.8.1 Reuse.

First consideration shall be given to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Coordinate reuse with the Contracting Officer. Sale or donation of waste suitable for reuse shall be considered.

1.8.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.8.3 Compost

Consider composting on site if a reasonable amount of compostable material will be available. Compostable materials include plant material, sawdust, and certain food scraps.

1.8.4 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

1.8.5 Return

Set aside and protect misdelivered and substandard products and materials
and return to supplier for credit.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

09/15

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 E1971 (2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37 (2012) Cleaning Products for Industrial and Institutional Use

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08 (2009, Change 2, 2011) Criteria for Transfer and Acceptance of DoD Real Property

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials
Warranty Management Plan
Warranty Tags
Final Cleaning
Spare Parts Data

SD-08 Manufacturer's Instructions

Preventative Maintenance
Condition Monitoring (Predictive Testing)
Inspection
Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals
Record Drawings

NAVFAC Sustainable & Energy Data Record Card; G
Certification of EPA Designated Items; G
Preliminary Interim DD Form 1354; G
Updated Interim DD Form 1354; G

1.3 PROJECT RECORD DOCUMENTS

1.3.1 Record Drawings

Drawings showing final as-built conditions of the project. This paragraph covers record drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions. The final CAD record drawings must consist of one set of electronic CAD drawing files in the specified format, 2 sets of prints, and one set of the approved working Record drawings.

1.3.1.1 Government Furnished Materials

One set of **electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference for projects requiring CADD file record drawings.**

1.3.1.2 Working Record and Final Record Drawings

Revise **2** sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final record drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the record drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. Show on the working and final record drawings, but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

- b. The location and dimensions of any changes within the building structure.
- c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- f. Changes or modifications which result from the final inspection.
- g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.
- h. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.
- i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.
 - (1) Follow directions in the modification for posting descriptive changes.
 - (2) Place a Modification **Delta** at the location of each deletion.
 - (3) For new details or sections which are added to a drawing, place a Modification **Delta** by the detail or section title.
 - (4) For minor changes, place a Modification **Delta** by the area changed on the drawing (each location).
 - (5) For major changes to a drawing, place a Modification **Delta** by the title of the affected plan, section, or detail at each location.
 - (6) For changes to schedules or drawings, place a Modification **Delta** either by the schedule heading or by the change in the schedule.
 - (7) The Modification **Delta** size shall be 1/2 inch diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

1.3.1.3 Drawing Preparation

Modify the record drawings as may be necessary to correctly show the features of the project as it has been constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the

permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

1.3.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only employ personnel proficient in the preparation of CADD drawings to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CADD files. The Contractor will be furnished "as-designed" drawings in AutoCad Release 2010 format compatible with a Windows 7 operating system. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). Provide all program files and hardware necessary to prepare final record drawings. The Contracting Officer will review final record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

- a. Provide CADD "base" colors of red, green, and blue. Color code for changes as follows:
 - (1) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.
 - (2) Additions (Green) - Added items, lettering in notes and leaders.
 - (3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.
- b. Rename the Contract Drawing files in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. All changes shall be made on the layer/level as the original item.
- c. When final revisions have been completed, show the wording "RECORD DRAWINGS / AS-BUILT CONDITIONS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Mark all other contract drawings either "Record" drawing denoting no revisions on the sheet or "Revised Record" denoting one or more revisions. Date original contract drawings in the revision block.
- d. Within 10 days for contracts less than \$5 million after Government approval of all of the working record drawings for a phase of work, prepare the final CADD record drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 7 days for contracts less than \$5 million revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 10 days for contracts less than \$5 million of substantial completion of all phases of work, submit

the final record drawing package for the entire project. Submit one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working record drawings. They must be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record drawing files and marked prints as specified will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made to the Contractor.

1.3.1.5 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

1.3.2 As-Built Record of Equipment and Materials

Furnish **one copy** of preliminary record of equipment and materials used on the project **15** days prior to final inspection. This preliminary submittal will be reviewed and returned **2** days after final inspection with Government comments. Submit **Two** sets of final record of equipment and materials **10** days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

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

1.3.3 Final Approved Shop Drawings

Furnish final approved project shop drawings **30** days after transfer of the completed facility.

1.3.4 Construction Contract Specifications

Furnish final record (as-built) construction contract specifications, including modifications thereto, **30** days after transfer of the completed facility.

1.3.5 Real Property Equipment

Furnish a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of

manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Furnish a draft list at time of transfer. Furnish the final list 30 days after transfer of the completed facility.

1.4 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

- a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

1.5 PREVENTATIVE MAINTENANCE

Submit Preventative Maintenance, Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

- a. Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., gpm, rpm, psi. Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.
- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials: 1) The product does not meet appropriate performance standards; 2) The product is not available within a reasonable time frame; 3) The product is not available competitively (from two or more sources); 4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)." Record each product used in the project that has a requirement or option of containing recycled or biobased content, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, total value of biobased content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled and biobased content values may be determined by weight or volume

percent, but must be consistent throughout.

1.7 WARRANTY MANAGEMENT

1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause **Warranty of Construction**. At least 30 days before the planned pre-warranty conference, submit one set sets of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

- a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, **Subcontractors**, manufacturers or suppliers involved.
- b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- d. A list for each warranted equipment, item, feature of construction or system indicating:
 - (1) Name of item.
 - (2) Model and serial numbers.
 - (3) Location where installed.
 - (4) Name and phone numbers of manufacturers or suppliers.
 - (5) Names, addresses and telephone numbers of sources of spare parts.
 - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
 - (7) Cross-reference to warranty certificates as applicable.
 - (8) Starting point and duration of warranty period.
 - (9) Summary of maintenance procedures required to continue the warranty in force.
 - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
 - (11) Organization, names and phone numbers of persons to call for

warranty service.

(12) Typical response time and repair time expected for various warranted equipment.

- e. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of all equipment covered by extended warranties.
- g. Copies of [instructions](#) to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.7.2 Performance Bond

The Contractor's Performance Bond [must remain effective throughout the construction period](#).

- a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
- b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.
- c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.7.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.7.4 [Warranty Tags](#)

At the time of installation, tag each warranted item with a durable, oil

and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit **two** record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

1.8 OPERATION AND MAINTENANCE MANUALS

Submit 6 copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.8.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must have **0.3937-inch** holes and be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.8.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

1.9 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment and comply with the Indoor Air Quality (IAQ) Management Plan. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on the project site.

1.10 REAL PROPERTY RECORD

DD Form 1354 "Transfer and Acceptance of Military Real Property" is utilized to record and maintain the Base's real property inventory and to manage capital improvements costs.

A Draft DD Form 1354 is attached to this section. Note: The Draft DD Form 1354 will not contain cost or quantity information. The Contractor shall provide this information based on "as constructed" conditions.

Near the completion of the project, but a minimum of 60 days prior to the projected Beneficial Occupancy Date (BOD), update the Draft DD Form 1354 and submit a Preliminary Interim DD Form 1354, accounting for all installed property. Required data will include costs, quantities, units of measure, etc. as indicated on the DD Form 1354. Include any additional assets/improvements/alterations from the Draft DD Form 1354. An Excel version of this document can be provided by the Government for use in providing this data. Contact the Contracting Officer for any project specific information necessary to complete the DD Form 1354.

The DD Form 1354 shall be prepared in accordance with UFC 1-300-08, available at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4.

Submit an Updated Interim DD Form 1354 for approval with the Final Invoice. The Updated Interim DD Form 1354 shall address all requested revisions to the Preliminary Interim DD Form 1354 and shall be updated to contain Contractor's "Final" quantity and cost information.

The Final DD Form 1354 will be prepared by the Activity Real Property Accountability Officer (RPAO) at final project closeout after all outstanding issues have been resolved. The Final DD Form 1354 will be prepared using the Contractor provided project data.

1.10.1 MCAS Cherry Point

Point of Contact (POC) for assistance in completing the DD Form 1354:

Facilities Planner
MCAS Facilities Development Department
163 Curtis Road
MCAS Cherry Point, NC 28533
Phone: (252) 466-4771

Coordinate with Section 01 20 00.00 20 PRICE AND PAYMENT PROCEDURES paragraph "EARNED VALUE REPORT".

The Contractor's Earned Value Report shall allocate the total cost of construction to the appropriate category codes. If a supporting facility feature has a unique category code, it shall be listed separately on the DD Form 1354. If a supporting facility does not have a unique category code the costs associated with the feature shall be included in the primary facility cost.

When documenting demolition work, the DD Form 1354 shall list the quantitative data associated with this work as a negative value to show the costs should be deleted from the Navy Asset Data Store. Coordinate with the POCs listed above in determining the negative value for demolition work.

The Contractor shall complete DD Form 1354 to the satisfaction of the Facilities Development Department of MCAS Cherry Point.

1.11 GEOSPATIAL INFORMATION SYSTEMS (GIS) DELIVERABLES

Provide geospatial data and documents for all features added, demolished or modified as part of this project in accordance with Section 01 78 30.00 22 DIGITAL DATA DELIVERABLES (GIS).

1.12 NAVFAC SUSTAINABLE & ENERGY DATA RECORD CARD

Within 60 days of the completion of Project, complete an electronic copy of the NAVFAC Sustainable & Energy Data Record Card, and submit to the Contracting Officer. Draft Record card for this project should be available from Designer of Record (DOR) or Contracting Officer. Instructions and a blank DD Form (fill-able) in ADOBE (PDF) may be obtained at the Whole Building Design Guide web site by navigating: Home > Participating Agencies > Department of Defense (DoD) > NAVFAC Sustainable Development Program > Contract Documents > NAVFAC Sustainable & Energy Data Record Card; or directly at http://www.wbdg.org/pdfs/navfac_sustainable_energy_data_record_card.pdf.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

F-35B Lift System Repair Facility
MCAS CHERRY POINT, NC

17P766
EPROJECT W.O. NO. 1564839

-- End of Section --

TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY												Form Approved OMB No. 0704-0188				
PAGE 1 OF 3 PAGES																
The public reporting burden for the collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Executive Services and Communications Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.																
PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION																
1. FROM (Installation/Activity/District and ZIP Code)					2. DATE PREPARED (YYYYMMDD) 20180507			3. PROJECT/JOB NUMBER P766		4. SERIAL NUMBER		8. TRANSACTION DETAILS				
5. TO (Installation/Activity/Service, ZIP Code & INSNO) NAVFAC MID ATLANTIC ATTN: FACILITIES ENGINEERING & AQUISITIONS DEPT MCAS CHERRY POINT PSC BOX 8006 HAVELOCK, NC 28532-5000					6. SITE/INSNO/ NAME M00146 - CHERRY POINT			7. CONTRACT NUMBER(S)		7a. PLACED-IN- SERVICE DATE (YYYYMMDD)		a. <input checked="" type="checkbox"/> NEW CONST. <input type="checkbox"/> EXISTING FAC. <input checked="" type="checkbox"/> CAPITAL IMP. <input type="checkbox"/> OTHER (Specify)			b. <input type="checkbox"/> PHYS. COM. AVAIL. <input type="checkbox"/> BENF/O <input type="checkbox"/> PARTIAL BOD <input type="checkbox"/> FINANCIAL COM. <input type="checkbox"/> OTHER (Specify)	
												c. <input checked="" type="checkbox"/> DRAFT <input type="checkbox"/> FINAL <input type="checkbox"/> INTERIM			d. EFFECTIVE DATE (YYYYMMDD)	
9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	AREA		OTHER		18. COST	19. FUND SOURCE	20. FUND ORG	21. INTER- EST CODE	22. ITEM REMARKS		
						14. UNIT OF MEAS 1	15. TOTAL QUANTITY UM 1	16. UNIT OF MEAS 2	17. TOTAL QUANTITY UM2							
1	4630	14334	21195	STORAGE WAREHOUSE (BUILDING 4630)	P	SF										
2	4224	21264	21133	A/C REWORK SHOP (BUILDING 4224)	P	SF										
3			21190	OTHER SUPPORT FACILITIES (DROP ANK STORAGE CANOPY)	P	SF										
4			81232	UNDERGROUND ELECTRICAL DISTRIBUTION LINES	P			LF								
5			83210	SANITARY SEWER	P			LF								
6			85235	OTHER PAVED AREA	P	SY										
7			93310	DEMOLITION		SF										
23a. TRANSFERRED BY (Typed Name and Signature)						23b. DATE SIGNED (YYYYMMDD)			24a. ACCEPTED BY (Typed Name and Signature)					24b. DATE SIGNED (YYYYMMDD)		
23c. TITLE (Area Engr./Base Engr./DPW)									24c. TITLE (DPW/RPAO)					25. PROPERTY VOUCHER NUMBER		

TITLE: P766 F35 Lift Repair Facility

						AREA		OTHER						
9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	14. UNIT OF MEAS 1	15. TOTAL QUANTITY UM 1	16. UNIT OF MEAS 2	17. TOTAL QUANTITY UM2	18. COST	19. FUND SOURCE	20. FUND ORG	21. INTER- EST CODE	22. ITEM REMARKS
8			88010	FIRE-ALARM SYSTEM	P	SF								
9			84210	WATER DISTRIBUTION POTABLE BASE	P			LF						
10			89021	COMPD AIR DISTRBTN SYSTEM	P			LF						
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														

This page is intentionally left blank.

DD Form 1354 Addendum

CLASS 2 PROPERTY RECORD DATA

ACTIVITY UIC: _____ DD Form 1354, Item 6

ACTIVITY NAME: _____ DD Form 1354, Item 5

SPEC AREA _____

PR NO _____

FACILITY NO: _____ DD Form 1354, Item 11

LOCATION GENERAL INFO

COUNTRY: iNFADS fills this based on UIC and Special Area

RPTG-CLMT-UIC _____

ACTION TYPE _____ (Acquisition, Capital Improvement, Disposal)

STATE: iNFADS fills this based on UIC and Special Area

COUNTY: iNFADS fills this based on UIC and Special Area

CITY: iNFADS fills this based on UIC and Special Area

FACILITY NAME: _____ Completed by gaining installation

MAP GRID: _____ Completed by gaining installation

FORMER ACTIVITY UIC: _____ DD Form 1354, Item 1, Transfer only

FORMER PR NO.: _____ Transfers within Dept of Navy only

FACILITY TYPE: _____ Determined by Prime Use Category Code

FAMILY HOUSING INDICATOR: _____ Y/N

MEASUREMENTS

LENGTH _____

WIDTH _____

HEIGHT _____

DEPTH _____

AREA/UM _____

STORIES _____

IRREGULAR _____ (Y or N)

ATTIC _____ (Y or N)

BASEMENT _____ (Y or N)

MEZZANINE _____ (Y or N)

PENTHOUSE _____ (Y or N)

CONSTRUCTION

YEAR BUILT _____ (New Construction)

YEAR IMPROVED _____ (Capital Improvement)

CURR PROJ NO _____ (Capital Improvement)

DD Form 1354 Addendum

ORIG PROJ NO _____ (New Construction)

CONSTRUCTION TYPE _____ (P, S, T, or R)

HERITAGE ASSET DATA – _____ Transfers only

MAINTENANCE

PRIME USE CAT CODE _____ (Largest Category Code for facility on DD Form 1354, Item 12)

MAINT FUND CODE _____ (Supplied by gaining installation)

MAINT RESP _____ (Supplied by gaining installation)

COST REF DOCUMENT NUMBERS: _____ DD Form 1354, Item 7

EXCESS / DISPOSAL (DISPOSAL DD FORM 1354 ONLY)

EXCESS ACTION CODE _____

EXCESS ACTION DATE _____

DISPOSAL METHOD _____

DISPOSAL DATE _____

EFD DISPOSAL CONTRACT _____

GSA DISPOSAL CONTRACT _____

DISP CONSOL PR _____

STATUS / UTILIZATION

USER UIC/OG ID _____ (Supplied by gaining installation)

CATEGORY CODE _____ DD Form 1354, Item 12

USE _____ (Optional)

AREA/UM _____ DD Form 1354, Items 15 and 16

OTHER/UM _____ DD Form 1354, Items 17 and 18

ALT/UM _____ Must be put in Remarks section of DD Form 1354, where applicable.

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

09/15

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 E1971 (2005; R 2011) Stewardship for the
Cleaning of Commercial and Institutional
Buildings

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors must compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor must compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section, Section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI), and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.2.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows.

1.2.3 Changes to Submittals

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

1.2.4 Review and Approval

The Government must verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts.

1.2.5 O&M Database

Develop a database from the O&M manuals that contains the information required to start a preventative maintenance program.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

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

1.3.1.3 Startup, Shutdown, and Post-Shutdown Procedures

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

1.3.1.4 Normal Operations

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

1.3.1.5 Emergency Operations

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

1.3.1.6 Operator Service Requirements

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

1.3.1.7 Environmental Conditions

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

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

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

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.3.2.3 Cleaning Recommendations

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

1.3.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

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

1.3.3.2 Wiring Diagrams and Control Diagrams

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

1.3.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

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

1.3.3.5 Spare Parts and Supply Lists

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

1.3.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.3.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.3.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.3.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.3.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.3.5.6 Personnel Training Requirements

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

1.3.5.7 Testing Equipment and Special Tool Information

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

1.3.5.8 Testing and Performance Data

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

1.3.5.9 Contractor Information

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

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply all functions,

features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

- b. Full as-built sequence of operations.
- c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).
- d. Full points list. A listing of rooms shall be provided with the following information for each room:
 - (1) Floor
 - (2) Room number
 - (3) Room name
 - (4) Air handler unit ID
 - (5) Reference drawing number
 - (6) Air terminal unit tag ID
 - (7) Heating and/or cooling valve tag ID
 - (8) Minimum cfm
 - (9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.
- f. Full as-built print out of software program.
- g. Electronic File:
 - (1) Assemble each manual into a composite electronically indexed file in PDF format. Provide HDD's, DVD's or CD's as appropriate, so that each one contains all maintenance and record files, and also the Project Record Documents and Training Videos, of the entire program for this facility.
 - (2) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - (3) Link the index to separate files within the composite of files. Book mark maintenance and record files, that have a Table of Contents, according to the Table of Contents
- h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.5.1 Data Package 1

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

1.5.2 Data Package 2

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

1.5.3 Data Package 3

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Lubrication data
- h. Preventive maintenance plan and schedule

- i. Cleaning recommendations
- j. Troubleshooting guides and diagnostic techniques
- k. Wiring diagrams and control diagrams
- l. Maintenance and repair procedures
- m. Removal and replacement instructions
- n. Spare parts and supply list
- o. Product submittal data
- p. O&M submittal data
- q. Parts identification
- r. Warranty information
- s. Testing equipment and special tool information
- t. Testing and performance data
- u. Contractor information

1.5.4 Data Package 4

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

- q. Product submittal data
- r. O&M submittal data
- s. Parts identification
- t. Warranty information
- u. Personnel training requirements
- v. Testing equipment and special tool information
- w. Testing and performance data
- x. Contractor information

1.5.5 Data Package 5

- a. Safety precautions
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan and schedule
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information

- q. Warranty information
- r. Testing and performance data
- s. Contractor information

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 78 24.00 20

FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI)
09/15

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

This section provides the requirements for electronic operation and maintenance support information (eOMSI). eOMSI contains detailed as-built information describing the efficient, economical, safe operation, maintenance, and repair of the facility. eOMSI is required to be in electronic format divided into the eOMSI Data and eOMSI Document files.

- a. Provide eOMSI Data files in the eOMSI Spreadsheet Workbook format that are uploaded by the Government into a Government computerized maintenance management system (CMMS). Maximo is the CMMS that will be used on this project.
- b. Provide eOMSI Document files in Portable Document Format (PDF), Computer Assisted Design and Drafting (CADD), and MS Word formats that can be uploaded into a document management system. The eOMSI document information is to be factual, concise, comprehensive, and written to be easily used by maintenance personnel. Descriptive matter and theory must include technical details that are essential for a comprehensive understanding of the operation, maintenance and repair of the system. The eOMSI Preparer shall ensure that the eOMSI reflect changes to systems and equipment, made during construction.

1.2 DEFINITIONS

1.2.1 Component Inventory Management Unit (CIMU)

CIMU is an organization of like-kind real property into manageable maintenance units. CIMU is a building component, group of components or component assemblies, serving a specific purpose in a facility that can be expected to follow a common and predictable lifecycle behavior. This class of non-equipment will include items such as exterior walls, exterior windows, interior finish, and roofs. This class of equipment will include items such as fan coil units, air handling units, lighting, and water closets. CIMUs can include items of installed equipment typically subject to routine scheduled maintenance.

1.2.2 Real Property Inventory Equipment (RPIE)

RPIE is a Government owned or leased individual pieces of equipment, apparatus, or fixture that are essential to the function of the real property (i.e. plumbing, electrical, heating, cooling and elevators). It is physically attached to, integrated into, and built in or on the property. Individual RPIE's can be combined to make a CIMU to facilitate facilities management.

1.2.3 BOTH (Combined CIMU and RPIE)

A BOTH is a stand-alone piece of equipment that can be managed independently and therefore is a Component Inventory Management Unit and a Real Property Installed Equipment. (If a CIMU has a Quantity of "One", it

would be considered a BOTH)

1.2.4 Utility and Energy Management (UEM)

UEM is a part of the Government Public Works (PW) Organization that manages the operation and maintenance of the Base utilities.

1.2.5 Systems

The words "system", "systems", and "equipment", when used in this document refer to as-built systems and equipment.

1.2.6 Computer Assisted Design and Drafting (CADD)

Electronic Computer Assisted Design and Drafting graphic software program that is used to create facility design contract documents.

1.2.7 eOMSI Spreadsheet Workbook

The eOMSI Spreadsheet Workbook is a group of Excel spreadsheets that provide forms, samples, and tools to assist the Contractor in identifying equipment and non-equipment data for the project. Use these Excel spreadsheets to organize and record maintenance data for the project. Use the eOMSI Spreadsheet Workbook in conjunction with this specification section with the file title: "eOMSI Facility Data Workbook 24SEPT2014.xlsm" located inside the zip file at the following web link:

<http://www.wbdg.org/ccb/NAVGRAPH/graphtoc.pdf>

1.2.8 Flat File

The flat file is the blank forms portion of the eOMSI Spreadsheet Workbook used to fill in the equipment and non-equipment data. These flat file forms are Excel templates with column headings that identify required information for equipment and non-equipment. The data placed on the flat file spreadsheets are organized by the Contractor into RPIE, and BOTH maintenance units.

1.2.9 KTR

KTR is an abbreviation for "Contractor."

1.3 ORGANIZATION of eOMSI

Prepare the eOMSI submittals in two components, eOMSI Data Files and eOMSI Document Files.

1.3.1 eOMSI Data Files

Provide facility specific information listed in the DESCRIPTION of WORK of this specification section and divide into Equipment Data and Non-Equipment Data on eOMSI Spreadsheet Workbook / Flat Files. The Government will use the completed eOMSI Spreadsheet Workbook to update information of the CMMS indicated above. The following tabs are included in the eOMSI Spreadsheet Workbook and serve the purpose stated:

- a. Flat File - Equipment Data; This spreadsheet provides an organized format for the contractor to fill in required information about dynamic equipment (fans, pumps,...) that is part of the project.

- b. **Flat** File - Non-Equipment Data; This spreadsheet provides an organized format for the Contractor to fill in required information about non-equipment (doors, windows, etc.) that is part of the project.
- c. **New** CONST - RENOVATION Schema; Provides information and instructions to explain the task of completing the Flat File - Equipment Data and Flat File - No-Equipment Data spreadsheets.
- d. **Facility** and UEM Uniformat; Provides a Uniformat division of facility and utility systems and components of the project. This information is used to complete the Master-System-Subsystem portions of the Flat File - Equipment Data and Flat File - Non-Equipment Data spreadsheets.
- e. **UEM** Asset Classification: Provides a list of critical Utility and Energy Management components that must be identified in the Flat File - Equipment Data spreadsheet.
- f. **Asset** Identification List: List of items that require equipment tagging. Tag numbering must be entered in the Equipment Tag Number of the Flat File - Equipment Data spreadsheet.
- g. **Data** Definitions; Provide definitions of terms used on the spreadsheet workbook.

1.3.2 eOMSI Document Files

Provide facility specific information, which was used to construct the project and provide information on operation and maintenance of the facility in a form that can be easily accessed and used. Organize the document files to facilitate storage in an electronic Government document file management system. Arrange the eOMSI Documents files in the following order and identify the document files as follows:

- a. **Product** and Drawing Information

Cross-referencing within or between the eOMSI Document File parts must be specific.

1.3.3 Order of Precedence of eOMSI Requirements

This specification section takes precedence over the eOMSI Spreadsheet Workbook in the event of conflict between this specification section and the eOMSI Spreadsheet Workbook.

1.3.4 Sources of eOMSI Information

The sources of data needed to prepare the eOMSI include, but are not limited to, the design plans and specifications, field visits, approved construction submittals and manufacturer's catalog data for materials, products, systems, as-built drawings, contract modifications, and construction methods used in this contract. Ensure that the eOMSI reflect changes to systems and equipment made during construction as a result of contract modifications. Collect and input needed information to complete the data and document files

1.3.5 Unified Facility Guide Specifications (UFGS) Operation and Maintenance Data Packages

Provide information necessary to maintain the equipment and non-equipment

of the facility by utilizing the SD-10 Operations and Maintenance Data Packages as defined in **Section 01 78 23** OPERATIONS AND MAINTENANCE DATA. Provide the SD-10 Data Packages required in the individual sections for each product, material, and system used on the project.

1.4 eOMSI MEETINGS

Organize, coordinate, and facilitate the meetings necessary to obtain the information to complete the eOMSI submittal.

1.4.1 eOMSI Start-Up Meeting

During the **Pre Construction Meeting** , discuss the following;

- a. **The** eOMSI Development Meetings schedules and participants.
- b. **Processes** and methods of gathering of facility eOMSI information during construction.
- c. **The** qualifications of the eOMSI Preparer.
- d. **The** eOMSI Submittals schedule. Place the eOMSI submittal schedule on the construction schedule.

1.4.2 eOMSI Development Meetings

Meet with key personnel to discuss the eOMSI requirements and the deliverables. These are a series of meetings that begin after the **Preconstruction Meeting** and conclude with the Contractor's first eOMSI submittal. Include the eOMSI Preparer and the Quality Control Manager to attend these meetings. Also include the Mechanical, Electrical and Fire Protection Sub Contractors as required. The purposes of these meetings are to:

- a. **Familiarize** the Contractor with the Government PW maintenance processes.
- b. **Provide** the Contractor with an understanding of the RPIE, CIMU, and BOTH to organize the facility into these information structures.
- c. **Obtain** the "By KTR Using Government Info" information for the eOMSI Flat File Spreadsheets.
- d. **Review** and identify the electronic format, units of measure, titles, and wording necessary to load the eOMSI data into the designated Government CMMS and eOMSI documents into the Government Document Management System.
- e. **Review** progress of eOMSI development and discuss issues that need to be resolved.
- f. **Coordinate** requirements for eOMSI training.

1.4.3 Facility Turnover Meetings

Refer to paragraph **FACILITY TURNOVER PLANNING MEETINGS (NAVFAC Red Zone - NRZ)** in **Section 01 30 00**, **ADMINISTRATIVE REQUIREMENTS**, for eOMSI facility turnover meeting requirements.

1.5 UNITS of MEASURE

Provide eOMSI utilizing the units of measure used in the Government created contract documents.

1.6 QUALIFICATIONS of eOMSI PREPARER

Submit Qualifications of eOMSI Preparer that meet the following:

- a. Possess multidiscipline technical knowledge of the operations and maintenance of building systems.
- b. Experience with the type of systems that are identified in this specification and capable of augmenting manufacturer's information to clarify operations instructions.
- c. Experience preparing detailed Operations and Maintenance Manuals for facilities of equal size and complexity as required by this contract
- d. Ability to prepare spreadsheets to be loaded into a CMMS.
- e. Experience presenting training and coordinating a team of manufacturer's representatives to provide training of Facility Users and Maintenance Personnel.

1.7 SUBMITTALS

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

SD-07 Certificates

Qualifications of eOMSI Preparer; G

SD-10 Operation and Maintenance Data

Training Plan; G

For each training session; submit dates start and finish times, and locations; outline of the information to be presented; names and qualifications of the presenters; and list of texts and other materials required to support training.

Training Outline; G

Training Content; G

SD-11 Closeout Submittals

eOMSI, 100 percent, Prefinal Submittal; G

eOMSI, Final Submittal; G

Training Video Recording; G

Validation of Training Completion; G

1.8 SUBMITTAL FORMAT

1.8.1 eOMSI Data Files

Provide eOMSI data on compact disks (CD) or data digital versatile disk (DVD) disks in formats that are compatible with those used on the project. Provide eOMSI Data information by completing the eOMSI Spreadsheet Workbook / Flat File initial templates:

- a. eOMSI Spreadsheet Workbook / Flat File - Equipment Data tab; Provide information to all spreadsheet fields. Obtain the information indicated to be supplied "By KTR using Government info" from the Contracting Officer and fill in this part of the Flat File. Typically identify individual pieces of equipment by RPIE. Group equipment with similar Uniformat classification, design life, install date, remaining service life, and direct condition rating - into manageable CIMUs. Except, when the individual RPIE is complex enough to require its own management planning and in this case the individual RPIE is also a BOTH. Each CIMU shall be greater than \$2,500 in value.
- b. eOMSI Spreadsheet Workbook / Flat File - Equipment Data tab; Provide information to all spreadsheet fields. Group Non-equipment with similar Uniformat classification, design life, install date, remaining service life, and direct condition rating - into manageable CIMUs. Obtain the information indicated to be supplied "By KTR using Government info" from the Contracting Officer to complete that portion of the Flat File. Each CIMU shall be greater than \$2,500 in value.

1.8.2 eOMSI Document Files

Provide eOMSI document files on CD or data DVD disks using the most current version of Adobe Acrobat or similar software capable of producing PDF files that can be used to upload the files into an electronic Government document management system. Bookmark the PDF files for easy access to the information. Bookmark Facility Information and Primary Systems Information to at least one level lower than the major system. Bookmark Product and Drawing Information documents using the current version of Masterformat and arrange submittals using the specification sections as a structure. Use Masterformat and UFGS numbers along with descriptive bookmarking titles that explain the content of the information that is being bookmarked.

Provide the following information on the compact disk label and disk holder/ case:

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

h. Date

i. Virus scanning program used

1.9 SUBMITTAL SCHEDULE

Provide the following eOMSI submittals. Scan electronic files of eOMSI Data and eOMSI Documents for malicious viruses using a commercially available scanning program that is routinely updated to identify/remove current virus threats.

1.9.1 100 percent - Prefinal eOMSI Submittal

Submit four electronically formatted copies of the 100 percent submittal of the eOMSI Data File and eOMSI Document File to the Contracting Officer for approval. The eOMSI, 100 percent, Prefinal Submittal is due 90 calendar days prior to Beneficial Occupancy Date (BOD)/ Placed In Service Date. This submittal shall be a complete, working document that can be used to operate and maintain the facility. Any portion of the submittal that is incomplete or inaccurate will require the entire submittal to be returned for correction. Incorporate all Government requested changes from the eOMSI Development Meetings comments into the Prefinal submission. Provide the same information required for each eOMSI document file CD/ DVD disk label, on the introductory page of each eOMSI submittal volume. Refer to paragraph titled "eOMSI Document Files" of this section for a list of this required introductory page information.

Submit Prefinal submittal when construction is approximately 90 percent complete that include;

a. eOMSI Data Files (Excel)

b. eOMSI Document Files (Bookmarked PDF) that include;

(1) Product and Drawing Information

1.9.1.1 Prefinal eOMSI Submittal Review Duration

Allow the Government a minimum of 30 calendar days to review and approve the submittal, from the time the Government receives the Prefinal eOMSI submittal. If the Prefinal submittal is required to be resubmitted, the Government review of subsequent submittals shall have the same review duration as the first submittal. No extension in project completion date will be granted due to resubmittal.

1.9.2 eOMSI, Final Submittal

Complete the eOMSI Data and Documents and provide Final submittal in Excel and bookmarked PDF format as required in the Prefinal Submittal. Deliver submittals to the Contracting Officer for approval. The Final submittal is due at BOD/ Placed in Service Date. Include all Government requested changes from the Prefinal submittal, and the Project Closeout Meetings to complete the Final submittal.

In addition to the formats stated above, provide four electronic copies of the Final submittal in editable formats. Provide editable eOMSI Document drawing and diagram files in CADD and other editable eOMSI Document files in MS Word or Excel. Refer to Product and Drawing Information below to describe the format of the Record Drawings submission.

1.10 FACILITY SYSTEMS

The project is anticipated to include the following critical systems. Provide eOMSI data, eOMSI documents, and training for all products, materials, and equipment that make up these systems in the final constructed facility, including the following systems:

- a. HVAC facility systems (including chillers, boilers, heat pumps, air handling equipment, exhaust fans, fan coil units, VAV boxes, heat recovery wheels, hot and chilled water hydronic systems, control valves, and backflow preventers)
- b. Direct Digital Controls/Space Temperature Controls
- c. Steam condensate pumps, Steam pressure relief valves.
- d. Electrical systems (including transformers, diesel electric generator sets, automatic transfer switches, primary switchgear, secondary switchgear, high voltage switches, variable frequency drives, and frequency converters).
- e. Fire protection systems and fire alarm detection systems
- f. Cathodic protection
- g. Site civil water utilities (including water, storm water collection, and treatment systems)
- h. Site civil wastewater utilities (including pumping station, tanks, treatment and filters)
- i. Potable water systems (including wells, tanks, pumps, back-flow preventers, filters, disinfection, and controllers)
- j. Site electrical utilities (including substations, transformers, and pad mounted switchgear)

PART 2 PRODUCTS

2.1 DESCRIPTION OF WORK

2.1.1 eOMSI DATA FILES

Provide the following items of data in a format compatible with the CMMS used on the project. Enter all data in the eOMSI Spreadsheet Workbook / Flat File.

2.1.1.1 Equipment Information

- a. Equipment Listing - Provide the following information for each piece of installed equipment and for each applicable item listed on the UEM Asset Classification tab of the eOMSI Spreadsheet Workbook. Enter all information on the Flat File - Equipment Data tab of the eOMSI Spreadsheet Workbook.

(1) Asset_ID

(2) Asset Description

- (3) ORG_ID
- (4) Site_ID
- (5) Building Name
- (6) Asset Type
- (7) Inventory Category
- (8) Location Code
- (9) Design Life
- (10) FCI
- (11) Remaining Service Life
- (12) DCR
- (13) Work Center
- (14) Belongs to (Parent Asset. ID)
- (15) Contract number
- (16) Task/delivery order number
- (17) Drawing reference ID
- (18) Location description
- (19) Master system Unifomat
- (20) System Unifomat
- (21) Subsystem Unifomat
- (22) Quantity
- (23) Install date
- (24) Replacement cost
- (25) Manufacturer
- (26) Model number
- (27) Serial number
- (28) Manufacturer Warranty end date
- (29) Warranty Company Info
- (30) Comment (Such as: Required information not to void warranty)
- (31) Status Date

(32) Asset Status

(33) UEM Classification ID

(34) UEM Classification Description

(35) Job Plan Code (Preventive Maintenance)

The Job Plan List is provided by NAVFAC to identify applicable Job Plan Codes. If NAVFAC does not have a Job Plan for the equipment used, provide information in paragraph entitled Job Plan for Equipment NOT assigned a NAVFAC Job Plan below.

(36) Equipment Tag Number

- b. **Job** Plan for Equipment NOT assigned a NAVFAC Job Plan - Preventive Maintenance Procedures, and Schedules. If the Government cannot provide a job plan for a specific piece of equipment, provide a detailed Job Plan (Preventive Maintenance Plan) using manufacturer's recommendations and sound engineering practice. Show associated frequencies when job plan is to be performed and include detailed preventive maintenance (PM) procedures such as inspections, tests, adjustments required to ensure proper and economical operation and minimize corrective maintenance. For periodic calibrations, provide manufacturer's specified frequency and procedures for each operation. Detailed Job Plans include the following:

- (1) Safety instructions and precautions,
- (2) Including lock out/tag out precautions,
- (3) Required skill level,
- (4) Number of personnel needed,
- (5) Frequency of performing the job plan,
- (6) Special tools needed,
- (7) Parts needed
- (8) Estimated time required to complete the task.
- (9) Lubrication schedules indicating types, grades and capacities.

2.1.1.1.2 Non-Equipment Information

- a. **Provide** the following information for each item of non-equipment. Enter all information on the eOMSI Spreadsheet Workbook - Flat File Non-Equipment Data tab.

- (1) Asset ID
- (2) Asset Description
- (3) ORG_ID
- (4) Site_ID

- (5) Asset Type
- (6) Inventory Category
- (7) Design Life
- (8) FCI
- (9) DCR
- (10) Building Name
- (11) Location Code
- (12) Contract Number
- (13) Task/ Delivery Order Number
- (14) Drawing Reference _ID
- (15) Notes on CIMU Structure
- (16) Master System Unifomat
- (17) System Unifomat
- (18) Subsystem Unifomat
- (19) Quantity
- (20) Install Date
- (21) Remaining Service Life
- (22) Replacement Cost
- (23) Warranty End Date
- (24) Warranty Company Info
- (25) Comments (Such as: Required information not to void warranty)

2.1.1.2 eOMSI DOCUMENT FILES

2.1.1.2.1 Product and Drawing Information

This portion of the eOMSI provides a record of the facility products, materials, equipment, and minimum information necessary to operate the facility. Provide Product and Drawing Information for all systems in the final constructed facility, including the anticipated critical systems identified in this specification section.

- a. **O&M Data.** Include, as a minimum O&M Data, required in the SD-10 Data Packages of the UFGS specifications. Provide the following for each product, material, and system on the project:

- (1) Materials
- (2) Equipment

- (3) Data Sheets
 - (4) Test Reports
 - (5) Warranties
 - (6) Certificates
 - (7) Shop Drawings
- b. **Drawings.** Provide original CADD drawings or original facility design drawings that have been edited to eliminate unneeded information and highlight eOMSI information in PDF format. Provide the following drawings at a large enough scale to be clear, legible, and able to differentiate designated isolation units from surrounding valves and switches.
- (1) **Utility Schematic Diagrams** - Provide a one line schematic diagram for each utility system such as power, water, wastewater, and gas/fuel. Schematic diagram must show from the point where the utility line is connected to the mainline up to the five-foot connection point to the facility. Indicate location or area designation for route of transmission or distribution lines; locations of duct banks, manholes/ handholes or poles; isolation units such as valves and switches; and utility facilities such as pump stations, lift stations, and substations.
 - (2) **Enlarged Connection and Cutoff Plans** - Provide enlarged floor plans that provide information between the five foot utility connection point and where utilities connect to facility distribution. Enlarge floor plans/ elevations of the rooms where the utility enters the building and indicate on these plans locations of the main interior and exterior connection and cutoff points for all utilities. Also enlarge floor plans/ elevations of the rooms where equipment is located. Include enough information to enable someone unfamiliar with the facility to locate the connection and cutoff points. Indicate the room number, panel number, circuit breaker, valve number, etc., of each utility and equipment connection and cutoff point, and what that connection and cutoff point controls.
- c. **Equipment Tags.** Provide equipment tags for all applicable items listed in eOMSI Spreadsheet Workbook/ Asset Identification List tab. Provide tags that are durable, oil and water-resistant and approved by the Contracting Officer. Attach tag with copper wire and spray with a clear silicone waterproof coating. Place tags on the equipment in a visible location that can be read by an inspector in a standing position. Provide tag information to include: Contract Number, Maximo Equipment Identification Numbers, and Equipment Tag Number that corresponds with the drawing. Only equipment with a value of greater than \$2,500 or sized as noted in eOMSI Spreadsheet Workbook/ Asset Identification List tab, shall be tagged.
- Provide** tags for the items listed below in addition to the items listed in eOMSI Spreadsheet Workbook/ Asset Identification List tab:
- (1) **Control** valves for heating, cooling, gas, fuel, water and wastewater for piping 1 1/2 inches or greater. Main interior and

exterior utility cut off valves (no dollar value restriction).

- d. **Record Drawings.** Provide an electronic copy of the Record Drawings for the project in PDF format, bookmarking all drawings using the sheet title and sheet number. Provide the Record Drawings on the same electronic media as used for the eOMSI submittal but on separate disks or files to allow simultaneous use of the eOMSI and Record Drawings.

PART 3 EXECUTION

3.1 eOMSI TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy/ Placed in Service Date, the eOMSI Preparer must provide a comprehensive project-specific Government personnel training program for the systems and equipment of the facility specified in the technical specifications of this Contract. The trainees must include the Facilities Management Specialist_(FEAD)Facility Project Lead, maintenance staff, and applicable building occupants. Coordinate, schedule, and ensure that training is completed. Instructors shall be well-versed in the particular systems that they are presenting. Provide instruction on site at a location approved by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Indicate prior approval of the training plan by the Quality Control Manager (QC) on the submittal forwarded to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer. Include within the plan the following elements:

- a. Equipment included in training.
- b. Intended audience.
- c. Location of training.
- d. Objectives.
- e. Subjects covered including description.
- f. Duration of training on each subject.
- g. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.).
- h. Instructor and instructor qualifications for each subject.

3.1.2 Training Content

The core of this training shall be based on manufacturer's recommendations and the operation and maintenance information defined in Section 01 78 23 OPERATIONS AND MAINTENANCE DATA. The QC is responsible for overseeing and approving the content and adequacy of the training. The eOMSI Preparer and the QC must interview the Government Facilities Management Specialist and the Contracting Officer to determine the special needs and areas where training will be most valuable. The Contracting Officer and QC must decide how rigorous the training should be for each piece of equipment. The

training shall include the following for each Primary System:

- a. **Start-up**, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.
- b. **Relevant** health and safety issues.
- c. **Discussion** of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.

3.1.3 Training Outline

The eOMSI Preparer shall provide each trainee in the course a written course outline, listing the major and minor topics to be discussed by the instructor on each day of the course. Provide the course outline 14 calendar days prior to the training.

3.1.4 Training Video Recording

Provide to the Contracting Officer two copies of the training course in DVD video recording format. Capture within the recording, in video and audio, all instructors' training presentations including question and answer periods with the trainees. Confirm proposed software, used to create the training is compatible with the using activity resources to play the training materials. The recording camera(s) shall be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

3.1.5 Unresolved Questions from Trainees

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

3.1.6 Validation of Training Completion

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

3.1.7 Quality Control Coordination

Coordinate the eOMSI training with the QC in **Section 01 45 00.00 20 QUALITY CONTROL**.

-- End of Section --

SECTION 01 78 30.00 22

GIS DATA DELIVERABLES

11/16

PART 1 GENERAL

1.1 OBJECTIVE

The primary objective of this section is to provide detailed specifications for collection and delivery of geospatial data commonly referred to as Geographic Information System (GIS) data. Additionally, this section shall provide guidance to ensure that all GIS data delivered is compatible and will add value to the [MCAS Cherry Point's Installation Geospatial Information and Services \(IGI&S\) GEODatabase](#).

Failure to comply with the specifications outlined in this document will result in non-acceptance of data deliverables.

1.1.1 Point of Contact for MCAS Cherry Point

The Point of Contact (POC) for assistance in preparation of GIS deliverables is:

MCAS Cherry Point Facilities Systems Service Office
GIS Section
chpt.facssoomb@usmc.mil

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. Submit the following in accordance with Section [01 33 00 SUBMITTAL PROCEDURES](#):

[SD-11 Closeout Submittals](#)

[GIS Data Deliverables; G](#)

1.3 GOVERNMENT GEOSPATIAL DATA AND SCHEMA

1. The IGI&S repository model schema is based on the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) GEOFidelis Data Model with recurring business driven modifications and or adaptations.
 - a. Data will be created and delivered by developing an ARCGIS Personal GEODatabase using ArcGIS 10.1 or higher if a higher version is being utilized by the Government at the time the deliverable is being developed.
 - b. The Contractor shall verify the ArcGIS and schema version, via the CM or PM, at the commencement of this contract. All GIS DATA DELIVERABLES will be created in accordance with the current version and these specifications.
 - c. The Contractor is responsible for requesting the existing GIS

Data, Schema and Domain Properties by means of a Data Request Package (DRP). Receipt of request will include Geospatial Database table structure, schema, Domain configuration, Attribute text format, i.e., case size as well as Meta Data information.

- d. The DRP should be submitted prior to the start of data collection efforts and again on an as needed basis. The Contractor shall ensure that all GIS data has been created and delivered utilizing the most up to date IGI&S GEODatabase schema.
2. The Contractor shall submit a request for a Geospatial DRP to the CM or the PM.
 - a. Request shall be completely filled out and include all the information as instructed on the data request form.
 - b. Request only GIS data and or schema for feature classes that are relevant to the contract and within the boundary of project area.
 - c. Utilize associated Government modified domain structure(s).
 - d. Attach Scope of Work, which is defined by this GIS DATA DELIVERABLES section for each project request.
 - e. Return the DRP to the CM or PM for sponsorship and submittal to the Installation Geospatial Information & Services (IGI&S) Office.
 - f. Incomplete forms may delay receipt of the requested GIS data and Schema.

The following Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) website may offer definitions for Feature data sets; Feature Classes and other applicable information. However, please note that specific Schema or Domain modifications are not available via this resource:

<http://www.sdsfieonline.org/>

1.3.1 Global Positioning System (GPS) and Spatial Reference Properties

GPS data shall be completed in accordance with the GPS Data Collection and Documentation Standards, Version 3 (or higher version if available at the time of this project) as prepared by Geographic Information Coordinating Council (GICC) Statewide Mapping Advisory Committee (SMAC) and adopted by the [North Carolina](#) Geographic Information Coordinating Council.

1. Prior to GPS efforts, ALL underground utilities shall be located utilizing a utility locating service in order to verify and obtain accurate feature locations.
2. Only bench marks included in the [North Carolina](#) Geodetic Survey Base Station Network shall be used for GPS data collection.
3. Mission planning is essential and Contractor shall utilize the best Position Dilution of Precision (PDOP) values for data accuracy.
4. Utility data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" will be collected utilizing Survey Grade GPS data collection methods.

5. Infrastructure data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be collected utilizing Sub-Foot or better GPS data collection methods.
 - a. Spatial accuracy requirements for Survey and Sub-Foot grade data collection are as follows:
 - i. Sub-Foot requirements
 - 1) All points shall be within + 12 inches
 - 2) 95 percent accuracy rate for all points.
 - ii. Survey Grade requirements
 - 1) All points shall be within + 1 centimeter
 - 2) 98 percent accuracy rate for all points
6. Every effort shall be made to capture feature locations without using offsets. All Offsets will be noted in the Final Report for each feature.
7. Excessive offsets included in the Final Data, which shall be referenced in the Final Report, shall be reviewed for quality control.
 - a. Resubmittal of data will be required if PDOP planning was not observed per this specification.

The following GEODatabase Coordinate Systems and Spatial Reference Properties should be used for Marine Corps Air Station, Cherry Point:

1. North Carolina Coordinate System of 1983
 - a. NAD 1983 StatePlane (North American Datum of 1927)
 - b. FIPS 3200 Feet
2. Domain precision of 1000 which will result in a database accuracy of 1/1000 m

1.3.2 Demolished and Abandoned in Place (AIP) features

The Contractor shall reference all Demolished and or AIP features in the data delivered. Should the current feature data class attributes and or domains not reference AIP or demolished features, the Contractor shall be responsible for appropriately delivering these features by creating an associated "Demolished" or AIP feature class, i.e., CLJN.CL.WastewaterUtilitySegment.

The Contractor shall:

1. Utilize a blank schema for the associated feature class.
2. Rename associated feature class and add DEMO or AIP as a prefix, i.e., DEMO.CLJN.CL.WastewaterUtilitySegment, AIP.CLJN.CL.WastewaterUtilitySegment.

3. All demolished and or AIP features should provide existing spatial and non-spatial data which may be copied from existing data.
4. The Contractor will update attributes appropriately to include the following:
 - a. Contract Number
 - b. Drawing Number
 - c. isDemolished
 - d. dateDemolished or dateAIP
 - e. Status

1.3.3 Creating a New Feature Class

Should a new feature class be required that is not readily available in the current GIS schema provided by the Government; the Contractor shall develop the feature class utilizing the schema consistent with the most current version of SDSFIE and document in the Final Report.

1. The Contractor shall include the following modifications (fields) to the schema structure and shall submit all information to the CM or PM for direction and final approval.
 - a. Contract Number
 - b. Drawing Number

1.3.4 GIS Topology Rules

All data must be created using GIS topology rules for polygons, points and lines, such as, but not limited to the following examples:

1. Polygons, Polylines and points rules; please reference illustrating topology rules in ArcGIS at www.esri.com.
2. Polygons must not have slivers.
3. All utility or infrastructure system data, which is, but is not limited to, transportation system and electrical, water, steam distribution, and wastewater collection, etc., will be created using GIS spatial connectivity rules which specify that vertex, edge and endpoints be snapped to features within the system.
4. Features will be snapped to the appropriate item.
5. Data will be created to represent the real world, for example, water, sewer and transportations systems, etc. will be drawn and or created in the direction of flow.
6. Utility and transportation systems will be created from source to sink, etc.
7. Abandoned In Place (AIP) utility lines will be located and updated in the current feature data set and identified as AIP in the attribute table.

1.3.5 Creation of Geographic Data Documentation (METADATA)

For each digital file delivered containing geographic information the Contractor shall provide documentation consistent with the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM). Both 'GEOFidelis Mandatory' and 'FGDC Mandatory' fields shall be completed for each geographic data set.

The Geospatial Information & Services (IGI&S) Metadata Authoring Guide is included in the DRP package.

Metadata generation tools included in the ArcGIS suite of software (or equivalent technology) shall be used in the production of the required metadata in XML format. Regardless of the tools used for metadata creation, the Contractor must ensure that the metadata is delivered in XML format and can be easily imported into the IGI&S GEODatabase. A copy of the FGDC metadata standard can be obtained on the internet at <http://www.fgdc.gov> or by contacting:

Federal Geographic Data Committee
590 National Center
Reston, Virginia 20192
Email: fgdc@fgdc.gov

(NOTE: The metadata should be formatted from the Government perspective, not the Contractor project perspective. Therefore such items as Point of Contact (POC) should be the POC currently associated with the data and NOT the Contractor's Project Manager. The Contractor shall use language and format consistent with existing metadata.)

1.3.6 New Feature Class Requirements

When developing a new feature class, the Contractor shall develop the initial structure consistent with the most current version of SDSFIE.

- a. If further modifications to the database structure are required, the Contractor shall consult with the Government Project Manager for direction and final approval.
- b. All new feature data classes shall be created in compliance with SDSFIE noted on the final report.

1.3.7 GIS Submittals Guidelines

All GIS Submittals will be submitted to the CM or PM and then analyzed by Government GIS personnel prior to final approval. Failure to comply with the specifications outlined in this document will result in non-acceptance of data deliverables.

1. Prior to any database development, the Contractor shall provide the Government with a technical approach document for review and approval. The Technical Approach document will describe in detail the Contractor's technical approach to designing and developing the database.
2. All attributes shall be populated in accordance with the "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" and shall be obtained via contract specifications, plans and record drawings.

3. The Contractor may be required to conduct research, collect data and make copies of reports and studies as necessary to verify existing and/or record drawing data. Record drawing data and closed contracts can be located in the Technical Records Section in the Public Works Department.
4. Raw GPS data and collection data files shall be included with every phase of delivery.
5. Actual spatial and non-spatial conditions in the field always supersede drawings. It is the Contractor's responsibility to locate and field verify all features to ensure attribute data and location is correctly recorded.
6. The Contractor shall submit a preliminary review of data at 15 to 25 percent contract completion to ensure specifications compliance.
7. The Contractor shall deliver digital geographic maps, GPS collection files and related data. All working text and documents and personal geodatabase shall be included for review in the draft and final delivery of data.
 - a. All maps of **GIS DATA DELIVERABLES** will be ANSI C size and include a project title, contract number, scale, legend, standard symbology, attributes, i.e., building numbers, road names, segment diameters, etc.
8. The Contractor may be required to provide a technical consultant to meet on site.
9. The Contractor shall not deliver blank unused schema or feature class data with no attributes. Deliver only data pertinent to the contract that adds value to the GEODatabase per this section.
10. The Contractor shall deliver GIS Data at the end of each phase for all Phased Projects and Construction projects.
11. The Contractor accepts the responsibility to perform quality assurance for all data and related materials required in the section prior to submitting product to the Government.
12. The data will be analyzed for discrepancies in subject content, correct format in accordance with this statement of work, and compatibility with the existing GIS system as well as all other specifications in this section.

1.3.8 Formats, Versions and Guidelines

All data deliverables will be in the following formats and/or versions.

1. GIS data will be provided in an ArcGIS 10.1 or higher if a higher version is being used by the Government at the time of this project. The Contractor shall verify the ArcGIS version, via the CM or PM at the commencement of this contract.
2. Microsoft Office (MS) Suite data shall be delivered in MS 2010.
3. Microsoft Windows 7 operating system, unless otherwise approved by the

Government.

4. All reports and maps will be delivered as a hard copy and in a searchable Adobe Portable Document Format (PDF).
5. All text, spreadsheet, and database files, reports and maps shall be delivered on Compact Disc read - only memory (CD-ROM) or Digital Versatile Disc read - only memory (DVD-ROM).
6. The Contractor shall verify required version(s) of software and schema, via the CM or PM.
7. Map submittals shall accompany each geospatial deliverable.
 - a. Include ANSI C map for each project/area.
 - b. Data should be labeled and attributed per specification.
 - c. All maps should include the date, a legend, scale, contract title and number.

1.3.9 Final Report Requirements with additional Guidelines

The Contractor shall follow the following:

1. Specific procedures and list of equipment, software and versions that were utilized for the GPS data collection and creation of geospatial data.
2. Submit all GPS data files.
3. Provide the date(s) the IGI&S schema and geospatial data was received.
4. Provide steps taken to create the GEODatabase.
5. Provide details on any offsets to include justification as to why offsets were utilized and on which features and or points offsets were used.
6. Describe all modifications to the geodatabase to include the name of all new features classes, i.e., new, demolished or AIP.
7. Provide the source that was utilized for required attributes.
 - a. Include an ANSI C size copy of all design drawings that were referenced in the attribute data. This information should be included in all phases of delivery to include draft and final reviews.
 - b. Provide the overall utility site plan drawing(s) with each submittal.
8. Specify Deliverable "Draft #" or "Final Submittal" when data is submitted to the CM or PM for review.
9. Provide the name and contact information for the GIS Technical Point of Contact who can answer questions regarding the data deliverable.
10. GIS DATA DELIVERABLES must be provided in a format that does not

require translation or pre/post processing prior to being loaded into the IGI&S GEODatabase.

11. Provide any miscellaneous information that the Contractor deems significant.
12. Provide the current version of the GIS DATA DELIVERABLES specification utilized for this contract submittal.

1.3.10 Ownership

All digital files, final hardcopy products, GPS raw data, source data acquired for this project, and related materials, including that furnished by the Government, shall become the property of the Government and will not be issued, posted, distributed, or published by the Contractor.

Note: No endorsement of software or hardware is implied.

1.4 ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES

For Attributes and Data Collection of specific MCAS Cherry Point features please consult the Cherry Point IGI&S Manager, chpt.facssoomb@usmc.mil, for a checklist and copy of the most recent Data Dictionary.

1.4.1 Non-Compliance

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Note: Geospatial data delivery does not replace record drawing requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 02 41 00

DEMOLITION
05/10

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K (2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145 (1991; R 2012) Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

AASHTO T 180 (2015) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (Jun 2000; Reaffirmed Oct 2010) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders
<http://www.aviation.dla.mil/UserWeb/aviationengineering/>

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M (2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures

MIL-STD-129 (2014; Rev R) Military Marking for Shipment and Storage

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

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 173.301	Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a [Demolition Plan](#) and submit proposed demolition, and removal procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be [removed](#), coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.2.2 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the station daily; do not allow accumulations inside or outside the buildings. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with [EM 385-1-1](#), Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements [and](#) pavements to remain. 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.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.3.3 Trees

Protect trees within the project site which might be damaged during demolition or deconstruction, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

1.3.4 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. .

1.3.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted

1.5 SUBMITTALS

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

SD-01 Preconstruction Submittals

Demolition Plan; G

Existing Conditions

SD-07 Certificates

Notification; G

SD-11 Closeout Submittals

Receipts

1.6 QUALITY ASSURANCE

Submit timely **notification** of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with **40 CFR 61**, Subpart M. Notify the State's environmental protection agency and local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with **40 CFR 61**, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in **ASSE/SAFE A10.6**. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.7 PROTECTION

1.7.1 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the **work** being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized **4 inch** will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the

Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

2.1 FILL MATERIAL

- a. Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures.
- b. Fill material shall conform to the definition of satisfactory soil material as defined in [AASHTO M 145](#), Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material shall be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than [2 inches](#) in any dimension.
- c. Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180 , Method B or D

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Utilities and Related Equipment

3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities , as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area.

3.1.2 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.3 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain, and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as specified for the new work. Provide square, straight edges and corners where existing masonry adjoins new work and other locations.

3.1.4 Concrete

Saw concrete along straight lines to a full depth of the pavement section. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

3.1.5 Miscellaneous Metal

Scrap metal shall become the Contractor's property. Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

3.1.6 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Concrete and Masonry: Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

3.1.7 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)." Turn in salvaged Class I ODS refrigerants as specified in paragraph, "Salvaged Materials and Equipment."

3.1.8 Locksets on Swinging Doors

Remove all locksets from all swinging doors indicated to be removed and disposed of. Deliver the locksets and related items to a designated location for receipt by the Contracting Officer after removal.

3.1.9 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Do not remove equipment until approved.

3.1.9.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, shall be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

3.1.9.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated for reuse, as scrap metal.

3.1.9.3 Ducts

Classify removed duct work as scrap metal.

3.1.9.4 Fixtures, Motors and Machines

Remove fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations.

3.1.10 Electrical Equipment and Fixtures

Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system.

3.1.10.1 Fixtures

Remove electrical fixtures.

3.1.10.2 Electrical Devices

Remove switches, switchgear, transformers, conductors including wire and

nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items.

3.1.10.3 Wiring Ducts or Troughs

Remove wiring ducts or troughs.

3.1.11 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.2.2 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.2.3 Salvaged Materials and Equipment

Remove materials and equipment that are specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, as indicated.

- a. Remove and capture all Class I ODS refrigerants in accordance with the Clean Air Act Amendment of 1990, and turn in to the Navy by shipping the refrigerant container to the Defense Logistics Agency at the following address:

Defense Depot Richmond VA (DDRV)
SW0400
Cylinder Operations
8000 Jefferson Davis Highway
Richmond, VA 23297-5900

3.2.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and

provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

3.2.4.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment
- e. National stock number (for information, call (804) 279-4525).

3.2.4.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.2.5 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.2.6 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable combustible material in the sanitary land fill area located off the site.

3.3 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.4 DISPOSAL OF REMOVED MATERIALS

3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified .

3.4.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.4.3 Removal to Spoil Areas on Government Property

Transport noncombustible materials removed from demolition and deconstruction structures to designated spoil areas on Government property.

3.4.4 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.5 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

SECTION 02 51 00

SURFACE CLEANING DECONTAMINATION

03/18

PART 1 GENERAL

1.1 SCOPE

Provide labor, material, equipment and services necessary for, and reasonably incidental to, furnishing and installing surface cleaning decontamination work indicated within the Instruments of Service. Incorporate related accessories and specialties to accomplish a complete and proper installation. Coordinate and schedule this work with the work of other trades to ultimately provide superior workmanship in the finished product.

Unless otherwise so qualified, engage an experienced, qualified and competent decontamination trade to perform this work.

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Surface Cleaning Decontamination Conference

SD-02 Shop Drawings

Procedures; G

1.3 Surface Cleaning Decontamination Conference

Schedule a Surface Cleaning Decontamination Conference to review substrates and material assemblies.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 INSTALLATION

A decontamination trade with a minimum of five years of experience in installations of a similar type, scope and scale is to perform work.

Protect equipment and machinery from free falling contamination. Isolate areas beyond the construction limits to prevent the spread of dust and debris. Use commercial equipment designed to access and clean substrates encountered.

Perform high overhead and factory cleaning [procedures](#). Remove dust, debris and grease contamination from piping, ductwork exteriors, conduit, light

fixture bodies, trusses, rafters, beams, ceiling decking, storage racks, shelving and similar overhead items.

Scrub glass windows with a solution of water and detergent. Clean interior surfaces.

Use dry ice blasting methods to eliminate medium and chemical residue clean up. Remove paint, oil, grease, asphalt, tar, decals, soot, dirt, ink, resins, barnacles, coolant, mildew, adhesives and similar contamination. Deliver carbon dioxide via compressed air through a jet nozzle at -164.7 degrees F and in the form of small, rice sized dry ice pellets. The frigid temperature of the dry ice pellets causes contamination and surface coatings to shrink and become unadhered from substrates. As coatings loosen, dry ice penetration behind coatings transforms into expansive carbon dioxide gas that further accelerates coating removal. Carbon dioxide gas is absorbed by the atmosphere limiting clean up to the contamination and surface coatings removed.

-- End of Section --

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

05/14

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 CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 301	(2010; ERTA 2015) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(1996; R 2008) Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 306R	(2010) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI 318	(2014; Errata 1-2 2014; Errata 3 2015) Building Code Requirements for Structural Concrete and Commentary
ACI 347	(2004; Errata 2008; Errata 2012) Guide to Formwork for Concrete
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

ACI SP-2 (2007; Abstract: 10th Edition) ACI Manual
of Concrete Inspection

ACI SP-66 (2004) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M (2011) Structural Welding Code -
Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M (2015) Standard Specification for
Carbon-Steel Wire and Welded Wire
Reinforcement, Plain and Deformed, for
Concrete

ASTM A53/A53M (2012) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM A615/A615M (2015a) Standard Specification for
Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement

ASTM A706/A706M (2014) Standard Specification for
Low-Alloy Steel Deformed and Plain Bars
for Concrete Reinforcement

ASTM A934/A934M (2013) Standard Specification for
Epoxy-Coated Prefabricated Steel
Reinforcing Bars

ASTM A996/A996M (2015) Standard Specification for
Rail-Steel and Axle-Steel Deformed Bars
for Concrete Reinforcement

ASTM C1017/C1017M (2013; E 2015) Standard Specification for
Chemical Admixtures for Use in Producing
Flowing Concrete

ASTM C1077 (2015) Standard Practice for Laboratories
Testing Concrete and Concrete Aggregates
for Use in Construction and Criteria for
Laboratory Evaluation

ASTM C1107/C1107M (2014a) Standard Specification for
Packaged Dry, Hydraulic-Cement Grout
(Nonshrink)

ASTM C1157/C1157M (2011) Standard Specification for
Hydraulic Cement

ASTM C1260 (2014) Standard Test Method for Potential
Alkali Reactivity of Aggregates
(Mortar-Bar Method)

ASTM C138/C138M (2014) Standard Test Method for Density

	("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2012) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2015) Standard Specification for Portland Cement
ASTM C1602/C1602M	(2012) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C172/C172M	(2014a) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C192/C192M	(2015) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C311/C311M	(2013) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
ASTM C33/C33M	(2016) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2015a) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2013) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C494/C494M	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C567/C567M	(2014) Determining Density of Structural Lightweight Concrete
ASTM C595/C595M	(2015; E 2015) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2012a) Standard Specification for Coal

Fly Ash and Raw or Calcined Natural
Pozzolan for Use in Concrete

ASTM C78/C78M	(2015a) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2014) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2004a; R 2013) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D2628	(1991; R 2011) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2835	(1989; R 2012) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D5759	(2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2012) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E1643	(2011) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2011) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
ASTM E329	(2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP (2009; 28th Ed) Manual of Standard Practice

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001 (2000) Principles and Criteria for Forest Stewardship

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC (2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, ground granulated blast-furnace slag, and silica fume.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Supplementary cementing materials" (SCM) include coal fly ash, silica fume, granulated blast-furnace slag, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.
- e. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.
- f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.
- g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.
- h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.
- i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

- j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Plan; G

Quality Control Personnel Certifications; G

Quality Control Organizational Chart

Laboratory Accreditation; G

SD-02 Shop Drawings

Reinforcing Steel; G

SD-03 Product Data

Joint Sealants;

Joint Filler;

Materials for Forms

Recycled Aggregate Materials;

Cementitious Materials;

Vapor retarder

Concrete Curing Materials

Reinforcement;

Liquid Chemical Floor Hardener

Admixtures

Mechanical Reinforcing Bar Connectors

Local/Regional Materials;

Biodegradable Form Release Agent

SD-05 Design Data

Concrete Mix Design; G

SD-06 Test Reports

Concrete Mix Design; G

Fly Ash

Pozzolan

Ground Granulated Blast-Furnace Slag

Aggregates

Compressive Strength Tests; G

Unit Weight of Structural Concrete

Air Content

Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Welder Qualifications

Forest Stewardship Council (FSC) Certification

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Liquid Chemical Floor Hardener

Curing Compound

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor retarder, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

1.6 QUALITY ASSURANCE

1.6.1 Design Data

1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, complementary cementitious materials, , and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, complementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

1.6.2 Shop Drawings

1.6.2.1 Reinforcing Steel

ACI SP-66. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.6.3 Test Reports

1.6.3.1 Fly Ash and Pozzolan

Submit test results in accordance with **ASTM C618** for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.6.3.2 Ground Granulated Blast-Furnace Slag

Submit test results in accordance with **ASTM C989/C989M** for ground granulated blast-furnace slag. Submit test results performed within 6 months of submittal date.

1.6.4 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of [ACI 121R](#) and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of [ACI SP-15](#) and [CRSI 10MSP](#) at project site.

1.6.5 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a [quality control organizational chart](#) defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

- a. CQC personnel responsible for inspection of concrete operations.
- b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
- c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

1.6.5.1 Quality Manager Qualifications

The quality manager must hold a current license as a professional engineer in a U.S. state or territory with experience on at least five (5) similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

1.6.5.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

- a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with [ACI SP-2](#) or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in [ACI SP-2](#).
- b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of [ASTM E329](#).
- c. Testing agencies that perform testing services on concrete materials must meet the requirements of [ASTM C1077](#).

1.6.6 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the

requirements of **ASTM C1077** and be Cement and Concrete Reference Laboratory (CCRL) inspected.

1.6.7 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with **ASTM C1077**, including **ASTM C78/C78M** and **ASTM C1260**. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

- a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state or territory competent in concrete materials who is competent in concrete materials and must sign all reports and designs.
- b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by **ASTM C31/C31M**.
- c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing period or for 72 hours after installation:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between **55 degrees F** and **84 degrees F** and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.7.1 Submittals for Environmental Performance

- a. Provide data indication the percentage of post-industrial pozzolan (fly ash, blast furnace slag) cement substitution as a percentage of the full product composite by weight.
- b. Provide data indicating the percentage of post-industrial and post-consumer recycled content aggregate.
- c. Provide product data indicating the percentage of post-consumer recycled steel content in each type of steel reinforcement as a percentage of the full product composite by weight.
- d. Provide product data stating the location where all products were manufactured

- e. For projects using FSC certified formwork, provide chain-of-custody documentation for all certified wood products.
- f. For projects using reusable formwork, provide data showing how formwork is reused.
- g. Provide MSDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.
- h. Provide MSDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

1.8 SUSTAINABLE DESIGN REQUIREMENTS

1.8.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total local material requirements. Concrete materials may be locally available. Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

1.8.2 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

1.9 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with AWS D1.4/D1.4M.

Verify that Welder qualifications are in accordance with AWS D1.4/D1.4M or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

PART 2 PRODUCTS

2.1 MATERIALS FOR FORMS

Provide wood, plywood, plastic, carton, or steel. Use plywood or steel forms where a smooth form finish is required.

2.2 CONCRETE MIX DESIGN

2.2.1 Contractor-Furnished Mix Design

ACI 211.1, ACI 301, ACI 318, and ACI 304.2R except as otherwise specified. Indicate the compressive strength (f'c) of the concrete for each portion of

the structure(s) as specified below. Where faster set time is required, use Type III cement before using calcium chloride with approval from the contracting officer.

2.2.1.1 Footings

Proportion normal-weight concrete mixture as follows:

- a. Minimum Compressive Strength: 3000 psi at 28 days.
- b. Maximum Water-Cementitious Materials Ratio: 0.45.
- c. Slump Limit: 5 inches, plus or minus 1 inch.
- d. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2 inch nominal maximum aggregate size.

2.2.1.2 Slab-on-Grade

Proportion normal-weight concrete mixture as follows:

- a. Minimum Compressive Strength: 4000 psi or 3000 psi at 28 days where indicated.
- b. Maximum Water-Cementitious Materials Ratio: 0.45.
- c. Slump Limit: 5 inches, plus or minus 1 inch.
- d. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2 inch nominal maximum aggregate size.
- e. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.2.1.3 Mix Proportions for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C39/C39M. Samples of all materials used in mixture proportioning studies must be representative of those proposed for use in the project and must be accompanied by the manufacturer's or producer's test report indicating compliance with these specifications. Base trial mixtures having proportions, consistencies, and air content suitable for the work on methodology described in ACI 211.1. In the trial mixture, use at least three different water-cementitious material ratios for each type of mixture, which must produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cementitious material ratio allowed must be based on equivalent water-cementitious material ratio calculations as determined by the conversion from the weight ratio of water to cement plus pozzolan by weight equivalency method. Design laboratory trial mixture for maximum permitted slump and air content. Each combination of material proposed for use must have separate trial mixture, except for accelerator or retarder use can be provided without separate trial mixture. Report the temperature of concrete in each trial batch. For each water-cementitious material ratio, at least three test cylinders for each test age must be made and cured in accordance with ASTM C192/C192M

and tested in accordance with [ASTM C39/C39M](#) for 7, 28, 56 days. From these results, plot a curve showing the relationship between water-cementitious material ratio and strength for each set of trial mix studies. In addition, plot a curve showing the relationship between 7 and 28 56 day strengths.

2.2.1.4 Required Average Strength of Mix Design

The selected mixture must produce an average compressive strength exceeding the specified strength by the amount indicated in [ACI 301](#), but may not exceed the specified strength at the same age by more than 20 percent. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation must be calculated and the required average compressive strength must be determined in accordance with [ACI 301](#).

2.2.2 Ready-Mix Concrete

Provide concrete that meets the requirements of [ASTM C94/C94M](#).

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by [ASTM C94/C94M](#):

Type and brand cement

Cement and complementary cementitious materials content in 94-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water cementitious material ratio

2.2.3 Concrete Curing Materials

Provide concrete curing material in accordance with [ACI 301](#) Section 5 and [ACI 308.1](#) Section 2. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

2.3 MATERIALS

2.3.1 Cementitious Materials

For exposed concrete, use one manufacturer and one source for each type of cement, ground slag, fly ash, and pozzolan.

2.3.1.1 Fly Ash

[ASTM C618](#), Class F, except that the maximum allowable loss on ignition must not exceed 6 percent. Class F fly ash for use in mitigating Alkali-Silica Reactivity must have a Calcium Oxide (CaO) content of less than 8 percent and a total equivalent alkali content less than 1.5 percent.

Add with cement. Fly ash content must be a minimum of 15 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level,

provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with [ASTM C311/C311M](#). Evaluate and classify fly ash in accordance with [ASTM D5759](#).

2.3.1.2 Raw or Calcined Natural Pozzolan

Natural pozzolan must be raw or calcined and conform to [ASTM C618](#), Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and must have an ignition loss not exceeding 3 percent. Class N pozzolan for use in mitigating Alkali-Silica Reactivity must have a Calcium Oxide (CaO) content of less than 13 percent and total equivalent alkali content less than 3 percent.

2.3.1.3 Ultra Fine Fly Ash and Ultra Fine Pozzolan

Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to [ASTM C618](#), Class F or N, and the following additional requirements:

- a. The strength activity index at 28 days of age must be at least 95 percent of the control specimens.
- b. The average particle size must not exceed 6 microns.
- c. The sum of SiO₂ + Al₂O₃ + Fe₂O₃ must be greater than 77 percent.

2.3.1.4 Ground Granulated Blast-Furnace Slag

[ASTM C989/C989M](#), Grade 120. Slag content must be a minimum of 50 percent by weight of cementitious material.

2.3.1.5 Portland Cement

Provide cement that conforms to [ASTM C150/C150M](#), Type II, low alkali with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali content of 0.80 percent Na₂O_e (sodium oxide) equivalent.. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

Supplier must certify that no hazardous waste is used in the fuel mix or raw materials.

2.3.1.6 Blended Cements

Blended cement must conform to [ASTM C595/C595M](#) and [ASTM C1157/C1157M](#), Type IP or IS, including the optional requirement for mortar expansion and sulfate soundness and consist of a mixture of [ASTM C150/C150M](#) Type I, or Type II cement and a complementary cementing material. The slag added to the Type IS blend must be [ASTM C989/C989M](#) ground granulated blast-furnace slag. The pozzolan added to the Type IP blend must be [ASTM C618](#) Class F and must be interground with the cement clinker. The manufacturer must state in writing that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. The percentage and type of mineral admixture used in the blend must not change from that submitted for the aggregate evaluation and mixture proportioning.

2.3.2 Water

Water must comply with the requirements of [ASTM C1602/C1602M](#). Minimize the amount of water in the mix. Improve workability by adjusting the grading

rather than by adding water. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete. Submit test report showing water complies with [ASTM C1602/C1602M](#).

2.3.3 [Aggregates](#)

[ASTM C33/C33M](#), except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Provide aggregates that do not contain any substance which may be deleteriously reactive with the alkalis in the cement. Submit test report showing compliance with [ASTM C33/C33M](#).

2.3.3.1 [Aggregates/Combined Aggregate Gradation \(Floor Slabs Only\)](#)

[ASTM C33/C33M](#), uniformly graded and as follows: Nominal maximum aggregate size of 1 inch. A combined sieve analysis must indicate a well graded aggregate from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3mm). Provide sand that is at least 50 percent natural sand.

2.3.3.2 [Recycled Aggregate Materials](#)

Use a minimum of 25 percent recycled aggregate, depending on local availability and conforming to requirements of the mix design. Recycled aggregate to include: recovered concrete and recovered stone that meets the aggregate requirements specified. Submit recycled material request with the aggregate certification submittals and do not use until approved by the Contracting Officer.

2.3.4 [Nonshrink Grout](#)

[ASTM C1107/C1107M](#).

2.3.5 [Admixtures](#)

[ASTM C494/C494M](#): Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures. Submit product data for admixtures used in concrete.

2.3.5.1 [Air-Entraining](#)

[ASTM C260/C260M](#).

2.3.5.2 [High Range Water Reducer \(HRWR\) \(Superplasticizers\)](#)

[ASTM C494/C494M](#), Type F and Type G (HRWR retarding admixture) and [ASTM C1017/C1017M](#). Silica fume and HRWR must come from the same manufacturer.

2.3.6 [Vapor Retarder](#)

[ASTM E1745](#) Class A reinforced polyethylene sheeting, minimum 15 mil thickness or other equivalent material with a maximum permeance rating of 0.03 perms per [ASTM E96/E96M](#).

Consider plastic vapor retarders and adhesives with a high recycled

content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.3.7 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 Type I or II. Material must be 1/2 inch thick, unless otherwise indicated.

2.3.8 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

2.3.8.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

2.3.8.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T .

2.3.8.3 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

2.3.8.4 Lubricant for Preformed Compression Seals

ASTM D2835.

2.3.9 Biodegradable Form Release Agent

Provide form release agent that is colorless, biodegradable, and water-based, with a low (maximum of 55 grams/liter (g/l)) VOC content. A minimum of 85 percent of the total product must be biobased material. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide form release agent that does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene. Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.

2.4 REINFORCEMENT

2.4.1 Reinforcing Bars

ACI 301 unless otherwise specified. Use deformed steel. ASTM A615/A615M with the bars marked A, Grade 60; or ASTM A996/A996M with the bars marked R, Grade 60, or marked A, Grade 60. Provide reinforcing bars that contain a minimum of 100 percent recycled content. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements. Reinforcing bars may contain post-consumer or post-industrial recycled content. Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project. Submit mill certificates for reinforcing bars.

2.4.1.1 Weldable Reinforcing Bars

Provide weldable reinforcing bars that conform to ASTM A706/A706M and ASTM A615/A615M and Supplement S1, Grade 60, except that the maximum carbon

content must be 0.55 percent.

2.4.2 Mechanical Reinforcing Bar Connectors

ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.

2.4.3 Wire

2.4.3.1 Welded Wire Reinforcement

ASTM A1064/A1064M. Provide wire reinforcement that contains a minimum of 100 percent recycled content. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements. Wire reinforcement may contain post-consumer or post-industrial recycled content. Provide flat sheets of welded wire reinforcement for slabs and toppings.

2.4.3.2 Steel Wire

Wire must conform to **ASTM A1064/A1064M.**

2.4.4 Reinforcing Bar Supports

Supports include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place.

Provide wire bar type supports of coated or non-corrodible material conforming to **ACI SP-66** and **CRSI 10MSP.**

Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

Minimum 10 percent post-consumer recycled content, or minimum 40 percent post-industrial recycled content. See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements. Plastic and steel may contain post-consumer or post-industrial recycled content.

2.4.5 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to **ASTM A615/A615M**, Grade 40. Provide dowel pipe that is steel conforming to **ASTM A53/A53M.**

2.5 FLOOR FINISH MATERIALS

2.5.1 Liquid Chemical Floor Hardener

Hardener must be a colorless aqueous solution containing a blend of inorganic silicate or siliconate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufacturer's instructions for placement of liquid chemical floor hardener.

Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content.

PART 3 EXECUTION

3.1 EXAMINATION

Do not begin installation until substrates have been properly constructed; verify that substrates are level.

If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.

Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

3.2.1 General

Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Foundations and Footings

When subgrade material is semiporous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

3.2.3 Subgrade Under Slabs on Ground

Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

Previously constructed subgrade or fill must be cleaned of foreign materials.

Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

3.2.4 Edge Forms and Screed Strips for Slabs

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off

templates or approved compacting-type screeds.

3.2.5 Reinforcement and Other Embedded Items

Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

3.3 FORMS

Provide forms, shoring, and scaffolding for concrete placement in accordance with [ACI 301](#) Section 2 and 5 and [ACI 347](#). Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete [0.75 inch](#) unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris.

3.3.1 Coating

Before concrete placement, coat the contact surfaces of forms with a form release agent.

3.3.2 Reshoring

Reshore concrete elements in accordance with [ACI 301](#) Section 2.

3.3.3 Reuse

Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.

3.3.4 Forms for Standard Rough Form Finish

Provide formwork in accordance with [ACI 301](#) Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.5 Forms for Standard Smooth Form Finish

Provide formwork in accordance with [ACI 301](#) Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view. Do not provide mockup of concrete surface appearance and texture.

3.3.6 Form Ties

Provide ties in accordance with [ACI 301](#) section 2.

3.3.7 Tolerances for Form Construction

Construct formwork to ensure that after removal of forms and prior to patching and finishing of formed surfaces, provide concrete surfaces in accordance with tolerances specified in [ACI 301](#) Section 5 and [ACI 117](#).

3.3.8 Removal of Forms and Supports

After placing concrete, removal of forms must be in accordance with [ACI 301](#) Section 2 except as modified by approved form removal schedule.

3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI 301 and **ACI SP-66**. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3.4.1 General

Provide details of reinforcement that are in accordance with **ACI 301** and **ACI SP-66** and as specified.

3.4.2 Vapor Retarder

Install in accordance with **ASTM E1643**. Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of **12 inches** and tape. Remove torn, punctured, or damaged vapor retarder material and provide with new vapor retarder prior to placing concrete. Concrete placement must not damage vapor retarder.

3.4.3 Perimeter Insulation

Install perimeter insulation at locations indicated. Adhesive must be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.4.4 Reinforcement Supports

Support reinforcement in accordance with **ACI 301** Section 3. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least **2 inches** beyond the point of contact with the bars.

3.4.5 Splicing

As indicated. For splices not indicated **ACI 301**. Do not splice at points of maximum stress. Overlap welded wire reinforcement the spacing of the cross wires, plus **2 inches**. **AWS D1.4/D1.4M**. Approve welded splices prior to use.

3.4.6 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.4.7 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.4.8 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

Provide fabrication tolerances that are in accordance with ACI 318 and ACI SP-66.

Provide hooks and bends that are in accordance with ACI 318 and ACI SP-66.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Tolerance on nominally square-cut, reinforcing bar ends must be in accordance with ACI SP-66.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.4.9 Placing Reinforcement

Place reinforcement in accordance with ACI 301 and ACI SP-66.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than 1 inch from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not larger than 3-1/2 by 3-1/2 inches, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 318, ACI SP-66 and CRSI 10MSP. Do not use supports to

support runways for concrete conveying equipment and similar construction loads.

Equip supports on ground and similar surfaces with sand-plates.

Support welded wire reinforcement as required for reinforcing bars.

Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to ACI SP-66.

Bending of reinforcing bars partially embedded in concrete is permitted only as specified in ACI SP-66 and ACI 318.

3.4.10 Spacing of Reinforcing Bars

Spacing must be as indicated. If not indicated, spacing must be in accordance with the ACI 318 and ACI SP-66.

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.4.11 Concrete Protection for Reinforcement

Concrete protection must be in accordance with the ACI 318 and ACI SP-66.

3.4.12 Welding

Welding must be in accordance with AWS D1.4/D1.4M.

3.5 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.5.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

3.5.2 Mixing

ASTM C94/C94M, ACI 301 and ACI 304R. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as

follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

3.5.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.6 PLACING CONCRETE

Place concrete in accordance with [ACI 301](#) Section 5.

3.6.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of [4 inches](#) greater than indicated.

3.6.2 Pumping

[ACI 304R](#) and [ACI 304.2R](#). Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed [2 inches](#) at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of coarse aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

3.6.3 Cold Weather

[ACI 306.1](#). Do not allow concrete temperature to decrease below [50 degrees F](#). Obtain approval prior to placing concrete when the ambient temperature is below [40 degrees F](#) or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain [50 degrees F](#) minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to [37 degrees F](#) in any 1 hour and [50 degrees F](#) per 24 hours after heat application.

3.6.4 Hot Weather

Maintain required concrete temperature using Figure 4.2 in [ACI 305R](#) to prevent the evaporation rate from exceeding [0.2 pound of water per square foot](#) of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh

concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.6.5 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

3.7 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

3.7.1 Mixing Equipment

Before concrete pours, designate Contractor-owned site meeting environmental standards for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.7.2 Hardened, Cured Waste Concrete

Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement. Use hardened, cured waste concrete as aggregate in concrete mix if approved by Contracting Officer.

3.7.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.7.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material. Return excess cement to supplier. Institute deconstruction and construction waste separation and recycling for use in manufacturer's programs. When such a program is not available, seek local recyclers to reclaim the materials.

3.8 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.8.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

3.8.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

3.8.3 Formed Surfaces

3.8.3.1 Tolerances

ACI 117 and as indicated.

3.8.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

3.8.3.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

3.8.4 Smooth-Rubbed Finish

Provide a smooth-rubbed finish per ACI 301 Section 5 in the locations indicated.

3.9 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI 301 and ACI 302.1R, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Depress the concrete base slab where quarry tile or ceramic tile, are indicated. Steel trowel and fine-broom finish concrete slabs that are to receive quarry tile, ceramic tile, or paver tile. Where straightedge measurements are specified, Contractor must provide straightedge.

3.9.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.9.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. Finish concrete in accordance with [ACI 301](#) Section 5 for a scratched finish.

3.9.1.2 Floated

Use for surfaces to receive waterproofing membranes, sand bed terrazzo, and exterior slabs where not otherwise specified. Finish concrete in accordance with [ACI 301](#) Section 5 for a floated finish.

3.9.1.3 Steel Troweled

Use for floors intended as walking surfaces and for reception of floor coverings. Finish concrete in accordance with [ACI 301](#) Section 5 for a steel troweled finish.

3.9.1.4 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with [ACI 301](#) Section 5 for a broomed finish.

3.9.1.5 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by a burlap drag. Drag a strip of clean, wet burlap from [3 to 10 feet wide and 2 feet longer](#) than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of [1/8 inch](#).

3.9.1.6 Chemical-Hardener Treatment

Apply liquid-chemical floor hardener where indicated after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat must be one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow to dry 24 hours between coats.

Approved proprietary chemical hardeners must be applied in accordance with manufacturer's printed directions.

3.9.1.7 Colored Wear-Resistant Finish

Give finish to monolithic slab surfaces where indicated.

Apply dry shake materials for colored wear-resistant finish at the rate of [60 pounds per 100 square feet](#) of surface.

Immediately following first floating operation, approximately two-thirds of specified weight of dry shake material must be uniformly distributed over surface and embedded by means of power floating. After first dry-shake application has been embedded, uniformly distribute remainder of dry-shake material over surface at right angles to first dry-shake application and

embed by means of power floating. Trueness of surface and other requirements for floating operations not specified in this paragraph must be as specified for float finish.

After completion of float finish, apply a trowel finish as specified.

3.9.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.9.3 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.9.4 Curbs

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

3.9.5 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be 24 inches long, 12 inches wide and 4 inches thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

3.10 JOINTS

3.10.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.10.1.1 Maximum Allowable Construction Joint Spacing

- a. In walls at not more than 60 feet in any horizontal direction.
- b. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.10.1.2 Construction Joints for Constructability Purposes

- a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.

- b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.
- c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.10.2 Isolation Joints in Slabs on Ground

Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

3.10.3 Contraction Joints in Slabs on Ground

Provide joints to form panels as indicated.

Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.

Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.

Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.

Sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

3.10.4 Sealing Joints in Slabs on Ground

Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.11 CURING AND PROTECTION

ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs.

3.11.1 Requirements for Type III, High-Early-Strength Portland Cement

The curing periods are required to be not less than one-fourth of those specified for portland cement, but in no case less than 72 hours.

3.11.2 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.11.3 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

3.11.4 Curing Unformed Surfaces

Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

Unless otherwise specified, accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.

Accomplish final curing of concrete surfaces to receive liquid floor hardener or finish flooring by moisture-retaining cover curing.

3.11.5 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete

placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

3.11.6 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.11.7 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.12 FIELD QUALITY CONTROL

3.12.1 Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

3.12.2 Testing

3.12.2.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge.

The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

3.12.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.12.2.3 Compressive Strength Tests

ASTM C39/C39M. Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, two cylinders at 56 days and hold two cylinder in reserve. Take samples for strength tests of each mix design of and for concrete placed each day not less than once a day, nor less than

once for each 100 cubic yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of ACI 318 Section 5.6. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.12.2.4 Air Content

ASTM C173/C173M or ASTM C231/C231M for normal weight concrete . Test air-entrained concrete for air content at the same frequency as specified for slump tests.

3.12.2.5 Unit Weight of Structural Concrete

ASTM C567/C567M and ASTM C138/C138M. Determine unit weight of normal weight concrete. Perform test for every 20 cubic yards maximum.

3.12.2.6 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

Failure to meet compressive strength tests as evaluated

Reinforcement not conforming to requirements specified

Concrete which differs from required dimensions or location in such a manner as to reduce strength

Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified

Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration

Poor workmanship likely to result in deficient strength

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

3.12.2.7 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the

Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

3.12.2.8 Testing Concrete Structure for Strength

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:

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.

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

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.

Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

3.13 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

3.13.1 Crack Repair

Prior to final acceptance, all cracks in excess of [0.02 inches](#) wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

3.13.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than [1/4 inch](#) thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than [1/4 inch](#) thick

must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

3.13.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

This page is intentionally left blank.

SECTION 05 30 00

STEEL DECKS

05/15

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 IRON AND STEEL INSTITUTE (AISI)

AISI D100 (1991; R 2008) Cold-Formed Steel Design Manual

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A123/A123M (2015) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A780/A780M (2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A792/A792M (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM D1056 (2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

ASTM D1149 (2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber

ASTM D746 (2014) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

ASTM E84 (2016) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM DS 1-28R (1998) Data Sheet: Roof Systems

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20 (2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)

STEEL DECK INSTITUTE (SDI)

ANSI/SDI QA/QC (2011) Standard for Quality Control and Quality Assurance for Installation of Steel Deck

SDI DDP (1987; R 2000) Deck Damage and Penetrations

SDI MOC2 (2006) Manual of Construction with Steel Deck

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2013; Change 1) Structural Engineering

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

29 CFR 1926 Safety and Health Regulations for Construction

UNDERWRITERS LABORATORIES (UL)

UL 580 (2006; Reprint Oct 2013) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor QC approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

SD-03 Product Data

Accessories

Deck Units

Galvanizing Repair Paint

Mechanical Fasteners

Touch-up Paint

Flexible Closure Strips

SD-05 Design Data

Deck Units

SD-07 Certificates

Powder-Actuated Tool Operator Wind Storm Resistance

Manufacturer's Certificate

SD-11 Closeout Submittals

Recycled Content of Steel Products;

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide [manufacturer's certificate](#) s attesting that the decking material meets the specified requirements.

1.3.2 Certification of [Powder-Actuated Tool Operator](#)

Provide manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.

1.3.3 Regulatory Requirements

1.3.3.1 [Wind Storm Resistance](#)

Provide roof construction assembly capable of withstanding a nominal uplift pressure of [90 pounds per square foot](#) when tested in accordance with the uplift pressure test described in the [FM DS 1-28R](#) or as described in [UL 580](#) and in general compliance with [UFC 3-301-01](#).

1.3.4 [Fabrication Drawings](#)

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, cant strips, ridge and valley plates, metal closure strips, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of [AISI D100](#).

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 DECK UNITS

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

[Recycled content of steel products](#): provide products with an average recycled content of steel products so postconsumer recycled content plus one half of preconsumer recycled content not less than 25 percent.

2.1.1 Roof Deck

Conform to [ASTM A792/A792M](#) or [ASTM A1008/A1008M](#) for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of the steel design thickness required by the design drawings and galvanized.

2.1.2 Length of Deck Units

Provide deck units of sufficient length to span three or more spacings where possible.

2.1.3 Touch-Up Paint

Provide a high zinc-dust content paint for regalvanizing welds in galvanized steel conforming to [ASTM A780/A780M](#).

Provide touch-up paint for shop-painted units of the same type used for the shop painting , and touch-up paint for zinc-coated units of an approved [galvanizing repair paint](#) with a high-zinc dust content . Touch-up welds with paint conforming to [SSPC Paint 20](#) in accordance with [ASTM A780/A780M](#). Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.0295 inch thick to close open ends at end walls, eaves, and openings through deck.

2.2.3 Flexible Closure Strips for Roof Decks

Provide strips made of vulcanized, closed-cell, synthetic rubber material specified and premolded to the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

Conforming to ASTM D1056, Grade 2A1, with the following additional properties:

Brittleness temperature of minus 40 degrees F when tested in accordance with ASTM D746.

Flammability resistance with a flame spread rating of less than 25 when tested in accordance with ASTM E84.

Resistance to ozone must be "no cracks" after exposure of a sample kept under a surface tensile strain of 25 percent to an ozone concentration of 100 parts per million of air by volume in air for 100 hours at 104 degrees F and tested in accordance with ASTM D1149.

Provide a elastomeric type adhesive as recommended by the manufacturer of the flexible closure strips.

2.2.4 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.5 Access Hole Covers

Sheet metal, minimum 0.0474 inch thick.

2.2.6 Hanger

Provide clips or loops for utility systems and suspended ceilings of one or more of the following types:

- a. Lip tabs or integral tabs where noncellular decking or flat plate of cellular section is 0.0474 inch thick or more, and a structural concrete fill is used over deck.
- b. Slots or holes punched in decking for installation of pigtails.
- c. Tabs driven from top side of decking and arranged so as not to pierce electrical cells.
- d. Decking manufacturer's standard as approved by the Contracting Officer.

2.2.7 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Bend strips to

form a 45-degree cant not less than 5 inch wide, with top and bottom flanges a minimum 3 inch wide. Length of strips 10 feet.

2.2.8 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.2.9 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36/A36M, and hot-dip galvanized in accordance with ASTM A123/A123M.

2.2.10 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated fasteners, pneumatically driven fasteners or self-drilling screws, for anchoring the deck to structural supports and adjoining units as indicated.

2.2.11 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0598 inch other metal accessories, 0.0358 inch unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with 29 CFR 1926, Subpart R - Steel Erection, ANSI/SDI QA/QC and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Lap 2 inch deck ends. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle

welds, fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Mechanical Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners. Drive screws to properly clamp desk to supporting steel.

3.2.1.2 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by welding or screws as indicated.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with **SDI DDP**. Reinforce holes and openings **6 to 12 inch** across by **0.0474 inch** thick steel sheet at least **12 inch** wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of **6 inch** on center. Reinforce holes and openings larger than **12 inch** by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists. Deck manufacturer shall approve holes or openings larger than **6 inch** in diameter prior to drilling or cutting.

3.2.3 Deck Damage

SDI MOC2, for repair of deck damage.

3.2.4 Touch-Up Paint

3.2.4.1 Roof Deck

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

3.2.5 Accessory Installation

3.2.5.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.5.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

3.2.5.3 Hangers

Provide as indicated to support utility system and suspended ceilings. Space devices so as to provide one device per 6.25 square feet.

3.3 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.4 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.5 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

3.6 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.7 FIELD QUALITY CONTROL

3.7.1 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges is 1/16 inch; when gap is more than 1/16 inch, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --

SECTION 05 40 00

COLD-FORMED METAL FRAMING

05/15

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 CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3 2015)
Building Code Requirements for Structural
Concrete and Commentary

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for
the Design of Cold-Formed Steel Structural
Members

AISI S200 (2007) North American Standard for
Cold-Formed Steel Framing - General
Provision

AISI S201 (2007) North American Standard for
Cold-Formed Steel Framing - Product Data

AISI S202 (2011) Code of Standard Practice for
Cold-formed Steel Structural Framing

AISI S211 (2007) North American Standard for
Cold-Formed Steel Framing - Wall Stud
Design

AISI S212 (2007) North American Standard for
Cold-Formed Steel Framing - Header Design

AISI S213 (2007; Suppl 1 2009) North American
Standard for Cold-Formed Steel Framing -
Lateral Design

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

AWS D1.3/D1.3M (2008; Errata 2008) Structural Welding
Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1003/A1003M (2015) Standard Specification for Steel
Sheet, Carbon, Metallic- and

Nonmetallic-Coated for Cold-Formed Framing
Members

ASTM A123/A123M	(2015) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A370	(2014) Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A653/A653M	(2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C1007	(2011a) Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
ASTM C1513	(2013) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM C955	(2011c) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM E119	(2016a) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E329	(2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E488/E488M	(2010) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F1554	(2015; E 2016; E 2017) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1941	(2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

ASTM F2329 (2013) Zinc Coating, Hot-Dip, Requirements
for Application to Carbon and Alloy Steel
Bolts, Screws, Washers, Nuts, and Special
Threaded Fasteners

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2013; Change 1) Structural Engineering

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor QC approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components; G

SD-03 Product Data

Steel Studs, Joists, Tracks, Bracing, Bridging and Accessories

SD-05 Design Data

Metal Framing Calculations; GSD-07 Certificates

Load-Bearing Cold-Formed Metal Framing

Welds

1.3 DELIVERY, STORAGE, AND HANDLING

Steel framing and related accessories shall be stored and handled in accordance with the AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing".

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include top and bottom tracks, bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. Design framing in accordance with AISI S100.

Submit mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A370.

1.5 MAXIMUM DEFLECTION

Deflections of structural members shall not exceed the more restrictive of the limitations of **ICC IBC** and **UFC 3-301-01**.

1.6 QUALITY ASSURANCE

- a. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a registered professional engineer.
- b. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to **ASTM E329** for testing indicated.
- c. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- d. Welding Qualifications: Qualify procedures and personnel according to the following:
 - (1) **AWS D1.1/D1.1M**, "Structural Welding Code - Steel".
 - (2) **AWS D1.3/D1.3M**, "Structural Welding Code - Sheet Steel".
- e. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per **ASTM E119** by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.
- f. AISI Specifications and Standards: Comply with:
 - (1) **AISI S100**, "North American Specification for the Design of Cold-Formed Steel Structural Members".
 - (2) **AISI S200**, "North American Standard for Cold-Formed Steel Framing - General Provision".
 - (3) **AISI S201**, "North American Standard for Cold-Formed Steel Framing - Product Data".
 - (4) **AISI S202**, "Code of Standard Practice for Cold-Formed Steel Structural Framing".
 - (5) **AISI S211**, "North American Standard for Cold-Formed Steel Framing - Wall Stud Design".
 - (6) **AISI S212**, "North American Standard for Cold-Formed Steel Framing - Header Design".
 - (7) **AISI S213**, "North American Standard for Cold-Formed Steel Framing - Lateral Design".

1.6.1 Drawing Requirements

Submit **framing components** to show sizes, thicknesses, layout, material designations, methods of installation, and accessories including the following:

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

Sign and seal fabrication drawings by a registered professional engineer.

1.6.2 Design Data Required

Submit **metal framing calculations** with design criteria and structural loading to verify sizes, thickness, and spacing of members and connections signed and sealed by a registered professional engineer. Show methods and practices used in installation.

PART 2 PRODUCTS

2.1 STEEL **STUDS, JOISTS**, TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with **ASTM C955** and the following.

- a. Steel Sheet: **ASTM A1003/A1003M**, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - (1) Grade: As required by structural performance.
 - (2) Coating: G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90).
- b. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: **0.0428 inch**.
 - (2) Flange Width: **1-5/8 inches**.
- c. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: **0.0428 inch**.
 - (2) Flange Width: **1-1/4 inches**.

2.1.1 Studs and Joists of **54 mils (0.054 Inch)** and Heavier

Galvanized steel, **ASTM A653/A653M** and **ASTM A1003/A1003M**, SS Grade 50, **G60**.

2.1.2 Studs and Joists of 43 mils (0.043 Inch) and Lighter

Studs and Joists of 43 mils (0.043 Inch) and Lighter, Track, and Accessories (All thicknesses): Galvanized steel, ASTM A653/A653M and ASTM A1003/A1003M, SS, Grade 33 33,000 psi G60.

2.1.3 Sizes, Thickness, Section Modulus, and Other Structural Properties

Size and thickness as required.

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

2.3 CONNECTIONS

2.3.1 Steel-To-Concrete Connections

- a. Anchor Rods: ASTM F1554, Grade 36; galvanized per ASTM A153/A153M.
- b. Post-Installed Concrete Anchors: Adhesive or expansion anchors fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
- c. Power-Actuated Fasteners: Fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC 70 greater than or equal to the design load as determined by testing per ASTM E1190 conducted by a qualified testing agency

2.3.2 Steel-To-Steel Connections

- a. Screws: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel screws of the type and size indicated. Provide low-profile head beneath sheathing and manufacturer's standard elsewhere. Electroplated to a minimum of 5 micron zinc coating per ASTM F1941 or hot-dipped galvanized per ASTM A123/A123M or ASTM A153/A153M.
- b. Bolts: ASTM A307 coated by hot-dip process per ASTM F2329 or zinc-coated by mechanical-deposition process per ASTM B695, Class 55.
- c. Welding Electrodes: Comply with AWS standards.

2.4 PLASTIC GROMMETS

Supply plastic grommets for stud webs as recommended by stud manufacturer, to protect electrical wires and plumbing piping. Prevent metal-to-metal contact between wiring/piping and studs.

2.5 SEALER GASKET

Closed-cell neoprene foam, 1/4-inch thick, selected from manufacturer's standard widths to match width of bottom track on concrete slab or foundation.

PART 3 EXECUTION

3.1 FASTENING

Fasten framing members together by welding or by using self-drilling, self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.1.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI S100. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. Submit certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 43 mils.

3.1.2 Screws

Screws shall be of the self-drilling self-tapping type, size, and location as required. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in AISI S100. Screws covered by sheathing materials shall have low profile heads.

3.1.3 Anchors

Anchors shall be of the type, size, and location as required.

3.1.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location as required.

3.2 INSTALLATION

Install cold-formed framing in accordance with ASTM C1007 and AISI S200.

Install cold-formed steel framing according to AISI S202 and to manufacturer's written instructions unless more stringent requirements are indicated.

3.2.1 Tracks

Provide accurately aligned runners at top and bottom of studs. Install sealer gasket under bottom of track on concrete slab or foundation. Anchor

tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least 3 inches from the edge of concrete slabs.

3.2.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings 2 feet wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and AISI S100. Bracing shall be not less than the following:

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
Wind load only	Up to 10 feet	One row at mid-height
	Over 10 feet	Rows 5'-0" o.c. maximum
Axial load	Up to 10 feet	Two rows at 1/3 points
	Over 10 feet	Rows 3'-4" o.c. maximum

3.2.3 Joists and Trusses

- a. Provide a stud directly under each joist or truss. The maximum spacing of studs as indicated shall be maintained.
- b. Install temporary bracing and supports. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- c. Do not alter, cut, or remove framing members or connections of trusses.

3.2.4 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:
 - (1) Layout of walls and partitions: 1/4 inch from intended position;
 - (2) Plates and runners: 1/4 inch in 8 feet from a straight line;

- (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
 - (4) Face of framing members: 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:
- (1) Layout of walls and partitions: 1/4 inch from intended position;
 - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;
 - (3) Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
 - (4) Face of framing members: 1/8 inch in 8 feet from a true plane.
- End of Section --

This page is intentionally left blank.

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS
05/10

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.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3 (2013) Operations - Safety Requirements
for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications:
Machine Screw Nuts, Hex, Square, Hex
Flange, and Coupling Nuts (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws,
Square Head Set Screws, and Slotted
Headless Set Screws: Inch Series

ASME B18.6.3 (2013) Machine Screws, Tapping Screws, and
Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2015) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M (2016) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A307	(2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A467/A467M	(2007; R 2012) Standard Specification for Machine Coil Chain
ASTM A47/A47M	(1999; R 2014) Standard Specification for Ferritic Malleable Iron Castings
ASTM A500/A500M	(2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786/A786M	(2015a) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2016a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B108/B108M	(2015) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B26/B26M	(2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C1513	(2013) Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base

Emulsions for Use as Protective Coatings
for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal
Primer

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3 (1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Floor Plates, Patterned; G

floor box; G

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.5 Floor Plates, Patterned

Floor plate ASTM A786/A786M. Steel plate must be 3/8 inch in thickness. Provide holes for lifting tools. Provide holes and openings with 1/2 inch clearance for pipes and equipment. Remove sharp edges and burrs from cover plates. Floor plates must be painted; color is to match the color of the floor paint.

At each floor plate, provide a floor box fabricated from 3/8 inch steel, hot dip galvanized after fabrication; see Drawings for dimensions. Provide continuous welded connections and grind surface smooth. Provide 1/8 inch clearance at edges between cover plate. Remove sharp edges and burrs from exposed edges of floor box. Exposed to view portions of the floor box must be painted; color is to match the color of the floor paint.

2.1.6 Anchor Bolts

ASTM A307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.6.1 Expansion Anchors and Adhesive Anchors

Provide sizes shown on the Drawings.

2.1.6.2 Lag Screws and Bolts

ASME B18.2.1, type and grade best suited for the purpose.

2.1.6.3 Toggle Bolts

ASME B18.2.1.

2.1.6.4 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 or ASTM A307.

2.1.6.5 Powder Actuated Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

2.1.6.6 Screws

ASME B18.2.1, ASME B18.6.2, ASME B18.6.3 and ASTM C1513.

2.1.6.7 Washers

Provide plain washers to conform to ASME B18.21.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

2.1.7 Aluminum Alloy Products

Conform to ASTM B209 for sheet plate, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: [ASTM A123/A123M](#), [ASTM A153/A153M](#), [ASTM A653/A653M](#) or [ASTM A924/A924M](#), G90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to [ASTM A780/A780M](#) or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with [SSPC SP 6/NACE No.3](#). Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with [SSPC SP 3](#) in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions. On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of [1.0 mil](#). Tint additional prime coat with a small amount of tinting pigment.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with a standard mill finish. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45. Provide a polished satin finish on items to be anodized.

2.3 CORNER GUARDS AND SHIELDS

For jambs and sills of openings and edges of platforms provide steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with glazed or ceramic tile finish on walls with 0.0625 inch thick corrosion-resisting steel with polished or satin finish, extend 5 feet above the top of cove base or to the top of the wainscot, whichever is less, and securely anchor to the supporting wall. Corner guards on exterior shall be galvanized.

2.4 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide four inch galvanized standard weight steel pipe as specified in ASTM A53/A53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.5 MISCELLANEOUS PLATES AND SHAPES

Provide for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings and frames. Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions as indicated and as required to support wall loads over openings. Provide with connections and fasteners. Construct to have at least 8 inches bearing on masonry at each end.

Provide angles and plates, ASTM A36/A36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A123/A123M.

2.6 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, 3/16 inch diameter, with at least twelve links per foot, and with snap hooks on each end. Test safety chain in accordance with ASTM A467/A467M, Class CS. Provide snap hooks of boat type. Provide galvanized 3/8 inch bolt with 3/4 inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 4 inches longer than the anchorage spacing, for each guarded area. Locate safety chain where indicated. Mount the top chain three feet 6 inches above the floor and mount the lower chain 2 feet above the floor.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts

necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 BUILT-IN WORK

Form for anchorage metal work built-in with concrete or masonry, or provide with suitable anchoring devices as indicated or as required. Furnish metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with [AWS D1.1/D1.1M](#). Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.6 FINISHES

3.6.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to [MPI 79](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with [ASTM D1187/D1187M](#), asphalt-base emulsion.

3.6.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when

assembled, shall be free of rust, grease, dirt and other foreign matter.

3.6.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.7 INSTALLATION OF GUARD POSTS (BOLLARDS/PIPE GUARDS)

Set pipe guards vertically in concrete piers. Construct piers of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 3000 psi.

3.8 MOUNTING OF SAFETY CHAINS

Mount safety chains 3 feet 6 inches and 2 feet above the floor.

-- End of Section --

SECTION 05 52 00

METAL RAILINGS

08/15

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 WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts
and Screws (Inch Series)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

ASME B18.6.1 (2016) Wood Screws (Inch Series)

ASME B18.6.3 (2013) Machine Screws, Tapping Screws, and
Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A283/A283M (2013) Standard Specification for Low and
Intermediate Tensile Strength Carbon Steel
Plates

ASTM A307 (2014) Standard Specification for Carbon
Steel Bolts and Studs, 60 000 PSI Tensile
Strength

ASTM A36/A36M (2014) Standard Specification for Carbon
Structural Steel

ASTM A467/A467M (2007; R 2012) Standard Specification for
Machine Coil Chain

ASTM A53/A53M (2012) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521

(2001) Pipe Railing Manual

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Pre-Installation Meetings

Submit fabrication drawings for the following items:

- a. Steel Railings
- b. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

- a. Masonry anchorage devices
- b. Steel railings
- c. Anchorage and fastening systems

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Fabrication Drawings; G

SD-07 Certificates

Welder Qualification; G

1.4 QUALITY CONTROL

1.4.1 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, make an immediate retest of two test welds and ensure each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 FABRICATION

Pre-assemble items in the shop to the greatest extent possible.
Disassemble units only to the extent necessary for shipping and handling.

Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes, including zinc coatings.

Provide railings detail plans and elevations at not less than 1-inch to 1-foot. Provide details of sections and connections at not less than 3-inches to 1-foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of required size and thickness to produce adequate strength and durability in finished product for intended use. Work materials to dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use type of materials indicated or specified for the various components of work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ensure all exposed edges are eased to a radius of approximately 1/32-inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth using concealed fasteners .

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

2.1.1.1 Steel Railings

Fabricate joint posts, rail, and corners by the following methods:

- a. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight fitting interior sleeve not less than 6 inches long.

2.1.1.2 Protective Coating

Shop prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS.

2.2 COMPONENTS

2.2.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to [ASTM A36/A36M](#), unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to [ASTM A283/A283M](#), Grade C.

Provide steel bars and bar-size shapes conforming to [ASTM A36/A36M](#), unless otherwise noted.

2.2.2 Steel Pipe

Provide pipe conforming to [ASTM A53/A53M](#), type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.2.3 Fasteners

Provide galvanized zinc-coated fasteners in accordance with [ASTM A153/A153M](#) used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to [ASTM A307](#), Grade A.

Provide square-head lag bolts conforming to [ASME B18.2.1](#).

Provide cadmium-plated steel machine screws conforming to [ASME B18.6.3](#).

Provide flat-head carbon steel wood screws conforming to [ASME B18.6.1](#).

Provide plain round, general-assembly-grade, carbon steel washers conforming to [ASME B18.21.1](#).

2.2.4 Steel Railings

Design handrails to resist a concentrated load of 200 lbs in any direction at any point of the top of the rail or 50 lbs per foot applied horizontally to top of the rail, whichever is more severe. [NAAMM AMP 521](#), provide the same size rail and post.

2.2.4.1 Steel Railings

Provide steel railings, steel pipe conforming to [ASTM A53/A53M](#). Provide steel railings of 1-1/2-inches nominal size, and shop painted.

Provide interior railings where indicated, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

2.2.5 Safety Chains

Provide safety chains of galvanized steel, straight link type, 3/16-inch diameter, with at least twelve links per foot, and with snap hooks on each end. Test safety chain in accordance with [ASTM A467/A467M](#), Class CS. Provide snap hooks of boat type. Provide galvanized 3/8-inch bolt with 3/4-inch eye diameter for attachment of chain, anchored as indicated. Supply two chains, 4-inches longer than the anchorage spacing, for each

guarded area. Provide bolts and nuts as indicated, conforming to the requirements of **ASTM A307**. Locate safety chain where indicated. Mount the top chain **three feet 6 inches** above the floor and mount the lower chain **two feet** above the floor.

PART 3 EXECUTION

3.1 PREPARATION

Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts **as indicated on the Drawings**. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

- a. Anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard weight, steel pipe, not less than **6-inches** long, and having an inside diameter not less than **1/2-inch** greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than **1-inch** greater than the outside diameter of the sleeve.

3.2 INSTALLATION

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

3.2.1 Steel Handrail

Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement with anchorage covered with standard pipe collar pinned to post.

3.2.2 Touchup Painting

Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of **2-mils**.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with **AWS D1.1/D1.1M**.

-- End of Section --

This page is intentionally left blank.

SECTION 06 41 16.00 10

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
08/10

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 A161.2 (1998) Decorative Laminate Countertops,
Performance Standards for Fabricated High
Pressure

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI AWS (2nd Edition) Architectural Woodwork
Standards

ASTM INTERNATIONAL (ASTM)

ASTM D1037 (2012) Evaluating Properties of Wood-Base
Fiber and Particle Panel Materials

ASTM E84 (2016) Standard Test Method for Surface
Burning Characteristics of Building
Materials

ASTM F547 (2006; R 2012) Nails for Use with Wood and
Wood-Base Materials

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.9 (2015) Cabinet Hardware

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1 (2016) Particleboard

CPA A208.2 (2016) Medium Density Fiberboard (MDF) for
Interior Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3 (2005) Standard for High-Pressure
Decorative Laminates

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A (2013) Interior Architectural Wood Flush
Doors

1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework cabinets and vanities as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Shop Drawings
Installation

SD-03 Product Data

Wood Materials

SD-04 Samples

Plastic Laminates
Cabinet Hardware

SD-07 Certificates

Quality Assurance
Laminate Clad Casework

1.4 QUALITY ASSURANCE

1.4.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the custom grade quality standards as outlined in AWI AWS, Section for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of AWI AWS requirements, in general, and the specific AWI AWS requirements provided in this specification. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units

to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

1.6 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Panel Products

2.1.1.1 Particleboard

All particleboard shall be industrial grade, medium density (40 to 50 pounds per cubic foot), 3/4 inch thick. A moisture-resistant particleboard in grade Type 2-M-2 or 2-M-3 shall be used as the substrate for plastic laminate components subjected to moisture. Particleboard shall meet the minimum standards listed in ASTM D1037 and CPA A208.1.

2.1.1.2 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in CPA A208.2.

2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06 61 16 SOLID SURFACING FABRICATIONS.

2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of ANSI/NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 5 by 7 inches in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.3.1 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

2.3.2 Vertical General Purpose Fire Rated (VGF) Grade

Vertical general purpose fire rated grade plastic laminate shall be 0.028 inches (plus or minus 0.004 inches) in thickness. This laminate grade shall have a class 1, class A fire rating in accordance with ASTM E84.

2.3.3 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.020 inches in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.3.4 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.020 inches. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior surfaces.

2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be 0.020 inch thick. Material width shall be 15/16 inches. Color and pattern shall match exposed door and drawer front laminate pattern and color.

2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include hinges, pulls, and drawer glides. Hardware exposed to view shall be satin chromium plated. All hardware shall conform to ANSI/BHMA A156.9, unless otherwise noted, and shall consist of the following components:

2.6.1 Door Hinges

Concealed Euro-Style, back mounted hinges with opening to 170 degrees and a self-closing feature at less than 90 degrees. Grade 1.

2.6.2 Cabinet Pulls

Drawer pulls shall be wire type pulls with center-to-center dimension not less than 4 inches and cross sectional diameter of 5/16 inch. The handle projection shall be not less than 1-5/16 inches.

2.6.3 Drawer Slide

Side mounted type, BHMA No. B05051 with full extension and a minimum 100 pound load capacity. Slides shall include a positive stop to avoid accidental drawer removal.

2.6.4 Adjustable Shelf Support System

Multiple holes with metal pin supports.

2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F547 where applicable.

2.8 ADHESIVES, CAULKS, AND SEALANTS

2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use . Adhesives shall withstand a bond test as described in [ANSI/WDMA I.S.1A](#). [Comply with Low VOC requirements.](#) Adhesives shall be moisture and mold resistance.

2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be a water-based contact adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone. [Comply with Low VOC requirements.](#)

2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture. [Comply with Low VOC requirements.](#)

2.9 FABRICATION

Verify field measurements as indicated in the [shop drawings](#) before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI custom grade unless otherwise indicated in this specification. Cabinet style, in accordance with [AWI AWS](#), Section 400-G descriptions, shall be flush overlay.

2.9.1 Base and Wall Cabinet Case Body

2.9.1.1 Cabinet Components

Cabinet components shall be constructed from the following materials and thicknesses:

2.9.1.1.1 Body Members (Ends, Divisions, Bottoms, and Tops)

[3/4 inch](#) particleboard [or](#) medium density fiberboard (MDF) panel product

2.9.1.1.2 Shelving

3/4 inch particleboard or medium density fiberboard (MDF) panel product

2.9.1.1.3 Cabinet Backs

1/4 inch particleboard or medium density fiberboard (MDF) panel product

2.9.1.1.4 Drawer Sides, Backs, and Subfronts

1/2 inch panel product

2.9.1.1.5 Drawer Bottoms

1/4 inch particleboard or medium density fiberboard (MDF) panel product

2.9.1.1.6 Door and Drawer Fronts

3/4-inch particleboard or medium density fiberboard (MDF) panel product

2.9.1.2 Joinery Method for Case Body Members

2.9.1.2.1 Tops, Exposed Ends, and Bottoms

a. Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).

b. Spline or biscuit, glued under pressure.

2.9.1.2.2 Cabinet Backs (Wall Hung Cabinets)

Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

2.9.1.2.2.1 Side Bound

Side bound, captured in groove or rabbetts; glued and fastened.

2.9.1.2.3 Cabinet Backs (Floor Standing Cabinets)

2.9.1.2.3.1 Side Bound with Rabbetts

Side bound, placed in rabbetts; glued and fastened in rabbetts.

2.9.1.2.4 Wall Anchor Strips

Wall Anchor Strips shall be required for all cabinets with backs less than 1/2 inch thick. Strips shall consist of minimum 1/2 inch thick lumber, minimum 2-1/2 inches width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.9.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of nominal 2 inch thick lumber. Base assembly components shall be treated lumber. Finished

height for each cabinet base shall be as indicated on the drawings. Bottom edge of the cabinet door or drawer face shall be flush with top of base.

2.9.3 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from 3/4 inch medium density particleboard or 3/4 inch medium density fiberboard (MDF). All door and drawer front edges shall be surfaced with PVC edgebanding, color and pattern to match exterior face laminate.

2.9.4 Drawer Assembly

2.9.4.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

2.9.4.1.1 Drawer Sides and Back For Thermoset Decorative Overlay (Melamine) Finish

1/2 inch thick medium density particleboard or MDF fiberboard substrate

2.9.4.1.2 Drawer Bottom

1/4 inch thick thermoset decorative overlay melamine panel product

2.9.4.2 Drawer Assembly Joinery Method

- a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.
- b. Doweled, glued under pressure.
- c. Bottoms shall be set into sides, front, and back, 1/4 inch deep groove with a minimum 3/8 inch standing shoulder.

2.9.5 Shelving

2.9.5.1 General Requirements

Shelving shall be fabricated from thermoset decorative overlay (melamine). Shelf edges shall be finished in a PVC edgebanding.

2.9.5.2 Shelf Support System

The shelf support system shall be:

2.9.5.2.1 Pin Hole Method

Drill holes on the interior surface of the cabinet side walls. Evenly space holes in two vertical columns. Space the holes in each column at 1 inch increments starting 6 inches from the cabinet interior bottom and extending to within 6 inches of the top interior surface of the cabinet. Drill holes to provide a level, stable surface when the shelf is resting on the shelf pins. Coordinate hole diameter with pin insert size to provide a firm, tight fit.

2.9.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and ANSI/NEMA LD 3, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

2.9.6.1 Base/Wall Cabinet Case Body

- a. Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGS.
- b. Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: Thermoset Decorative Overlay (melamine).

2.9.6.2 Adjustable Shelving

2.9.6.2.1 Top and Bottom Surfaces

Thermoset Decorative Overlay (melamine)

2.9.6.2.2 All Edges

PVC edgebanding

2.9.6.3 Fixed Shelving

2.9.6.3.1 Top and Bottom Surfaces

Thermoset Decorative Overlay (melamine)

2.9.6.3.2 Exposed Edges

PVC edgebanding

2.9.6.4 Door, Drawer Fronts, Access Panels

2.9.6.4.1 Exterior (Exposed) and Interior (Semi-Exposed) Faces

HPDL Grade VGS

2.9.6.4.2 Edges

PVC edgebanding

2.9.6.5 Drawer Assembly

All interior and exterior surfaces: Thermoset Decorative Overlay (melamine).

2.9.6.6 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the **AWI AWS** custom grade requirements.

2.9.7 Finishing

2.9.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

PART 3 EXECUTION

3.1 **INSTALLATION**

Installation shall comply with applicable requirements for **AWI AWS** custom quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other **laminated clad casework** assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.1.1 Anchoring Systems

3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners. Where assembly abuts a wall surface, anchoring shall include a minimum **1/2 inch** thick lumber or panel product hanging strip, minimum **2-1/2 inch** width; securely attached to the top of the wall side of the cabinet back.

3.1.1.2 Wall

Cabinets and vanities to be wall mounted shall utilize minimum **1/2 inch** thick lumber or panel product hanging strips, minimum **2-1/2 inch** width; securely attached to the wall side of the cabinet back, both top and bottom.

3.1.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk. Loose side splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks.

3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on

the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 3/16 inch "Euro screws". The use of wood screws without insertion dowels is prohibited.

3.1.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI AWS custom grade requirements.

3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

-- End of Section --

SECTION 06 61 16

SOLID SURFACING FABRICATIONS
08/10

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 D2583 | (2013a) Indentation Hardness of Rigid
Plastics by Means of a Barcol Impressor |
| ASTM D570 | (1998; E 2010; R 2010) Standard Test
Method for Water Absorption of Plastics |
| ASTM D638 | (2014) Standard Test Method for Tensile
Properties of Plastics |
| ASTM D696 | (2016) Standard Test Method for
Coefficient of Linear Thermal Expansion of
Plastics Between -30 degrees C and 30
degrees C With a Vitreous Silica
Dilatometer |
| ASTM E84 | (2016) Standard Test Method for Surface
Burning Characteristics of Building
Materials |
| ASTM G21 | (2015) Determining Resistance of Synthetic
Polymeric Materials to Fungi |

CSA GROUP (CSA)

- | | |
|-------------------------|--------------------------------------------------------------------|
| CSA B45.5-11/IAPMO Z124 | (2011; Update 1 2012) Plastic Plumbing
Fixtures - First Edition |
|-------------------------|--------------------------------------------------------------------|

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|----------------|-----------------------------------------------------------|
| ANSI/NEMA LD 3 | (2005) Standard for High-Pressure
Decorative Laminates |
|----------------|-----------------------------------------------------------|

NSF INTERNATIONAL (NSF)

- | | |
|-------------|---------------------------------|
| NSF/ANSI 51 | (2012) Food Equipment Materials |
|-------------|---------------------------------|

TILE COUNCIL OF NORTH AMERICA (TCNA)

- | | |
|-----------|--------------------------------------------------------------------|
| TCNA Hdbk | (2013) Handbook for Ceramic, Glass, and
Stone Tile Installation |
|-----------|--------------------------------------------------------------------|

1.2 SYSTEM DESCRIPTION

- a. Work under this section includes **countertops** and other items utilizing solid polymer (solid surfacing) fabrication as shown on the drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.
- b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.
- c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus **1/8 inch**.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Detail Drawings; G
Installation; G

SD-03 Product Data

Solid Polymer Material
Qualifications
Fabrications

SD-04 Samples

Material; G
Counter and Vanity Tops; G
Shower Wall Panel System

SD-06 Test Reports

Solid Polymer Material

SD-07 Certificates

Fabrications
Qualifications

SD-10 Operation and Maintenance Data

Clean-up

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials. Submit solid polymer manufacturer's certification attesting to fabricator qualification approval.

1.4.2 Detail Drawings

Submit **Detail Drawings** indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

1.6 WARRANTY

Provide manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

PART 2 PRODUCTS

2.1 MATERIAL

Provide **solid polymer material** that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting **CSA B45.5-11/IAPMO Z124** requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of **0.01 inch** shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than **1/4 inch** in thickness. Submit a minimum **6 by 6 inch** sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work. Submit test report results from an independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (max.)	ASTM D638
Hardness	55-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4 inch sheet	36 inches, 1/2 lb ball, no failure	
1/2 inch sheet	140 inches, 1/2 lb ball, no failure	
3/4 inch sheet	200 inches, 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be those indicated on the project drawings. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.3 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer

manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting TCNA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

2.2.5 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

2.3.1 Joints and Seams

Form joints and seams between solid polymer components using manufacturer's

approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Fabricate backsplashes and end splashes from 1/2 inch thick solid surfacing material 4 inches high. Backsplashes and end splashes shall be provided for all counter tops and vanity tops and at locations indicated on the drawings. Backsplashes shall be shop fabricated and be permanently attached.

2.3.3.1 Permanently Attached Backsplash

Permanently attached backsplashes shall be attached straight with seam adhesive to form a 90 degree transition.

2.3.3.2 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Counter and Vanity Tops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 1/2 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops shall be complete with 4 inch high permanently attached, 90 degree transition. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile and backsplash as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

2.3.4.1 Counter Top With Sink

- a. Stainless Steel. Countertops with sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for stainless steel installation shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Sink, faucet, and plumbing requirements shall be in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.3.4.2 Vanity Tops With Bowls

- a. Faucet, and plumbing requirements shall be in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- b. Solid polymer bowls shall be a solid polymer manufacturer's standard, pre-molded product specifically designed for attachment to solid polymer counter tops.

2.3.5 Solid Polymer Vanity Bowls

Solid polymer vanity bowls shall be a standard product of the solid polymer manufacturer, designed specifically to be attached to (undermount) in solid polymer vanity tops. Bowls shall be of the same polymer composition as the adjoining counter top. Bowl design shall support a seam adhesive undermount installation method. The bowl and countertop shall align with inconspicuous seams. Bowl dimensions shall be 18" side-to-side, 11" front-to-side, and 5-1/2" depth.

2.3.6 Shower Wall Panel System

Tub/shower wall enclosures shall provide a system of solid polymer components to include: panels, corner trim, soap dish, shampoo shelf and panel edge trim. Dimensions of all components shall be as indicated on the drawings. Panels shall be formed from manufacturer's standard 1/4 inch thick sheet product. Panels shall be full width and height with seams occurring only at the inside corners of the enclosure. Soap dish and shampoo shelf shall be of a configuration, shape, and location as standard with the manufacturer's system. Panels shall have a smooth, honed finish.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal sinks to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.1.1 Wall Panels & Panel Systems

Installation of wall panels and system components to substrates shall be an adhesive which is required by the panel manufacturer. Depending on the condition (flatness) of the wall surface, if required, provide additional adhesive to ensure contact between the substrate and the wall panel. Provide a water or oil-based primer/sealer on the substrate as required by the panel manufacturer. Use seam adhesive to adhere all solid polymer components to each other with the exception of expansion joints and inside corners. All inside corners and expansion joints between solid polymer components shall be joined with silicone sealant. All joints between solid polymer components and non-solid polymer surfaces shall be sealed with a clear silicone sealant.

3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid

surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. Submit a minimum of six copies of maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided, if available. Maintenance kit for matte finishes shall be submitted.

-- End of Section --

SECTION 07 21 16

MINERAL FIBER BLANKET INSULATION

11/11

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 C665	(2012) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2012) Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM E136	(2016) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(2016) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 31	(2016) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2015) National Fuel Gas Code
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code

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

29 CFR 1910.134	Respiratory Protection
-----------------	------------------------

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket Insulation and Blanket Insulation - Sound Attenuation

SD-08 Manufacturer's Instructions

Insulation

SD-11 Closeout Submittals

Recycled Content for Insulation Materials;

Reduce Volatile Organic Compounds (VOC) for Insulation Materials;

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.3.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.4 SAFETY PRECAUTIONS

1.4.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.4.2 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Recycled Content for Insulation Materials

Provide insulation materials meeting the recycled content requirements as stated within this section.

2.1.2 Reduce Volatile Organic Compounds (VOC) for Insulation Materials

Provide insulation materials meeting the reduced VOC requirements as stated within this section.

2.2 BLANKET INSULATION AND BLANKET INSULATION - SOUND ATTENUATION

ASTM C665, Type I, blankets without membrane coverings, except a flame spread rating of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E84.

2.2.1 Recycled Materials

Provide Thermal Insulation containing recycled materials to the extent practicable, provided the material meets all other requirements of this section. The minimum required recycled materials content by weight are:

Fiberglass: 20 to 25 percent glass cullet

2.2.2 Prohibited Materials

Do not provide asbestos-containing materials.

2.3 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E136 for blocking around chimneys and heat producing devices.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, or compressed insulation. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

- a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 3 inches from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 24 inches above fixture.
- b. Masonry chimneys or masonry enclosing a flue: 2 inches from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.
- c. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.
- d. Gas Fired Appliances: Clearances as required in NFPA 54.

e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, joists, sill plates, headers and any obstructions. Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

3.3.1.5 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

-- End of Section --

SECTION 07 84 00

FIRESTOPPING
05/10

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

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.

ASTM INTERNATIONAL (ASTM)

ASTM E119	(2016a) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1399/E1399M	(1997; E 2013;R 2013) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2015) Fire-Resistive Joint Systems
ASTM E2174	(2014b) Standard Practice for On-Site Inspection of Installed Fire Stops
ASTM E2307	(2015a) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

ASTM E814 (2013a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops

ASTM E84 (2016) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM 4991 (2013) Approval of Firestop Contractors

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

UNDERWRITERS LABORATORIES (UL)

UL 1479 (2015) Fire Tests of Through-Penetration Firestops

UL 2079 (2004; Reprint Dec 2014) Tests for Fire Resistance of Building Joint Systems

UL 723 (2008; Reprint Aug 2013) Test for Surface Burning Characteristics of Building Materials

UL Fire Resistance (2014) Fire Resistance Directory

1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals shall be submitted to the NAVFAQ Midlant FPE for approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System; G

SD-03 Product Data

Firestopping Materials; G

SD-06 Test Reports

Inspection; G

SD-07 Certificates

Firestopping Materials
Installer Qualifications; G

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage an experienced Installer who meets the following installer qualifications:

- a. FM Research approved in accordance with FM 4991
- b. Operating as a UL Certified Firestop Contractor, or
- c. Firestopping subcontractor/installer shall be in the business of installing firestopping and related work only. Firestopping Contractor shall be certified/licensed by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years' experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. The firestopping shall not be installed by any other subcontractors such as the electrical contractor, mechanical contractor, sprinkler contractor, etc. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer and submit written certification of training, and retain proof of certification for duration of firestop installation.

One firestopping subcontractor/installer shall perform all firestopping throughout the project.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

PART 2 PRODUCTS

2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal must indicate the

firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.2.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.2.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

2.2.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SYSTEM DESCRIPTION, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479. Fire resistance ratings shall be as follows:

2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = Rating of wall or partition being penetrated.

2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SYSTEM DESCRIPTION, and gaps such as those between floor slabs and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire

resistance rating. Systems installed at construction joints shall meet the cycling requirements of [ASTM E1399/E1399M](#) or [UL 2079](#). All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with [UL 1479](#).

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids [4 inches](#) or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal

thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products or devices.

3.2.3.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf at 0 percent to 100 percent visual fill.

3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

Contractor and manufacturer representative shall inspect and provide a report of penetrations. At this inspection, the manufacturer's technical representative of the firestopping material shall be present. For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved. Inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.1 Inspection Standards

Inspect all firestopping in accordance to ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results to be submitted.

3.3.2 Inspection Reports

Submit inspection report stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

-- End of Section --

F-35B Lift System Repair Facility
MCAS CHERRY POINT, NC

17P766
EPROJECT W.O. NO. 1564839

This page is intentionally left blank.

SECTION 07 92 00

JOINT SEALANTS

08/16

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 C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM C1521	(2013) Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2004; Add 2004-01) Standard Practice for the Testing Of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers
--------------------	---------------------------------------------------------------------------------------------------------------------------------------------------

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage
-----	--------------------------------------------

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(1989; R 2005) Adhesive and Sealant Applications
------------------	--------------------------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings
---------	-----------------------------------------------------------------------------------------------------------------

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. Submit the following in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants; G

Primers; G

Bond Breakers; G

Backstops; G

SD-07 Certificates

Indoor Air Quality; G

SD-11 Closeout Submittals

Indoor Air Quality For Interior Sealants;

Indoor Air Quality For Interior Floor Joint Sealants

1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Material Safety Data Sheet (MSDS) for each solvent, primer and sealant material proposed.

1.4 CERTIFICATIONS

1.4.1 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.

1.4.1.1 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 validation by other third-party program that products meet the requirements of this paragraph. Sealants and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) must meet either emissions requirements of [CDPH SECTION 01350](#) (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of [SCAQMD Rule 1168](#). Provide current product certification documentation from certification body.

1.5 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between [40 and 90 degrees F](#).

1.6 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed shipping containers, with brand name, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding [90 degrees F](#) or lower than [0 degrees F](#). Keep materials and containers closed

and separated from absorptive materials such as wood and insulation.

1.7 QUALITY ASSURANCE

1.7.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

1.7.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.7.3 Adhesion

Provide in accordance with [ASTM C1193](#) or [ASTM C1521](#).

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied.

2.1.1 Interior Sealants

Provide [ASTM C920](#), Type S or M, Grade NS, Class 12.5, Use NT. Provide certification of [indoor air quality for interior sealants](#). Location(s) and color(s) of sealant for the following. Note, color "as selected" refers to manufacturer's full range of color options

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface mounted equipment and fixtures, and similar items.	As selected
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	As Selected__
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	As Selected
d. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	As Selected

LOCATION	COLOR
e. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	As Selected
f. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	As Selected

2.1.2 Exterior Sealants

For joints in vertical surfaces, provide **ASTM C920**, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide **ASTM C920**, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Expansion and control joints.	As Selected
c. Voids where items pass through exterior walls.	As Selected

LOCATION	COLOR
d. Metal-to-metal joints where sealant is indicated or specified.	As Selected

2.1.3 Floor Joint Sealants

ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide certification of indoor air quality for interior floor joint sealants. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	Gray
b. Control and expansion joints in floors, slabs and walkways.	Gray

2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.4 BACKSTOPS

Provide glass fiber roving, neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Provide backstop material that is compatible with sealant. Do not use oakum or other types of absorptive materials as backstops.

2.4.1 Rubber

Provide in accordance with ASTM D1056, Type 2, closed cell, Class A, Grade 1, round cross section for cellular rubber sponge backing.

2.4.2 Neoprene

Provide in accordance with [ASTM D1056](#), closed cell expanded neoprene cord Type 2, Class C, Grade 2C2 neoprene backing.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer and in accordance with environmental requirements herein. Protect adjacent aluminum and bronze surfaces from solvents. Provide solvents for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finished work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue free solvent. Remove resulting debris and solvent residue prior to sealant installation.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive prior to sealant application. For removing protective coatings and final cleaning, use non-staining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

3.1.4 Wood Surfaces

Ensure wood surfaces that will be in contact with sealants are free of splinters, sawdust and other loose particles.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

<u>JOINT WIDTH</u>	<u>JOINT DEPTH</u>	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
over 1/2 inch to 1 inch	1/2 inch	5/8 inch
Over 1 inch	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

3.3.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

3.3.3 Masking Tape

Place masking tape on the finished surface on one or both sides of joint cavities to protect adjacent finished surfaces from primer or sealant smears. Remove masking tape within 10 minutes of joint filling and tooling.

3.3.4 Backstops

Provide backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide joints in specified depths. Provide backstops where indicated and where backstops are not indicated but joint cavities exceed the acceptable maximum depths specified in JOINT WIDTH-TO-DEPTH RATIOS Table.

3.3.5 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

3.3.6 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

3.3.7 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent moistened cloth. Remove solvent residue in accordance with solvent manufacturer's printed instructions.

-- End of Section --

SECTION 08 11 13

STEEL DOORS AND FRAMES

02/10

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.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2015; E 2016) Standard Specification for
Steel Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM A879/A879M (2012) Standard Specification for Steel
Sheet, zinc Coated by the Electrolytic
Process for Applications Requiring
Designation of the Coating Mass on Each
Surface

ASTM A924/A924M (2016a) Standard Specification for General
Requirements for Steel Sheet,
Metallic-Coated by the Hot-Dip Process

ASTM C578 (2016) Standard Specification for Rigid,
Cellular Polystyrene Thermal Insulation

ASTM C591 (2016) Standard Specification for Unfaced
Preformed Rigid Cellular Polyisocyanurate
Thermal Insulation

ASTM D2863 (2013) Measuring the Minimum Oxygen
Concentration to Support Candle-Like
Combustion of Plastics (Oxygen Index)

ASTM E1300 (2016) Standard Practice for Determining
Load Resistance of Glass in Buildings

ASTM F2248 (2012) Standard Practice for Specifying an
Equivalent 3-Second Duration Design
Loading for Blast Resistant Glazing
Fabricated with Laminated Glass

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2016) Hardware Preparation in Steel Doors
and Steel Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2016) Standard for Installation of Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 80	(2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111	(2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories
SDI/DOOR 113	(2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
SDI/DOOR A250.11	(2001) Recommended Erection Instructions for Steel Frames
SDI/DOOR A250.6	(2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
SDI/DOOR A250.8	(2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C	(2016) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies
--------	-------------------------------------------------------------------------------

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G

Frames; G

Accessories

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors; G

Schedule of frames; G

Submit door and frame locations.

SD-03 Product Data

Doors; G

Frames; G

Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap knock-down frames in bundles. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated. Provide exterior glazing in accordance with ASTM F2248 and ASTM E1300.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Extra Heavy Duty Doors

SDI/DOOR A250.8, Level 3, physical performance Level A, Model 2 Seamless with core construction as required by the manufacturer, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. All doors are to be insulated.

2.2 ACCESSORIES

2.2.1 Louvers

2.2.1.1 Interior Louvers

SDI/DOOR 111, Louvers shall be stationary sightproof. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 20 gage steel and louver blades of a minimum 24 gage. Sightproof louvers to be inverted "V" blade design with minimum 55 percent net-free opening.

2.2.1.2 Exterior Louvers

Louvers shall be inverted "V" type with minimum of 55 percent net-free opening. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. Louvers shall have steel-framed insect screens secured to room side and readily removable. Provide aluminum wire cloth, 18 by 18 or 18 by 16 inch mesh, for insect screens. Net-free louver area to be before screening.

2.2.2 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors. For interior pairs of fire rated and smoke control doors, provide stainless steel astragals complying with NFPA 80 for fire rated assemblies and NFPA 105 for smoke control assemblies.

2.2.3 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

2.3 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

- a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or
- b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or

2.4 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 3, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, unless otherwise indicated.

2.4.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

2.4.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide

locknuts for bolted connections.

2.4.3 Mullions and Transom Bars

Mullions and transom bars shall be closed or tubular construction and be a member with heads and jambs butt-welded thereto or knock-down for field assembly. Bottom of door mullions shall have adjustable floor anchors and spreader connections.

2.4.4 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.4.5 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.4.5.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111, "Recommended Existing Wall Anchors for Standard Steel Doors and Frames"

2.5 FIRE AND SMOKE DOORS AND FRAMES

NFPA 80 and NFPA 105 and this specification. The requirements of NFPA 80 and NFPA 105 shall take precedence over details indicated or specified.

2.5.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.5.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.5.3 Astragal on Fire and Smoke Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements. On smoke control doors, conform to NFPA 105.

2.6 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.7 FINISHES

2.7.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8. Where coating is removed by welding, apply touchup of factory primer.

2.7.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924M and ASTM A653/A653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8.

2.7.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A879/A879M, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI/DOOR A250.8.

2.8 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with

the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound.

2.9 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

3.1.3 Fire and Smoke Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80. Install fire rated smoke doors and frames in accordance with NFPA 80 and NFPA 105.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

This page is intentionally left blank.

SECTION 08 33 23

OVERHEAD COILING DOORS

08/15

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 SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

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

ASHRAE FUN IP (2013; Addenda and Corrigendum 2013) Fundamentals Handbook, I-P Edition

ASME INTERNATIONAL (ASME)

ASME B29.400 (2001; R 2013) Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A27/A27M (2013; R 2016) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A307 (2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A36/A36M (2014) Standard Specification for Carbon Structural Steel

ASTM A48/A48M (2003; R 2012) Standard Specification for Gray Iron Castings

ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A653/A653M (2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2016a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D2000	(2012) Standard Classification System for Rubber Products in Automotive Applications
ASTM E330/E330M	(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2016; SUPP 2016) Motors and Generators
NEMA ST 1	(1988; R 1994; R 1997) Specialty Transformers (Except General Purpose Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code
---------	------------------------------------------------------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 674	(2011; Reprint Jul 2013) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
--------	----------------------------------------------------------------------------------------------------------------

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Overhead Coiling Doors; G
- Counterbalancing Mechanism; G
- Electric Door Operators; G
- Bottom Bars; G
- Guides; G
- Mounting Brackets; G
- Overhead Drum; G
- Hood; G
- Installation Drawings; G

SD-03 Product Data

- Overhead Coiling Doors; G
- Hardware; G
- Counterbalancing Mechanism; G
- Electric Door Operators; G

SD-05 Design Data

- Overhead Coiling Doors; G
- Hardware; G
- Counterbalancing Mechanism; G
- Electric Door Operators; G

SD-10 Operation and Maintenance Data

- Operation and Maintenance Manuals; G
- Materials; G
- Devices; G
- Procedures; G
- Manufacture's Brochures; G

Parts Lists

SD-11 Closeout Submittals

Warranty; G

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in an adequately ventilated dry location that is free from dirt and dust, water, or other contaminants. Store in a manner that permits easy access for inspection and handling.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated. Use grease-sealed or self-lubricating bearings for rotating members.

2.1.1 Design Requirements

2.1.1.1 Overhead Coiling Door Detail Shop Drawings

Provide [installation drawings](#) for overhead coiling door assemblies which show: elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, details of [guides](#) and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Include a schedule showing the location of each door with the drawings.

2.1.2 Performance Requirements

2.1.2.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least [50 pounds per square foot](#) with a maximum deflection of 1/120 of the opening width. Provide test data showing compliance with [ASTM E330/E330M](#). Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested. Ensure complete assembly meets or exceeds the requirements of [ASCE 7](#).

2.1.2.2 Operational Cycle Life

Design all portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

2.2 COMPONENTS

2.2.1 Overhead Coiling Doors

2.2.1.1 Curtain Materials and Construction

Provide curtain slats fabricated from Grade A steel sheets conforming to [ASTM A653/A653M](#), with the additional requirement of a minimum yield point of 33,000 psi. Provide sheets, galvanized in accordance with [ASTM A653/A653M](#) and [ASTM A924/A924M](#).

Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Ensure the provided slats are continuous without splices for the width of the door.

Provide slats filled with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to [ASTM E84](#). Enclose insulation completely within slat faces on interior surface of slats.

2.2.1.2 Insulated Curtains

Form Curtains from manufacturer's standard shapes of interlocking slats. Supply slat system with a minimum R-value of 4 when calculated in accordance with [ASHRAE FUN IP](#). Slats to consist of a urethane core not less than 11/16-inch thick, completely enclosed within metal facings. Ensure the exterior face of slats are the same gauge as specified for curtains. Select an interior face not lighter than 0.0219-inches. The insulated slat assembly requires a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with [ASTM E84](#).

2.2.1.3 Curtain Bottom Bar

Install curtain bottom bars as pairs of angles from the manufacturer's standard steel, stainless and aluminum extrusions not less than 2.0 by 2.0-inches by 0.188-inch. Ensure steel extrusions conform to [ASTM A36/A36M](#). Stainless steel extrusions conforming to [ASTM A666](#), Type 304. Aluminum extrusions conforming to [ASTM B221](#). Galvanize angles and fasteners in accordance with [ASTM A653/A653M](#) and [ASTM A924/A924M](#). Coat welds and abrasions with paint conforming to [ASTM A780/A780M](#).

2.2.1.4 Locks

Provide end and/or wind locks of Grade B cast steel conforming to [ASTM A27/A27M](#), galvanized in accordance with [ASTM A653/A653M](#), [ASTM A153/A153M](#) and [ASTM A924/A924M](#). Secure locks at every other curtain slat.

2.2.1.5 Weather Stripping

Ensure weather-stripping at the door-head and jamb is 1/8-inch thick sheet of natural or neoprene rubber with air baffles. Secure weather stripping to the insides of hoods with galvanized-steel fasteners through continuous galvanized-steel pressure bars at least 5/8-inch wide and 1/8-inch thick.

Ensure threshold weather-stripping is 1/8-inch thick sheet natural or neoprene rubber secured to the bottom bars.

Provide weather-stripping of natural or neoprene rubber conforming to [ASTM D2000](#).

2.2.1.6 Locking Devices

Provide an interior slide bolt lock for electric operation with interlock switch.

2.2.1.7 Safety Interlock

Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.2.1.8 Overhead Drum

Fabricate drums from nominal [0.028-inch](#) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with [ASTM A653/A653M](#).

2.2.1.9 Slats

Provide minimum No. 5F, 22 gauge, Grade 40 steel, [ASTM A653/A653M](#) galvanized steel zinc coating. Provide heavier gauge if required by wind design loads.

2.2.2 Hardware

Ensure all hardware conforms to [ASTM A153/A153M](#), [ASTM A307](#), [ASTM F568M](#), and [ASTM A27/A27M](#).

2.2.2.1 Guides

Fabricate with structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Flare the top of inner and outer guide angles outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

2.2.2.2 Equipment Supports

Fabricate door-operating equipment supports from the manufacturer's standard steel shapes and plates conforming to [ASTM A36/A36M](#), galvanized in accordance with [ASTM A653/A653M](#) and [ASTM A924/A924M](#). Size the shapes and plates in accordance with the industry standards for the size, weight, and type of door installation.

2.2.2.3 Hood

Provide a 24-gauge galvanized steel hood with reinforced top and bottom edges. Provide minimum [1/4-inch](#) steel intermediate support brackets as required to prevent excessive sag. Provide with internal hood baffle weatherseal.

2.2.3 Counterbalancing Mechanism

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted, around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

2.2.3.1 Brackets

Provide the manufacturer's standard mounting brackets with one located at each end of the counterbalance barrel conforming to ASTM A48/A48M. Provide brackets of either cast iron or cold-rolled steel.

2.2.3.2 Counterbalance Barrels

Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M. Ensure the barrel is of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats. Limit barrel deflection to not more than 0.03 inch per foot of span under full load.

Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed 0.033 inches per foot of door span and to be correctly balanced by helical springs, oil tempered torsion type. Use cast iron barrel plugs to anchor springs to tension shaft and pipe.

a. Barrel

Provide steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.

b. Spring Balance

Provide an oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Ensure that effort to operate manually operated units does not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

2.2.4 Electric Door Operators

Provide electrical wiring and door operating controls conforming to the applicable requirements of NFPA 70.

Electric door-operator assemblies needs to be the sizes and capacities recommended and provided by the door manufacturer for specified doors. Furnish complete assemblies with electric motors and factory-prewired motor controls, starter, gear reduction units, solenoid-operated brakes, clutch, remote-control stations, manual or automatic control devices, and accessories as required for proper operation of the doors.

Design the operators so that motors may be removed without disturbing the limit-switch adjustment and affecting the emergency auxiliary operators.

Provide a manual operator of crank-gear or chain-gear mechanisms with a release clutch to permit manual operation of doors in case of power failure. Arrange the emergency manual operator so that it may be put into and out of operation from floor level, and its use does not affect the adjustment of the limit switches. Provide an electrical or mechanical device that automatically disconnects the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

2.2.4.1 Door-Operator Types

Provide a bench mounted operator mounted to the right or left door head

plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.

2.2.4.2 Electric Motors

Provide motors which are the high-starting-torque, reversible, constant-duty electrical type with overload protection of sufficient torque and horsepower to move the door in either direction from any position. Ensure they produce a door-travel speed of not less than 8 nor more than 12 inches per second without exceeding the horsepower rating.

Provide motors which conform to NEMA MG 1 designation, temperature rating, service factor, enclosure type, and efficiency to the requirements specified.

Certify and label explosion-proof motors to indicate conformance to the following:

UL 674, Class I, Groups C and D

UL 674, Class II, Groups F and G

2.2.4.3 Motor Bearings

Select bearings with bronze-sleeve or heavy-duty ball or roller antifriction type with full provisions for the type of thrust imposed by the specific duty load.

Pre-lubricate and factory seal bearings in motors less than 1/2 horsepower.

Equip motors coupled to worm-gear reduction units with either ball or roller bearings.

Equip bearings in motors 1/2 horsepower or larger with lubrication service fittings. Fit lubrication fittings with color-coded plastic or metal dust caps.

In any motor, bearings that are lubricated at the factory for extended duty periods do not need to be lubricated for a given number of operating hours. Display this information on an appropriate tag or label on the motor with instructions for lubrication cycle maintenance.

2.2.4.4 Motor Starters, Controls, and Enclosures

Provide each door motor with: a factory-wired, unfused, disconnect switch; a reversing, across-the-line magnetic starter with thermal overload protection; 120-volt operating coils with a control transformer limit switch; and a safety interlock assembled in a NEMA ICS 6 type enclosure as specified herein. Ensure control equipment conforms to NEMA ICS 2.

Provide adjustable switches, electrically interlocked with the motor controls and set to stop the door automatically at the fully open and fully closed position.

2.2.4.5 Control Enclosures

Provide control enclosures that conform to NEMA ICS 6 for general purpose NEMA Type 1.

2.2.4.6 Transformer

Provide starters with 230/460 to 115 volt control transformers with one secondary fuse when required to reduce the voltage on control circuits to 120 volts or less. Provide a transformer conforming to NEMA ST 1.

2.2.4.7 Safety-Edge Device

Provide each door with a pneumatic safety device extending the full width of the door and located within a U-section neoprene or rubber astragal, mounted on the bottom rail of the bottom door section. Device needs to immediately stop and reverse the door upon contact with an obstruction in the door opening during downward travel and cause the door to return to full-open position. A safety device is not a substitute for a limit switch.

Connect safety device to the control circuit through a retracting safety cord and reel.

2.2.4.8 Remote-Control Stations

Provide interior remote control stations which are full-guarded, momentary-contact three-button, heavy-duty, surface-mounted NEMA ICS 6 type enclosures as specified. Mark buttons "OPEN," "CLOSE," and "STOP." Ensure the "CLOSE" button requires a constant pressure to maintain the closing motion of the door. When the door is in motion and the "STOP" button is pressed, ensure the door stops instantly and remains in the stopped position. From the stopped position, the door may then be operated in either direction.

2.2.4.9 Speed-Reduction Units

Provide speed-reduction units consisting of hardened-steel worm and bronze worm gear assemblies running in oil or grease and inside a sealed casing, coupled to the motor through a flexible coupling. Drive shafts need to rotate on ball- or roller-bearing assemblies that are integral with the unit.

Provide minimum ratings of speed reduction units in accordance with AGMA provisions for class of service.

Ground worm gears to provide accurate thread form; machine teeth for all other types of gearing. Surface harden all gears.

Provide antifriction type bearings equipped with oil seals.

2.2.4.10 Chain Drives

Provide roller chains that are a power-transmission series steel roller type conforming to ASME B29.400, with a minimum safety factor of 10 times the design load.

Heat-treat or otherwise harden roller-chain side bars, rollers, pins, and bushings.

Provide high-carbon steel chain sprockets with machine-cut hardened teeth, finished bore and keyseat, and hollow-head setscrews.

2.2.4.11 Brakes

Provide 360-degree shoe brakes or shoe and drum brakes. Ensure the brakes are solenoid-operated and electrically interlocked to the control circuit to set automatically when power is interrupted.

2.2.4.12 Clutches

Ensure clutches are either the 4-inch diameter, multiple face, externally adjustable friction type or adjustable centrifugal type.

2.2.4.13 Weather/Smoke Seal Sensing Edge

Provide automatic stop control by an automatic sensing switch within neoprene astragal extending the full width of door bottom bar.

Provide an electric sensing edge device. Ensure the door immediately stops downward travel when contact occurs before door fully closes. Provide a self-monitoring wireless sensing edge connection to the motor operator; eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator. Supervised system alters normal door operation; preventing damage, injury or death due to an inoperable sensing edge system.

2.2.5 Surface Finishing

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.2.5.1 Finish

Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 shall receive rust-inhibitive, roll coating process, composed of 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester topcoat.

PART 3 EXECUTION

3.1 INSTALLATION

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, ensure doors are free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the contract documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

3.2 ADJUSTING AND CLEANING

3.2.1 Acceptance Provisions

After installation, adjust hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to manufacturer's written instructions.

Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset door-closing mechanism after successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

3.2.1.1 Maintenance and Adjustment

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.

3.2.1.2 Cleaning

Clean doors in accordance with manufacturer's approved instructions.

3.3 CLOSEOUT ACTIVITIES

3.3.1 [Warranty](#)

Furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship for not less than two years after completion and acceptance of the project. [Door and operator system is to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.](#)

Warrant that upon notification by the Government, any defects in material, workmanship, and door operation are immediately correct within the same time period covered by the guarantee, at no cost to the Government.

3.3.2 Operation And Maintenance

Submit 6 copies of the [Operation and Maintenance Manuals](#) 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

[Materials](#)

[Devices](#)

Electric Door Operators

Hood

Counterbalancing Mechanism

Painting

Procedures

Manufacture's Brochures

Parts Lists

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, operating procedures, and safety precautions. Provide test data that is legible and of good quality.

-- End of Section --

SECTION 08 71 00

DOOR HARDWARE
02/16

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 E283 (2004; R 2012) 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 (2013) Butts and Hinges
ANSI/BHMA A156.13 (2012) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.16 (2013) Auxiliary Hardware
ANSI/BHMA A156.18 (2016) Materials and Finishes
ANSI/BHMA A156.2 (2011) Bored and Preassembled Locks and Latches
ANSI/BHMA A156.21 (2014) Thresholds
ANSI/BHMA A156.22 (2012) Door Gasketing and Edge Seal Systems
ANSI/BHMA A156.26 (2012) Continuous Hinges
ANSI/BHMA A156.3 (2014) Exit Devices
ANSI/BHMA A156.4 (2013) Door Controls - Closers
ANSI/BHMA A156.6 (2015) Architectural Door Trim
ANSI/BHMA A156.7 (2016) Template Hinge Dimensions
ANSI/BHMA A156.8 (2015) Door Controls - Overhead Stops and Holders

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2015; ERTA 2015) Life Safety Code
NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

NFPA 72 (2016) National Fire Alarm and Signaling Code

NFPA 80 (2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended 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

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2012) Building Materials Directory

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. 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; G

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. 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](#)

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr Name and Catalog No.	Key Control Symbols	UL Mark (If fire-rated and listed)	BHMA Finish Designation

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:

- Complete listing of all keys (e.g. AA1 and AA2).
- Complete listing of all key cuts (AA1-123456, AA2-123458).
- Tabulation showing which key fits which door.
- Copy of floor plan showing doors and door numbers.
- 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, and closers of one lock, hinge, 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 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 72 for door alarms, 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.

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.

2.3.2 Continuous Hinges

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

2.3.3 Locks and Latches

2.3.3.1 Mortise Locks and Latches

Provide in accordance with ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to fit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Provide knobs and roses of mortise locks with screwless shanks and no exposed screws.

2.3.3.2 Bored Locks and Latches

Provide in accordance with ANSI/BHMA A156.2, Series 4000, Grade 1.

2.3.4 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 Best Lock Corp., with removable core, master key system, "A" keyway. Rim cylinders, mortise cylinders, and levers 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.

2.3.5 Keying System

Provide an extension of the existing keying system. Provide construction interchangeable cores.

2.3.6 Lock Trim

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

2.3.6.1 Levers and Roses

Provide in accordance with ANSI/BHMA A156.2 and ANSI/BHMA A156.13 for levers, roses, and escutcheons. For unreinforced levers, roses, and escutcheons, provide a 0.050 inch thickness. For reinforced levers, roses, and escutcheons, provide an outer shell thickness of 0.035 inch and a combined total thickness of 0.070 inch, except at knob shanks. Provide lever shanks 0.060 inch thick.

2.3.6.2 Lever Handles

Provide lever handles . Provide in accordance with ANSI/BHMA A156.3 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Escutcheon trim for mortise locksets is to be similar to Best "J". Lever trim for mortise locksets is to be similar to Best 16. Lever trim for bored locksets is to be similar to Best 16K.

2.3.6.3 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

2.3.7 Keys

Furnish one file key, one duplicate key, and one working key for each key change . Furnish one additional working key for each lock of each keyed-alike group. 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.

2.3.8 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.

2.3.9 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. Covers are to be metal. 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.

2.3.9.1 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.

2.3.10 Overhead Holders

Provide in accordance with ANSI/BHMA A156.8.

2.3.11 Door Protection Plates

Provide in accordance with ANSI/BHMA A156.6.

2.3.11.1 Architectural Door Trim

ANSI/BHMA A156.6. Door pulls shall be 1 inch diameter, 12 inches center to center with 1-3/4 inch clearance, stainless steel finish.

2.3.11.2 Sizes of Armor Mop and Kick Plates

Plates must be 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. Provide a minimum 36 inch armor plates for flush doors, except 16 inch high armor plates on fire doors. Provide 6 inch mop plates.

2.3.12 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.

2.3.13 Thresholds

Provide in accordance with ANSI/BHMA A156.21. Provide J35120, handicap accessible, unless specified otherwise.

2.3.14 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](#). Provide weatherstripping with one of the following:

2.3.14.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than [0.050 inch](#) wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

2.3.15 Auxiliary Hardware (Other than locks)

Provide in accordance with [ANSI/BHMA A156.16](#), Grade 1.

2.3.16 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 prime coat finish for surface door closers, and except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish.

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.

3.1.1.1 Stop Applied Weatherstripping

Fasten in place with color matched sheet metal screws not more than [9 inch](#) on center after doors and frames have been finish painted.

3.1.2 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.

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 and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.
- b. Mop Plates: Bottom flush with bottom of door.

3.4 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.

3.5 HARDWARE SETS

Quantity	Item	Description
HW-1 Doors 101A		
1 1/2 Pair	Hinges	A5111
1	Lockset	F109
1	Closer/Stop	C42021
1	Kickplate	J102
1 set	Weatherstripping	As specified
1	Threshold	As Specified
HW-2 Doors 101D		
1 1/2 Pair	Hinges	A5111
1	Lockset	F109
1	Closer/Stop	C42021
1	Kickplate	J102
1 set	Weatherstripping	As specified
1	Threshold	As specified
1	Door Rain Drip	As specified
HW-3 Doors 103A, 104A, 107A		
1 1/2 Pair	Hinges	A5111
1	Lockset	F75
1	Closer/Stop	C42021
1	Kickplate	J102
1 set	Weatherstripping	As specified
HW-4 Doors 103B, 104B		
1 1/2 Pair	Hinges	A5111
1	Lockset	F86
1	Closer/Stop	C42021
1	Kickplate	J102
1 set	Weatherstripping	As specified
HW-5 Doors 105A, 106A		
1 1/2 Pair	Hinges	A5111
1	Lockset	F109
1	Wall Stop	L02251
3	Silencers	L03011
HW-6 Doors 108A, 110A		
1 1/2 Pair	Hinges	A5111
1	Push Plate	J301
1	Pull Plate	J405
1	Closer/Stop	C42021
3	Silencers	L03011
1	Kickplate	J102
1 set	Weatherstripping	As specified
HW-7 Doors 109A		
1 1/2 Pair	Hinges	A5111

F-35B Lift System Repair Facility
MCAS CHERRY POINT, NC

17P766
EPROJECT W.O. NO. 1564839

1	Lockset	F86
1	Wallstop	L02251
1	Mop Plate	J103
3	Silencers	L03011

HW-8 Door 111A

1 1/2 Pair	Hinges	A5111
1	Lockset	F75
1	Closer	C42021
1	Wallstop	L02251
1	Kickplate	J102
1 set	Weatherstripping	As specified

-- End of Section --

SECTION 08 81 00

GLAZING

08/11

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 Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2016) Standard Specification for Flat Glass

ASTM C1048 (2012; E 2012) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

ASTM E119 (2016a) Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E1300 (2016) Standard Practice for Determining Load Resistance of Glass in Buildings

ASTM E2074 (2000e1) Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual (2009) Glazing Manual

GANA Sealant Manual (2008) Sealant Manual

GANA Standards Manual (2001) Tempering Division's Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-3001 (2001) Guidelines for Sloped Glazing

IGMA TM-3000 (1990; R 2004) North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

NFPA 80 (2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

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

16 CFR 1201 Safety Standard for Architectural Glazing Materials

UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint Feb 2015) Fire Tests of Door Assemblies

UL 10C (2016) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SSD-03 Product Data

Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

Fire/Safety Rated Glass

SD-08 Manufacturer's Instructions

Glass Setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

1.3 SYSTEM DESCRIPTION

Fabricate and install watertight and airtight glazing systems to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, or defects in the work. Glazed panels must comply with the safety standards, in accordance with ANSI Z97.1, and comply with indicated wind/snow loading in accordance with ASTM E1300.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for

installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

PART 2 PRODUCTS

2.1 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (transparent), Quality q3, 1/4 inch thick, conforming to ASTM C1048 and GANA Standards Manual. Color must be clear. Provide wherever safety glazing material is indicated or specified.

2.1.2 Fire/Safety Rated Glass

2.1.2.1 Fire Rated Doors

Fire protection-rated glazing used in doors shall bear the identification D-H-NT-XXX, where the "XXX" is the placeholder that specifies the fire protection rating period in minutes. See door schedule, located on the drawings, for required fire protection rating for specific doors. Glass shall meet NFPA 252, NFPA 80, UL 10B for wood doors, UL 10C for steel doors, and ASTM E2074. Glass shall meet CPSC 16 CFR 1201 (Cat: I and II) for Impact Safety Resistance.

2.1.2.2 Fire Rated Wall and Partitions

Fire/safety rated glass shall be laminated Type I transparent flat type, Class 1-clear. Glass shall have a 20, 45, or 60 minute rating when tested in accordance with ASTM E119. Glass shall be permanently labeled with appropriate markings. Glass shall meet ANSI Z97.1 and CPSC 16 CFR 1201 (Cat: I and II) for Impact Safety Resistance.

PART 3 EXECUTION

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.1 PREPARATION

Preparation, unless otherwise specified or approved, must conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the

installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, must conform to applicable recommendations in the [GANA Glazing Manual](#), [GANA Sealant Manual](#), [IGMA TB-3001](#), [IGMA TM-3000](#), and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass must be clean at the time the work is accepted.

3.4 PROTECTION

Protect glass work immediately after installation. Identify glazed openings with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. [Upon removal, separate protective materials for reuse or recycling.](#) Remove and replace glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities with new units.

-- End of Section --

SECTION 08 91 00

METAL WALL LOUVERS

05/11

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (2012) Laboratory Methods of Testing
Dampers for Rating

AMCA 511 (2010) Certified Ratings Program for Air
Control Devices

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2605 (2013) Voluntary Specification,
Performance Requirements and Test
Procedures for Superior Performing Organic
Coatings on Aluminum Extrusions and Panels

ASTM INTERNATIONAL (ASTM)

ASTM B209 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

ASTM B221 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Extruded Bars, Rods,
Wire, Profiles, and Tubes

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. Submit the following in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall louvers

SD-03 Product Data

Metal Wall Louvers

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.5 COLOR SAMPLES

Colors of finishes for wall louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

2.1.2 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 45 pounds per square foot. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-D and AMCA 511. The rating shall show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute. High Performance Louvers shall have a minimum 62% free area.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch for blades. Frame depth shall be 4 inches minimum with 0.125 inch nominal wall thickness.

2.2.2 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions where indicated and for all louvers more than 5 feet in width at not more than 5 feet on centers. Provide mullions covers on both faces of joints between louvers.

2.2.3 Screens and Frames

For aluminum louvers, provide 5/8 inch square mesh, 14 or 16 gage aluminum, 16 gage aluminum bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an organic coating. Color shall be as selected.

2.4.1.1 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a high-performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 1.2 mils.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.2 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

This page is intentionally left blank.

SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

02/10

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 A653/A653M (2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C645 (2014; E 2015) Nonstructural Steel Framing Members

ASTM C754 (2015) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal support systems; G

Submit for the erection of metal furring,. Indicate materials, sizes, thicknesses, and fastenings.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60.

2.1.1 Materials for Attachment of Gypsum Wallboard

2.1.1.1 Nonload-Bearing Furring/Hat Channel

ASTM C645. Provide 1-1/2 inch depth with a 2-11/16 inch wide base, 33 mils metal thickness; yield stress, 33 ksi.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Gypsum Wallboard

3.1.1.1 Non-loadbearing Furring

ASTM C754, except as indicated otherwise.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/4 inch in 8 feet from a straight line;
- c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/8 inch in 8 feet from a straight line;
- c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

SECTION 09 29 00

GYPSUM BOARD

08/16

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 A108.11 (1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM C1002 (2014) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

ASTM C1047 (2014a) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

ASTM C1396/C1396M (2014a) Standard Specification for Gypsum Board

ASTM C1629/C1629M (2015) Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels

ASTM C475/C475M (2015) Joint Compound and Joint Tape for Finishing Gypsum Board

ASTM C840 (2016) Standard Specification for Application and Finishing of Gypsum Board

ASTM C954 (2015) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM D1037 (2012) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM D226/D226M (2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D2394	(2005; R 2011) Simulated Service Testing of Wood and Wood-Base Finish Flooring
ASTM D3273	(2016) Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
ASTM D5420	(2016) Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Strike Impacted by a Falling Weight (Gardner Impact)
ASTM E695	(2003; R 2015; E 2015) Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
GYPSUM ASSOCIATION (GA)	
GA 214	(2010) Recommended Levels of Gypsum Board Finish
GA 216	(2010) Application and Finishing of Gypsum Panel Products
UNDERWRITERS LABORATORIES (UL)	
UL Fire Resistance	(2014) Fire Resistance Directory

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cementitious Backer Units

Abuse Resistant Gypsum Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

Gypsum Board

SD-07 Certificates

Asbestos Free Materials; G

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

SD-08 Manufacturer's Instructions

Material Safety Data Sheets

SD-10 Operation and Maintenance Data

Manufacturer Maintenance Instructions

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range.

Do not store gypsum wallboard with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Do not use materials that have visible moisture or biological growth.

1.3.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.4 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 3 years of documented successful experience.

1.5 SCHEDULING

The gypsum wallboard must be taped, finished and primed before the installation of the highly-emitting materials, including .

Commence application only after the area scheduled for gypsum board work is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the gypsum board. If the mechanical system cannot be activated before gypsum board is begun, the gypsum board work may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply gypsum board prior to the installation of finish flooring and

acoustic ceiling.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum board to excessive sunlight prior to gypsum board application. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of gypsum board work, while the gypsum board application is being done, and for at least one week after the gypsum board is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during gypsum board application, set, and until gypsum board jointing is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Reduce openings in cold weather to prevent freezing of joint compound when applied. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following gypsum boarding and until gypsum board jointing complete and is dry.

1.7 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated per UL Fire Resistance or FM APP GUIDE.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.

Submit Material Safety Data Sheets and manufacturer maintenance instructions for gypsum materials including adhesives.

2.1.1 Gypsum Board

ASTM C1396/C1396M. All gypsum board must be Abuse Resistant Type "X" Gypsum Board.

2.1.1.1 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges, moisture and mold resistant Type X gypsum core encased in a heavy, abrasion and mold/mildew/moisture resistant paper. At all Toilet Room ceiling locations provide 48 inch wide, 5/8 inch thick, Type X, tapered edges, moisture and mold resistant Type X gypsum core encased in a heavy, abrasion and mold/mildew/moisture resistant coated fiberglass mat.

2.1.1.2 Mold Resistant / Anti-Microbial Gypsum

ASTM D3273. 48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Abuse Resistant Gypsum Board

48 inch wide, 5/8 inch thick, Type X, tapered edges, moisture and mold resistant Type X gypsum core encased in a heavy, abrasion and

mold/mildew/moisture resistant paper. At Toilets provide 48 inch wide, 5/8 inch thick, Type X, tapered edges, moisture and mold resistant Type X gypsum core encased in a heavy, abrasion and mold/mildew/moisture resistant coated fiberglass mat. Abuse Resistant Gypsum board must be a reinforced gypsum panel with imbedded fiber mesh or lexan backing tested in accordance with the following tests. Hard body impact test must attain a Level 2 performance in accordance with [ASTM C1629/C1629M](#). Provide fasteners that meet manufacturer requirements and specifications stated within this section. Abuse resistant gypsum board, when tested in accordance with [ASTM E84](#), have a flame spread rating of 15 or less and a smoke developed rating of 0 or less for.

2.1.2.1 Soft Body Impact Test

[ASTM E695](#) or [ASTM D2394](#) for impact penetration and deformation. [ASTM E695](#) using a 60 lb leather bag filled with steel pellets, resisting no less than 300 ft. lb. cumulative impact energy before failure or [ASTM D2394](#) using 5.5 inch hemispherical projectile resisting no less than 264 ft. lb. before failure. Provide test specimen stud spacing a minimum 16 inch on center.

2.1.2.2 Hard Body Impact Test

Comply with hard body impact test in accordance with [ASTM C1629/C1629M](#) Classification Level 2.

2.1.2.3 Surface Abrasion Test

Comply with test surface abrasion test in accordance with [ASTM C1629/C1629M](#).

2.1.2.4 Indentation Test

[ASTM D5420](#) or [ASTM D1037](#) for indentation resistance. [ASTM D5420](#) using a 32 oz weight with a 5/8 inch hemispherical impacting head dropped once 3 feet creating not more than 0.137 inch indentation or [ASTM D1037](#) using no less than 470 lb weight applied to the 0.438 inch diameter ball to create not more than a 0.0197 inch indentation depth.

2.1.3 Cementitious Backer Units

In accordance with the Tile Council of America (TCA) Handbook, surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; complying with ANSI A118.9 and ASTM C1325.

2.1.4 Joint Treatment Materials

[ASTM C475/C475M](#). Product must be low emitting VOC types with VOC limits not exceeding 50 g/L. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds must be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

2.1.4.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.4.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.4.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.4.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.4.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.5 Fasteners

2.1.5.1 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.6 Accessories

ASTM C1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.7 Asphalt Impregnated Building Felt

Provide a 15 lb asphalt moisture barrier over glass mat covered or reinforced gypsum sheathing. Conforming to ASTM D226/D226M Type 1 (No. 15) for asphalt impregnated building felt.

2.1.8 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Building Construction Materials

Do not install building construction materials that show visual evidence of biological growth.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with [ASTM C840](#) or [GA 216](#) and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive, except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with [ASTM C840](#), System VIII or [GA 216](#).

3.2.2 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with [ASTM C840](#), System XIII or [GA 216](#). [Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.](#)

3.2.3 Application of Abuse Resistant Gypsum Board

Apply in accordance with applicable system of [ASTM C840](#) as specified or [GA 216](#). Follow manufacturers written instructions on how to cut, drill and attach board.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with [ANSI A108.11](#). Place a [15 lb](#) asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum [6 inch](#) overlap of sheets laid shingle style.

3.3.2 Joint Treatment

[ANSI A108.11](#).

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with [ASTM C840](#), [GA 214](#) and [GA 216](#). Finish plenum areas above ceilings to Level 1 in accordance with [GA 214](#).

Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214. Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use self-adhering fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.4.1 Uniform Surface

In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated. Joints of fire-rated gypsum board enclosures must be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

-- End of Section --

SECTION 09 65 00

RESILIENT FLOORING
08/10

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 F1861 (2016) Standard Specification for
Resilient Wall Base

GREEN SEAL (GS)

GS-36 (2011) Commercial Adhesives

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168 (1989; R 2005) Adhesive and Sealant
Applications

1.2 SYSTEM DESCRIPTION

1.3 SUBMITTALS

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

SD-03 Product Data

Wall Base

SD-04 Samples

Resilient Flooring and Accessories; G

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained above 68 degrees F and below 85 degrees F, stacked according to manufacturer's recommendations. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other

heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store exposed rubber surface materials in occupied spaces. Do not store near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 68 degrees F and below 85 degrees F for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 55 degrees F thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.6 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

PART 2 PRODUCTS

2.1 WALL BASE

Conform to ASTM F1861, Type TS (vulcanized thermoset rubber) Style B (coved). Provide 4 inch high and a minimum 1/8 inch thick wall base. Provide job formed corners in matching height, shape, and color.

2.2 ADHESIVES

Provide adhesives for base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. the current VOC content limits of GS-36 and SCAQMD Rule 1168. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

2.3 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

2.4 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories as indicated on the drawings. Color listed is not intended to limit the selection of equal colors from other manufacturers. Submit manufacturer's descriptive data and three samples of each indicated color and type of base, and accessories sized a minimum 2-1/2 by 4 inch. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 3 EXECUTION

3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government. Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

3.2 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

3.3 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

This page is intentionally left blank.

SECTION 09 90 00

PAINTS AND COATINGS

05/11

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 CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100 (2015; Suppl 2002-2016) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)

ASTM D235 (2002; R 2012) Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D4214 (2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D4263 (1983; R 2012) Indicating Moisture in Concrete by the Plastic Sheet Method

ASTM D4444 (2013) Use and Calibration of Hand-Held Moisture Meters

ASTM D523 (2014) Standard Test Method for Specular Gloss

ASTM D6386 (2016) Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

ASTM F1869 (2016) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

MASTER PAINTERS INSTITUTE (MPI)

MPI 1 (Oct 2009) Aluminum Paint

MPI 101 (Oct 2009) Epoxy Anti-Corrosive Metal Primer

MPI 107 (Oct 2009) Rust Inhibitive Primer (Water-Based)

MPI 108 (Oct 2009) High Build Epoxy Coating, Low Gloss

MPI 134	(Oct 2009) Galvanized Primer (Waterbased)
MPI 141	(Oct 2009) Interior High Performance Latex MPI Gloss Level 5
MPI 147	(May 2016) Institutional Low Odor / VOC Interior Latex, Semi-Gloss, MPI Gloss Level 5
MPI 163	(Oct 2009) Exterior W.B. Light Industrial Coating, Semi-Gloss, MPI Gloss Level 5
MPI 21	(Oct 2009) Heat Resistant Enamel, Gloss (up to 205 degrees C and 400 degrees F), MPI Gloss Level 6
MPI 23	(Oct 2009) Surface Tolerant Metal Primer
MPI 42	(Oct 2009) Latex Stucco and Masonry Textured Coating
MPI 47	(Oct 2009) Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
MPI 50	(Oct 2009) Interior Latex Primer Sealer
MPI 77	(Oct 2009) Epoxy Gloss
MPI 79	(Oct 2009) Alkyd Anti-Corrosive Metal Primer
MPI 94	(Oct 2009) Exterior Alkyd, Semi-Gloss, MPI Gloss Level 5
MPI 95	(Oct 2009) Quick Drying Primer for Aluminum

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01	(2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints
-----------	-----------------------------------------------------------------------------------------------------------

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007; E 2004) Brush-Off Blast Cleaning
SSPC Guide 6	(2015) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
SSPC Guide 7	(2004; E 2004) Guide to the Disposal of Lead-Contaminated Surface Preparation Debris
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC PA Guide 3	(1982; E 1995) A Guide to Safety in Paint

Application

SSPC SP 1	(2015) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 12/NACE No.5	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; E 2000; E 2004) Hand Tool Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual
------------	----------------------------------------------

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101	(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders
-------------	-------------------------------------------------------------------------

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA Method 24	(2000) Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings
---------------	-------------------------------------------------------------------------------------------------------------------------------

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(2014; Rev E) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
-------------	--------------------------------------------------------------------------------------------------------------------------------------

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

29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1001	Asbestos
29 CFR 1910.1025	Lead
29 CFR 1926.62	Lead

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS SP-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

SD-03 Product Data

Materials;

Coating; G

Manufacturer's Technical Data Sheets;

Indicate VOC content.

SD-04 Samples

Color; G

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in **FED-STD-313**.

SD-10 Operation and Maintenance Data

Coatings; G

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

SD-11 Closeout Submittals

Materials

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.4 QUALITY ASSURANCE

1.4.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph "Sampling Procedures." Test each chosen product as specified in the paragraph "Testing Procedure." Products which do not conform, shall be removed from the job site and replaced with new products that conform to the referenced specification. Testing of replacement products that failed initial testing

shall be at no cost to the Government.

1.4.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor shall provide **one quart** samples of the selected paint materials. The samples shall be taken in the presence of the Contracting Officer, and labeled, identifying each sample. Provide labels in accordance with the paragraph "Packaging, Labeling, and Storage" of this specification.

1.5 REGULATORY REQUIREMENTS

1.5.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.5.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.5.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.5.4 Asbestos Content

Materials shall not contain asbestos.

1.5.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.5.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.5.7 Human Carcinogens

Materials shall not contain **ACGIH 0100** confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.6 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, **color**, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than **5 gallons**. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between **40 to 95 degrees F**. **Do not store paint, polyurethane,**

varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions, . Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.7 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.7.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

1.7.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH 0100, threshold limit values.
- d. The appropriate OSHA standard in 29 CFR 1910.1025 and 29 CFR 1926.62 for surface preparation on painted surfaces containing lead. Additional guidance is given in SSPC Guide 6 and SSPC Guide 7. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.
- e. The appropriate OSHA standards in 29 CFR 1910.1001 for surface preparation of painted surfaces containing asbestos. Refer to drawings for list of hazardous materials located on this project. Contractor to coordinate paint preparation activities with this specification section.

1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation. Isolate area of application from rest of building when applying high-emission paints or coatings.

1.8.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer

recommendations.

1.8.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.9 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs.

1.10 LOCATION AND SURFACE TYPE TO BE PAINTED

1.10.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.10.1.1 Exterior Painting

Includes new surfaces of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.10.1.2 Interior Painting

Includes new surfaces and existing coated surfaces of the buildings and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

- a. Exposed columns, girders, beams, joists; and
- b. Other contiguous surfaces.

1.10.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

1.10.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
 - (1) Exposed piping, conduit, and ductwork;
 - (2) Supports, hangers, air grilles, and registers;
 - (3) Miscellaneous metalwork and insulation coverings.
- b. Do not paint the following, unless indicated otherwise:
 - (1) New zinc-coated, aluminum, and copper surfaces under insulation
 - (2) New aluminum jacket on piping
 - (3) New interior ferrous piping under insulation.

1.10.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

- a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
- b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 1.0 mil.

1.10.4 Definitions and Abbreviations

1.10.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.10.4.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.10.4.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.10.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.10.4.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.10.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.10.4.7 EXT

MPI short term designation for an exterior coating system.

1.10.4.8 INT

MPI short term designation for an interior coating system.

1.10.4.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.10.4.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.10.4.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.10.4.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with [ASTM D523](#). Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.10.4.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.10.4.14 Paint

See Coating definition.

1.10.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.10.4.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 [MATERIALS](#)

Conform to the [coating](#) specifications and standards referenced in PART 3.

Submit [manufacturer's technical data sheets](#) for specified [coatings](#) and solvents. Comply with applicable regulations regarding toxic and hazardous materials.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.
- b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, [ASTM D235](#). Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.
- c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- d. The requirements specified are minimum. Comply also with the [application instructions](#) of the paint manufacturer.
- e. Previously painted surfaces specified to be repainted shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.
- f. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.
- g. Chalk shall be removed so that when tested in accordance with [ASTM D4214](#), the chalk resistance rating is no less than 8.

- h. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.
- i. Edges of chipped paint shall be feather edged and sanded smooth.
- j. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.
- k. New, proposed coatings shall be compatible with existing coatings.

3.2.2 Existing Coated Surfaces with Minor Defects

Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings. Remove chalking by sanding so that when tested in accordance with [ASTM D4214](#), the chalk rating is not less than 8.

3.2.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

- a. Surfaces containing large areas of minor defects;
- b. Surfaces containing more than 20 percent peeling area; and
- c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

3.2.4 Substrate Repair

- a. Repair substrate surface damaged during coating removal;
- b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and
- c. Clean and prime the substrate as specified.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with [SSPC SP 1](#) to remove oil and grease. Where shop coat is missing or damaged, clean according to [SSPC SP 2](#), [SSPC SP 3](#), [SSPC SP 6/NACE No.3](#), or [SSPC SP 10/NACE No. 2](#). Brush-off blast remaining surface in accordance with [SSPC 7/NACE No.4](#); Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.
- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign Substances: Clean entire surface in accordance with [SSPC SP 6/NACE No.3](#) /[SSPC SP 12/NACE No.5](#) WJ-3.

3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in [SSPC SP 2](#) and [SSPC SP 3](#). As a visual reference, cleaned surfaces shall be similar to photographs in [SSPC VIS 3](#).

For abrasive blast cleaned surfaces, the requirements are stated in [SSPC 7/NACE No.4](#), [SSPC SP 6/NACE No.3](#), and [SSPC SP 10/NACE No. 2](#). As a visual reference, cleaned surfaces shall be similar to photographs in [SSPC VIS 1](#).

3.3.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, in accordance with [SSPC SP 1](#). If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in [ASTM D6386](#), Appendix X2, and remove by one of the methods described therein.
- b. Galvanized with Slight Coating Deterioration or with Little or No Rusting: Water jetting to [SSPC SP 12/NACE No.5](#) WJ3 to remove loose coating from surfaces with less than 20 percent coating deterioration and no blistering, peeling, or cracking. Use inhibitor as recommended by the coating manufacturer to prevent rusting.
- c. Galvanized With Severe Deteriorated Coating or Severe Rusting: Water jet to [SSPC SP 12/NACE No.5](#) WJ3 degree of cleanliness. Spot abrasive blast rusted areas as described for steel in [SSPC SP 6/NACE No.3](#), and waterjet to [SSPC SP 12/NACE No.5](#), WJ3 to remove existing coating.

3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with [SSPC SP 1](#) and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.3.5 Existing Surfaces with a Bituminous or Mastic-Type Coating

Remove chalk, mildew, and other loose material by washing with a solution of [1/2 cup](#) trisodium phosphate, [1/4 cup](#) household detergent, [one quart](#) 5 percent sodium hypochlorite solution and [3 quarts](#) of warm water.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

- a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.
- b. Surface Cleaning: Remove the following deleterious substances.
 - (1) Dirt, Chalking, Grease, and Oil: Wash new and existing uncoated surfaces with a solution composed of [1/2 cup](#) trisodium phosphate,

1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.

- (2) Fungus and Mold: Wash new, existing coated, and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
 - (3) Paint and Loose Particles: Remove by wire brushing.
 - (4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.
 - (5) Removal of Existing Coatings: For surfaces to receive textured coating MPI 42, remove existing coatings including soundly adhered coatings if recommended by textured coating manufacturer.
- c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.
- d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.4.2 Gypsum Board, Plaster, and Stucco

- a. Surface Cleaning: Plaster and stucco shall be clean and free from loose matter; gypsum board shall be dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.
- b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.
- c. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by ASTM D4263. New plaster to be coated shall have a maximum moisture content of 8 percent, when measured in accordance with ASTM D4444, Method A, unless otherwise authorized. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting.

3.5 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.5.1 New and Existing Coated Plywood and Wood Surfaces, Except Floors:

- a. Wood surfaces shall be cleaned of foreign matter.

Surface Cleaning: Surfaces shall be free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood. Scrape to remove loose coatings. Lightly sand to roughen the entire area of previously enamel-coated wood surfaces.

- b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution composed of 3 ounces (2/3 cup) trisodium phosphate, 1 ounce (1/3 cup) household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh water.
- c. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter in accordance with ASTM D4444, Method A, unless otherwise authorized.
- d. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints.
- e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.
- f. Cosmetic Repair of Minor Defects:
 - (1) Knots and Resinous Wood : Prior to application of coating, cover knots and stains with two or more coats of 3-pound-cut shellac varnish, plasticized with 5 ounces of castor oil per gallon. Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.
 - (2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.
 - (3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.
- g. Prime Coat For New Exterior Surfaces: Prime coat trim before wood becomes dirty, warped, or weathered.

3.5.2 Interior Wood Surfaces, Stain Finish

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

3.6 APPLICATION

3.6.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are

applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 1.0 mil. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

- a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. Finished Surfaces: Provide finished surfaces free from runs, drops,

ridges, waves, laps, brush marks, and variations in colors.

- d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

3.6.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.6.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.6.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 5.	Exterior Metal, Ferrous and Non-Ferrous Paint Table
Division 3.	Interior Concrete Paint Table
Division 5.	Interior Metal, Ferrous and Non-Ferrous Paint Table
Division 6.	Interior Wood Paint Table
Division 9:	Interior Plaster, Gypsum Board, Textured Surfaces Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
 - (1) One coat of primer.
 - (2) One coat of undercoat or intermediate coat.
 - (3) One topcoat to match adjacent surfaces.

- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.7 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.8 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.9 COATING SYSTEMS FOR WOOD AND PLYWOOD

- a. Apply coatings of Tables in Division 6 for Exterior and Interior.
- b. Prior to erection, apply two coats of specified primer to treat and prime wood and plywood surfaces which will be inaccessible after erection.
- c. Apply stains in accordance with manufacturer's printed instructions.

3.10 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide in accordance with MIL-STD-101. Place stenciling in clearly visible locations. On piping not covered by MIL-STD-101, stencil approved names or code letters, in letters a minimum of 1/2 inch high for piping and a minimum of 2 inches high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.11 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate

mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.12 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste in designated containers. Coordinate with manufacturer for take-back program. Set aside scrap to be returned to manufacturer for recycling into new product. When such a service is not available, local recyclers shall be sought after to reclaim the materials. Set aside extra paint for future color matches or reuse by the Government. Where local options exist for leftover paint recycling, collect all waste paint by type and provide for delivery to recycling or collection facility for reuse by local organizations.

3.13 PAINT TABLES

All DFT's are minimum values. Use only materials with a GPS green check mark having a minimum MPI "Environmentally Friendly" E1 E2 E3 rating based on VOC ([EPA Method 24](#)) content levels. Use only interior paints and coatings that meet VOC requirements of LEED low emitting materials credit. Acceptable products are listed in the MPI Green Approved Products List, available at <http://www.specifygreen.com/APL/ProductIdxByMPInum.asp>.

3.13.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned to [SSPC SP 2](#) or [SSPC SP 3](#)

1. Alkyd

New; MPI EXT 5.1Q-G5 (Semigloss) Existing; MPI REX 5.1D-G5

Primer: Intermediate: Topcoat:

[MPI 23](#) [MPI 94](#) [MPI 94](#)

System DFT: 5.25 mils

B. New Steel that has been blast-cleaned to [SSPC SP 6/NACE No.3](#):

1. Alkyd

New; MPI EXT 5.1D-G5 (Semigloss) / Existing; MPI REX 5.1D-G5

Primer: Intermediate: Topcoat:

[MPI 79](#) [MPI 94](#) [MPI 94](#)

System DFT: 5.25 mils

C. Existing steel that has been spot-blasted to [SSPC SP 6/NACE No.3](#):

1. Surface previously coated with alkyd or latex:

Waterborne Light Industrial Coating

STEEL / FERROUS SURFACES

MPI REX 5.1C-G5 (Semigloss)

Spot Primer:	Intermediate:	Topcoat:
MPI 79	MPI 163	MPI 163

System DFT: 5 mils

2. Surface previously coated with epoxy:

Waterborne Light Industrial

a. MPI REX 5.1L-G5 (Semigloss)

Spot Primer:	Intermediate:	Topcoat:
MPI 101	MPI 163	MPI 163

System DFT: 5 mils

D. New and existing steel blast cleaned to SSPC SP 10/NACE No. 2:

1. Waterborne Light Industrial

MPI EXT 5.1R-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 108	MPI 163

System DFT: 8.5 mils

EXTERIOR GALVANIZED SURFACES

E. New Galvanized surfaces:

1. Waterborne Primer / Waterborne Light Industrial Coating

MPI EXT 5.3J-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 134	MPI 163	MPI 163

System DFT: 4.5 mils

F. Galvanized surfaces with slight coating deterioration; little or no rusting:

1. Waterborne Light Industrial Coating

MPI REX 5.3J-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 134	N/A	MPI 163

System DFT: 4.5 mils

G. Galvanized surfaces with severely deteriorated coating or rusting:

1. Waterborne Light Industrial Coating

MPI REX 5.3L-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 101	MPI 108	MPI 163

System DFT: 8.5 mils

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

H. Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefabricated equipment. Match surrounding finish:

1. Alkyd

MPI EXT 5.4F-G5 (Semigloss)

Primer:	Intermediate:	Topcoat:
MPI 95	MPI 94	MPI 94

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

System DFT: 5 mils

- I. Surfaces adjacent to painted surfaces; Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. Alkyd

MPI EXT 5.1D-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 79 MPI 94 MPI 94

System DFT: 5.25 mils

- J. Hot metal surfaces including smokestacks subject to temperatures up to 400 degrees F:

1. Heat Resistant Enamel

MPI EXT 5.2A

Primer: Intermediate: Topcoat:

MPI 21 Surface preparation and number of coats per manufacturer's instructions.

System DFT: Per Manufacturer

3.13.2 INTERIOR PAINT TABLES

DIVISION 3: INTERIOR CONCRETE PAINT TABLE

- A. New and uncoated existing and Existing, previously painted Concrete, vertical surfaces, not specified otherwise:

1. Institutional Low Odor / Low VOC Latex

New; MPI INT 3.1M-G5 (Semigloss) / Existing; MPI RIN 3.1L-G5 (Semigloss)

Primer: Intermediate: Topcoat:

MPI 50 MPI 147 MPI 147

System DFT: 4 mils

- B. Uncoated existing and Existing, previously painted concrete floors :

1. Epoxy Floor Paint

New; MPI INT 3.2C-G6 (Gloss) / Existing; MPI RIN 3.2C-G6 (Gloss)

Primer: Intermediate: Topcoat:

MPI 77 MPI 77 MPI 77

System DFT: 5 mils

Note: Primer may be reduced for penetration per manufacturer's instructions.

- C. High Performance Floor Coating (Building 4224)

Provide a high performance floor coating in locations indicated on the Drawings.

1. Saw cut and chase perimeter edges to provide a "key-in" of material.
2. Prepare surface utilizing mechanical means where possible, (i.e. self-contained Blastrac with HEPA filter vacuum system, scarifiers,

scabblers, etc.).

3. Apply a Moisture Mitigation Primer.
4. Screed box apply floor base material using hand/power trowel to achieve a smooth, dense surface of 1/4" nominal thickness (thickness is prior to finishing and grinding).
5. Smooth base after initial cure to further ensure appearance.
6. Squeegee and roller apply one coat of 100% solids epoxy coating.
7. Broadcast light coating of aggregate as required for slip resistance.
8. Squeegee and roller apply one coat of 100% solids epoxy coating.
9. Apply two topcoats of Chemical Resistant Urethane.
10. Provide sealants that are chemically compatible or resistant to adjacent materials, or materials that may come into contact with the sealants in the course of the building life.

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. Existing, previously painted Concrete masonry:

1. Institutional Low Odor / Low VOC Latex
Existing; MPI RIN 4.2L-G5 (Semigloss)
Spot Primer: Intermediate: Topcoat:
MPI 50 MPI 147 MPI 147
System DFT: 4 mils

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

A. Metal, Mechanical, Electrical, Fire extinguishing sprinkler systems including valves, conduit, hangers, supports, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. High Performance Architectural Latex
MPI INT 5.1R-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 79 MPI 141 MPI 141
System DFT: 5 mils

B. Metal floors at Mezzanine and Stairs (Building 4224), (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations.:

1. Clean and dry ice blast to remove all contaminants and existing coatings as specified in Section 02 51 00 Surface Cleaning Decontamination.

2. Epoxy
MPI INT 5.1L-G6 (Gloss)
Primer: Intermediate: Topcoat:

INTERIOR STEEL / FERROUS SURFACES

MPI 101 MPI 77 MPI 77 (plus NSA)
System DFT: 5.25 mils

C. Metal in toilets and other high-humidity areas not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. Alkyd
MPI INT 5.1E-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 79 MPI 47 MPI 47
System DFT: 5.25 mils

D. Ferrous metal in concealed damp spaces or in exposed areas having unpainted adjacent surfaces:

1. Aluminum Paint
MPI INT 5.1M
Primer: Intermediate: Topcoat:
MPI 79 MPI 1 MPI 1
System DFT: 4.25 mils

E. Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. Alkyd
MPI INT 5.4J-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 95 MPI 47 MPI 47
System DFT: 5 mils

F. Hot metal surfaces subject to temperatures up to 400 degrees

1. Heat Resistant Enamel
MPI INT 5.2A
Primer: Intermediate: Topcoat:
MPI 21
Surface preparation and number of coats per manufacturer's instructions.
System DFT: Per Manufacturer

G. Underside of the Mezzanine, High Bay and adjacent areas - Structural Steel and Steel Roof Decking (Existing previously painted steel/ferrous surfaces-Building 4224)

1. Clean and dry ice blast to remove all contaminants and existing coatings as specified in Section 02 51 00 Surface Cleaning Decontamination.
2. Provide two coats of a one-component, multi-purpose epoxy, low gloss, 4.0-6.0 mils dry film thickness.

DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

A. New Wallboard

DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

1. Epoxy

New; MPI INT 9.2E-G6 (Gloss) / Existing; MPI RIN 9.2D-G6 (Gloss)

Primer: Intermediate: Topcoat:

MPI 50 MPI 77 MPI 77

System DFT: 4 mils

-- End of Section --

This page is intentionally left blank.

SECTION 10 14 00.20

INTERIOR SIGNAGE
11/12

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 basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in
Buildings - Safety Performance
Specifications and Methods of Test

ASTM INTERNATIONAL (ASTM)

ASTM B209 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

ASTM B221 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Extruded Bars, Rods,
Wire, Profiles, and Tubes

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

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Installation; G
Warranty; G

SD-04 Samples

Interior Signage; G

SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions; G
Protection and Cleaning; G

1.3 QUALITY ASSURANCE

1.3.1 Samples

Submit interior signage samples of each of the following sign types showing typical quality, workmanship and color: Standard Room sign.

1.3.2 Detail Drawings

Submit detail drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, mounting height, shape and thickness of materials, and details of construction. Include a schedule showing the location, each sign type, and message.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be packaged to prevent damage and deterioration during shipment, handling, storage and installation. Product shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

1.5 WARRANTY

Warrant the interior signage for a period of 2 years against defective workmanship and material. Warranties shall be signed by the authorized representative of the manufacturer. Submit warranty accompanied by the document authenticating the signer as an authorized representative of the guarantor. Guarantee that the signage products and the installation are free from any defects in material and workmanship from the date of delivery.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Signs shall be the standard product of a manufacturer regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

2.2 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

2.2.1 Standard Room Signs

Signs shall consist of acrylic plastic 0.080 inch thickness minimum conforming to ANSI Z97.1 6063-T5 extruded aluminum in accordance with ASTM B221 and ASTM B209 and shall conform to the following:

- a. End caps shall be aluminum with square style corners.

2.2.2 Type of Mounting For Signs

Provide extruded aluminum brackets for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs shall be by mechanical fasteners.

- a. All mounting materials shall be materials that are approved by the sign manufacturer for the mounting surface.

2.2.3 Character Proportions and Heights

Letters and numbers on signs conform to 36 CFR 1191.

2.2.4 Tactile Letters, Symbols and Braille

Raised letters and numbers on signs shall conform to 36 CFR 1191.

2.3 FABRICATION

- a. Comply with requirements indicated for materials, thickness, finishes, colors, designs, shapes, sizes, and details of construction.
- b. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation in a location not exposed to view after final assembly.
- c. Conceal fasteners.

2.4 TYPEFACE

ADA-ABA compliant font for Room Signs.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed plumb and true and in accordance with approved manufacturer's instructions at locations identified on the drawings. Mounting height and mounting location shall conform to 36 CFR 1191. Required blocking shall be installed. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions.

3.1.2 Protection and Cleaning

Protect the work against damage during construction.

-- End of Section --

This page is intentionally left blank.

SECTION 10 21 13

TOILET COMPARTMENTS
01/07

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.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2015) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A167 (2011) Standard Specification for
Stainless and Heat-Resisting
Chromium-Nickel Steel Plate, Sheet, and
Strip

ASTM A385/A385M (2011) Standard Practice for Providing
High-Quality Zinc Coatings (Hot-Dip)

ASTM A653/A653M (2015; E 2016) Standard Specification for
Steel Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM D6386 (2016) Standard Practice for Preparation
of Zinc (Hot-Dip Galvanized) Coated Iron
and Steel Product and Hardware Surfaces
for Painting

ASTM D7611/D7611M (2013; E 2014) Standard Practice for
Coding Plastic Manufactured Articles for
Resin Identification

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 COMM (2009) Standard And Commentary and Usable
Buildings and Facilities

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60003 (Basic) Partitions, Toilet, Complete

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

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

SD-03 Product Data

Cleaning and Maintenance Instructions
Colors And Finishes
Galvanized Steel Sheet
Sound-Deadening Cores
Anchoring Devices and Fasteners
Hardware and Fittings
Brackets
Door Hardware
Toilet Enclosures
Urinal Screens;
Pilaster Shoes

SD-04 Samples

Colors and FinishesG

SD-07 Certificates

Warranty

SD-10 Operation and Maintenance Data

Plastic Identification; G

1.3 REGULATORY REQUIREMENTS

Conform to ICC A117.1 COMM code for access for the handicapped operation of toilet compartment door and hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's original unopened packages with the brand, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated; free from dust, water, other contaminants, and damage during delivery, storage, and construction.

1.5 WARRANTY

Provide certification or warranties that metal toilet partitions will be free of defects in materials, fabrication, finish, and installation and will remain so for a period of not less than 15 years after completion.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

Provide a complete and usable toilet partition system, including toilet enclosures, room entrance screens, urinal screens, system of panels, hardware, and support components. Furnish the partition system from a single manufacturer, with a standard product as shown in the most recent catalog data. Submit manufacturer's Cleaning and Maintenance Instructions with Fabrication Drawings for review.

2.1.1 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D7611/D7611M. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

Type 1	Polyethylene Terephthalate (PET, PETE)
Type 2	High Density Polyethylene (HDPE)
Type 3	Vinyl (Polyvinyl Chloride or PVC)
Type 4	Low Density Polyethylene (LDPE)
Type 5	Polypropylene (PP)
Type 6	Polystyrene (PS)
Type 7	Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

2.2 MATERIALS

2.2.1 Galvanized Steel Sheet

Provide galvanized steel sheet cold-rolled, stretcher-level, commercial quality material, conforming to ASTM A653/A653M. Conform surface preparation of material for painting to ASTM D6386, Method A.

2.2.2 Sound-Deadening Cores

Provide sound deadening consisting of treated kraft paper honeycomb cores with a cell size of not more than 1 inch. Resin-material content shall weigh not less than 11 percent of the finished core weight. Expanded cores shall be faced on both sides with kraft paper.

2.2.3 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after

fabrication, in conformance with ASTM A385/A385M and ASTM A123/A123M.
Conceal all galvanized anchoring devices.

2.2.4 Brackets

Wall brackets shall be two-ear panel brackets, T-style, 1-inch stock.
Provide stirrup style panel-to-pilaster brackets.

2.2.5 Hardware and Fittings

2.2.5.1 General Requirements

Conform hardware for the toilet partition system to CID A-A-60003 for the specified type and style of partitions. Provide hardware finish highly resistant to alkalis, urine, and other common toilet room acids. Comply latching devices and hinges for handicap compartments with 36 CFR 1191; provide stainless steel devices and hinges with door latches that operate without either tight grasping or twisting of the wrist of the operator. Submit three samples of each item, including anchoring devices and fasteners. Approved hardware samples may be installed in the work if properly identified.

Material	Conformance Standard
Corrosion-resistant steel	ASTM A167, Type 304

2.2.5.2 Finishes

- a. Corrosion-resistant steel shall have a No. 4 finish.
- b. Exposed fasteners shall match the hardware and fittings.

2.2.6 Door Hardware

2.2.6.1 Hinges

Hinges shall be adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees. Provide self-lubricating hinges with the indicated swing. Hinges shall be the cutout-insert type and have the following type of return movement:

- a. Gravity return movement

2.2.6.2 Latch and Pull

Latch and pull shall be a combination rubber-faced door strike and keeper equipped with emergency access.

2.2.6.3 Coat Hooks

Coat hooks shall be combination units with hooks and rubber tipped pins.

2.3 PARTITION PANELS AND DOORS

Fabricate partition panels and doors not less than 1 inch thick with face sheets not less than 0.0396 inch thick.

2.3.1 Toilet Enclosures

Conform toilet enclosures to CID A-A-60003, Type I, Style C, overhead braced. Furnish width, length, and height of toilet enclosures as shown. Provide a width of 1 inch. Finish surface of panels shall be solid polyethylene, Finish 5; water resistant; graffiti resistant; non-absorbent. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required. Provide grab bars to withstand a bending stress, shear stress, shear force, and a tensile force induced by 250 lbf. Grab bars shall not rotate within their fittings.

2.3.2 Urinal Screens

Conform urinal screens to CID A-A-60003, Type III, Style A, floor supported. Provide finish for surface of screens as solid polyethylene, Finish 5; water resistant; graffiti resistant; non-absorbent; . Furnish width and height of urinal screens as shown. Provide thickness of 1 inch. Secure wall hung urinal screens with 42 inch long, continuous flanges. Fabricate screens from the same types of panels and pilasters as the toilet partitions. Use corrosion-resistant steel fittings and fasteners.

2.4 OVERHEAD-BRACED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0393 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a channel-shaped floor stirrup fabricated from not less than 0.0635 inch thick material and a leveling bolt. Secure the stirrup to the pilaster with not less than a 3/16 inch bolt and nut after the pilaster is leveled. Secure the stirrup to the floor with not less than two lead expansion shields and sheetmetal screws. Fabricate overhead brace from a continuous extruded aluminum tube not less than 1 inch wide by 1-1/2 inch high, 0.125-inch wall thickness. Finish shall be AA-C22A31 in accordance with AA DAF45. Set and secure brace into the top of each pilaster. Fabricate 3 inch high trim piece at the floor from not less than 0.030 inch thick corrosion-resistant steel.

2.5 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Pilaster shoes shall be stainless steel. Height shall be 3 inches.

2.6 HARDWARE

Provide hardware for the toilet partition system that conforms to CID A-A-60003 for the specified type and style of partitions. Provide hardware pre-drilled by manufacturer. Use a hardware finish that is highly resistant to alkalis, urine, and other common toilet room acids. Hardware includes: chrome plated non ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; chrome plated aluminum door latch; door strike and keeper with rubber bumper; and cast

alloy chrome plated coat hook and bumper. Provide latching devices and hinges for handicap compartments complying with 36 CFR 1191 and stainless steel door latches that operate without either tight grasping or twisting of the wrist of the operator. Use stainless steel, tamper proof type screws and bolts. Wall mounting brackets must be heavy-duty anodized extruded aluminum 6063-T5 alloy), 1/8 inch thick, in accordance with toilet compartment manufacturer's instructions. Provide floor-mounted anchorage consisting of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.

2.7 COLORS AND FINISHES

2.7.1 Colors

Provide manufacturer's standard color charts for color of finishes for toilet partition system components.

2.7.2 Finishes No. 5

Provide solid plastic fabricated of polymer resins (polyethylene) formed under high pressure rendering a single component section not less than one inch thick. Colors shall extend throughout the panel thickness. Provide exposed finish surfaces: orange peel texture, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions shall not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 80 degrees F for a minimum of 30 days:

Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
Acetone	Hydrogen Peroxide (30 percent)
Ammonia (liquid)	Isopropyl Alcohol
Ammonia Phosphate	Lactic Acid (25 percent)
Bleach (12 percent)	Lime Sulfur
Borax	Nicotine
Brine	Potassium Bromide
Caustic Soda	Soaps
Chlorine Water	Sodium Bicarbonate
Citric Acid	Trisodium Phosphate
Copper Chloride	Urea; Urine
Core Oils	Vinegar

PART 3 EXECUTION

3.1 PREPARATION

Take field measurements prior to the preparation of drawing and fabrication to ensure proper fits. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work. Verify correct spacing of plumbing fixtures. Verify correct location of built in framing, anchorage, and bracing. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the work of this section. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

Install partitions rigid, straight, plumb, and level, with the panels centered between the fixtures. Provide a panel clearance of not more than $1/2$ inch and secure the panels to walls and pilasters with not less than two wall brackets attached near the top and bottom of the panel. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints. Secure Panels to pilasters with brackets matching the wall brackets. Provide for adjustment due to minor floor variations. Locate head rail joints at pilaster center lines. Install adjacent components for consistency of line and plane. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors.

- a. Secure panels to hollow plastered walls with toggle bolts using not less than $1/4$ -20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.
- b. Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than $1/4$ -20 screws of the length required for the wall thickness. Toggle bolts shall have a load-carrying strength of not less than 600 pounds per anchor.
- c. Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with not less than $1/4$ -20 screws, with a shield length of not less than $1-1/2$ inch. Expansion shields shall have a load-carrying strength of not less than 600 pounds per anchor.
- d. Submit Installation Drawings for metal toilet partitions and urinal screens showing plans, elevations, details of construction, hardware, reinforcing and blocking, fittings, mountings and escutcheons. Indicate on drawings the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

3.3 FLOOR-ANCHORED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level tops of doors with tops of pilasters when doors are in a closed position. Expansion shields shall have a minimum 2 -inch penetration into the concrete slab.

3.4 OVERHEAD-BRACED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Secure overhead brace to the pilaster face with not less than two fasteners per face. Expansion shields shall have a minimum 2-inch penetration into the concrete slab. Make tops of doors parallel with the overhead brace when doors are in a closed position.

3.5 FINAL ADJUSTMENT

After completion of the installation, make final adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly. Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched.

3.6 CLEANING

Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Clean all surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner compliant with the manufacturer's recommended cleaning and protection from damage procedures until accepted. Remove all equipment, tools, surplus materials, and work debris from the site.

-- End of Section --

SECTION 10 22 13

WIRE MESH PARTITIONS

08/16

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 IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3 (2002; Suppl 2001-2004; R 2008)
Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2014) Standard Specification for Carbon
Structural Steel

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wire Mesh Partitions

Show layout, details, materials, dimensions, finishes, and all information necessary for fabrication and installation.

SD-03 Product Data

Wire Mesh Partitions

Submit for each type of partition, door, and window.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials in manufacturer's original, unopened containers or packaging with labels intact and legible. Deliver, store, and handle materials so as to prevent damage. Replace damaged or defective materials with new.

1.4 DESCRIPTION OF WORK

Wire mesh partitions must be heavy duty for extra heavy industrial use. Provide partitions complete with fasteners, capping bars, adjustable floor sockets, bracing, doors, hardware, and other items necessary for a complete, useable, and rigid installation.

PART 2 PRODUCTS

2.1 MATERIALS

Metal post and framing materials listed below must contain a minimum of 15 percent post-consumer recycled content and wire materials must contain a minimum of 50 percent post-industrial recycled content.

2.1.1 Steel Shapes, Plates, and Bars

ASTM A36/A36M.

2.1.2 Cold-Formed Steel

AISI SG03-3.

2.1.3 Wire Mesh

Carbon steel wire, woven diamond mesh, intermediate crimped.

2.1.4 Floor Sockets

Cast or forged steel or ductile iron, adjustable, approximately 2-1/2 inches high.

2.2 HEAVY DUTY PARTITIONS

2.2.1 Wire Mesh

6 gage wire, 2 inch mesh.

2.2.2 Panel Frames

1-1/2 by 3/4 by 1/8 inch steel channels.

2.2.3 Center Reinforcing Bar

One 1-1/2 by 3/4 by 1/8 inch channel with all wires woven through, or two 1-1/4 by 3/8 by 1/8 inch channels bolted together with mesh in between.

2.2.4 Capping Bar

Structural steel channel, 3 inch by 4.1 pounds.

2.2.5 Corner Posts

Structural steel angles, 1-3/4 by 1-3/4 by 1/8 inch.

2.2.6 Line Posts

Unless otherwise indicated, provide partitions with flat bar line posts bolted between vertical frame channels. Sizes of posts must be as follows:

Partition Height	Size of Posts
7 feet to 12 feet	2-1/2 by 5/16 inch

Partition Height	Size of Posts
12 feet to 16 feet	3 by 5/16 inch or 2-1/2 by 3/8 inch
16 feet to 20 feet	3-1/2 by 5/16 inch

2.2.7 Hinged Doors

Frames must be 1-1/2 by 3/4 by 1/8 inch channels with 1-1/2 by 1/8 inch flat bar cover on top and bottom rails and on hinge stile and a 1-5/8 by 7/8 by 1/8 inch angle riveted to the lock stile. Provide 1-1/2 pairs of heavyweight, wrought steel, non-removable pin, butt hinges riveted or welded to the door and the door opening frame for each door.

2.3 DOOR OPENING FRAMES

Provide frames the same size and shape as the vertical frames for the mesh panels.

2.4 LOCKS

Provide each door with a mortise type lock with a six-pin tumbler lock cylinder on the outside and a recessed knob on the inside.

2.5 FABRICATION

2.5.1 Standard Panels

Wire must be woven into diamond mesh, intermediate crimped, and securely clinched to frames. Joints must be mortised and tenoned. Wire must be continuous at center reinforcing bars, either woven through a single channel or bolted between two channels. Panel vertical frames must have 3/8 inch bolt holes 18 inches o.c. for heavy duty partitions.

2.5.2 Doors

Construction must be similar to that specified for panels. Wire mesh must be the same as that used in the adjacent partition panels.

2.5.3 Finish

Thoroughly clean ferrous metal, treat with phosphate, and paint with gray enamel in the shop.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wire Mesh Partitions

Install plumb, level, and true to line, within a tolerance of 1/8 inch in 10 feet or the height or run of the partition, if less than 10 feet. Anchor floor sockets to the floor with expansion bolts. Bolt vertical frames and posts together with 3/8 inch bolts 18 inches o.c. for heavy duty partitions. Secure top frames to a continuous capping bar with 1/4 inch diameter U bolts not more than 28 inches o.c.

3.1.2 Doors

Install in accordance with the manufacturers' recommendations. Adjust as required so that doors and hardware operate freely and properly.

3.1.3 Bracing

Brace free standing partitions more than 20 feet in length, at intervals not greater than 20 feet with a steel channel brace connected to the capping bar and anchored to the building wall or framing member, or with a structural steel I section or tube post welded to a 9 by 9 inch steel base plate anchored to the floor with 4 expansion bolts.

3.1.4 Touch-Up

Clean and paint scratches, abrasions, and other damage to shop painted surfaces to match the shop-applied finish.

Repair minor surface rust areas. Clean and prime with rust inhibitive primer paint. Apply final paint to match shop-applied finishes.

-- End of Section --

SECTION 10 26 00

WALL AND DOOR PROTECTION
08/10

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 A167 (2011) Standard Specification for
Stainless and Heat-Resisting
Chromium-Nickel Steel Plate, Sheet, and
Strip

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards

SD-03 Product Data

Corner Guards

SD-04 Samples

Finish

1.3 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. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, corner guards shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items

differing in minor details from those shown will be acceptable.

2.2 CORNER GUARDS

2.2.1 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 18 gauge thick material conforming to ASTM A167, type 302 or 304. Corner guards shall extend from floor to ceiling and have 2-inch legs. Corner guards shall have a adhesive backing for permanent backing.

2.3 FINISH

2.3.1 Stainless Steel Finish

Finish for stainless steel shall be in accordance with ASTM A167, Type 302 or 304, finish number 4.

2.4 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

3.1.2 Stainless Steel Guards

- a. Mount guards on external corners of interior walls, partitions and columns as in accordance with manufacturer's recommendations.
- b. 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.

-- End of Section --

SECTION 10 28 13

TOILET ACCESSORIES
07/06

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 C1036 (2016) Standard Specification for Flat Glass

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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes; G
Accessory Items; G

SD-07 Certificates

Accessory Items

1.3 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Provide toilet accessories where indicated on the Drawings. Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited

for use with the supporting construction. Provide tamperproof design exposed fasteners with finish to match the accessory.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

2.2.1 Grab Bar (GB)

Provide an 18 gauge, 1-1/4 inch grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide concealed mounting flange. Provide grab with satin finishpeened non-slip surface. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

2.2.2 Mirrors, Glass (MG)

Provide Type I transparent flat type, Class 1-clear glass for mirrors. Glazing Quality q1 1/4 inch thick conforming to ASTM C1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication. All mirrors are to have frames. Frames shall be as follows: Alloy 18-8, type 304, 18 gauge stainless steel. Unitized all welded construction. Corners mitered, welded and polished. Exposed surfaces shall have No. 4 satin finish. Edges and corners to be burrfree.

2.2.3 Automatic, Universal Surface-Mounted Roll Towel Dispenser (RTD)

Provide paper towel dispenser constructed of durable plastic construction with translucent cover, surface mounted. Furnish tumbler key lock locking mechanism. Roll paper towel mechanism must accept universal standard-core, non-perforated rolls 8" wide, 8" diameter by 800 feet long. Operation must

be electronic sensor which automatically dispenses towel when hands are placed under the towel opening. Dispenser must be powered by alkaline batteries.

2.2.4 Combination Paper Towel Dispenser/Waste Receptacle (PTDWR)

Provide semi-recessed dispenser/receptacle with a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Design waste receptacle to be locked in unit and removable for service. Provide tumbler key locking mechanism. Provide waste receptacle capacity of 12 gallons. Fabricate a minimum 0.03 inch stainless steel welded construction unit with all exposed surfaces having a satin finish. Provide waste receptacle that accepts reusable liner standard for unit manufacturer.

2.2.5 Sanitary Napkin Disposer (SND)

Construct a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners. Provide fifty disposable liners of the type standard with the manufacturer. Retain receptacle in cabinet by tumbler lock. Provide disposer with a door for inserting disposed napkins, surface mounted.

2.2.6 Shower Curtain (SC)

Provide shower curtain, size to suit conditions. Provide anti-bacterial nylon/vinyl fabric curtain. Furnish white color .

2.2.7 Shower Curtain Rods (SCR)

Provide Type 304 stainless steel shower curtain rods 1-1/4 inch OD by 0.049 inch minimum straight to meet installation conditions.

2.2.8 Soap Dispenser (SD)

Provide soap dispenser surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.9 Towel Bar (TB)

Provide stainless steel towel bar with a minimum thickness of 0.015 inch. Provide minimum 3/4 inch diameter bar, or 5/8 inch square. Provide satin finish.

2.2.10 Toilet Tissue Dispenser, Jumbo (TTDJ)

Provide surface mounted toilet tissue dispenser with 2 rolls of jumbo tissue. Fabricate cabinet of high-impact plastic body and transparent plastic front cover. Provide cover with key lock.

2.2.11 Folding Shower Seat (FSS)

Folding shower seat shall have a frame constructed of type-304 satin finish stainless steel, 16-gauge, 1-1/4 inch square tubing, and 18-gauge, 1 inch diameter seamless tubing. Seat shall be constructed of one-piece, 1/2 inch thick water-resistant, ivory colored solid phenolic with black edge. Clearance between back of shower seat and wall shall be 1-1/2 inches to comply with ADA Accessibility Guidelines (ADAAG). Seat supports shall not

come into contact with the floor. Seat shall be able to lock in upright position when not in use. Seat shall be attached to wall by two 3 inch diameter mounting flanges constructed of type-304, 3/16 inch thick stainless steel with satin finish. Manufacturer's service and parts manual shall be provided to building owner/manager upon completion of project.

2.2.12 Mop and Broom Holder (MH)

Stainless steel, minimum 18 gauge with grip jaw cam mechanism securing 3 mop or broom handles. Mop holders are to be riveted to the strip. Also include storage shelf, 8 inches deep with return edges.

2.2.13 Recycling Stations (RS)

Provide triangular stainless steel (satin finish) recycling receptacles with 17-1/2 inch length per side and 32 inch height. Provide lids molded from polyethylene with a UL94HB fire rating. Provide liners molded from durable black polyethylene with a UL94HB fire rating. The capacity must be 16 gallons minimum with a weight of approximately 40 pounds for each station. The top of the station will have labels and text. Provide five (5 total) stations for: Refuse (2); Recycle-Paper; Recycle-Plastic; Recycle-Aluminum Cans.

2.2.14 Robe Hook (RH)

Provide double robe hook, satin finish contoured 4 inch wide bar with hook at each end, projects 1-7/8 inch from wall.

PART 3 EXECUTION

3.1 INSTALLATION

Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates. Install accessories with sheet metal screws or wood screws in lead-lined braided jute, PTFE or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required

by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

-- End of Section --

This page is intentionally left blank.

SECTION 10 44 16

FIRE EXTINGUISHER CABINETS

05/15

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings
Cabinets; G

SD-03 Product Data
Cabinets; G

1.2 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.

PART 2 PRODUCTS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: cabinets.

2.1 SYSTEM DESCRIPTION

2.2 EQUIPMENT

2.2.1 Cabinets

2.2.1.1 Material

Provide enameled steel cabinets.

2.2.1.2 Type

Provide semi-recessed cabinet for a 4-inch wall.

2.2.1.3 Size

Dimension cabinets to accommodate a standard 10 pound extinguisher..

PART 3 EXECUTION

3.1 INSTALLATION

Fire Extinguisher cabinets where indicated on the drawings. Verify exact locations prior to installation.

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 10 56 13

STEEL SHELVING

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.

MATERIAL HANDLING INDUSTRY OF AMERICA (MHI)

MHI MH28.1 (1997) Specification: Industrial Steel
Grade Shelving

1.2 DEFINITIONS

For the purposes of this specification the shelf category, "heavy duty" will be as follows. Load is given per shelf in pounds for evenly distributed load. This does not limit the shelf size, only the shelving category.

Minimum Evenly Distributed Load Per Shelf in Pounds		
Shelf Size		Type Heavy Duty
18 by 36 in.		1300
18 by 48 in.		900

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

Shelving Units

SD-03 Product Data

Shelving Units

Accessories

Installation instructions

SD-04 Samples

Finish

SD-06 Test Reports

Shelving Units

Finish

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in original packages, containers or bundles bearing the brand name and identification of the manufacturer. Store inside under cover. Protect surfaces from damage.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

MHI MH28.1. Provide shelving units indicated with fixed plywood shelves. Provide 5/8 inch thick High Density Overlay (HDO) plywood mechanically fastened (no exposed fasteners on top of shelf) to steel shelf support framing. Provide shelving units to meet loads, designated in paragraph 1.2 "DEFINITIONS". Provide units with base plates for floor anchorage, with anchor bolts epoxied into the concrete slab. Post shelving weight limit placards indicating maximum capacities..

2.2 "ACCESSORIES

- a. Label holder 2 1/4 by 3/4 inches.

2.3 FINISH

Provide the shelving units in the manufacturer's standard colors. Clean metal by multiple stage phosphatizing and sealing process, for rust resistance and paint adhesion. Provide electrostatically applied enamel finish coats, baked hard for a minimum of 30 minutes at 300 degrees F. Color must be grey.

2.4 SOURCE QUALITY CONTROL

- a. MHI MH28.1, for tests of shelf capacity, lateral stability and shelf connections.

PART 3 EXECUTION

3.1 EXAMINATION

Before installation, examine shelving units for dents and scratches. Replace damaged shelving.

3.2 INSTALLATION

Install shelving according to manufacturer's installation instructions. Make floor connections as indicated.

3.3 PROTECTION

Cover and protect shelving from damage during the completion of construction. Remove prior to acceptance of project.

F-35B Lift System Repair Facility
MCAS CHERRY POINT, NC

17P766
EPROJECT W.O. NO. 1564839

-- End of Section --

This page is intentionally left blank.

SECTION 13 34 19

METAL BUILDING SYSTEMS

11/11

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2011; Errata 1 2012; Errata 2 2013; Errata 3 2015) Steel Construction Manual

AISC 341 (2012) Seismic Provisions for Structural Steel Buildings

AISC 360 (2016) Specification for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121 (2004) Standard Definitions for Use in the Design of Steel Structures

AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M (2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

AWS D1.3/D1.3M (2008; Errata 2008) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A1011/A1011M (2017) Standard Specification for Steel

Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM A193/A193M

(2016) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications

ASTM A307

(2014) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A325

(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A36/A36M

(2014) Standard Specification for Carbon Structural Steel

ASTM A463/A463M

(2010; R 2015) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A475

(2003; R 2014) Standard Specification for Zinc-Coated Steel Wire Strand

ASTM A500/A500M

(2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A501/A501M

(2014) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

ASTM A529/A529M

(2014) Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality

ASTM A53/A53M

(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A563

(2015) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A563M

(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)

ASTM A572/A572M

(2015) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

ASTM A653/A653M

(2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A755/A755M	(2016; E 2016) Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A992/A992M	(2011) Standard Specification for Structural Steel Shapes
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1308	(2013) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D1667	(2017) Standard Specification for Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D2794	(1993; R 2010) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D3363	(2005; E 2011; R 2011; E 2012) Film Hardness by Pencil Test
ASTM D4214	(2007; R 2015) Standard Test Method for

Evaluating the Degree of Chalking of
Exterior Paint Films

ASTM D522/D522M	(2014) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2014) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2009) Evaluating Degree of Blistering of Paints
ASTM D822	(2013) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D968	(2015) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM DEFONLINE	(2008) ASTM Online Dictionary of Engineering Science and Technology
ASTM E1592	(2005; R 2012) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E1646	(1995; R 2011) Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Air Pressure Difference
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F1554	(2015; E 2016; E 2017) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
ASTM F1852	(2014) Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM F436	(2011) Hardened Steel Washers
ASTM F844	(2007a; R 2013) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM G152	(2013) Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA MBSM (2002) Metal Building Systems Manual

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 (2006) Metal Finishes Manual

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA RoofMan (2011 thru 2014) The NRCA Roofing Manual

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

SMACNA 1793 (2012) Architectural Sheet Metal Manual,
7th Edition

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 15 (1999; E 2004) Steel Joist Shop Primer

SSPC Painting Manual (2002) Good Painting Practice, Steel
Structures Painting Manual, Volume 1

SSPC SP 2 (1982; E 2000; E 2004) Hand Tool Cleaning

UNDERWRITERS LABORATORIES (UL)

UL 580 (2006; Reprint Oct 2013) Tests for Uplift
Resistance of Roof Assemblies

1.2 GENERAL REQUIREMENTS

1.2.1 Structural Performance

Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within the limits and conditions indicated.

1.2.1.1 Engineering

Design metal building systems conforming to procedures described in **MBMA MBSM**.

1.2.1.2 Design Loads

Conform to the requirements of **MBMA MBSM**, **ASCE 7**, and the building code applicable to the project geographical location.

1.2.1.3 Live Loads

Include all vertical loads induced by the building occupancy indicated on the drawings, as well as loads induced by maintenance workers, materials and equipment for roof live loads.

1.2.1.4 Roof Snow Loads

Include vertical loads induced by the ground snow load at the project site

of 10 pounds per square foot. Allow for unbalanced and drift loads.

1.2.1.5 Wind Loads

Include horizontal loads induced by a basic wind speed Project site of 138 miles per hour.

1.2.1.6 Collateral Loads

Include additional dead loads other than the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings.

1.2.1.7 Auxiliary Loads

Include dynamic live loads, such as those generated by cranes and materials-handling equipment indicated on detail drawings.

1.2.1.8 Load Combinations

Design metal building systems to withstand the most critical effects of load factors and load combinations as required by MBMA MBSM, ASCE 7, and the building code applicable to the project location.

1.2.1.9 Deflection Limits

Engineer assemblies to withstand design loads with deflections no greater than the following:

- a. Purlins and Rafters; vertical deflection of 1/240 of the span.
- b. Metal Roof Panels; vertical deflection of 1/240 of the span.

Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings. Provide metal panel assemblies capable of withstanding the effects of loads and stresses indicated, based on testing according to ASTM E1592.

1.2.2 Seismic Performance

Design and engineer metal building system capable of withstanding the effects of earthquake motions determined according to ASCE 7, AISC 341, and the applicable portions of the building code in the geographic area where the construction will take place.

1.2.3 Thermal Movements

Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss as follows:

Temperature Change (Range); 120 F, ambient; 180 F, material surfaces.

1.2.4 Water Penetration for Metal Roof Panels

No water penetration when tested according to [ASTM E1646](#) at test-pressure difference of [2.86 lbf/sq.ft.](#).

1.2.5 Wind-Uplift Resistance

Provide metal roof panel assemblies that comply with [UL 580](#) for Class 90.

1.3 DEFINITIONS

[ASTM DEFONLINE](#) applies to this definition paragraph.

- a. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.
- b. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
- c. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
- d. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).
- e. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
- f. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.
- g. Terminology Standard: Refer to MBMA "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 SYSTEM DESCRIPTION

General: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal roof panels, and accessories complying with requirements indicated.

Provide metal building system of size and with spacing, slopes, and spans indicated.

1.4.1 Primary Frame Type

- a. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

1.4.2 Fixed End-Wall Framing

Provide manufacturer's standard fixed end wall, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

1.4.3 Secondary Frame Type

Provide manufacturer's standard purlins .

1.4.4 Eave Height

Eave height must be as indicated by nominal height on Drawings.

1.4.5 Bay Spacing

Bay Spacing must be as indicated on the Drawings.

1.4.6 Roof Slope

Roof slope must be as indicated on the Drawings.

1.4.7 Roof System

Provide manufacturer's standard trapezoidal-rib standing-seam metal roof panels.

1.5 SUBMITTALS

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

SD-01 Preconstruction Submittals

Manufacturer's Qualifications; G

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Manufacturer's catalog data; G

SD-04 Samples

Flush Profile Metal Panels (Soffit)

Manufacturer's color charts and chips, 4 by 4 inches; G

SD-05 Design Data

Manufacturer's descriptive and technical literature; G

Manufacturer's building design analysis; G

SD-06 Test Reports

test reports; G

Coatings and base metals; G

Factory Color Finish Performance Requirements; G

SD-07 Certificates

system components ; G

Coil Stock certification; G

Qualification of Manufacturer; G

Qualification of Erector; G

SD-08 Manufacturer's Instructions

Installation of Roof panels; G

SD-11 Closeout Submittals

Manufacturer's Warranty; G

Contractor's Warranty for Installation; G

1.6 QUALITY ASSURANCE

1.6.1 Pre-Erection Conference

After submittals are received and approved but before metal building system work, including associated work, is performed, the Contracting Officer will hold a pre-erection conference to review the following:

- a. The detail drawings, specifications, and manufacturer's descriptive and technical literature.
- b. Finalize construction schedule and verify availability of materials, erector's personnel, equipment, and facilities needed to make progress and avoid delays.
- c. Methods and procedures related to metal building system erection, including, but not limited to: qualification of manufacturer, qualification of erector, manufacturer's catalog data, building design analysis, written instructions and test reports.
- d. Support conditions for compliance with requirements, including alignment between and erection of structural members.
- e. Flashing, special roofing and siding details, roof and wall penetrations, openings, and condition of other construction that will affect metal building system, including coatings and base metals, factory color finish performance requirements, system components, and certificates for coil stock.
- f. Governing regulations and requirements for, certificates, insurance, tests and inspections if applicable.

- g. Temporary protection requirements for metal panel assembly during and after installation.

1.6.1.1 Pre-Roofing and Siding Installation Conference

After structural framing system erection and approval but before roofing work, including associated work, is performed; the Contracting Officer will hold a pre-roofing conference to review the following:

- a. Examine purlins and formed shapes conditions for compliance with requirements, including flatness and attachment to structural members.
- b. Review structural limitations of purlins and formed shapes during and after roofing and siding.
- c. Review flashings, special roof and wall details, roof drainage, roof penetrations, roof equipment curbs, and condition of other construction that will affect the metal building system.
- d. Review temporary protection requirements for metal roof panels' assembly during and after installation.
- e. Review roof observation and repair procedures after metal building system erection.

1.6.2 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products, erection of structural framing and [installation of roof panels](#) in the geographical area where construction will take place.

1.6.3 [Manufacturer's Qualifications](#)

Metal building system manufacturer must have a minimum of five (5) years experience as a qualified manufacturer and a member of MBMA of metal building systems and accessory products.

Provide engineering services by an authorized currently licensed engineer in the geographical area where construction will take place, having a minimum of four years experience as an engineer knowledgeable in building design analysis, protocols and procedures for the "Metal Building Systems Manual" ([MBMA MBSM](#)); [ASCE 7](#), and [ASTM E1592](#).

Provide certified engineering calculations using the products submitted for:

- a. Roof and Wall Wind Loads with basic wind speed, exposure category, co-efficient, importance factor, designate type of facility, negative pressures for each zone, methods and requirements of attachment.
- b. Roof Dead and Live Loads
- c. Collateral Loads
- d. Foundation Loads
- e. Roof Snow Load

f. Seismic Loads

1.6.4 Qualification of Erection Contractor

An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and must be approved and certified by the metal building system manufacturer.

1.6.5 Single Source

Obtain primary and secondary components and structural framing members, each type of metal roof, wall and liner panel assemblies, clips, closures and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

1.6.6 Welding

Qualify procedures and personnel according to AWS A5.1/A5.1M, AWS D1.1/D1.1M, and AWS D1.3/D1.3M.

1.6.7 Structural Steel

Comply with AISC 325, AISC 341 for seismic impacted designs, and AISC 360, for design requirements and allowable stresses.

1.6.8 Cold-Formed Steel

Comply with AISC/AISI 121 and AISI SG03-3 for design requirements and allowable stresses.

1.6.9 Surface-Burning Characteristics

Provide metal panels having material with the following surface-burning characteristics as determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency showing:

- a. Flame-Spread Index: 25 or less.
- b. Smoke-Developed Index: 450 or less.

1.6.10 Fabrication

Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles with dimensional and structural requirements

Provide metal panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel. .

Fabricate metal panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA 1793 that apply to the design, dimensions, metal, and other characteristics of item indicated:

- a. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- b. End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- c. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- d. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
- e. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA or by metal building system manufacturer for application, but not less than thickness of metal being secured.

1.6.11 Finishes

Comply with **NAAMM AMP 500** for recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.7 SHIPPING, HANDLING AND STORAGE

1.7.1 Delivery

Package and deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed and protected during transportation and handling.

Stack and store metal panels horizontally on platforms or pallets, covered with suitable weather-tight and ventilated covering to ensure dryness, with positive slope for drainage of water. Store in a manner to prevent bending, warping, twisting, and surface damage. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage. Retain strippable protective covering on metal panel for entire period up to metal panel installation.

1.8 PROJECT CONDITIONS

1.8.1 Weather Limitations

Proceed with installation preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing panel system or building.

1.8.2 Field Measurements

1.8.2.1 Established Dimensions for Foundations

Comply with established dimensions on approved anchor-bolt plans, established foundation dimensions, and proceed with fabricating structural framing. Do not proceed without verifying field measurements. Coordinate

anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

1.8.2.2 Established Dimensions for Metal Panels

Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8.2.3 Verification Record

Verify locations of all framing and opening dimensions by field measurements before metal panel fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in section on CAST-IN-PLACE CONCRETE.

Coordinate installation of fire suppression system equipment supports piping and supports and accessories, which are specified in Division 21 - FIRE SUPPRESSION.

Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leak-proof, secure, and non-corrosive installation.

1.10 WARRANTY

1.10.1 Building System Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal building system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Government. The warranty must provide that if within the warranty period, the metal building system shows evidence of deterioration resulting from defective materials and/or workmanship, correcting of any defects is the responsibility of the metal building system manufacturer. Repairs that become necessary because of defective materials and workmanship while metal building system is under warranty are to be performed within 32 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within 32 hours of notification will constitute grounds for having emergency repairs performed by others and will not void the warranty.

1.10.2 Roof System Weather-Tightness Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Government.

The warranty is to provide that if within the warranty period the roof panel system shows evidence of corrosion, perforation, rupture, loss of

weather-tightness or excess weathering due to deterioration of the panel system resulting from defective materials and correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Repairs that become necessary because of defective materials and workmanship while roof panel system is under warranty are to be performed within 24 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within 24 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty.

1.10.3 Roof Panel Finish Warranty

Furnish manufacturer's no-dollar-limit warranty for the metal panel system. The warranty period is to be no less than 20 years from the date of acceptance of the work and be issued directly to the Government.

The warranty is to provide that if within the warranty period the metal panel system shows evidence of checking, delaminating cracking, peeling, chalk in excess of a numerical rating of eight, as determined by [ASTM D4214](#) test procedures; or change colors in excess of five CIE or Hunter units in accordance with [ASTM D2244](#) or excess weathering due to deterioration of the panel system resulting from defective materials and finish or correction of the defective workmanship is to be the responsibility of the metal building system manufacturer.

Liability under this warranty is exclusively limited to replacing the defective coated materials.

Repairs that become necessary because of defective materials and workmanship while roof and wall panel system is under warranty are to be performed within 32 hours after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within 32 hours of notification will constitute grounds for having emergency repairs performed by others and not void the warranty.

PART 2 PRODUCTS

2.1 STRUCTURAL FRAMING MATERIALS

2.1.1 W-Shapes

[ASTM A992/A992M](#); [ASTM A572/A572M](#) or [ASTM A529/A529M](#).

2.1.2 Channel, Angles, M-Shapes and S-Shapes

[ASTM A36/A36M](#); [ASTM A572/A572M](#) or [ASTM A529/A529M](#).

2.1.3 Plate and Bar

[ASTM A36/A36M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#).

2.1.4 Steel Pipe

[ASTM A36/A36M](#), [ASTM A53/A53M](#), [ASTM A572/A572M](#) or [ASTM A529/A529M](#).

2.1.1.5 Cold-Formed and Hot Formed Hollow Structural Sections

Cold formed: [ASTM A500/A500M](#) or [ASTM B221](#), [ASTM B221M](#). Hot-formed: [ASTM A501/A501M](#).

2.1.1.6 Structural-Steel Sheet

Hot-rolled, [ASTM A1011/A1011M](#) or cold-rolled, [ASTM A1008/A1008M](#).

2.1.1.7 Metallic-Coated Steel Sheet Pre-painted with Coil Stock Coating

Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with [ASTM A755/A755M](#).

- a. Aluminum-Zinc Alloy-Coated Steel Sheet: [ASTM A792/A792M](#), and [ASTM A463/A463M](#).

2.1.1.8 High-Strength Bolts, Nuts, and Washers

[ASTM A325](#), heavy hex steel structural bolts; [ASTM A563](#) heavy hex carbon-steel nuts; and [ASTM F436](#) hardened carbon-steel washers.

Finish: Plain.

Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: [ASTM F1852](#), heavy-hex-head steel structural bolts with spline.

Finish: Plain.

2.1.1.9 Non-High-Strength Bolts, Nuts, and Washers

[ASTM A307](#), [ASTM A563](#), and [ASTM F844](#).

Finish: Plain.

2.1.1.10 Anchor Rods

[ASTM F1554](#).

- a. Configuration: Straight.
- b. Nuts: [ASTM A563](#) hex carbon steel.
- c. Plate Washers: [ASTM A36/A36M](#) carbon steel.
- d. Washers: [ASTM F436](#) hardened carbon steel.
- e. Finish: Plain.

2.1.1.11 Threaded Rods

[ASTM A193/A193M](#).

- a. Nuts: [ASTM A563](#) hex carbon steel.
- b. Washers: [ASTM A36/A36M](#) carbon steel.
- c. Finish: Plain.

2.1.1.12 Primer

SSPC-Paint 15, Type I, red oxide.

2.2 FABRICATION

2.2.1 General

Comply with **MBMA MBSM** - "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

2.3 STRUCTURAL FRAMING

2.3.1 General

Clean all framing members to remove loose rust and mill scale. Provide 1 shop coat of primer to an average dry film thickness of 1 mil according to **SSPC SP 2**. Balance of painting and coating procedures must conform to **SSPC Paint 15** and **SSPC Painting Manual**.

2.3.2 Primary Framing

Manufacturer's standard structural primary framing system includes transverse and lean-to frames; rafter, rakes, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing designed to withstand required loads and specified requirements. Provide frames with attachment plates, bearing plates, and splice members. Provide frame span and spacing indicated.

Shop fabricate framing components by welding or by using high-strength bolts to the indicated size and section with base-plates, bearing plates, stiffeners, and other items required. Cut, form, punch, drill, and weld framing for bolted field erection.

- a. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
- b. Frame Configuration: One-directional sloped.
- c. Exterior Column Type: Tapered.
- d. Rafter Type: Tapered.

2.3.3 Secondary Framing

Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre-painted with coil coating, unless otherwise indicated.

Shop fabricate framing components by roll-forming or break-forming to the indicated size and section with base-plates, bearing plates, stiffeners, and other plates required for erection. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

- a. Purlins: C or Z-shaped sections; fabricated from steel sheet, built-up steel plates, or structural-steel shapes; minimum depth As required to comply with system performance requirements.
- b. Eave Struts: Unequal-flange, C-shaped sections; fabricated from steel

sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.

- c. Flange Bracing: Structural-steel angles or cold-formed structural tubing to stiffen primary frame flanges.
- d. Sag Bracing: Structural-steel angles.
- e. Base or Sill Angles: Zinc-coated (galvanized) steel sheet.
- f. Purlin and Girt Clips: Steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
- g. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from structural-steel sheet.
- h. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

2.3.4 Bracing

Provide adjustable wind bracing as follows:

- a. Rods: ASTM A36/A36M; ASTM A572/A572M; or ASTM A529/A529M threaded a minimum of 1 foot, 0 inches at each end.
- b. Cable: ASTM A475, 0.625 inch diameter, extra-high-strength grade, zinc-coated, multi-strand steel; with threaded end anchors. Increase cable thickness and strand count as needed to resist the calculated loading.
- c. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
- d. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- e. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- f. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- g. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

2.4 PANEL MATERIALS

2.4.1 Steel Sheet

Roll-form steel roofliner panels to the specified profile, with $f_y = 22$ gauge and depth as indicated. Material must be plumb and true, and within the tolerances listed:

- a. Aluminum-Zinc Alloy-coated Steel Sheet conforming to ASTM A792/A792M

and AISI SG03-3.

- b. Individual panels to have continuous length to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified;

profile to be a 1-1/2 inch high rib at 12 inches o.c. with small stiffening ribs, 38 inch overall width with 36 inch coverage and exposed fasteners.

Smooth, flat Surface Texture.

2.4.2 Flush Profile Metal Panels (Soffit)

Flush panels 24 gauge aluminum-zinc alloy coated steel conforming to ASTM A792/A792M with concealed fasteners, smooth finish, panel height - 7/8 inch and panel width - 12 inches. Factory finish is to be 70% fluoropolymer coating. Nominal dry-film thickness of coating is to be 1.0 mil.

- a. Fasteners:
 - 1. Manufacturer's standard #10 - 16 x 1" long self-drilling, self-tapping pancake head Phillips drive screws for metal, or fasteners required for the substrate the panels are being attached to.
- b. Accessories:
 - 1. Provide Manufacturer's standard accessories and other items essential to completeness of metal soffit system.
 - 2. Contiguous flashings to be fabricated to the same gauge and color as the panels(nonperforated).

2.4.3 Finish

All panels are to receive a factory-applied polyvinylidene fluoride finish consisting of a baked-on top-coat with a manufacturer's recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough drying.
- b. Prime Coating: A base coat of epoxy paint, specifically formulated to interact with the top-coat, is to be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. This prime coat must be oven cured prior to application of finish coat.
- c. Exterior Finish Coating: Apply the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 5 mils (3.80 plus 0.50 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol). This finish coat must be oven-cured.

- d. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. The wash-coat must be oven-cured.
- e. Color: The exterior finish chosen from the [manufacturer's color charts and chips](#).
- f. Physical Properties: Coating must conform to the industry and manufacturer's standard performance criteria as listed by the following certified test reports:

Chalking: [ASTM DEFONLINE](#)
Color Change and Conformity: [ASTM D2244](#)
Weatherometer: [ASTM G152](#), [ASTM G153](#) and [ASTM D822](#)
Humidity: [ASTM D2247](#) and [ASTM D714](#)
Salt Spray: [ASTM B117](#)
Chemical Pollution: [ASTM D1308](#)
Gloss at 60 degrees: [ASTM D523](#)
Pencil Hardness: [ASTM D3363](#)
Reverse Impact: [ASTM D2794](#)
Flexibility: [ASTM D522/D522M](#)
Abrasion: [ASTM D968](#)
Flame Spread: [ASTM E84](#)

2.4.4 Repair Of Finish Protection

Repair paint for color finish enameled metal panel must be compatible paint of the same formula and color as the specified finish furnished by the metal panel manufacturer, conforming to [ASTM A780/A780M](#).

2.5 MISCELLANEOUS METAL FRAMING

2.5.1 General

Cold-formed metallic-coated steel sheet conforming to [ASTM A653/A653M](#) and specified in Section [05 40 00 COLD-FORMED METAL FRAMING](#) unless otherwise indicated.

2.5.2 Fasteners for Miscellaneous Metal Framing

Refer to the following paragraph "FASTENERS".

2.6 FASTENERS

2.6.1 General

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of [1 inch](#) with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the metal panel manufacturer's and [ASCE 7](#) requirements.

2.6.2 Exposed Fasteners

Fasteners for metal panels to be corrosion resistant coated steel, aluminum, stainless steel, or nylon capped steel compatible with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads. Fasteners for accessories to be the manufacturer's standard [factory painted to match the](#)

color of the panels and accessory trims encountered. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately 3/32 inch thick.

2.6.3 Screws

Screws to be corrosion resistant coated steel, aluminum and/or stainless steel being the type and size recommended by the manufacturer to meet the performance requirements.

2.6.4 Rivets

Rivets to be closed-end type, corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

2.6.5 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A653/A653M or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

2.7 ACCESSORIES

2.7.1 General

All accessories to be compatible with the metal panels; sheet metal flashing, trim, metal closure strips, caps and similar metal accessories must not be less than the minimum thickness specified for the metal panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Molded foam rib, ridge and other closure strips to be non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

2.7.2 Roof and Wall Accessories and Specialties

Steel roof curbs, equipment supports, roof hatches, dropout-type heat and smoke vents, hatch-type heat and smoke vents, gravity and roof ridge ventilators, wall louvers and other miscellaneous roof and wall equipment or penetrations conforming to AAMA, ASTM, and UL as specified in Division 07 unless otherwise indicated.

2.7.3 Rubber Closure Strips

Closed-cell, expanded cellular rubber conforming to ASTM D1056 and ASTM D1667; extruded or molded to the configuration of the specified metal panel and in lengths supplied by the metal panel manufacturer.

2.7.4 Metal Closure Strips

Factory fabricated steel closure strips to be the same gauge, color, finish and profile of the specified panel.

2.7.5 Joint Sealants

2.7.5.1 Sealants

Sealants are to be an approved gun type for use in hand or air-pressure caulking guns at temperatures above 40 degrees F (or frost-free application

at temperatures above 10 degrees F with minimum solid content of 85 percent of the total volume. Sealant is to dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the metal panel manufacturer.

2.7.5.2 Shop-Applied

Sealant for shop-applied caulking must be an approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C920, Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

2.7.5.3 Field-Applied

Sealant for field-applied caulking must be an approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and conforming to ASTM C920, Type II. Color to match panel colors.

2.7.5.4 Tape Sealant

Pressure sensitive, 100 percent solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the metal panel manufacturer.

2.8 SHEET METAL FLASHING AND TRIM

2.8.1 Fabrication

Shop fabricate sheet metal flashing and trim where practicable to comply with recommendations in SMACNA 1793 that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.

Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

2.9 FINISHES

2.9.1 General

Comply with NAAMM AMP 500 for recommendations for applying and designating finishes.

2.9.2 Appearance of Finished Work

Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

Before erection proceeds examine with the erector present the concrete foundation dimensions, concrete and/or masonry bearing surfaces, anchor bolt size and placement, survey slab elevation, locations of bearing plates, and other embedment's to receive structural framing with the metal building manufacturer's templates and drawings before erecting any steel components for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Examine primary and secondary framing to verify that rafters, purlins, angles, channels, and other structural and metal panel support members and anchorages have been installed within alignment tolerances required by metal building manufacturer, UL, ASTM, [ASCE 7](#) and as required by the building code for the geographical area where construction will take place.

Examine roughing-in for components and systems penetrating metal roof or wall panels to verify actual locations of penetrations relative to seam locations of metal panels before metal roof or wall panel installation.

Submit to the Contracting Officer a written report, endorsed by Erector, listing conditions detrimental to performance of the Work.

Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Provide temporary shoring, guys, braces, and other supports during erection to keep the structural framing secure, plumb, and in alignment against temporary construction loading or loads equal in intensity of the building design loads. Remove temporary support systems when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment and performance.

Miscellaneous Framing: Install sub-purlins, girts, angles, furring, and other miscellaneous support members or anchorage for the metal roof or wall panels, doors, windows, roof curbs, ventilators and louvers according to metal building manufacturer's written instructions.

3.3 ERECTION OF STRUCTURAL FRAMING

Erect metal building system according to manufacturer's written erection instructions, approved shop drawings and other erection documents in accordance with [MBMA MBSM](#) - "Metal Building Systems Manual".

Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer and the Contracting Officer.

Set structural framing accurately in locations and to elevations indicated and according to [AISC 325](#) specifications. Maintain structural stability of frame during erection.

Clean and roughen concrete and masonry bearing surfaces prior to setting plates. Clean bottom surface of plates.

Align and adjust structural framing before permanent bolt-up and connections. Perform necessary adjustments and alignment to compensate for changes or discrepancies in elevations.

Maintain erection tolerances of structural framing in accordance with [AISC 360](#).

3.4 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place in accordance with [NRCA RoofMan](#) and [MBMA MBSM](#).

Erect roofing system in accordance with the approved erection drawings, the printed instructions and safety precautions of the metal building manufacturer.

Sheets are not to be subjected to overloading, abuse, or undue impact. Do not install bent, chipped, or defective sheets.

Sheets must be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake and eave overhang.

Work must allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Field cutting metal roof panels by torch is not permitted.

Roofing sheets must be laid with corrugations in the direction of the roof slope. End laps of exterior roofing must not be less than [8 inches](#); the side laps of standard exterior corrugated sheets must not be not less than 2-1/2 corrugations.

Do not permit storage, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to the installed roofing materials, and to distribute weight to conform to the indicated live load limits of roof construction.

3.5 METAL PANEL FASTENER INSTALLATION

Anchor metal panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.6 FLASHING, TRIM AND CLOSURE INSTALLATION

- a. Comply with performance requirements, manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

- b. Sheet metalwork is to be accomplished to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades is to be performed by sheet metal mechanics.

3.7 ACCESSORY INSTALLATION

3.7.1 General

Install accessories with positive anchorage to building and weather-tight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

3.7.2 Dissimilar Metals

Where dissimilar metals contact one another or corrosive substrates are present, protect against galvanic action by painting dissimilar metal surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each surface, or by other permanent separation techniques as recommended by the metal building manufacturer.

3.7.3 Gutters and Downspouts

Comply with performance requirements, manufacturer's written installation instructions, and install sheet metal roof drainage items to produce complete roof drainage system according to [SMACNA 1793](#) recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

3.7.4 Roof and Wall Accessories and Specialties

Install roof and wall accessories and specialties complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports as specified in Division 07 - THERMAL AND MOISTURE PROTECTION, unless otherwise indicated.

3.8 CLEAN-UP AND PROTECTION

3.8.1 Structural Framing

Clean all exposed structural framing at completion of installation. Remove metal shavings, filings, bolts, and wires from work area. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

3.8.2 Metal Panels

Clean all exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from work area. Remove protective coverings/films, grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces to be free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

3.8.3 Touch-Up Painting

After erection, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories. Clean and touch-up paint with manufacturer's touch-up paint as specified in Section 09 90 00 PAINTS AND COATINGS, unless otherwise indicated.

3.9 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan, placing copper materials, ferrous materials, and galvanized sheet metal in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

Collect and place scrap/waste debris in containers. Promptly dispose of scrap/waste debris. Do not allow scrap/waste debris to accumulate on-site; transport scrap/waste debris from government property and legally dispose of them.

3.10 WARRANTY

3.10.1 MANUFACTURER'S WARRANTY

Submit all manufacturers' signed warranties to Contracting Officer prior to final commissioning and acceptance.

3.10.2 CONTRACTOR'S WARRANTY for INSTALLATION

Submit contractor's warranty for installation to the Contracting Officer prior to final commissioning and acceptance.

-- End of Section --

This page is intentionally left blank.

SECTION 21 13 13.00 20

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

04/08

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 D709 (2016) Standard Specification for
Laminated Thermosetting Materials

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2016) Standard for the Installation of
Sprinkler Systems

NFPA 24 (2013) Standard for the Installation of
Private Fire Service Mains and Their
Appurtenances

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Design and modify existing automatic wet pipe fire extinguishing sprinkler systems for complete fire protection coverage throughout the areas of Renovation in Building 4630 .

1.3 SPRINKLER SYSTEM DESIGN

Except as modified herein, design automatic wet pipe fire extinguishing sprinkler systems in accordance with the required and advisory provisions of NFPA 13 , including all recommendations and advisory portions, which shall be considered mandatory; this includes advisory provisions listed in the appendices of such standard(s), as though the word "shall" had been substituted for the word "should" wherever it appears. Design system by hydraulic calculations for uniform distribution of water over the design area. Hydraulic calculations shall assume a 12 psi pressure loss for the backflow preventer assembly. Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. Provide sprinklers and piping system layout. All Devices and equipment for fire protection service shall be UL Fire Prot Dir listed or FM APP GUIDE approved for use in wet pipe sprinkler systems.

1.3.1 Location of Sprinklers

Sprinklers in relation to the ceiling and the spacing of sprinklers shall not exceed that permitted by NFPA 13 for the hazards indicated on the contract drawings. Uniformly space sprinklers on the branch piping. Sprinklers shall provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms, boiler rooms, switchgear rooms, transformer rooms, and other electrical and mechanical spaces.

1.3.2 Water Distribution

Distribution shall be uniform throughout the area in which the sprinklers will open. Discharge from individual sprinklers in hydraulically most remote area shall be between 100 percent and 120 percent of the specified density.

1.3.3 Density of Application of Water

Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be as indicated on the contract drawings. Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be as indicated on the contract drawings.

1.3.4 Sprinkler Discharge Area

Area shall be the hydraulically most remote area as indicated on the plans. Area reductions and increases from NFPA 13 shall not be applied to this area.

1.3.5 Outside Hose Allowances

Hydraulic calculations shall include a hose allowance of 250 gpm for outside hose streams

1.3.6 Water Supply

Base hydraulic calculations on the water supply data shown on the fire protection contract drawings

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval.

Partial submittals and submittals not fully complying with the requirements and recommended practices of NFPA 13 and this specification section shall be returned disapproved without review. This contract stipulation is non-negotiable.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G

Prepare 24 by 36 inch detail working drawings of sprinklers and piping. Floor plans shall be drawn to a scale not less than 1/8" = 1'-0". Show data essential for proper installation of each system. Show details, plan view, elevations and sections of the systems supply and piping. Show piping schematic of systems supply, devices, valves, pipe and fittings. Show point to point electrical wiring diagrams. Submit drawings signed by a registered fire protection engineer. Provide three copies of the Sprinkler System Shop Drawings, no later than 21 days prior to the start of sprinkler system installation.

SD-03 Product Data

Pipe; G

Fittings ; G

Valves, including gate, check, and globe ; G

Sprinklers ; G

Pipe hangers and supports ; G

Sprinkler Alarm Switches;

Mechanical couplings ; G

Annotate descriptive data to show the specific model, type, and size of each item. Catalog cuts shall also indicate UL Listing/FM Approval and country of manufacture.

SD-05 Design Data

Hydraulic Calculations; G

Submit computer program generated hydraulic calculations to substantiate compliance with hydraulic design requirements. Calculations shall be performed by computer using software intended specifically for fire protection system design. Calculations shall include isometric diagram indicating hydraulic nodes and pipe segments. Submit name of software program used.

SD-06 Test Reports

request to schedule Preliminary Tests; G

Preliminary Test Report; G

Provide Three copies of the completed Preliminary Test Report, no later than 7 days after the completion of the Preliminary Tests. The Preliminary Tests Report shall include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping.

request to schedule Final Acceptance Test; G

Final Acceptance Test Report; G

Provide Three copies of the completed Final Acceptance Tests

Reports, no later than 7 days after the completion of the Final Acceptance Tests. All items in the Final Acceptance Report shall be signed by the Fire Protection Engineer.

SD-07 Certificates

Fire Protection Engineer; G

The name and documentation of certification of the proposed Fire Protection Engineer, no later than 14 days after the Notice to Proceed and prior to the submittal of the sprinkler system drawings and hydraulic calculations.

Sprinkler System Installer; G

Submit data showing the Sprinkler System Installer has successfully installed systems of the same type and design as specified herein, Data shall include names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months. Provide NICET certification of the system technician. Contractor shall submit data along with submittal of the Fire Protection Engineer Qualifications.

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modifies by this specification section.

Provide six manuals in accordance with NFPA 13. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.

SD-11 Closeout Submittals

As-built drawings

As-built shop drawings, at no later than 14 days after completion of the Final Tests. The Sprinkler System Drawings shall be updated to reflect as-built conditions after all related work is completed. Provide electronic drawings in dwg or pdf format.

On-site training

1.5 QUALIFICATIONS

1.5.1 Fire Protection Engineer

A Fire Protection Engineer is a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered

by the National Council of Examiners for Engineering and Surveys (NCEES).

1.5.2 Sprinkler System Installer

The Sprinkler System Installer shall be regularly engaged in the installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months. Installation drawings, shop drawings and as-built drawings shall be prepared, by or under the supervision of, an system technician who is experienced with the types of works specified herein, and is currently certified by the National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level IV certification in Automatic Sprinkler System program or by a fire protection engineer.

1.6 QUALITY ASSURANCE

1.6.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.6.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.6.3 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.

1.6.4 Field Fabricated Nameplates

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections 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.

1.7 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.

1.8 DELIVERY, STORAGE AND HANDLING

All equipment delivered and placed in storage shall be housed in a manner to preclude any damage from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall either be capped or plugged until installed.

PART 2 PRODUCTS

2.1 ABOVEGROUND PIPING COMPONENTS

All components of the aboveground piping shall fully comply with the requirements and recommended practices of NFPA 13 and this specification section. Aboveground piping shall be steel.

2.1.1 Steel Pipe

Pipe shall be black steel. Steel pipe shall be Schedule 40 for sizes less than 3 inches and Schedule 10 for sizes 3 inches or larger. Fittings into which sprinklers, sprinkler riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe and segmented welded fittings shall not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1.5 inches and larger. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Side outlet tees using rubber gasketed fittings shall not be permitted. Sprinkler pipe and fittings shall be metal.

2.1.2 Grooved Mechanical Joints and Fittings

Grooved couplings, fittings and grooving tools shall be products of the same manufacturer.

2.1.3 Sprinklers

Provide nominal 0.50 inch or 0.53 inch orifice sprinklers. Sprinklers with internal O-rings shall not be used. Sprinklers shall be used in accordance with their listed coverage limitations. Provide Recessed quick response sprinklers. Sprinklers shall have a polished chrome finish. Temperature classification shall be ordinary. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with NFPA 13. Extended coverage sprinklers shall not be used. Provide corrosion-resistant sprinklers and sprinkler guards as required by NFPA 13. Deflector shall not be more than 3 inches below suspended ceilings. Ceiling plates shall not be more than 0.5 inch deep. Ceiling cups shall not be permitted.

2.1.4 Valves

Provide valves of types approved for fire service. Valves shall open by counterclockwise rotation. Check valves shall be clear opening swing-check type with inspection and access cover plate for sizes 8 inches and larger. Each control valve shall be electrically supervised; minimum contact ratings shall be 2.5 amps at 24 volts DC. Provide supervision

against valve closure or tampering of valve.

2.1.5 Pipe Supports

Provide Pipe hangers and supports in accordance with NFPA 13.

2.2 ALARM INITIATING AND SUPERVISORY DEVICES

2.2.1 Sprinkler Alarm Switches

Provide vane type flow switch(es) with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system. Connection of switch shall be under Section 28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM

2.2.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.3 ACCESSORIES

2.3.1 Sprinkler Cabinet

Provide metal cabinet with extra sprinklers, including a representative sample of dry pendent type sprinklers and sprinkler wrench adjacent to each alarm valve. The number and types of extra sprinklers shall be as specified in NFPA 13.

2.3.2 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

PART 3 EXECUTION

3.1 UNDERGROUND PIPING INSTALLATION

The methods of fabrication and installation of the underground piping shall fully comply with the requirements and recommended practices of NFPA 13, NFPA 24 and the contract drawings.

3.2 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping shall fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

3.2.1 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and

similar vertical runs of piping in finished areas shall be concealed.

3.2.2 Pendent Sprinklers

Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grids.

3.2.3 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. Bushings are prohibited.

3.2.4 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes penetrate fire walls, fire partitions, or floors, pipes shall be fire stopped in accordance with Section 07 84 00 FIRESTOPPING. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.2.5 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Valve identification signs shall be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in NFPA 13.

3.3 ELECTRICAL WORK

Except as supplemented and modified herein, electric equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system shall be in accordance with 28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM

3.4 PIPE PAINTING AND COLOR CODE MARKING

Paint and color code mark sprinkler piping system as specified in Section 09 90 00 PAINTS AND COATINGS.

3.5 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground

piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with [NFPA 13](#) and [NFPA 24](#). Submit [request to schedule Preliminary Tests](#), no later than 14 days prior to the proposed start of the tests. Upon completion of specified tests, the Contractor shall submit for approval a [Preliminary Test Report](#).

3.5.1 Underground Piping

3.5.1.1 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with [NFPA 24](#).

3.5.2 Aboveground Piping

3.5.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with [NFPA 13](#).

3.6 FINAL ACCEPTANCE TEST

Final Acceptance Test shall begin only when the Preliminary Test Report has been approved. Submit [request to schedule Final Acceptance Test](#), no later than 14 days prior to the proposed start of the tests. Notification shall include a copy of the Contractor's Material & Test Certificates. The Contractor shall submit the [Final Acceptance Test Report](#) as specified in the Submittals paragraph.

An experienced technician regularly employed by the system installer shall be present during the inspection. At this inspection, repeat any or all of the required tests as directed. Correct defects in work provided by the Contractor, and make additional tests until the systems comply with contract requirements. Furnish appliances, equipment, electricity, instruments, connecting devices, and personnel for the tests. The Government will furnish water for the tests. The Division, Naval Facilities Engineering Command, Fire Protection Engineer, will witness formal tests and approve systems before they are accepted.

3.7 ON-SITE TRAINING

Submit request to schedule the On-site Training, at least 14 days prior to the start of related training but prior to the final inspections and tests. The sprinkler contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a [suitable](#) period of hours of normal working time and shall start after the system is functionally complete and after the Final Acceptance Test. The On-Site Training shall cover all of the items contained in the approved [Operating and Maintenance Instructions](#).

-- End of Section --

This page is intentionally left blank.

SECTION 21 13 16.00 20

DRY-PIPE FIRE SPRINKLER SYSTEMS

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.

FM GLOBAL (FM)

FM APP GUIDE

(updated on-line) Approval Guide
<http://www.approvalguide.com/>

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58

(1993; Reaffirmed 2010) Pipe Hangers and
Supports - Materials, Design and
Manufacture, Selection, Application, and
Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13

(2016) Standard for the Installation of
Sprinkler Systems

NFPA 70

(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25

(1997; E 2004) Zinc Oxide, Alkyd, Linseed
Oil Primer for Use Over Hand Cleaned
Steel, Type I and Type II

UNDERWRITERS LABORATORIES (UL)

UL Fire Prot Dir

(2012) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Design and provide new automatic dry pipe fire extinguishing sprinkler systems for complete fire protection coverage throughout the exterior storage area in Building 4630. The new dry pipe system shall be connected from the existing wet-pipe sprinkler system via a dry-pipe valve assembly.

1.3 SPRINKLER SYSTEM DESIGN

Design automatic dry pipe fire extinguishing sprinkler systems in accordance with the required and advisory provisions of NFPA 13, hydraulic calculations using the area/density method for uniform distribution of water over the design area as indicated on the contract drawings. Each system shall include materials, accessories, and equipment inside and

outside the building to provide each system complete and ready for use. Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed working drawings to be submitted for approval. Locate sprinkler heads in a consistent pattern with ceiling grid, lights, and air supply diffusers. Devices and equipment for fire protection service shall be **UL Fire Prot Dir** listed or **FM APP GUIDE** approved for use in dry pipe sprinkler systems.

1.3.1 Location of Sprinkler Heads

Spacing of sprinklers and position and orientation of sprinklers in relation to the ceiling, walls, and obstructions shall conform to **NFPA 13** for ordinary hazard occupancy; except for discharge density greater than **0.20 gpm per sq ft** the spacing of sprinkler heads shall not exceed that for extra hazard occupancy. Uniformly space sprinklers on the branch piping.

1.3.2 Water Distribution

Distribution shall be uniform throughout the area in which the sprinkler heads will open. Discharge from individual sprinklers in the hydraulically most remote area shall be not less than 100 percent of the specified density.

1.3.3 Density of Application of Water

Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be **as indicated on the contract drawings**.

1.3.4 Sprinkler Design Area

Area shall be the hydraulically most remote **as shown on the contract drawings and** defined in **NFPA 13**.

1.3.5 Outside Hose Allowances

Hydraulic calculations shall include an allowance of **250 gpm** for outside hose streams.

1.3.6 Friction Losses

Calculate losses in piping in accordance with the Hazen-Williams formula with 'C' value of 100 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping. Velocity in the sprinkler piping shall be limited to a maximum of **20 ft/sec**.

1.3.7 Water Supply

Base hydraulic calculations on a static pressure of **49 psig** with **1000 gpm** available at a residual pressure of **45 psig** at the junction with the water distribution piping system.

1.3.8 Detail Drawing

Prepare **24 by 36 inch** detail working drawings of **sprinkler heads and piping system layout** in accordance with **NFPA 13**, "Working Drawings (Plans)." Show data essential for proper installation of each system. Show details, plan view, elevations, and sections of the systems supply and

piping. Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point [electrical wiring diagrams](#). Show location and orientation of sprinkler heads in relation to obstructions.

1.3.9 Detail Drawings

After completion, but before final acceptance, submit complete set of [as-built drawings of each system](#) for record purposes. Submit [24 by 36 inch](#) drawings on reproducible mylar film with title block similar to full size contract drawings. Furnish the as-built (record) working drawings in addition to as-built contract drawings required by Division 1, "General Requirements."

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section [01 33 00](#)
SUBMITTAL PROCEDURES:

[SD-02 Shop Drawings](#)

[Sprinkler heads and piping system layout; G](#)

[Electrical wiring diagrams; G](#)

[SD-03 Product Data](#)

[Piping; G](#)

[Valves, including gate, check, and globe; G](#)

[Sprinkler heads; G](#)

[Pipe hangers and supports; G](#)

[Low air pressure supervisory switch; G](#)

[Dry pipe valves; G](#)

[Air compressor; G](#)

[Mechanical couplings; G](#)

[Pressure Switch; G](#)

Annotate descriptive data to show the specific model, type, and size of each item.

[SD-05 Design Data](#)

Sprinkler system design; G

Submit computer program generated hydraulic calculations to substantiate compliance with hydraulic design requirements. Calculations generated by computer program shall include the name, address, and telephone number of the software manufacturer.

SD-06 Test Reports

Preliminary tests on piping system; G

SD-07 Certificates

Qualifications of installer; G

SD-10 Operation and Maintenance Data

Dry pipe valves, Data Package 3; G

Air compressor, Data Package 3; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

As-built drawings of each system; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications of Installer

Prior to installation, submit data showing that the Contractor has successfully installed systems of the same type and design as specified herein, or that Contractor has a firm contractual agreement with a subcontractor having such required experience. Data shall include names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

Qualifications of System Technician: Installation drawings, shop drawing and as-built drawings shall be prepared, by or under the supervision of, an individual who is experienced with the types of works specified herein, and is currently certified by the National Institute for Certification in Engineering Technologies (NICET) as an engineering technician with minimum Level-III certification in automatic sprinkler system program. Contractor shall submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.

PART 2 PRODUCTS

2.1 ABOVEGROUND PIPING SYSTEMS

Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing pipe fittings; bushings will not be permitted. Perform welding in the shop; field welding will not be permitted. Conceal piping in areas with suspended ceiling.

2.1.1 Sprinkler Piping

NFPA 13, except as modified herein. Steel piping shall be Schedule 40. Fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into the pipe when pressure is applied will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1.5 inches and larger. Fittings shall be UL Fire Prot Dir listed or FM APP GUIDE approved for use in dry pipe sprinkler systems. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer. Steel piping with wall thickness less than Schedule 30 shall not be threaded. Sprinkler pipe and fittings shall be metal.

2.1.2 Sprinkler Heads

Provide nominal 0.50 inch orifice quick response sprinkler heads. No o-rings will be permitted in sprinkler heads. Release element of each head shall be of the ordinary temperature rating or higher as suitable for the specific application. Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings. Provide corrosion-resistant sprinkler heads and sprinkler head guards as required by NFPA 13. Automatic sprinklers installed in the pendent position shall be of the dry-pendent type.

2.1.3 Cabinet

Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each dry pipe valve. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

2.1.4 Dry Pipe Valves

Provide valve complete with accessories and appurtenances for the proper operation of the system.

2.1.5 Pressure Switch

Provide switch with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system. Connection of switch shall be under Section 28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM. Do not install a shutoff valve in the piping between the dry pipe valve and any pressure switch.

2.1.6 Low Air Pressure Supervisory Switch

Provide switch for each sprinkler system and connect to building fire alarm system to activate the system supervisory alarm when air pressure in system drops halfway from the normal pressure to the tripping point. Connection of switch shall be under Section 28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM. Provide a bleeder valve in the air line ahead of the switch for testing operation of the switch. The valve shall be normally open. Closing the valve shall shut off the air supply to the switch and exhaust the pressure between the switch and valve.

2.1.1.7 Tank Mounted Air Compressor

Provide an approved, automatic type, electric motor-driven air compressor including pressure switch, air piping, and 10 gallon minimum capacity tank. Compressor shall have a minimum capacity capable of charging the complete sprinkler system to normal system air pressure within 30 minutes. Provide an approved automatic air maintenance device for each system.

2.1.1.8 Pipe Hangers and Supports

Provide in accordance with NFPA 13. Attach to steel joists with MSS SP-58, Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor.

2.1.1.9 Valves

NFPA 13. Provide valves of types approved for fire service. Valves shall open by counterclockwise rotation. Provide an OS&Y valve beneath each dry pipe valve. Check valves shall be flanged clear opening swing-check type valves with flanged inspection and access cover plate for sizes 4 inches and larger.

2.1.1.9.1 Valve Supervision

Provide supervision of each control valve against closure and tampering in accordance with NFPA 13. Provide switch with SPDT (Form C) dry contacts for the automatic transmittal of a supervisory signal over the facility fire alarm system; minimum switch contact rating shall be 2.5 amperes at 24 VDC. A supervisory signal shall be initiated during the first two revolutions of the hand wheel, or during the first 1/5th of travel distance of the valve stem, from the full open position. Connection of the switch shall be under Section 28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM.

2.1.1.10 Identification Signs

NFPA 13. Attach properly lettered and approved metal signs to each valve and alarm device. Permanently affix hydraulic design information sign to the riser of each system.

2.1.1.11 Inspector's Test Connection

Provide test connections approximately 6 feet above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device; locate at the hydraulically most remote part of each system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without property damage. Provide discharge orifice of same size as corresponding sprinkler orifice. Provide a precast concrete splash block under each exterior discharge orifice.

2.1.1.12 Main Drains

Provide separate drain piping to discharge at safe points outside each building. The penetration of the exterior wall shall be no greater than 2.0 feet above finished grade. Provide auxiliary drains as required by NFPA 13.

Provide precast concrete splash blocks under each exterior drain discharge.

2.2 PIPE SLEEVES

Provide where piping passes entirely through walls, floors, and roofs. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs. Provide **one inch** minimum clearance between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with UL listed fill, void, or cavity material.

- a. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are grouted smooth.
- b. Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide 26 gage galvanized steel sheet.

2.3 ESCUTCHEON PLATES

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

PART 3 EXECUTION

3.1 INSTALLATION

Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with **NFPA 13**, except as modified herein. Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings. Keep the interior and ends of new piping and existing piping affected by Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter. Inspect piping before placing into position. Provide Teflon pipe thread paste on male threads.

3.1.1 Electrical Work

Provide electrical work associated with this section under Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM, except for control wiring. Provide control and fire alarm wiring, including connections to fire alarm systems, under this section in accordance with **NFPA 70**. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

3.1.2 Field Painting

Clean, prime, and paint new sprinkler system piping, valves, hangers,

accessories, and miscellaneous metal work as specified in Section 09 90 00 PAINTS AND COATINGS. Clean surfaces prior to painting. Immediately after cleaning, prime metal surfaces with SSPC Paint 25 or SSPC Paint 25 metal primer applied to a minimum dry film thickness of 1.5 mils. Exercise care to avoid painting sprinkler heads and operating devices. Upon completion of painting, remove materials which were used to protect sprinkler heads and operating devices which have been inadvertently painted and provide new clean sprinkler heads and operating devices of the proper type. Finish primed surfaces as follows:

3.1.2.1 Systems in Finished Areas

Finished areas are defined as areas where walls or ceilings are painted or are constructed of a prefinished material. Paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with two coats of gloss red enamel. Provide piping with 2 inch wide red bands spaced at maximum 20 feet intervals throughout the piping system. Bands shall be gloss red enamel or self-adhering plastic.

3.2 FIELD QUALITY CONTROL

Perform test to determine compliance with the specified requirements in the presence of the Contracting Officer. Test, inspect, and approve piping before covering or concealing.

3.2.1 Preliminary Tests

Hydrostatically test each system at 50 psig above normal system static pressure or 200 psig, whichever is greater, for a 2-hour period with no leakage or reduction in pressure. Flush piping with potable water and air test each system in accordance with NFPA 13. Piping above suspended ceilings shall be tested, inspected, and approved before installation of ceilings. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. Water shall be delivered to the system test connection in not more than 60 seconds, starting at the normal air pressure on the system and at the time of a fully opened inspection test connection. When tests have been completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13.

3.2.2 Formal Tests and Inspections

Do not submit a request for formal test and inspection until the preliminary test and corrections are completed and approved. Submit a written request for formal inspection at least 15 days prior to inspection date. An experienced technician regularly employed by the system installer shall be present during the inspection. At this inspection, repeat any or all of the required tests as directed. Correct defects in work provided by the Contractor, and make additional tests until the systems comply with contract requirements. Furnish appliances, equipment, electricity, instruments, connecting devices, and personnel for the tests. The Government will furnish water for the tests. The NAVFAQ Division, Naval Facilities Engineering Command, Fire Protection Engineer, will witness formal tests and approve systems before they are accepted.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE
11/15

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010 (2002) Self-Contained, Mechanically
Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1/CSA 4.1 (2009; Addenda A 2009; Addenda B 2011) Gas
Water Heaters Vol. I, Storage Water
Heaters with Input Ratings of 75,000 Btu
Per Hour or Less

ANSI Z21.10.3/CSA 4.3 (2013) Gas Water Heaters Vol.III, Storage
Water Heaters With Input Ratings Above
75,000 Btu Per Hour, Circulating and
Instantaneous

ANSI Z21.22/CSA 4.4 (2015) Relief Valves for Hot Water Supply
Systems

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

ASHRAE 189.1 (2014) Standard for the Design of
High-Performance Green Buildings Except
Low-Rise Residential Buildings

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings
Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001 (2008) Performance Requirements for
Atmospheric Type Vacuum Breakers (ANSI
approved 2009)

ASSE 1003 (2009) Performance Requirements for Water
Pressure Reducing Valves for Domestic
Water Distribution Systems - (ANSI
approved 2010)

ASSE 1010 (2004) Performance Requirements for Water
Hammer Arresters (ANSI approved 2004)

ASSE 1011 (2004; Errata 2004) Performance

Requirements for Hose Connection Vacuum
Breakers (ANSI approved 2004)

- ASSE 1012 (2009) Performance Requirements for Backflow Preventer with an Intermediate Atmospheric Vent - (ANSI approved 2009)
- ASSE 1013 (2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
- ASSE 1018 (2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002)
- ASSE 1019 (2011) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved 2004)
- ASSE 1020 (2004; Errata 2004; Errata 2004) Performance Requirements for Pressure Vacuum Breaker Assembly (ANSI Approved 2004)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA 10084 (2005) Standard Methods for the Examination of Water and Wastewater
- AWWA B300 (2010; Addenda 2011) Hypochlorites
- AWWA B301 (2010) Liquid Chlorine
- AWWA C203 (2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
- AWWA C606 (2015) Grooved and Shouldered Joints
- AWWA C651 (2014) Standard for Disinfecting Water Mains
- AWWA C652 (2011) Disinfection of Water-Storage Facilities
- AWWA C700 (2015) Standard for Cold Water Meters - Displacement Type, Bronze Main Case
- AWWA C701 (2012) Standard for Cold-Water Meters - Turbine Type for Customer Service

AMERICAN WELDING SOCIETY (AWS)

- AWS A5.8/A5.8M (2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding

AWS B2.2/B2.2M

(2010) Specification for Brazing Procedure
and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2

(2012) Standard for Air Gaps in Plumbing
Systems (For Plumbing Fixtures and
Water-Connected Receptors)

ASME A112.14.1

(2003; R 2012) Backwater Valves

ASME A112.19.2/CSA B45.1

(2013) Standard for Vitreous China
Plumbing Fixtures and Hydraulic
Requirements for Water Closets and Urinals

ASME A112.19.3/CSA B45.4

(2008; R 2013) Stainless Steel Plumbing
Fixtures

ASME A112.36.2M

(1991; R 2012) Cleanouts

ASME A112.6.1M

(1997; R 2012) Floor Affixed Supports for
Off-the-Floor Plumbing Fixtures for Public
Use

ASME A112.6.3

(2001; R 2007) Standard for Floor and
Trench Drains

ASME A13.1

(2015) Scheme for the Identification of
Piping Systems

ASME B1.20.1

(2013) Pipe Threads, General Purpose (Inch)

ASME B16.15

(2013) Cast Copper Alloy Threaded Fittings
Classes 125 and 250

ASME B16.18

(2012) Cast Copper Alloy Solder Joint
Pressure Fittings

ASME B16.21

(2011) Nonmetallic Flat Gaskets for Pipe
Flanges

ASME B16.22

(2013) Standard for Wrought Copper and
Copper Alloy Solder Joint Pressure Fittings

ASME B16.23

(2011) Cast Copper Alloy Solder Joint
Drainage Fittings - DWV

ASME B16.24

(2011) Cast Copper Alloy Pipe Flanges and
Flanged Fittings: Classes 150, 300, 600,
900, 1500, and 2500

ASME B16.29

(2012) Wrought Copper and Wrought Copper
Alloy Solder Joint Drainage Fittings - DWV

ASME B16.34

(2013) Valves - Flanged, Threaded and
Welding End

ASME B16.5

(2013) Pipe Flanges and Flanged Fittings:
NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.50	(2013) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B31.1	(2016; Errata 2016) Power Piping
ASME B31.5	(2016) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME CSD-1	(2012) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2014) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A193/A193M	(2016) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A515/A515M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 2012) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A74	(2013a) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A888	(2013a) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B306	(2013) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B370	(2012) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B42	(2015a) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B43	(2014) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B813	(2016) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2002; R 2010) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B88	(2016) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2013) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C564	(2014) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM D1004	(2013) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D2564	(2012) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2583	(2013a) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2822/D2822M	(2005; E 2011; R 2011) Asphalt Roof Cement
ASTM D2855	(2015) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311	(2011) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D4551	(2012) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D790	(2010) Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM E1	(2014) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM F1760	(2001; R 2011) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F462	(1979, R2007) Standard Consumer Safety specification for Slip-Resistant Bathing Facilities
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F891	(2010) Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (2010) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
(IAPMO)

IAPMO Z124.1.2 (2005) Plastic Bathrubs and Shower Units

IAPMO Z124.3 (2005) Plastic Lavatories

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (2009) Accessible and Usable Buildings and Facilities

ICC IPC (2012) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded,
Socket-Welding, Solder Joint, Grooved and
Flared Ends

MSS SP-25 (2013) Standard Marking System for Valves,
Fittings, Flanges and Unions

MSS SP-58 (1993; Reaffirmed 2010) Pipe Hangers and
Supports - Materials, Design and
Manufacture, Selection, Application, and
Installation

MSS SP-67 (2011) Butterfly Valves

MSS SP-70 (2011) Gray Iron Gate Valves, Flanged and
Threaded Ends

MSS SP-71 (2011; Errata 2013) 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-78 (2011) Cast Iron Plug Valves, Flanged and
Threaded Ends

MSS SP-80 (2013) Bronze Gate, Globe, Angle and Check
Valves

MSS SP-85 (2011) Gray Iron Globe & Angle Valves
Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE SP0169 (2013) Control of External Corrosion on
Underground or Submerged Metallic Piping
Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
NEMA MG 1	(2016; SUPP 2016) 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 54	(2015) National Fuel Gas Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 372	(2011) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2017b) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2016) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction
---------------	---------------------------------------------------------------------

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(2010) Water Hammer Arresters Standard
------------	----------------------------------------

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(2009) Hose Clamp Specifications
-----------	----------------------------------

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
PL 93-523	(1974; A 1999) Safe Drinking Water Act

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

10 CFR 430	Energy Conservation Program for Consumer Products
40 CFR 141.80	National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements

PL 109-58

Energy Policy Act of 2005 (EPAct05)

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. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Fixtures

List of installed fixtures with manufacturer, model, and flow rate.

Flush Valve Water Closets;G

Flush Valve Urinals;G

Countertop Lavatories;G

Break Room Sinks;G

Mop Sinks;G

Drinking-Water Coolers;G

Precast Plastic Shower Floors;G

Water Heaters;G

Pumps;G

Backflow Prevention Assemblies;G

Shower Faucets;G

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Vibration-Absorbing Features; G

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies; G.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-07 Certificates

Materials and Equipment

Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements.

SD-10 Operation and Maintenance Data

Plumbing System; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and Section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSII).

SD-11 Closeout Submittals

Water-Efficient Products; S

Energy-Efficient Water Heaters; S

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be 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.

1.3.3 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.

1.3.4 Modification of References

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.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

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 the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - IP

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, 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, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the

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.

1.9 ACCESSIBILITY OF EQUIPMENT

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.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Water-Efficient Products

Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING that the following products meet water efficiency requirements as outlined in this section and when applicable, that they are EPA WaterSense labeled products:

- a. Fixtures
- b. Flush valve water closets
- c. Flush valve urinals
- d. Countertop lavatories
- e. Break Room sinks
- f. Mop sinks
- g. Drinking-water coolers
- h. Water heaters
- i. Pumps
- j. Showerheads

2.1.2 Energy-Efficient Water Heaters

Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING that the following products meet energy efficiency requirements as outlined in this section and when applicable, that they are Energy Star certified or FEMP-designated products:

- a. Electric Resistance Water Heaters (Residential)
- c. Gas Water Heaters (Commercial)

2.2 Materials

Materials for various services shall be in accordance with TABLES I and II. PVC pipe shall contain a minimum of 25 percent recycled content in accordance with [ASTM F1760](#). Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet [NSF/ANSI 14](#) and shall be NSF listed for the service intended. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with [NSF/ANSI 61](#), Annex G or [NSF 372](#). In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with [PL 93-523](#) and [NSF/ANSI 61](#), Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of [NSF/ANSI 61](#), Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Cast-iron pipe shall contain a minimum of 100 percent recycled content. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings. All water lines are to be copper and the under slab DWV piping is to be cast iron. PVC solid wall DWV piping may be used ONLY above grade for waste and vent piping. PVC solid wall DWV piping may be used ONLY above grade for waste and vent piping and where concealed in walls or enclosed in pipe chases.

Penetrations through the accreditation barrier are to be dielectrically decoupled and grounded in accordance with Section 13 37 00, RADIANT BARRIER CONSTRUCTION and ICD 705.

2.2.1 Pipe Joint Materials

Hubless cast-iron soil pipe shall not be used underground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type [ASTM A74](#), [AWWA C606](#). For hubless type: [CISPI 310](#)
- b. Coupling for Steel Pipe: [AWWA C606](#).
- c. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with [ASME B16.21](#). Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- d. Brazing Material: Brazing material shall conform to [AWS A5.8/A5.8M](#), BCuP-5.
- e. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

- f. Solder Material: Solder metal shall conform to ASTM B32.
- g. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.
- h. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.
- i. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.
- j. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F477.
- k. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.
- l. Flanged fittings including, but not limited to, flanges, bolts, nuts and bolt patterns shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.
- m. Copper tubing shall conform to ASTM B88, Type K, L or M.

2.2.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201. Water hammer arrester shall be diaphragm or piston type.
- b. Copper, Sheet and Strip for Building Construction: ASTM B370.
- c. Asphalt Roof Cement: ASTM D2822/D2822M.
- d. Hose Clamps: SAE J1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

1. Thermometers: **ASTM E1**. Mercury shall not be used in thermometers.

2.2.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.3 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to **MSS SP-58**.

2.4 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4

Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.4.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.4.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.4.3 Wall Hydrants (Frostproof)

ASSE 1019 with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.4.4 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a

relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.4.5 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.5 FIXTURES

Fixtures shall be water conservation type, in accordance with ASHRAE 189.1 Section 6.3.2.1 (Plumbing fixtures and Fittings). Water closet replacements in major renovations may have a flush valve of up to 1.28 GPF to accommodate existing plumbing capacity. Fixtures for use by the physically handicapped shall be in accordance with ICC A117.1. Vitreous China, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush valves and flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers shall be copper alloy with all visible surfaces chrome plated. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.

2.5.1 Flush Valve Water Closets

ASME A112.19.2/CSA B45.1, white vitreous china, siphon jet, elongated bowl, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 14 to 15 inches, except 17 to 19 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide white solid plastic elongated open-front seat.

Water flushing volume of the water closet and flush valve combination shall not exceed 1.28 gallons per flush. Water closets must meet the EPA WaterSense product definition specified in

http://www.epa.gov/watersense/partners/product_program_specs.html and must be EPA WaterSense labeled products.

Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls.

2.5.2 Flush Valve Urinals

ASME A112.19.2/CSA B45.1, white vitreous china, wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 24 inches above the floor or Water flushing volume of the urinal and flush valve combination shall not exceed 0.125 gallons per flush. Urinals must meet the specifications of http://www.epa.gov/watersense/partners/product_program_specs.html and must be EPA WaterSense labeled products. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. .

2.5.3 Countertop Lavatories

Refer to Section 06 61 16 SOLID POLYMER (SOLID SURFACING) FABRICATIONS for specification of solid polymer (solid surfacing) lavatory. Furnish template and mounting kit by lavatory manufacturer. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide top mounted washerless centerset lavatory faucets. Lavatory faucets and lavatory faucet accessories must meet the EPA WaterSense product definition specified in http://www.epa.gov/watersense/partners/product_program_specs.html and must be EPA WaterSense labeled products. Mount counter with the top surface 34 inches above floor and with 29 inches minimum clearance from bottom of the counter face to floor. Provide top mounted washerless centerset lavatory faucets.

2.5.4 Break Room Sinks

ASME A112.19.3/CSA B45.4, 20 gage stainless steel for undermount installation, minimum dimensions of 20 inches wide by 18 inches front to rear, single compartment, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets and with 3.5 inch drain outlet. Provide aerator with faucet. Water flow rate shall not exceed 1.5 gpm when measured at a flowing water pressure of 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide top mounted gooseneck-style sink faucet.

2.5.5 Drinking-Water Coolers

AHRI 1010 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bi-level type, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, bottle filler and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler

spout for the lower-mounted bubbler shall be mounted at a maximum of 36 inches above floor and at front of unit basin. Spouts shall direct water flow at least 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit. Provide ASME A112.6.1M concealed steel pipe chair carriers. Provide bottle filler option on low cooler. Provide bi-level ADA compliant unit.

2.5.6 Precast Plastic Shower Floors

IAPMO Z124.1.2, solid cast polyester/acrylic blend resin with drain location as indicated. Provide coved side walls, minimum one-inch panel platform with a 5 degree slope and a 12 inch minimum water dam. Provide a non-skid floor surface with water channels directing water to the drain at a 2 degree slope (1/4 inch per foot). The slip resistance coefficient of the non-skid surface shall be in accordance with ASTM F462. Provide color as indicated on the drawings. Provide matching inside corner trim molding to protect and conceal corner sealant and provide matching corner shelf cast from solid surface polymer material.

Shower floor characteristics shall be as follows:

- a. Hardness shall be in accordance with ASTM D2583.
- b. Flex strength shall be in accordance with ASTM D790.
- c. Water absorption after 24 hours shall be in accordance with ASTM D570.
- d. Boiling water resistance shall be in accordance with ANSI/NEMA LD 3.
- e. Stain Resistance shall be in accordance with IAPMO Z124.3.
- f. Flame Spread shall be Class I when tested in accordance with ASTM E84.

2.5.7 Mop Sinks

Terrazzo shall be made of marble chips cast in white portland cement to produce 3000 psi minimum compressive strength 7 days after casting. Provide floor or wall outlet copper alloy body drain cast integral with terrazzo, with polished stainless steel strainers. Provide a 24 inch stainless steel backsplash at the walls. Provide with all mounted washerless service faucet with integral vacuum breaker and 0.75 inch external hose threads. Provide faucet with spout support brace with wall bracket, integral service stops, integral pail hook on spout, and hose and bracket, and mop holder.

2.6 BACKFLOW PREVENTERS

Backflow prevention devices must be approved by the State or local regulatory agencies. If there is no State or local regulatory agency requirements, the backflow prevention devices must be listed by the Foundation for Cross-Connection Control & Hydraulic Research, or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention devices and assemblies.

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be meet the above requirements.

Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.7 DRAINS

2.7.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping. Primer shall meet ASSE 1018.

2.7.2 Shower Faucets

Provide single control pressure equalizing shower faucets with body mounted from behind the wall with threaded connections. Provide ball joint self-cleaning shower heads. Provide shower heads which deliver a maximum of 1.5 GPM per ASHRAE 189.1 Section 6.3.2.1 (Plumbing Fixtures and Fittings) requirements. Showerheads must meet the EPA WaterSense product definition specified in http://www.epa.gov/watersense/partners/product_program_specs.html and must be EPA WaterSense labeled products. Provide bathtub and shower valve with ball type control handle.

2.8 SHOWER PAN

Shower pan may be copper, or nonmetallic material.

2.8.1 Sheet Copper

Sheet copper shall be 16 ounce weight.

2.8.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 0.040 inch minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and shall be in accordance with ASTM D4551.

2.8.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 0.040 inch minimum thickness of nonplasticized PVC and shall have the following minimum properties:

a. or ASTM D638:

Ultimate Tensile Strength:	2600 psi
Ultimate Elongation:	398 percent
100 Percent Modulus:	445 psi

b. ASTM D1004:

Tear Strength:	300 pounds per inch
----------------	---------------------

c. ASTM E96/E96M:

Permeance:	0.008 perms
------------	-------------

d. Other Properties:

Specific Gravity:	1.29
PVC Solvent:	Weldable
Cold Crack:	minus 53 degrees F
Dimensional stability	212 degrees F minus 2.5 percent
Hardness, Shore A:	89

2.9 TRAPS

Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.10 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory

pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 200 degrees F water temperature and 150 psi working pressure. The expansion tank size and acceptance volume shall be as indicated.

2.10.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve. Automatic storage type heaters must meet the Energy Star product definition specified in <https://www.energystar.gov/products/spec> and must be Energy Star certified.

2.10.1.1 Gas-Fired Type

Gas-fired water heaters shall conform to ANSI Z21.10.1/CSA 4.1 when input is 75,000 BTU per hour or less or ANSI Z21.10.3/CSA 4.3 for heaters with input greater than 75,000 BTU per hour.

2.11 PUMPS

2.11.1 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump and motor shall be supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze.

Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. The pump shall be certified for use in potable water systems in accordance with NSF/ANSI 61.

2.11.2 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.12 DOMESTIC WATER SERVICE METER

Cold water meters 2 inches and smaller shall be positive displacement type conforming to AWWA C700. Cold water meters 2-1/2 inches and larger shall be turbine type conforming to AWWA C701. Meter register may be round or straight reading type, as provided by the local utility. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

Provide water meters to monitor use in building consuming indoor and outdoor water as required by DODI 4170.11 (Installation Energy Management). Implement sub-metering when authorized in writing by the installation. Refer to ASHRAE 189.1 Section 7.3.3 (Energy Consumption Management) for subsystem implementation.

Meters must be connected to the base wide energy and utility monitoring and control system (if this system exists) using the installation's advanced metering protocols.

2.13 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall 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. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.14 MISCELLANEOUS PIPING ITEMS

2.14.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.14.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

2.14.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.14.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.14.3 Pipe Hangers (Supports)

Provide **MSS SP-58** Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.14.4 Nameplates

Provide **0.125 inch** thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of **0.25 inch** high normal block lettering into the white core. Minimum size of nameplates shall be **1.0 by 2.5 inches**. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to **NFPA 90A** requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with **NFPA 90A**. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with **PPFA Fire Man**. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended **5 feet** outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately **6 inches** above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least **12 inches** below the finish grade or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable

isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than $1/2$ inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made 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. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets and changes in direction where indicated and required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that

piping will spring enough to allow for expansion without straining.

3.1.1.6 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.3 Copper Tube and Pipe

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015.
- c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

3.1.2.4 Plastic Pipe

PVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.5 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Corrosion Protection for Buried Pipe and Fittings

Cast iron pipe, fittings, and joints shall have a protective coating. Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical

equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. 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. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level

between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

- a. A standard roof coupling for threaded pipe up to 6 inches in diameter.
- b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs FLASHING REQUIREMENTS and WATERPROOFING, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

3.1.5.6 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07 84 00 FIRESTOPPING.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to **MSS SP-58** except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per **MSS SP-58** and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe **4 inches** and larger when the temperature of the medium is **60 degrees F** or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
 - (1) Be used on insulated pipe less than **4 inches**.
 - (2) Be used on insulated pipe **4 inches** and larger when the temperature of the medium is **60 degrees F** or less.
 - (3) Have a high density insert for all pipe sizes. High density inserts shall have a density of **8 pcf** or greater.
- i. Horizontal pipe supports shall be spaced as specified in **MSS SP-58** and a support shall be installed not over **1 foot** from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over **5 feet** apart at valves. Operating temperatures in determining hanger spacing for PVC pipe shall be **120 degrees F** for PVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than **15 feet** nor more than **8 feet** from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
 - (1) On pipe **4 inches** and larger when the temperature of the medium is **60 degrees F** or higher, a Type 39 saddle, welded to the pipe, may

freely rest on a steel plate.

- (2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
 - (3) On pipe 4 inches and larger carrying medium less than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
 - m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
 - n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs,

except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Installation of Gas-Fired Water Heater

Installation shall conform to NFPA 54 for gas fired water heaters. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 24 inches just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

3.2.3 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.4 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed **39 inches** above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately **30 inches** above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim **31 inches** above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim **42 inches** above floor. Wall-hung service sinks shall be mounted with rim **28 inches** above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with **ICC A117.1**.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.4.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.4.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.5 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.3.7 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D3311. Traps for acid-resisting

waste shall be of the same material as the pipe.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors.

3.5 WATER METER REMOTE READOUT REGISTER

The remote readout register shall be mounted at the location indicated or as directed by the Contracting Officer.

3.6 IDENTIFICATION SYSTEMS

3.6.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.6.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.6.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be in accordance with ASME A13.1.

3.7 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.8 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS.

3.8.1 Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.8.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 3000 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall 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 shall be designed for the temperature service.

3.8.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, 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 shall be cleaned to bare metal.

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 shall be 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 shall 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 one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

- b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall 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 shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

3.9 TESTS, FLUSHING AND DISINFECTION

3.9.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with , except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure and reasons for choosing this option in lieu of the smoke test to the Contracting Officer for approval.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests.

3.9.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test

Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.9.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.9.3 System Flushing

3.9.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

3.9.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.9.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the

Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.9.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator and booster pump until the entire system is completely filled.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then

be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take addition samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer. Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, minimum overall efficiency.

ET = Minimum thermal efficiency with 70 degrees F delta T.

SL = Standby loss is maximum (Btu/h) based on a 70 degrees F temperature difference between stored water and ambient requirements.

V = Rated volume in gallons

Q = Nameplate input rate in kW (Btu/h)

3.11.1 Storage Water Heaters

3.11.1.1 Gas

- a. Storage capacity of 50 gallons or less shall have a minimum energy factor (EF) of 0.67 or higher per FEMP requirements.
- b. Storage capacity of 20 gallons - or more and input rating of 75,000 Btu/h or less: minimum EF shall be 0.62 - 0.0019V per 10 CFR 430.
- c. Rating of less than 22980 W: (75,000 Btu/h) ET shall be 80 percent; maximum SL shall be $(Q/800 + 110 \times (V^{1/2}))$, per ANSI Z21.10.3/CSA 4.3

3.12 TABLES

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
<u>Item #</u>	<u>Pipe and Fitting Materials</u>	<u>SERVICE A</u>	<u>SERVICE B</u>	<u>SERVICE C</u>	<u>SERVICE D</u>	<u>SERVICE E</u>	<u>SERVICE F</u>
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888 Pipe and fittings shall be marked with the CISPI trademark.		X		X	X	

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B				X	X	
11	Seamless red brass pipe, ASTM B43				X	X	
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
13	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X	
14	Seamless copper pipe, ASTM B42						X
15	Cast bronze threaded fittings, ASME B16.15				X	X	
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X	
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F891, (Sch 40) ASTM F1760		X		X	X	X
22	High-silicon content cast iron pipe and fittings (hub and spigot), ASTM A518/A518M		X			X	X

TABLE I							
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, AND VENT PIPING SYSTEMS							
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F
SERVICE: A - Underground Building Soil, Waste and Storm Drain B - Aboveground Soil, Waste, Drain In Buildings C - Underground Vent D - Aboveground Vent E - Interior Rainwater Conductors Aboveground F - Corrosive Waste And Vent Above And Belowground * - Hard Temper							

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
<u>Item #</u>	<u>Pipe and Fitting Materials</u>	<u>SERVICE A</u>	<u>SERVICE B</u>	<u>SERVICE C</u>	<u>SERVICE D</u>
	<p>SERVICE:</p> <p>A - Cold Water Service Aboveground</p> <p>B - Hot and Cold Water Distribution 180 degrees F Maximum Aboveground</p> <p>C - Compressed Air Lubricated</p> <p>D - Cold Water Service Belowground</p> <p>Indicated types are minimum wall thicknesses.</p> <p>** - Type L - Hard</p> <p>*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors</p> <p>**** - In or under slab floors only brazed joints</p>				

TABLE III				
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT				
<u>FUEL</u>	<u>STORAGE CAPACITY GALLONS</u>	<u>INPUT RATING</u>	<u>TEST PROCEDURE</u>	<u>REQUIRED PERFORMANCE</u>
A. STORAGE WATER HEATERS				
Gas	100,	199,000	10 CFR 430	EF = 0.98
<p>TERMS:</p> <p>EF = Energy factor, minimum overall efficiency.</p> <p>ET = Minimum thermal efficiency with 70 degrees F delta T.</p> <p>SL = Standby loss is maximum Btu/h based on a 70 degree F temperature difference between stored water and ambient requirements.</p> <p>V = Rated storage volume in gallons</p> <p>Q = Nameplate input rate in Btu/h</p>				

-- End of Section --

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
08/10

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

- AMCA 201 (2002; R 2011) Fans and Systems
- AMCA 210 (2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
- AMCA 300 (2014) Reverberant Room Method for Sound Testing of Fans
- AMCA 301 (2014) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

- AHRI Guideline D (1996) Application and Installation of Central Station Air-Handling Units

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

- ASHRAE 62.1 (2013) Ventilation for Acceptable Indoor Air Quality
- ASHRAE 70 (2006; R 2011) Method of Testing for Rating the Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

- ASME A13.1 (2015) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

- ASTM A123/A123M (2015) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A53/A53M (2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASTM A924/A924M (2016a) Standard Specification for General

Requirements for Steel Sheet,
Metallic-Coated by the Hot-Dip Process

ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B766	(1986; R 2015) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C553	(2013) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM D1654	(2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D3359	(2009; E 2010; R 2010) Measuring Adhesion by Tape Test
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E2016	(2011) Standard Specification for Industrial Woven Wire Cloth

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2016; SUPP 2016) Motors and Generators
NEMA MG 10	(2017) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2015) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

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

SMACNA 1966	(2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition
SMACNA 1981	(2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
-------------	---------------------------------------------------------------------

40 CFR 82	Protection of Stratospheric Ozone
PL 109-58	Energy Policy Act of 2005 (EPAct05)

UL 181	(2013) Factory-Made Air Ducts and Air Connectors
UL 1738	(2010; Reprint Nov 2014) Venting Systems for Gas-Burning Appliances, Categories II, III and IV
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 705	(2004; Reprint Dec 2013) Standard for Power Ventilators
UL Bld Mat Dir	(2012) Building Materials Directory
UL Electrical Constructn	(2012) Electrical Construction Equipment Directory

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics.

Submit proposed diagrams, at least 2 weeks prior to start of related testing. provide neat mechanical drawings provided with extruded aluminum frame under 1/8-inch glass or laminated plastic, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items

where directed.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation. Labels shall be in accordance with equipment schedules located on the Drawings.

Identify similar services with different temperatures or pressures. Where pressures could exceed 125 pounds per square inch, gage, include the maximum system pressure in the label. Label and arrow piping in accordance with the following:

- a. Each point of entry and exit of pipe passing through walls.
- b. Each change in direction, i.e., elbows, tees.
- c. In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.
- d. In long straight runs, locate labels at distances within eyesight of each other not to exceed 75 feet. All labels shall be visible and legible from the primary service and operating area.

For Bare or Insulated Pipes	
for Outside Diameters of	Lettering
1/2 thru 1-3/8 inch	1/2 inch
1-1/2 thru 2-3/8 inch	3/4 inch
2-1/2 inch and larger	1-1/4 inch

1.2.3 Color Coding

Color coding of all piping systems shall be in accordance with ASME A13.1 .

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-03 Product Data

Metallic Flexible Duct
Duct Connectors
Duct Access Doors; G
Manual Balancing Dampers; G

Sound Attenuation EquipmentDiffusers
Registers and Grilles
Louvers
Air Vents, Penthouses, and Goosenecks

Centrifugal Type Power Roof Ventilators
Energy Recovery Devices; G
Test Procedures
Diagrams; G
Metal Ductwork; G
Dedicated Outdoor Air System (DOAS); G

SD-06 Test Reports

Performance Tests; G
Damper Acceptance Test; G

SD-07 Certificates

Bolts
Ozone Depleting Substances

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions
Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G
Manual Balancing Dampers; G

Centrifugal Type Power Roof Ventilators; G
Energy Recovery Devices; G
Dedicated Outdoor Air System (DOAS); G

SD-11 Closeout Submittals

Energy Efficient Equipment; S
Reduce Volatile Organic Compounds (VOC); S
Indoor Air Quality During Construction; S
Ozone Depleting Substances for Refrigerants; S

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

- a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in [UL Bld Mat Dir](#), and [UL 6](#) is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items

have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

- b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.
- c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.
- d. Where products are specified to meet or exceed the specified energy efficiency requirement of FEMP-designated or Energy Star certified product categories, equipment selected shall have as a minimum the efficiency rating identified under "Energy-Efficient Products" at <http://www1.eere.energy.gov/femp/procurement>.

These specifications conform to the efficiency requirements as defined in Public Law PL 109-58, "Energy Policy Act of 2005" for federal procurement of energy-efficient products. Equipment having a lower efficiency than Energy Star or FEMP requirements may be specified if the designer determines the equipment to be more life-cycle cost effective using the life-cycle cost analysis methodology and procedure in 10 CFR 436.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A123/A123M for exterior locations and cadmium-plated in conformance with ASTM B766 for interior locations. Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Use of Ozone Depleting Substances, Other than Refrigerants

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

- a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon
- b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays.

- c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial cabling.
- d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

1.4.4 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.4.5 Test Procedures

Submit proposed test procedures and test schedules for the ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

1.6 Salt Spray Protection

All outdoor equipment exposed to outdoor air furnished under this specification section shall pass the ASTM B117 three thousand (3000) hour salt spray resistant test.

1.7 Indoor and Outdoor Coil Corrosion Coating

Provide ASTM B117 rated coil corrosion protection to all indoor mechanical equipment coils subjected to 50 percent or greater outside air. All outdoor coils, including the entire outdoor unit, shall receive corrosion protection. Coating shall be immersion applied baked phenolic or other approved coating. Field applied coatings not acceptable.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Energy Efficient Equipment

Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph ENERGY EFFICIENT EQUIPMENT that the following products meet energy efficiency requirements as outlined in this section:

- a. Centrifugal Fans
- b. In-Line Centrifugal Fans
- c. Centrifugal Type Power Roof Ventilators
- d. Energy Recovery Devices
- e. Dedicated Outdoor Air System

2.1.2 Reduce Volatile Organic Compounds (VOC) for sealants, coatings or adhesives

Low or no VOC's and no added urea formaldehyde for duct sealants, coatings or adhesives, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS (VOC).

2.1.3 Ozone Depleting Substances for Refrigerants

Do not use any Ozone Depleting Substances (ODS) as Refrigerants per requirements in 01 33 29 SUSTAINABILITY REPORTING paragraph OZONE DEPLETING SUBSTANCES.

2.2 STANDARD PRODUCTS

Except for the fabricated duct, plenums and casings specified in paragraphs "Metal Ductwork" and "Plenums and Casings for Field-Fabricated Units", provide components and equipment that are standard products of manufacturers regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. This requirement applies to all equipment, including diffusers, registers, fire dampers, and balancing dampers. All energy consuming HVAC equipment must be Energy Star or Federal Energy management Program (FEMP) designated efficiency in conformance to Section 01 33 29 SUSTAINABILITY REPORTING paragraph ENERGY EFFICIENT EQUIPMENT.

- a. Standard products are defined as components and equipment that have been in satisfactory commercial or industrial use in similar applications of similar size for at least two years before bid opening.
- b. Prior to this two year period, these standard products shall have been sold on the commercial market using advertisements in manufacturers' catalogs or brochures. These manufacturers' catalogs, or brochures shall have been copyrighted documents or have been identified with a manufacturer's document number.
- c. Provide equipment items that are supported by a service organization. In product categories covered by Energy Star or the Federal Energy Management Program, provide equipment that is listed on the Energy Star Qualified Products List or that meets or exceeds the FEMP-designated

Efficiency Requirements.

2.3 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

2.4 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard. The requirements for catwalks, operating platforms, ladders, and guardrails are specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

2.5 ELECTRICAL WORK

- 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, include manufacturer provided controllers with the required monitors and timed restart.
- b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.
- c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.
- d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque 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. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

- e. Provide variable frequency drives for motors as specified in Section 23 09 23.13 22 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

2.6 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.7 SEISMIC ANCHORAGE

Anchor equipment in accordance with applicable seismic criteria for the area and as defined in SMACNA 1981

2.8 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.9 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.10 DUCT SYSTEMS

2.10.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this specification .

- a. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.
- b. Provide radius type elbows with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes are allowed.
- c. Provide ductwork that meets the requirements of Seal Class A.
- d. Provide sealants that conform to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.
- e. Make spiral lock seam duct, and flat oval with duct sealant and lock with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA 1966. Apply the sealant to the exposed male part of the fitting collar so that the sealer is on the inside of the joint and fully protected by the metal of the duct fitting. Apply one brush coat of the sealant over the outside of the joint to at least

2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar are not acceptable. Fabricate outdoor air intake ducts and plenums with watertight soldered or brazed joints and seams.

- f. All exposed round or oval duct shown on the drawings shall consist of double wall spiral lockseam factory fabricated duct with 1" of fiberglass insulation between the solid sheetmetal outer wall and the solid sheetmetal inner wall.

2.10.1.1 Metallic Flexible Duct

- a. Provide duct that conforms to UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Provide duct assembly that does not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of 2 inches water gauge positive and 1.5 inches water gauge negative. Provide flexible round duct length that does not exceed 5 feet. Secure connections by applying adhesive for 2 inches over rigid duct, apply flexible duct 2 inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.
- b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of aluminum.
- c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of 1 inch thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.10.1.2 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector system that complies with NFPA 701 and is classified as "flame-retardant fabrics" in UL Bld Mat Dir.

2.10.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.10.3 Manual Balancing Dampers

- a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control

dampers that are operated by locking-type quadrant operators.

- b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.
- c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.10.3.1 Square or Rectangular Dampers

2.10.3.1.1 Duct Height 12 inches and Less

2.10.3.1.1.1 Frames

Width	Height	Galvanized Steel Thickness	Length
Maximum 19 inches	Maximum 12 inches	Minimum 20 gauge	Minimum 3 inches
More than 19 inches	Maximum 12 inches	Minimum 16 gauge	Minimum 3 inches

2.10.3.1.1.2 Single Leaf Blades

Width	Height	Galvanized Steel Thickness	Length
Maximum 19 inches	Maximum 12 inches	Minimum 20 gauge	Minimum 3 inches
More than 19 inches	Maximum 12 inches	Minimum 16 gauge	Minimum 3 inches

2.10.3.1.1.3 Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

Width	Height	Material	Square Shaft
Maximum 19 inches	Maximum 12 inches	Galvanized Steel	Minimum 3/8 inch
More than 19 inches	Maximum 12 inches	Galvanized Steel	Minimum 1/2 inch

2.10.3.1.1.4 Axle Bearings

Support the shaft on each end at the frames with shaft bearings. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

Width	Height	Material
Maximum 19 inches	Maximum 12 inches	solid nylon, or equivalent solid plastic, or oil-impregnated bronze
More than 19 inches	Maximum 12 inches	oil-impregnated bronze

2.10.3.1.1.5 Control Shaft/Hand Quadrant

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.10.3.1.1.6 Finish

Mill Galvanized

2.10.3.1.2 Duct Height Greater than 12 inches

2.10.3.1.2.1 Dampers

Provide dampers with multi-leaf opposed-type blades.

2.10.3.1.2.2 Frames

Maximum 48 inches in height; maximum 48 inches in width; minimum of 16 gauge galvanized steel, minimum of 5 inches long.

2.10.3.1.2.3 Blades

Minimum of 16 gauge galvanized steel; 6 inch nominal width.

2.10.3.1.2.4 Blade Axles

To support the blades of round dampers, provide galvanized square steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

2.10.3.1.2.5 Axle Bearings

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a

tight joint between blade shaft and damper frame.

2.10.3.1.2.6 Blade Actuator

Minimum 1/2 inch diameter galvanized steel.

2.10.3.1.2.7 Blade Actuator Linkage

Mill Galvanized steel bar and crank plate with stainless steel pivots.

2.10.3.1.2.8 Control Shaft/Hand Quadrant

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.10.3.1.2.9 Finish

Mill Galvanized

2.10.3.2 Round Dampers

2.10.3.2.1 Frames

Size	Galvanized Steel Thickness	Length
4 to 20 inches	Minimum 20 gauge	Minimum 6 inches
22 to 30 inches	Minimum 20 gauge	Minimum 10 inches
32 to 40 inches	Minimum 16 gauge	Minimum 10 inches

2.10.3.2.2 Blades

Size	Galvanized Steel Thickness
4 to 20 inches	Minimum 20 gauge
22 to 30 inches	Minimum 16 gauge
32 to 40 inches	Minimum 10 gauge

2.10.3.2.3 Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Axle shafts shall extend through standoff bracket and hand quadrant.

Size	Shaft Size and Shape
4 to 20 inches	Minimum 3/8 inch square
22 to 30 inches	Minimum 1/2 inch square
32 to 40 inches	Minimum 3/4 inch square

2.10.3.2.4 Axle Bearings

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Shaft bearings configuration shall be a pressed fit to provide a tight joint between blade shaft and damper frame.

Size	Material
4 to 20 inches	solid nylon, or equivalent solid plastic, or oil-impregnated bronze
22 to 30 inches	solid nylon, or equivalent solid plastic, or oil-impregnated bronze
32 to 40 inches	oil-impregnated bronze, or stainless steel sleeve bearing

2.10.3.2.5 Control Shaft/Hand Quadrant

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Stand-off distance shall be a minimum of 2 inches off the metal duct surface. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.10.3.2.6 Finish

Mill Galvanized

2.10.4 Automatic Balancing Dampers

Provide dampers as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.10.5 Sound Attenuation Equipment

2.10.5.1 System with total pressure of 4 Inch Water Gauge and Lower

Use sound attenuators only where indicated. Provide factory fabricated sound attenuators that are constructed of galvanized steel sheets. Provide attenuator with outer casing that is not less than 22 gauge. Provide fibrous glass acoustical fill. Provide net sound reduction indicated. Obtain values on a test unit not less than 24 by 24 inches outside

dimensions made by a certified nationally recognized independent acoustical laboratory. Provide air flow capacity as indicated or required. Provide pressure drop through the attenuator that does not exceed the value indicated, or that is not in excess of 15 percent of the total external static pressure of the air handling system, whichever is less. Acoustically test attenuators with metal duct inlet and outlet sections while under the rated air flow conditions. Include with the noise reduction data the effects of flanking paths and vibration transmission. Construct sound attenuators to be airtight when operating at the internal static pressure indicated or specified for the duct system, but in no case less than 2 inch water gauge.

2.10.6 Diffusers, Registers, and Grilles

Provide factory-fabricated units of aluminum that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70. Provide sound rated and certified inlets and outlets according to ASHRAE 70. Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

2.10.6.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Constructn for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.10.6.2 Perforated Plate Diffusers

Provide adjustable one-way, two-way, three-way, or four-way air pattern controls as indicated. Provide diffuser faceplates that do not sag or deflect when operating under design conditions.

2.10.6.3 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 6 inches below the ceiling unless otherwise indicated. Locate return and exhaust registers 6 inches above the floor unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of

horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

2.10.6.4 Registers

Double-deflection supply registers. Provide opposed blade type volume dampers where indicated on Drawings. Provide exhaust and return registers as specified for supply registers, except provide exhaust and return registers that have a single set of nondirectional face bars or vanes having the same appearance as the supply registers.

2.10.7 Louvers

Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as specified in Section 08 91 00 METAL WALL LOUVERS.

2.10.8 Air Vents, Penthouses, and Goosenecks

Fabricate air vents, penthouses, and goosenecks from aluminum sheets with aluminum structural shapes. Provide sheet metal thickness, reinforcement, and fabrication that conform to SMACNA 1966. Accurately fit and secure louver blades to frames. Fold or bead edges of louver blades for rigidity and baffle these edges to exclude driving rain. Provide air vents, penthouses, and goosenecks with bird screen.

2.10.9 Bird Screens and Frames

Provide bird screens that conform to ASTM E2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.11 AIR SYSTEMS EQUIPMENT

2.11.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 120 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D (A fixed-pitch sheave is provided on both the fan shaft and the motor shaft. This is a non-adjustable speed drive.). Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the

fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to [AMCA 300](#). Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to [UL 705](#) and have a UL label.

2.11.1.1 Centrifugal Type Power Roof Ventilators

Provide direct driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with [aluminum](#) birdscreen, disconnect switch, gravity dampers, roof curb, and extended base. Provide dripproof type motor enclosure. Provide centrifugal type kitchen exhaust fans according to [UL 705](#), fitted with V-belt drive, round hood, and windband upblast discharge configuration, integral residue trough and collection device, with motor and power transmission components located in outside positively air ventilated compartment. Use only lubricated bearings.

2.12 CORROSION PROTECTION FOR COASTAL INSTALLATIONS

2.12.1 Salt Spray Resistant Coatings

The corrosion protection shall meet or exceed the requirements of a 3000 hour salt spray test in accordance with ASTM B117. The specified capacities on the plans and specifications shall be the capacities after the required corrosion protection coatings are applied. At these coastal locations, this corrosion protection is also required on HVAC equipment within buildings that are subject to the outside weather conditions. Specifically, equipment requiring protection is defined as the first HVAC equipment (excluding louvers) met by the outside air in the supply air ductwork system.

2.13 ENERGY RECOVERY DEVICES

2.13.1 Dedicated Outdoor Air System (DOAS) - Split System

The split system Dedicated Outdoor Air System unit shall consist of an indoor air handling section and an outdoor condensing section. The indoor section shall be supplied with a supply fan, total energy heat wheel, return/exhaust fan, DX cooling coil, DX hot gas reheat coil, LP gas heat (or reheat), motorized dampers and filters. The outdoor section shall be air cooled and shall be supplied with a condensing coil and compressors. Indoor and outdoor units shall be matched assemblies. Provide unit complete with frame and enclosure, interconnecting piping and wiring, necessary controls and safety devices, and operating charge of oil. Provide unit that is ready for full-capacity operation after removal of shipping protection, connection to remote compressor/condenser or condenser, charging, and connection to utilities. Completely charge system in the field. Have units shipped with a refrigerant holding-charge.

2.13.2 Cabinet

Provide double wall construction with an outer casing that is constructed of 18-gage galvanized metal panels, adequately reinforced, with minimum 1" thick fiberglass or foam-in-place insulation and minimum 22 gauge solid inner wall of galvanized steel. Insulation shall meet NFPA 90A and UL 181

requirements, including a maximum flame spread of 25 and smoke developed of 50. Provide cabinet with easily removable insulated hinged access panels located for access to all parts of the equipment. Provide metal surfaces that are Bonderite treated, phosphatized, and have a baked enamel finish. Provide casing and insulation that are designed to limit noise and vibration within acceptable levels.

2.13.3 Fans and Motors

Provide centrifugal-type fans with forward curved aluminum type blades in each fan section. Provide fans that are mounted on a common shaft. Provide antifriction type bearings, manufactured from vacuum processed alloys. Provide bearings that have an L-10 life expectancy rating of 40,000 hours under service load conditions. Fans shall be statically and dynamically balanced and shall be designed for continuous operation at maximum rated fan speed and horsepower.. Provide fans that are direct drive driven with variable speed motors. Fan performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210. Fan motors greater than $\frac{3}{4}$ horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower.

2.13.4 Desiccant Wheel

Provide counterflow supply, regeneration airstreams, a rotary type dehumidifier designed for continuous operation, and extended surface type wheel structure in the axial flow direction with a geometry that allows for laminar flow over the operating range for minimum air pressure differentials. Provide the dehumidifier complete with a drive system utilizing a fractional-horsepower electric motor and speed reducer assembly driving the rotor. Include a slack-side tensioner for automatic take-up for belt-driven wheels. Provide an adsorbing type desiccant material. Apply the desiccant material to the wheel such that the entire surface is active as a desiccant and the desiccant material does not degrade or detach from the surface of the wheel which is fitted with full-face, low-friction contact seals on both sides to prevent cross leakage. The wheel shall be constructed to permit cleaning and servicing. Provide rotary structure that has underheat, overheat and rotation fault circuitry. The wheel assembly shall come with a warranty for a minimum of five years.

2.13.5 Coils

Coils shall be constructed of seamless copper tubing, permanently mechanically bonded to aluminum fins, at 12 fins per inch maximum, and enclosed in a galvanized steel frame. Provide coils equipped with liquid-feed distributors to ensure equal feed to each refrigerant circuit. Test coils at 400 pounds per square inch (psi) at the factory and completely dehydrated. Limit air flow to 500 feet per minute (fpm). Provide design that precludes carryover of water. If a reheat coil is specified, it shall be factory installed and shall have a modulating hot gas reheat valve. If two compressors are used as components of a DX system in the unit, then the evaporator coil shall be of "interlaced" configuration, permitting independent operation of either compressor without conflict with the other compressor. The condensate drain pan under the coils shall be formed of welded austenitic stainless steel sheet

material and provided with a welded drain connection at the front for connection to a p-trap. Drain pan shall be sloped in two directions to provide positive draining. All coils shall be coated per the "Indoor and Outdoor Coil Corrosion Coating" and "Corrosion Protection for Coastal Installations" paragraphs of this specification section.

2.13.6 Gas Heater

The gas heater shall be ETL Certified as a component of the unit, shall have an integral combustion gas blower and shall have fault sensors to provide fault conditions to building controls. The tubular heat exchanger shall be constructed of aluminized steel or type 409 stainless steel. Heat exchanger tubes shall be installed on the vest plate by means of swaged assembly, welded connections are not acceptable. Heat exchanger tubes shall be supported by a minimum of two fabricated assemblies that support the tubes and also permit expansion and contraction of the tubes. Gas heater shall be compatible with LP gas. Heat exchanger shall have a 5 year extended warranty. Furnace control shall be minimum 4:1 modulating. Provide kit for indoor mounting a separated 2 pipe flue and combustion air system. Flue shall be AL-429C stainless steel piping, the combustion air pipe shall be stainless steel. Provide compatible wall or roof caps for termination of flue/combustion air. Flue shall meet all requirements of UL 1738.

2.13.7 Dampers

Motorized dampers shall be provided in both the exhaust air and intake air connection points on the indoor unit. The motorized dampers shall be Class 1a insulated low leakage type with a maximum leakage rate of 3 CFM per sq. ft. at 1" of differential static pressure and shall be factory installed.

2.13.8 Filters

Combination of MERV 8 and MERV 13 disposable pleated filters shall be provided in the intake air stream and MERV 8 filters in the exhaust air stream. Provide filters that limit air velocities to 500 fpm. Filter thickness shall be a minimum of 2".

2.13.9 Controls

Unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various sensors. The DDC controller shall connect to the building DDC system and must allow complete access for controlling the DOAS unit, in addition to unit monitoring and operating status. The microprocessor controls shall be capable of stand-alone operation, if communication with building DDC is lost.

Unit shall incorporate a DDC controller with integral LCD screen that provides text readouts of status, operating settings and alarm conditions. DDC controller shall have a built-in keypad to permit operator to access read-out screens and change settings without the use of ancillary equipment, devices or software. DDC controllers that require the use of equipment or software that is not factory-installed in the unit are not acceptable. Alarm readouts consisting of flashing light codes are not acceptable.

Operating protocol: The DDC shall be factory-programmed for BACnet MSTP.

Unit shall have factory installed variable frequency drives for modulation

of the blower motors. The VFDs shall be factory-programmed for unit-specific requirements and shall not require additional field programming to operate.

Provide the following sensors on the unit: Dirty Filter Sensors on Outside Air Inlet filters and Exhaust Inlet filters; Temperature Sensors on the Outside Air Intake, Return/Exhaust Air Inlet, Outside Air after Wheel, Outside Air after Cooling Coil, Outside Air leaving Unit; Current Sensor on Supply Fan and Exhaust Fan; Rotation Sensor

2.13.10 Condensing Units

2.13.10.1 Cabinet

Provide air-cooled condenser with vertical discharge, in a weather-protected casing, that is suitable for installation remote from air-conditioning unit. Provide air inlet and discharge grilles with aluminum wire-mesh birdscreens. Provide condenser enclosure that is constructed of not less than 18-gage sheet steel, with access panels and with rust-inhibitive baked enamel or galvanized finish. The cabinet and entire condensing unit shall be coated per the "Indoor and Outdoor Coil Corrosion Coating" and "Corrosion Protection for Coastal Installations" paragraphs of this specification section.

2.13.10.2 Compressors

For compressors over 20 tons, compressor speed shall not exceed 3450 rpm. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units shall have multiple compressors with means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide a pumpdown cycle for units 20 tons and over. If compressors are paralleled, provide not less than two independent circuits.

The refrigerant compressor(s) shall include at least one digital scroll type compressor. The compressor shall be equipped with liquid line filter drier, thermostatic expansion valves (TXV)(s), manual reset high pressure and low pressure cutouts and all appurtenant sensors, service ports and safety devices. Compressed refrigerant system shall be fully charged with refrigerant. Hot gas bypass shall be provided on the lead circuit to prevent icing of the evaporator coil under low load conditions.

Provide compressors with high/low pressure safety cutoff. Equip compressor with reversible oil pump for lubrication, an oil-pressure-failure switch, crankcase heaters, suction and discharge flanged valves, head pressure, and suction pressure gages with shutoff valves. Mount compressor on spring-type vibration isolators.

2.13.10.3 Condensing Coils

Coils shall be seamless copper tube mechanically bonded to aluminum fin construction. Coils shall be factory pressure tested. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. Provide a coating on condenser and evaporator coils and fins as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins. All coils shall be coated per the "Indoor and Outdoor Coil Corrosion

Coating" and "Corrosion Protection for Coastal Installations" paragraphs of this specification section.

2.13.10.4 Condenser Fans

Condenser fan assemblies shall be factory installed as integral subassemblies of the unit and mounted on the exterior of the unit. Condenser fan motors shall be open air over type. Each condenser fan motor shall have a vented frame, rated for continuous duty and be equipped with an automatic reset thermal protector. Motors shall be UL Recognized. Fans shall be direct drive all aluminum propeller type construction, with aluminum

2.13.10.5 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to 15 degrees F.

2.14 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to [ASTM A123/A123M](#) or [ASTM A924/A924M](#). Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to [ASTM B117](#), [ASTM D1654](#), and [ASTM D3359](#). Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 3000 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to [ASTM D520](#) Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.15 SUPPLEMENTAL COMPONENTS/SERVICES

2.15.1 Refrigerant Piping

The requirements for refrigerant piping are specified in Section [23 23 00](#) REFRIGERANT PIPING.

2.15.2 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate in accordance with Section [22 00 00](#) PLUMBING, GENERAL PURPOSE except as modified herein.

2.15.3 Backflow Preventers

The requirements for backflow preventers are specified in Section [22 00 00](#) PLUMBING, GENERAL PURPOSE.

2.15.4 Insulation

The requirements for shop and field applied insulation are specified in

Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.15.5 Controls

The requirements for controls are specified in 23 09 23.13 22 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

PART 3 EXECUTION

3.1 CONSTRUCTION-RELATED SUSTAINABILITY CRITERIA

Perform and document Indoor Air Quality During Construction. Provide documentation showing that after construction ends, and prior to occupancy, new filters were installed in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph INDOOR AIR QUALITY DURING CONSTRUCTION.

3.2 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.3 INSTALLATION

- a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.
- b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices) and an additional 3 feet.
- c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.3.1 Condensate Drain Lines

Provide water seals in the condensate drain from all units. Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.3.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated.

Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS. Provide concrete for foundations as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.3.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.3.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended. Limit the length of flexible ductwork to 5' maximum.

3.3.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

3.3.6 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.3.7 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit.

3.3.8 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.3.9 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.4 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 14 calendar days before being loaded.

3.5 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.6 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. When the work area is in an occupied space such as office, laboratory or warehouse protect all furniture and equipment from dirt and debris. Incorporate housekeeping for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.

3.7 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct

insulation with mineral fiber conforming with ASTM C553, Type 1, Class B-2.

3.7.1 Sleeves

Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A53/A53M, Schedule 40.

3.7.2 Framed Prepared Openings

Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.

3.7.3 Insulation

Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

3.7.4 Closure Collars

Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.

3.7.5 Firestopping

Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING.

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.10 DAMPER ACCEPTANCE TEST

Damper acceptance test shall be witnessed by NAVFAC Midland Fire Protection Engineer.

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers and smoke dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.11 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.12 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than 2 days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the ductwork leak test, and performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.13 CLEANING AND ADJUSTING

Inside of air terminal units, thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer. Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet

specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.14 OPERATION AND MAINTENANCE

3.14.1 Operation and Maintenance Manuals

Submit six manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA and Section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI). Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.14.2 Operation And Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 48 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

08/10

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 B117 (2016) Standard Practice for Operating
Salt Spray (Fog) Apparatus

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

Energy Efficient Equipment for Motors; S

1.3 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory

tests, can be shown.

1.4.3 Service Support

The equipment items must be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations must be 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.

1.4.4 Manufacturer's Nameplate

For each item of equipment, provide 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.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" 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.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions must be considered mandatory, the word "should" is interpreted as "must." Reference to the "code official" must be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" must be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" must be interpreted to mean the "lessor." References to the "permit holder" must be interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

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 the ICC Codes to sections of Chapter 1, must be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and

contactors must conform to and have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and must have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work must be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment must be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, 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, of the specified equipment or system. Instructors must be thoroughly familiar with all parts of the installation and must be trained in operating theory as well as practical operation and maintenance work.

Instruction must be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished must be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the 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.

1.8 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.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Energy Efficient Equipment for Motors

Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph ENERGY EFFICIENT EQUIPMENT that the motors meet energy efficiency requirements as outlined in this section.

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

New equipment painting must be factory applied or shop applied, and must be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that 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. Salt-spray fog test must be in accordance with [ASTM B117](#), and for that test the acceptance criteria must be as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage beyond [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.

3.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, 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 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 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](#).

-- End of Section --

SECTION 23 05 48.00 40

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

08/15

PART 1 GENERAL

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section to the extent applicable.

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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S2.71 (1983; R 2006) Guide to the Evaluation of Human Exposure to Vibration in Buildings

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

ASHRAE HVAC APP IP HDBK (2016) HVAC Applications Handbook, I-P Edition

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

1.2 ADMINISTRATIVE REQUIREMENTS

Within ten working days of Contract Award, submit equipment and performance data for vibration isolator systems including equipment base design; inertia-block mass relative to support equipment weight; spring loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

Ensure the data includes information on the following:

- a. Mountings
- b. Bases
- c. Isolators
- d. Floor-Mounted Piping
- e. Vertical Piping

Five working days prior to commencement of installation, submit

installation drawings for vibration isolator systems including equipment and performance requirements.

Indicate within outline drawings for vibration isolator systems, overall physical features, dimensions, ratings, service requirements, and weights of equipment.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

Outline Drawings; G

SD-03 Product Data

Equipment and Performance Data; G

SD-06 Test Reports

Type of Isolator; G

1.4 QUALITY CONTROL

Ensure all vibration-control apparatus is the product of a single manufacturing source, where possible. Human exposure levels should be considered using ASA S2.71 and NEBB PROCEDURAL STANDARDS.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Scheduled isolation mounting is in inches and is a minimum static deflection.

Spans referred to in paragraph EQUIPMENT, means longest bay dimension.

Determine exact mounting sizes and number of isolators by the isolator manufacturer based on equipment that will be installed. Check equipment revolutions per minute (rpm) and spring deflections to verify that resonance cannot occur.

2.1.1.1 Design Requirements

Design for vibration isolation using **ASHRAE HVAC APP IP HDBK**, Chapter 48, as applicable to the following sections.

2.1.1.1.1 Mountings

Provide the following mountings:

Type B: Double rubber-in-shear **or** elastomer-in-shear with molded-in steel reinforcement in top and bottom. Maximum deflections up to **0.50-inch** are allowed.

Type C: Free-standing laterally stable open-spring type for deflections over **0.50-inch**, with built-in bearing and leveling provisions, **0.25-inch** thick Type A base elastomer pads, and accessories. Ensure outside diameter of each spring is equal to or greater than 0.9 times the operating height of the spring under rated load.

Type D: Partially housed type, containing one or more vertically restrained springs with at least **0.50-inch** clearance maintained around springs, with adjustable limit stops, **0.25-inch** thick Type A base elastomer pads, and accessories.

2.2 EQUIPMENT

Vibration isolation design per **ASHRAE HVAC APP IP HDBK**, Chapter 37,.

2.2.1 Air-Cooled Condensing Unit Locations

TYPE EQUIPMENT	20-FOOT ROOF-SPAN PROVISIONS*	30-FOOT ROOF-SPAN PROVISIONS*	40-FOOT ROOF-SPAN PROVISIONS*
Through 5 hp over 900 rpm	B-U-0.5	D-U-1.0	D-U-1.75
Over 5 hp to 500 rpm	B-U-0.5	D-U-1.75	D-U-2.5
500 rpm and over	B-U-0.5	D-U-1.0	D-U-1.75
*TYPE OF MOUNTING, BASE, AND MINIMUM DEFLECTION IN INCHES			

2.2.2 Low-Pressure AHU Locations

Vibration-isolation provisions apply to floor-mounted Air Moving and Conditioning Association Class A packaged central-station units.

TYPE EQUIPMENT	BASEMENT BELOW-GRADE PROVISIONS*	ON/ABOVE GRADE 20-FOOT FLOOR-SPAN PROVISIONS*	ON/ABOVE GRADE 30-FOOT FLOOR-SPAN PROVISIONS*	ON/ABOVE GRADE 40-FOOT FLOOR-SPAN PROVISIONS*
Through 5 hp	B-U-0.35	C-U-1.0	C-U-1.0	C-U-1.0

TYPE EQUIPMENT	BASEMENT BELOW-GRADE PROVISIONS*	ON/ABOVE GRADE 20-FOOT FLOOR-SPAN PROVISIONS*	ON/ABOVE GRADE 30-FOOT FLOOR-SPAN PROVISIONS*	ON/ABOVE GRADE 40-FOOT FLOOR-SPAN PROVISIONS*
7-1/2 hp and over 250 to 500	B-U-0.35	C-U-1.75	C-U-1.75	C-U-1.75
500 rpm	B-U-0.35	C-U-1.0	C-U-1.5	
*TYPE OF MOUNTING, BASE, AND MINIMUM DEFLECTION IN INCHES				

2.2.3 Pipe And Duct Vibration Isolation

2.2.3.1 Vertical Piping

2.3 MATERIALS

Ensure rubber is natural rubber and elastomer is chloroprene. Shore A durometer measurement of both materials and range between 40 and 60.

Inorganic materials such as precompressed, high-density, fibrous glass encased in a resilient moisture-impervious membrane may be used in lieu of specified natural rubber and elastomers. Where this substitution is made, ensure specified deflections are modified by the manufacturing source to accommodate physical characteristics of inorganic materials and to provide equal or better vibration isolation.

Ensure weather-exposed metal vibration-isolator parts are corrosion protected. Chloroprene coat springs.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit test reports for testing vibration isolation for each [type of isolator](#). Meet referenced standards contained within this section.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations.

Ensure structural steel bases are raised not less than [1-inch](#) above the floor and are level when equipment supported is under operating load.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests and Reports

Ensure vibration-isolation devices are deflection tested. Submit test reports substantiating that all equipment has been isolated as specified and that minimum specified deflections have been met. Make all measurements in the presence of the Contracting Officer.

-- End of Section --

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

11/15

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 203 (1990; R 2011) Field Performance
Measurements of Fan Systems

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

ASHRAE 62.1 (2013) Ventilation for Acceptable Indoor
Air Quality

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002; 6th ed) National Standards for
Total System Balance

AABC MN-4 (1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV (2006) Procedural Standards for
Measurements and Assessment of Sound and
Vibration

NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB
(Testing, Adjusting and Balancing)
Environmental Systems

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

SMACNA 1780 (2002) HVAC Systems - Testing, Adjusting
and Balancing, 3rd Edition

SMACNA 1858 (2004) HVAC Sound And Vibration Manual -
First Edition

SMACNA 1972 CD (2012) HVAC Air Duct Leakage Test Manual -
2nd Edition

1.2 DEFINITIONS

- a. AABC: Associated Air Balance Council
- b. COTR: Contracting Officer's Technical Representative

- c. DALT: Duct air leakage test
- d. DALT'd: Duct air leakage tested
- e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling
- f. NEBB: National Environmental Balancing Bureau
- g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."
- h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.
- i. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.
- j. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.
- k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).
- l. TAB: Testing, adjusting, and balancing (of HVAC systems)
- m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed
- n. TAB Agency: TAB Firm
- o. TAB team field leader: TAB team field leader
- p. TAB team supervisor: TAB team engineer
- q. TAB team technicians: TAB team assistants
- r. TABB: Testing Adjusting and Balancing Bureau

1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only.

Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS			
Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures	Field Readiness Check & Prelim. Field Procedures

1.3 WORK DESCRIPTION

The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air distribution systems including equipment and performance data, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

Conduct DALT and TAB of the indicated existing systems and equipment and submit the specified DALT and TAB reports for approval. Conduct DALT testing in compliance with the requirements specified in SMACNA 1972 CD, except as supplemented and modified by this section. Conduct DALT and TAB work in accordance with the requirements of this section.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 TAB SCHEMATIC DRAWINGS

Show the following information on TAB Schematic Drawings:

1. A unique number or mark for each piece of equipment or terminal.

2. Air quantities at air terminals.
3. Air quantities and temperatures in air handling unit schedules.

7. Ductwork Construction and Leakage Testing Table that defines the DALT test requirements, including each applicable HVAC duct system ID or mark, duct pressure class, duct seal class, and duct leakage test pressure. This table is included in the file for Graphics for Unified Facilities Guide Specifications:
<http://www.wbdg.org/FFC/NAVGRAPH/graphdoc.pdf>

The Testing, Adjusting, and Balancing (TAB) Specialist must review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the effective and accurate TAB of the system, including systems readiness check. The TAB Specialist must provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

Submit three copies of the [TAB Schematic Drawings and Report Forms](#) to the Contracting Officer, no later than 21 days prior to the start of TAB field measurements.

1.3.3 Related Requirements

Requirements for price breakdown of HVAC TAB work are specified in Section 01 20 00.00 20 PRICE AND PAYMENT PROCEDURES.

Requirements for construction scheduling related to HVAC TAB work are specified in Section 01 32 17.00 20 COST LOADED NETWORK ANALYSIS SCHEDULES (NAS).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[SD-01 Preconstruction Submittals](#)

[Independent TAB Agency and Personnel Qualifications; G](#)

[TAB Design Review Report; G](#)

[SD-02 Shop Drawings](#)

[TAB Schematic Drawings and Report Forms; G](#)

SD-03 Product Data

Equipment and Performance Data; G

TAB Related HVAC Submittals; G

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB team engineer and assistant.

SD-06 Test Reports

Completed Pre-Final DALT Report; G

Certified Final DALT Report; G

Prerequisite HVAC Work Checkout List For Proportional Balancing; G

Certified Final TAB Report for Proportional Balancing; G

Prerequisite HVAC Work Checkout List For Season 1; G

Certified Final TAB Report for Season 1; G

Prerequisite HVAC Work Checkout List For Season 2; G

Certified Final TAB Report for Season 2; G

SD-07 Certificates

Independent TAB Agency and Personnel Qualifications; G

DALT and TAB Submittal and Work Schedule; G

TAB Pre-Field Engineering Report; G

Instrument Calibration Certificates; G

DALT and TAB Procedures Summary; G

Completed Pre-Final DALT Work Checklist; G

Advance Notice of Pre-Final DALT Field Work; G

Advance Notice of TAB Field Work for Proportional Balancing; G

Advance Notice of TAB Field Work for Season 1; G

Advance Notice of TAB Field Work for Season 2 G

1.5 QUALITY ASSURANCE

1.5.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.

c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.5.1.1 TAB Standard

Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard are considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practical, to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations.

All quality assurance provisions of the TAB Standard such as performance guarantees are part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures must be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and

requirements are considered mandatory, including the latest requirements of ASHRAE 62.1.

1.5.1.2 Qualifications

a. TAB Firm

The TAB Firm must be either a member of AABC or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems and the measuring of sound and vibration in environmental systems.

Certification must be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor must immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award is not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm will be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor.

These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm must be a prime subcontractor of the Contractor and be financially and corporately independent of the mechanical subcontractor, reporting directly to and paid by the Contractor.

b. TAB Specialist

The TAB Specialist must be either a member of AABC, an experienced technician of the Firm certified by the NEBB, or a Supervisor certified by the TABB. The certification must be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist will be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

c. TAB Specialist Responsibilities

TAB Specialist responsibilities include all TAB work specified herein and in related sections under his direct guidance. The TAB specialist is required to be onsite on a daily basis to direct TAB efforts. The TAB Specialist must participate in the commissioning process.

1.5.1.3 TAB Related HVAC Submittals

The TAB Specialist must prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. Accompany the submittals identified on this list with a letter of

approval signed and dated by the TAB Specialist when submitted to the Government. Ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

1.5.2 Responsibilities

The Contractor is responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate TAB execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in the paragraph TAB SUBMITTAL AND WORK SCHEDULE.

1.5.2.1 Contractor

- a. TAB personnel: Ensure that the DALT work and the TAB work is accomplished by a group meeting the requirements specified in the paragraph TAB PERSONNEL QUALIFICATION REQUIREMENTS.
- b. Pre-DALT/TAB meeting: Attend the meeting with the TAB Supervisor, and ensure that a representative is present for the sheetmetal contractor, mechanical contractor, electrical contractor, and automatic temperature controls contractor.
- c. HVAC documentation: Furnish one complete set of the following HVAC-related documentation to the TAB agency:
 - (1) Contract drawings and specifications
 - (2) Approved submittal data for equipment
 - (3) Construction work schedule
 - (4) Up-to-date revisions and change orders for the previously listed items
- d. Submittal and work schedules: Ensure that the schedule for submittals and work required by this section and specified in the paragraph TAB SUBMITTAL AND WORK SCHEDULE is met.
- e. Coordination of supporting personnel:

Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the DALT and the TAB field measurement work.

Provide equipment mechanics to operate HVAC equipment and ductwork mechanics to provide the field designated test ports to enable TAB field team to accomplish the DALT and the TAB field measurement work. Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the DALT and the TAB field work.

Conversely, ensure that the HVAC controls installer has required support from the TAB team field leader to complete the controls check out.

- f. Deficiencies: Ensure that the TAB Agency supervisor submits all Design/Construction deficiency notifications directly to the

Contracting officer within 3 days after the deficiency is encountered. Further, ensure that all such notification submittals are complete with explanation, including documentation, detailing deficiencies.

- g. Prerequisite HVAC work: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as prerequisite work items, the deficiencies pointed out by the TAB team supervisor in the design review report.
- h. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. Do not allow the TAB team to commence TAB field work until all of the following are completed.
 - (1) HVAC system installations are fully complete.
 - (2) HVAC prerequisite checkout work lists specified in the paragraph PRE-FIELD TAB ENGINEERING REPORT are completed, submitted, and approved. Ensure that the TAB Agency gets a copy of the approved prerequisite HVAC work checklist.
 - (3) DALT field checks for all systems are completed.
 - (4) HVAC system filters are clean for both Season 1 and Season 2 TAB field work.
- i. Advance notice: Furnish to the Contracting Officer with advance written notice for the commencement of the DALT field work and for the commencement of the TAB field work.
- j. Insulation work: For required DALT work, ensure that insulation is not installed on ducts to be DALT'd until DALT work on the subject ducts is complete. Later, ensure that openings in duct and machinery insulation coverings for TAB test ports are marked, closed and sealed.

1.5.2.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of the paragraph INDEPENDENT TAB AGENCY PERSONNEL QUALIFICATIONS. The work to be performed by the TAB agency is limited to testing, adjusting, and balancing of HVAC air and water systems to satisfy the requirements of this specification section.

1.5.2.3 TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Pre-DALT/TAB meeting: Attend meeting with Contractor.
- c. Design review report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices

needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.

- d. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report, the during the DALT or TAB field work.
- e. Pre-field DALT preliminary notification: Monitor the completion of the duct installation of each system and provide the necessary written notification to the Contracting Officer.
- f. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
- g. Prerequisite HVAC work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.
- h. Technical assistance for DALT work.
 - (1) Technical assistance: Provide immediate technical assistance to TAB field team.
 - (2) DALT field visit: Near the end of the DALT field work effort, visit the contract site to inspect the HVAC installation and the progress of the DALT field work. Conduct a site visit to the extent necessary to verify correct procedures are being implemented and to confirm the accuracy of the Pre-final DALT Report data which has been reported. Also, perform sufficient evaluation to allow the TAB supervisor to issue certification of the final report. Conduct the site visit full-time for a minimum of two 8 hour workdays duration.
- i. Final DALT report: Certify the DALT report. This certification includes the following work:
 - (1) Review: Review the Pre-final DALT report data. From these field reports, prepare the Certified Final DALT report.
 - (2) TAB Verification: Verify adherence, by the TAB field team, to the procedures specified in this section.
- j. Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.
 - (1) TAB field visit: At the midpoint of the Season 1 and Season 2 TAB field work effort, visit the contract site to inspect the HVAC installation and the progress of the TAB field work. Conduct site visit full-time for a minimum of one 8 hour workdays duration.
- k. Certified TAB report: Certify the TAB report. This certification includes the following work:

- (1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.
- (2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.

- 1. Design/Construction deficiencies: Within 3 working days after the TAB Agency has encountered any design or construction deficiencies, the TAB Supervisor must submit written notification directly to the Contracting Officer, with a separate copy to the Contractor, of all such deficiencies. Provide in this submittal a complete explanation, including supporting documentation, detailing deficiencies. Where deficiencies are encountered that are believed to adversely impact successful completion of TAB, the TAB Agency must issue notice and request direction in the notification submittal.
- m. TAB Field Check: The TAB team supervisor must attend and supervise Season 1 and Season 2 TAB field check.

1.5.2.4 TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, EXECUTION.
- b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

1.5.3 Sequencing and Scheduling

1.5.3.1 DALT and TAB Submittal and Work Schedule

Comply with additional requirements specified in Appendix C: DALT AND TAB SUBMITTAL AND WORK SCHEDULE included at the end of this section.

a. TAB Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

b. Pre-Field DALT Preliminary Notification

Notification: On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing within 7 calendar days after completion.

1.5.3.2 TAB Pre-Field Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

- (1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.
- (2) Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.
- (3) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or **SMACNA 1780** data report forms with the following pre-field information filled in:

- (1) Design data obtained from system drawings, specifications, and approved submittals.
- (2) Notations detailing additional data to be obtained from the contract site by the TAB field team.
- (3) Designate the actual data to be measured in the TAB field work.
- (4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.

c. **Prerequisite HVAC work checkout list:** Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the **NEBB PROCEDURAL STANDARDS**, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

1.5.4 Subcontractor Special Requirements

Perform all work in this section in accordance with the paragraph

SUBCONTRACTOR SPECIAL REQUIREMENTS in Section 01 30 00 ADMINISTRATIVE REQUIREMENTS, stating that all contract requirements of this section must be accomplished directly by a first tier subcontractor. No work may be performed by a second tier subcontractor.

1.5.5 Instrument Calibration Certificates

It is the responsibility of the TAB firm to provide instrumentation that meets the minimum requirements of the standard under which the TAB Firm's qualifications are approved for use on a project. Instrumentation must be in proper operating condition and must be applied in accordance with the instrumentation's manufacturer recommendations.

All instrumentation must bear a valid NIST traceable calibration certificate during field work and during government acceptance testing. All instrumentation must be calibrated within no later than one year of the date of TAB work or government acceptance testing field work.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's technical representative (COTR) to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 DALT PROCEDURES

3.3.1 Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.3.2 Advance Notice of Pre-Final DALT Field Work

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COTR's duct selection field visit.

3.3.3 Ductwork To Be DALT'd

From each duct system indicated as subject to DALT, the COTR will randomly select sections of each completed duct system for testing by the Contractor's TAB Firm. The sections selected will not exceed 20 percent of

the total measured linear footage of duct systems indicated as subject to DALT. Sections of duct systems subject to DALT will include 20 percent of main ducts, branch main ducts, branch ducts and plenums for supply, return, exhaust, and plenum ductwork.

It is acceptable for an entire duct system to be DALT'd instead of disassembling that system in order to DALT only the 20 percent portion specified above.

3.3.4 DALT Testing

Perform DALT on the HVAC duct sections of each system as selected by the COTR. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in [SMACNA 1972 CD](#).

In spite of specifications of [SMACNA 1972 CD](#) to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Complete DALT work on the COTR selected ductwork within 48 hours after the particular ductwork was selected for DALT. Separately conduct DALT work for large duct systems to enable the DALT work to be completed in 48 hours.

3.3.5 Completed Pre-Final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COTR that the field check of the Pre-Final DALT Report data can commence.

3.3.6 Quality Assurance - COTR DALT Field Acceptance Testing

In the presence of the COTR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COTR. For each duct system, this acceptance testing shall be conducted on a maximum of 50 percent of the duct sections DALT'd.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COTR.

3.3.7 Additional COTR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction class and sealant class, terminate data checking for that section. The associated Pre-final DALT Report data for the given duct system will be disapproved. Make the necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COTR.

3.3.8 Certified Final DALT Report

On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report in compliance with Appendix B REPORTS - DALT and TAB to the Contracting Officer for approval.

3.3.9 Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.4 TAB PROCEDURES

3.4.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the requirements of AABC MN-1 or SMACNA 1780 (TABB) and SMACNA 1858 (TABB), except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section. The only air flow reporting which can be deferred until the Season 2 is that data which would be affected in terms of accuracy due to outside ambient conditions.

3.4.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3 TAB Air Distribution Systems

3.4.3.1 Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

- a. For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of [AABC MN-4](#), Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with [AABC MN-4](#), Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

- b. For units with capacities of [7.5 tons \(90,000 Btu\)](#) or less, such as fan coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

3.4.3.2 Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

3.4.3.3 Makeup Air Units

Makeup air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.4 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.4 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph WORKMANSHIP, provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.5 TAB Reports

[Additional requirements for TAB Reports are specified in Appendix B REPORTS - DALT and TAB](#)

3.4.6 Quality Assurance - COTR TAB Field Acceptance Testing

3.4.6.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COTR, random selections of data (water, air quantities, air motion, sound level readings) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COTR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: All chillers, boilers, return fans, computer room units, and air handling units (rooftop and central stations).

Group 2: 25 percent of the VAV terminal boxes and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply fans, exhaust fans, and pumps.

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COTR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

3.4.6.2 Additional COTR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COTR.

3.4.6.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.5 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

3.7 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS
Appendix B REPORTS - DALT and TAB
Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE
Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

- a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.
- b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.
- d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.
- e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph CONSTRUCTION DEFICIENCIES. Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.
- f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.
- g. Give Notice of Testing: Submit advance notice of [proportional balancing](#), [Season 1](#), and [Season 2](#) TAB field work accompanied by completed prerequisite HVAC Work List

- h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.
- e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.
- f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

- g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
- h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.
- i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph CONSTRUCTION DEFICIENCIES. Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.

- j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, EXECUTION.
- b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

Appendix B

REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

- a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.
- b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.
- c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.
- d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.
- e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.
- f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.
- g. A thorough checklist of the work items and inspections that need to be accomplished before the Season 1 TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Season 1 Pre-TAB Work Checklist before the Season 1 TAB field work can be accomplished.
- h. A thorough checklist of the work items and inspections that need to be accomplished before the Season 2 TAB field work can be performed. The

Contractor must complete, submit, and receive approval of the Completed Season 2 Pre-TAB Work Checklist before the Season 2 TAB field work can be accomplished.

- i. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to **NEBB PROCEDURAL STANDARDS**, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

3. Design Review Report

Submit report containing the following information:

- a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
- b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

4. Completed Pre-Final DALT Work Checklist

Report the data for the Pre-Final DALT Report meeting the following requirements:

- a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the **SMACNA 1972 CD**. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.
- c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.

- e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COTR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report for Proportional Balancing, Season 1, and Season 2 in the following manner:

- a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
- c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:

AHU-1,2,3; OAU-1

- (1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.
 - (2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.
 - (3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the Season 1 and Season 2 TAB Report.
- d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.
 - e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems including: AHU-1,2; OAU-1. Report static pressure data

for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:

- (1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.
- (2) Report static pressure drop across chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.
- (3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
- (4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

- (5) Report static pressure drop across outside air and relief/exhaust air louvers.
 - (6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.
- f. Duct Transverses: Report duct traverses for main supply, return, exhaust, relief and outside air ducts. This shall include all ducts, including those which lack 7 1/2 duct diameters upstream and 2 1/2 duct diameters downstream of straight duct unobstructed by duct fittings/offsets/elbows. The TAB Agency shall evaluate and report findings on the duct traverses taken. Evaluate the suitability of the duct traverse measurement based on satisfying the qualifications for a pitot traverse plane as defined by [AMCA 203](#), "Field Measurements", Section 8, paragraph 8.3, "Location of Traverse Plane".
- g. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

- h. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on

the job.

- i. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.
- j. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph WORKMANSHIP.

Appendix C

DALT AND TAB SUBMITTAL AND WORK SCHEDULE

Perform the following items of work in the order listed adhering to the dates schedule specified below. Include the major items listed in this schedule in the project network analysis schedule required by Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULES (NAS).

Submit TAB Agency and TAB Personnel Qualifications: Within 42 calendar days after date of contract award.

Submit the DALT and TAB Work Execution Schedule: within 14 days after receipt of the TAB agency and TAB personnel qualifications approval. Revise and re-submit this schedule 28 days prior to commencement of DALT work and 28 days prior to the commencement of TAB Season 1 work and TAB Season 2 work.

Submit the DALT and TAB Work Procedures Summary: within 14 days after receipt of the initial approved DALT and TAB Work Execution Schedule.

Meet with the COTR at the Pre-DALT/TAB Meeting: Within 28 calendar days after receipt of the approved initial DALT/TAB Execution Schedule.

Submit Design Review Report: Within 56 calendar days after the receipt of the approved initial DALT and TAB Work Execution Schedule.

Advance Notice of Pre-Final DALT Field Work: After the completed installation of the HVAC duct system to be DALT'd, submit to the Contracting Officer an Advance Notice of Pre-Final DALT Field Work accompanied by the completed Pre-Final DALT Work Checklist for the subject duct system.

Ductwork Selected for DALT: Within 14 calendar days after receiving an acceptable completed Pre-Final DALT Work Checklist, the Contracting Officer's technical representative (COTR) will select the project ductwork sections to be DALT'd.

DALT Field Work: Within 48 hours of COTR's selection, complete DALT field work on selected project ductwork.

Submit Pre-Final DALT Report: Within two working days after completion of DALT field work, submit Pre-final DALT Report. Separate Pre-final DALT reports may be submitted to allow phased testing from system to system.

Quality Assurance - COTR DALT Field Checks: Upon approval of the Pre-final DALT Report, the COTR's DALT field check work shall be scheduled with the Contracting Officer.

Submit Final DALT Report: Within 14 calendar days after completion of successful DALT Work Field Check, submit Season 1 TAB report.

Advance Notice of Season 1 TAB Field Work: At a minimum of 14 calendar days prior to Season 1 TAB Field Work, submit advance notice of TAB field work accompanied by completed Season 1 Pre-TAB Work Checklist.

Season 1 TAB Field Work: At a minimum of 84 calendar days prior to

CCD, and when the ambient temperature is within Season 1 limits, accomplish Season 1 TAB field work.

Submit Season 1 TAB Report: Within 14 calendar days after completion of Season 1 TAB field work, submit initial Season 1 TAB report.

Season 1 Quality Assurance - COTR TAB Field Check: 30 calendar days after initial Season 1 TAB report is approved by the Contracting Officer, conduct Season 1 field check.

Complete Season 1 TAB Work: Prior to CCD, complete all TAB work except Season 2 TAB work and submit final.

Receive the approved TAB report: Within 21 calendar days, receive the report from Contracting Officer approved TAB report.

Advance Notice of Season 2 TAB Field Work: At a minimum of 126 calendar days after CCD, submit advance notice of Season 2 TAB field work accompanied by completed Season 2 Pre-TAB Work Checklist.

Season 2 TAB Field Work: Within 14 calendar days after date of advance notice of Season 2 TAB field work and when the ambient temperature is within Season 2 limits, accomplish Season 2 TAB field work.

Submit Season 2 TAB Report: Within 14 calendar days after completion of Season 2 TAB field work, submit Season 2 TAB report.

Season 2 Quality Assurance - COTR TAB Field Checks: 28 calendar days after the Season 2 TAB report is approved by the Contracting Officer, conduct Season 2 field check.

Complete Season 2 TAB Work: Within 14 calendar days after the completion of Season 2 TAB field data check, complete all TAB work.

Receive the approved TAB report: Within calendar 21 days, receive the report from Contracting Officer.

Appendix D			
REQUIREMENTS FOR DUCT AIR LEAK TESTING			
		SYSTEMS	
		AHU/OAU	Exhaust Air Systems
Duct System Static Pressure, in inches W.C.	for Supply	2	
	for Return	1	
	for Exhaust	1	1
	for Outside Air	1	
System Oval/Round Duct and Rectangular Duct SMACNA Seal Class	for Supply	A	
	for Return	A	
	for Exhaust	A	A
	for Outside Air	A	
System Oval/Round Duct SMACNA Leak Class	for Supply	6	
	for Return	6	
	for Exhaust	24	24
	for Outside Air		

Appendix D			
REQUIREMENTS FOR DUCT AIR LEAK TESTING			
		SYSTEMS	
		AHU/OAU	Exhaust Air Systems
System Rectangular Duct SMACNA Leak Class	for Supply	6	
	for Return	24	
	for Exhaust	24	24
	for Outside Air		
Duct Test Pressure, in inches W.C.	for Supply	2	
	for Return	1	
	for Exhaust	1	1
	for Outside Air	1	

-- End of Section --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS
02/13

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. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

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

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings
Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A580/A580M (2016) Standard Specification for
Stainless Steel Wire

ASTM B209 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

ASTM C1136 (2017) Standard Specification for
Flexible, Low Permeance Vapor Retarders
for Thermal Insulation

ASTM C1710 (2011) Standard Guide for Installation of
Flexible Closed Cell Preformed Insulation
in Tube and Sheet Form

ASTM C195 (2007; R 2013) Standard Specification for
Mineral Fiber Thermal Insulating Cement

ASTM C450 (2008) Standard Practice for Fabrication
of Thermal Insulating Fitting Covers for
NPS Piping, and Vessel Lagging

ASTM C534/C534M (2016) Standard Specification for
Preformed Flexible Elastomeric Cellular
Thermal Insulation in Sheet and Tubular
Form

ASTM C547 (2015) Standard Specification for Mineral
Fiber Pipe Insulation

ASTM C552 (2016a) Standard Specification for
Cellular Glass Thermal Insulation

ASTM C647 (2008; R 2013) Properties and Tests of

Mastics and Coating Finishes for Thermal
Insulation

ASTM C795	(2008; R 2013) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	(2014) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C920	(2014a) Standard Specification for Elastomeric Joint Sealants
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D2863	(2013) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
ASTM D5590	(2000; R 2010; E 2012) Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
ASTM D882	(2012) Tensile Properties of Thin Plastic Sheeting
ASTM E2231	(2015) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)	
ISO 2758	(2014) Paper - Determination of Bursting Strength
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds (1999) National Commercial & Industrial
Insulation Standards

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179 (1969; Rev A; Am 2 1980; Notice 1 1987)
Adhesive, Flexible Unicellular-Plastic
Thermal Insulation

MIL-A-3316 (1987; Rev C; Am 2 1990) Adhesives,
Fire-Resistant, Thermal Insulation

MIL-PRF-19565 (1988; Rev C) Coating Compounds, Thermal
Insulation, Fire- and Water-Resistant,
Vapor-Barrier

UNDERWRITERS LABORATORIES (UL)

UL 723 (2008; Reprint Aug 2013) Test for Surface
Burning Characteristics of Building
Materials

UL 94 (2013; Reprint Mar 2016) UL Standard for
Safety Tests for Flammability of Plastic
Materials for Parts in Devices and
Appliances

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.2.2 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meet all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool	75 percent slag of weight
Fiberglass	20-25 percent glass cullet by weight
Rigid Foam	9 percent recovered material

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S"

are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-02 Shop Drawings

Pipe Insulation Systems and Associated Accessories
Duct Insulation Systems and Associated Accessories

SD-03 Product Data

Pipe Insulation Systems; G
Duct Insulation Systems; G
; G

SD-08 Manufacturer's Instructions

Pipe Insulation Systems; G
Duct Insulation Systems; G
; G

SD-11 Closeout Submittals

Reduce Volatile Organic Compounds (VOC) for Caulking, Sealant and Adhesive Materials; S
Recycled Content for Pipe and Ductwork Insulation Materials; S

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material, date codes, and approximate shelf life (if applicable). Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Reduce Volatile Organic Compounds (VOC) for Caulking, Sealant and Adhesive Materials

For interior applications, provide caulking, sealant and adhesive materials meeting the reduced VOC requirements as stated within Section 01 33 29 SUSTAINABILITY REPORTING paragraph REDUCE VOLATILE ORGANIC COMPOUNDS (VOC).

2.1.2 Recycled Content for Pipe and Ductwork Insulation Materials

Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING that the following products meet the recycled content requirements as outlined in this section:

- a. Pipe Insulation Systems
- b. Duct Insulation Systems

2.2 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet.

2.2.1 Insulation System

Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems that are located within, on, under, and adjacent to buildings; and for plumbing systems. Provide CFC and HCFC free insulation.

2.2.2 Surface Burning Characteristics

Unless otherwise specified, insulation must have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes, shall be determined by ASTM E84 or UL 723. Test insulation in the same density and installed thickness as the material to be used in the actual construction. Prepare and mount test specimens according to ASTM E2231.

2.3 MATERIALS

Provide insulation that meets or exceeds the requirements of [ASHRAE 90.1 - IP](#). Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet [ASTM C795](#) requirements. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free. Provide product recognized under [UL 94](#) (if containing plastic) and listed in [FM APP GUIDE](#).

2.3.1 Adhesives

2.3.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to [ASTM C916](#), Type I.

2.3.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with [ASTM C195](#).

2.3.1.3 Lagging Adhesive

Lagging is the material used for [thermal insulation](#), especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. To resist mold/mildew, lagging adhesive shall meet [ASTM D5590](#) with 0 growth rating. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E84](#). Adhesive shall be [MIL-A-3316](#), Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

2.3.1.4 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E84](#). The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to [212 degrees F](#). The dried adhesive shall be nonflammable and fire resistant. Flexible Elastomeric Adhesive: Comply with [MIL-A-24179](#), Type II, Class I. Provide product listed in [FM APP GUIDE](#).

2.3.2 Caulking

[ASTM C920](#), Type S, Grade NS, Class 25, Use A.

2.3.3 Corner Angles

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B209, Alloy 3003, 3105, or 5005.

2.3.4 Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems in accordance with ASTM C1710. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor). For satisfactory performance, properly installed protective vapor retarder/barriers and vapor stops shall be used on high relative humidity and below ambient temperature applications to reduce movement of moisture through or around the insulation to the colder interior surface.

2.3.5 Finishing Cement

ASTM C450: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C795.

2.3.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

2.3.7 Staples

Outward clinching type monel .

2.3.8 Jackets

2.3.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.3.9 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require manufacturer or fabricator applied pipe insulation jackets are cellular glass, when all joints are sealed with a vapor barrier mastic, and mineral fiber. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible elastomerics require (in addition to vapor barrier skin) vapor retarder jacketing for high relative humidity and below ambient temperature applications.

2.3.9.1 White Vapor Retarder All Service Jacket (ASJ)

ASJ is for use on hot/cold pipes, ducts, or equipment indoors or outdoors if covered by a suitable protective jacket. The product shall meet all physical property and performance requirements of ASTM C1136, Type I, except the burst strength shall be a minimum of 85 psi. ASTM D2863 Limited Oxygen Index (LOI) shall be a minimum of 31.

In addition, neither the outer exposed surface nor the inner-most surface contacting the insulation shall be paper or other moisture-sensitive material. The outer exposed surface shall be white and have an emittance of not less than 0.80. The outer exposed surface shall be paintable.

2.3.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

2.3.9.2.1 Vapor Barrier

The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Permeability shall be less than 0.02 when tested in accordance with ASTM E96/E96M. Products shall meet UL 723 or ASTM E84 flame and smoke requirements and shall be UV resistant.

2.3.9.2.2 Vapor Retarder

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be 0.013 perms or less at 43 mils dry film thickness as determined according to procedure B of ASTM E96/E96M utilizing apparatus described in ASTM E96/E96M. The coating shall be nonflammable, fire resistant type. To resist mold/mildew, coating shall meet ASTM D5590 with 0 growth rating. Coating shall meet MIL-PRF-19565 Type II (if selected for indoor service) and be Qualified Products Database listed. All other application and service properties shall be in accordance with ASTM C647.

2.3.9.3 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork; where Type II, maximum moisture vapor transmission 0.02 perms, a

minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E84](#). Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and an excellent WVT rate.

2.3.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of [30 lb/inch](#) when tested in accordance with [ASTM D882](#), and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E84](#).

2.3.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

2.3.9.6 Vapor Barrier/Weather Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with [ASTM E96/E96M](#)). Vapor barrier shall meet [UL 723](#) or [ASTM E84](#) 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength [185 psi](#) in accordance with [ISO 2758](#). Tensile strength [68 lb/inch](#) width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.3.10 Vapor Retarder Not Required

[ASTM C921](#), Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E84](#).

2.3.11 Wire

Soft annealed [ASTM A580/A580M](#) Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.3.12 Insulation Bands

Insulation bands shall be [1/2 inch](#) wide; 26 gauge stainless steel.

2.3.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum permeance of 0.02 perms based on Procedure B for [ASTM E96/E96M](#), and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E84](#).

2.4 PIPE INSULATION SYSTEMS

Conform insulation materials to Table 1 and minimum insulation thickness as listed in Table 2 and meet or exceed the requirements of [ASHRAE 90.1 - IP](#).

Comply with EPA requirements for material with recycled content in accordance with Section 01 33 29 SUSTAINABILITY REPORTING, paragraph RECYCLED CONTENT. Limit pipe insulation materials to those listed herein and meeting the following requirements:

2.4.1 Aboveground Cold Pipeline (-30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

2.4.1.1 Cellular Glass

ASTM C552, Type II, and Type III. Supply the insulation from the fabricator with (paragraph WHITE VAPOR RETARDER ALL SERVICE JACKET (ASJ)) ASJ vapor retarder and installed with all longitudinal overlaps sealed and all circumferential joints ASJ taped or supply the insulation unfaced from the fabricator and install with all longitudinal and circumferential joints sealed with vapor barrier mastic.

2.4.1.2 Flexible Elastomeric Cellular Insulation

Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive, complying with ASTM C534/C534M, Grade 1, Type I or II. Type I, Grade 1 for tubular materials. Type II, Grade 1, for sheet materials. Type I and II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation, and require an additional exterior vapor retarder covering for high relative humidity and below ambient temperature applications.

2.4.2 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

2.4.2.1 Mineral Fiber

ASTM C547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

2.5 DUCT INSULATION SYSTEMS

2.5.1 Factory Applied Insulation

Provide factory-applied ASTM C552, cellular glass thermal insulation according to manufacturer's recommendations for insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier, with identification of installed thermal resistance (R) value and out-of-package R value.

2.5.1.1 Rigid Insulation

Calculate the minimum thickness in accordance with ASHRAE 90.1 - IP.

2.5.1.2 Blanket Insulation

Calculate minimum thickness in accordance with ASHRAE 90.1 - IP.

2.5.2 Duct Insulation Jackets

2.5.2.1 All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with **MICA Insulation Stds** plates except where modified herein or on the drawings.

3.1.2 Painting and Finishing

Painting shall be as specified in Section **09 90 00 PAINTS AND COATINGS**.

3.1.3 Installation of Flexible Elastomeric Cellular Insulation

Install flexible elastomeric cellular insulation with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than **220 degrees F**. Stagger seams when applying multiple layers of insulation. Protect insulation exposed to weather and not shown to have vapor barrier weatherproof jacketing with two coats of UV resistant finish or PVC or metal jacketing as recommended by the manufacturer after the adhesive is dry and cured.

3.1.3.1 Adhesive Application

Apply a brush coating of adhesive to both butt ends to be joined and to both slit surfaces to be sealed. Allow the adhesive to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled

apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.3.2 Adhesive Safety Precautions

Use natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

3.1.4 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.5 Pipes/Ducts/Equipment That Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Air chambers.
- e. Adjacent insulation.
- f. ASME stamps.
- g. Access plates of fan housings.
- h. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

Pipe insulation shall be continuous through the sleeve.

Provide an aluminum jacket or vapor barrier/weatherproofing self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder over the insulation wherever penetrations require sealing.

3.2.1.2.1 Penetrate Interior Walls

The aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plies standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

3.2.1.2.2 Penetrating Floors

Extend the aluminum jacket from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

3.2.1.2.3 Penetrating Exterior Walls

Continue the aluminum jacket required for pipe exposed to weather through the sleeve to a point 2 inches beyond the interior surface of the wall.

3.2.1.2.4 Hot Water Pipes Supplying Lavatories or Other Similar Heated Service

Terminate the insulation on the backside of the finished wall. Protect the insulation termination with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). Extend the coating out onto the insulation 2 inches and seal the end of the insulation. Overlap glass tape seams 1 inch. Caulk the annular space between the pipe and wall penetration with approved fire stop material. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

3.2.1.2.5 Domestic Cold Water Pipes Supplying Lavatories or Other Similar Cooling Service

Terminate the insulation on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). Protect the insulation with two coats of weather barrier mastic (breather emulsion type weatherproof mastic impermeable to water and permeable to air) with a minimum total thickness of 1/16 inch. Extend the mastic out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and caulk the wall penetration with an approved fire stop material having vapor retarder properties. Cover the pipe and wall penetration with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8 inches.

3.2.1.3 Pipes Passing Through Hangers

Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the

insulation in accordance with MSS SP-58. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

3.2.1.3.1 Horizontal Pipes Larger Than 2 Inches at 60 Degrees F and Above

Supported on hangers in accordance with MSS SP-58, and Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2.1.3.2 Horizontal Pipes Larger Than 2 Inches and Below 60 Degrees F

Supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-58. An insulation insert of cellular glass, prefabricated insulation pipe hangers, or perlite above 80 degrees F shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

3.2.1.3.3 Inserts

Covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, overlap the adjoining pipe jacket 1-1/2 inches, and seal as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to ASTM C1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation. Type II requires an additional exterior vapor retarder/barrier covering for high relative humidity and below ambient temperature applications.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, and mechanical platforms, welded PVC, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000 permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be

protected. Other areas that specifically require protection to the 6 foot level are Mechanical Platforms.

3.2.1.6 Pipe Insulation Material and Thickness

Pipe insulation materials must be as listed in Table 1 and must meet or exceed the requirements of ASHRAE 90.1 - IP.

TABLE 1					
Insulation Material for Piping					
Service					
	Material	Specification	Type	Class	VR/VB Req'd
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping					
	Cellular Glass	ASTM C552	II	2	No
Hot Domestic Water Supply & Recirculating Piping (Max 200 F)					
	Mineral Fiber	ASTM C547	I	1	No
Refrigerant Suction Piping (35 degrees F nominal)					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
	Cellular Glass	ASTM C552	II	1	Yes
Compressed Air Discharge (201 to 250 Degrees F)					
	Cellular Glass	ASTM C552	II		No
	Mineral Fiber	ASTM C547	I	1	No
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel					
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
Condensate Drain Located Inside Building					
	Cellular Glass	ASTM C552	II	2	No
	Flexible Elastomeric Cellular	ASTM C534/C534M	I		No
Note: VR/VB = Vapor Retarder/Vapor Barrier Flexible Elastomeric Cellular insulation shall only be used on exposed domestic water and drain piping under handicapped lavatory fixtures, and on refrigerant piping.					

TABLE 2						
Piping Insulation Thickness (inch) Do not use integral wicking material in Chilled water applications exposed to outdoor ambient conditions in climatic zones 1 through 4.						
Service						
	Material	Tube And Pipe Size (inch)				
		<1	1-<1.5	1.5-<4	4-<8	> or = >8
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping						
	Cellular Glass	1.5	1.5	1.5	1.5	1.5
Hot Domestic Water Supply & Recirculating Piping (Max 200 F)						
	Mineral Fiber	1	1	1	1.5	1.5
Refrigerant Suction Piping (35 degrees F nominal)						
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
	Cellular Glass	1.5	1.5	1.5	1.5	1.5
Compressed Air Discharge, Steam and Condensate Return (201 to 250 Degrees F)						
	Mineral Fiber	1.5	1.5	2	2	2
		1.5*	2*	2.5*	3*	3.5*
	Cellular Glass	2	2.5	3	3	3
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel						
	Flexible Elastomeric Cellular	0.5	0.5	0.5	0.5	0.5
Condensate Drain Located Inside Building						
	Cellular Glass	1.5	1.5	1.5	1.5	1.5
	Flexible Elastomeric Cellular	1	1	1	N/A	N/A
Note: Flexible Elastomeric Cellular insulation shall only be used on exposed domestic water and drain piping under handicapped lavatory fixtures, and on refrigerant piping.						

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in

subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

c. Refrigerant suction lines.

f. Air conditioner condensate drains.

h. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

i. Domestic cold and chilled drinking water.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.2.2 Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, silver, white, black and embossed for use with Mineral Fiber, Cellular Glass, and Phenolic Foam Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, Embossed Silver, White & Black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, White & Black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft level. Other areas that specifically require protection to the 6 ft level are Mechanical Platforms.

3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe

Apply insulation to the pipe with tight butt joints. Seal all butted joints and ends with joint sealant and seal with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.

3.2.2.3.1 Longitudinal Laps of the Jacket Material

Overlap not less than 1-1/2 inches. Provide butt strips 3 inches wide for circumferential joints.

3.2.2.3.2 Laps and Butt Strips

Secure with adhesive and staple on 4 inch centers if not factory self-sealing. If staples are used, seal in accordance with paragraph STAPLES below. Note that staples are not required with cellular glass systems.

3.2.2.3.3 Factory Self-Sealing Lap Systems

May be used when the ambient temperature is between 40 and 120 degrees F during installation. Install the lap system in accordance with manufacturer's recommendations. Use a stapler only if specifically recommended by the manufacturer. Where gaps occur, replace the section or repair the gap by applying adhesive under the lap and then stapling.

3.2.2.3.4 Staples

Coat all staples, including those used to repair factory self-seal lap systems, with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. Coat all seams, except those on factory self-seal systems, with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

3.2.2.3.5 Breaks and Punctures in the Jacket Material

Patch by wrapping a strip of jacket material around the pipe and secure it with adhesive, staple, and coat with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. Extend the patch not less than 1-1/2 inches past the break.

3.2.2.3.6 Penetrations Such as Thermometers

Fill the voids in the insulation and seal with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

3.2.2.3.7 Flexible Elastomeric Cellular Pipe Insulation

Install by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. Secure all seams and butt joints and seal with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Push insulation on the pipe, never pulled. Stretching of insulation may result in open seams and joints. Clean cut all edges. Rough or jagged edges of the insulation are not be permitted. Use proper tools such as sharp knives. Do not stretch Grade 1, Type II sheet insulation around the pipe when used on pipe larger than 6 inches. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.2.4 Insulation for Fittings and Accessories

- a. Pipe insulation shall be tightly butted to the insulation of the

fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

- b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow". Submit a booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.
 - (1) The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.
 - (2) If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.
- c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a 2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.
- d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.
- e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

- a. Domestic hot water supply & re-circulating system.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.3.2 Insulation for Fittings and Accessories

Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

3.2.3.2.1 Precut or Preformed

Place precut or preformed insulation around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

3.2.3.2.2 Rigid Preformed

Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform

to MICA Tables 12.20 "Mitered Insulation Elbow".

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket or PVC jacket shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with metal jacketing/flashings sealant while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant).

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

3.3.1 Duct Insulation Minimum Thickness

Duct insulation minimum thickness in accordance with Table 4.

Table 4 - Minimum Duct Insulation (inches)	
Cold Air Ducts	2.0
Relief Ducts	2.0
Fresh Air Intake Ducts	2.0
Warm Air Ducts	2.0
Relief Ducts	2.0
Fresh Air Intake Ducts	2.0

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

- a. Supply ducts.
- b. Return air ducts.
- c. Relief ducts.
- d. Flexible run-outs (field-insulated).
- e. Plenums.
- f. Duct-mounted coil casings.
- g. Coil headers and return bends.
- h. Coil casings.
- i. Fresh air intake ducts.
- j. Filter boxes.
- k. Mixing boxes (field-insulated).
- l. Supply fans (field-insulated).
- m. Site-erected air conditioner casings.
- n. Ducts exposed to weather.
- o. Combustion air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf, and rigid type where exposed, minimum density 3 pcf. Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 3/4 pcf or a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly

butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

- a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.
- d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.
- e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.
- f. Jacket overlaps shall be secured with staples and tape as necessary to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.
- g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.
- h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the

penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

- i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.
- j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

- a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches. Mechanical fasteners shall be as corrosion resistant as G60 coated galvanized steel, and shall indefinitely sustain a 50 lb tensile dead load test perpendicular to the duct wall.
- b. Form duct insulation with minimum jacket seams. Fasten each piece of rigid insulation to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder/barrier jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors.
- c. Impale insulation on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.
- d. Seal joints in the insulation jacket with a 4 inch wide strip of tape. Seal taped seams with a brush coat of vapor retarder coating.
- e. Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.
- f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a flashing sealant.
- g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.
- h. Oval and round ducts, flexible type, shall be insulated with factory

Type I jacket insulation with minimum density of 3/4 pcf, attached as in accordance with MICA standards.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

- a. Supply ducts.
- b. Return air ducts.
- c. Relief air ducts
- d. Flexible run-outs (field insulated).
- e. Plenums.
- f. Duct-mounted coil casings.
- g. Coil-headers and return bends.
- h. Coil casings.
- i. Fresh air intake ducts.
- j. Filter boxes.
- k. Mixing boxes.
- l. Supply fans.
- m. Site-erected air conditioner casings.
- n. Ducts exposed to weather.

Insulation for rectangular ducts shall be flexible type where concealed, and rigid type where exposed. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

- a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.

- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.
- d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.
- e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.
- f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

- a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.
- b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin trimmed and bent over.
- d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.
- e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.
- f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.
- g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 60 degrees F, ducts shall be insulated as specified for cold air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

-- End of Section --

This page is intentionally left blank.

This specification section applies to MCB Camp Lejeune, MCAS New River, and
MCAS Cherry Point projects only.

SECTION 23 09 23.13 22

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
10/15

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (2012) Laboratory Methods of Testing
Dampers for Rating

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

ASHRAE 135 (2012; Addenda AR 2013; Errata 1 2013; INT
1-9 2013; Errata 2 2013; INT 10-12 2014;
Errata 3-4 2014; Addenda AI-AY 2014; INT
13-17 2015) BACnet-A Data Communication
Protocol for Building Automation and
Control Networks

ASME INTERNATIONAL (ASME)

ASME B31.1 (2016; Errata 2016) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM B117 (2016) Standard Practice for Operating
Salt Spray (Fog) Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges
Environment in Low-Voltage (1000 V and
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on
Characterization of Surges in Low-Voltage
(1000 V and Less) AC Power Circuits

IEEE C62.45 (2002; R 2008) Recommended Practice on
Surge Testing for Equipment Connected to
Low-Voltage (1000v and less) AC Power
Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8802-3 (2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code

NFPA 72 (2016) National Fire Alarm and Signaling Code

NFPA 90A (2015) Standard for the Installation of Air Conditioning and Ventilating Systems

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

SMACNA 1966 (2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2014; Reprint Mar 2015) Surge Protective Devices

UL 506 (2008; Reprint Oct 2013) Specialty Transformers

UL 508A (2013; Reprint Jan 2014) Industrial Control Panels

UL 916 (2007; Reprint Aug 2014) Standard for Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

1.2.2 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

1.2.3 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

1.2.4 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

1.2.5 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

1.2.6 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.7 BBMD

BACnet Broadcast Management Device (BBMD). A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

1.2.8 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.2.9 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices. The "A" device uses data provided by the "B" device, or requests an action from the "B" device.

1.2.10 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.2.11 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

1.2.12 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

1.2.13 Broadcast

A message sent to all devices on a network segment.

1.2.14 DADMS

DON Application and Database Management System, (DADMS) is a listing of digital applications approved for purchase and use.

1.2.15 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

1.2.16 Device Object

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.

1.2.17 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in [ASHRAE 135](#), Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported and must be tested and listed by BACnet Testing Laboratory (BTL).

1.2.18 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device". There are different levels of controllers, with varying levels of complexity and flexibility.

1.2.18.1 Terminal Device Controllers

Terminal device controllers typically are controllers with less control features, may have integrated actuators, and may be mounted directly on equipment (with enclosures).

1.2.18.2 Field Controllers

Field controllers typically have a greater capability for input/output and customization, do not have integral actuators, are mounted in an enclosure not on the equipment and are used for equipment such as VAV air handlers.

1.2.18.3 Plant Controllers

Plant Controllers are typically used to control various equipment in mechanical rooms such as pumps, heat exchangers, and chillers.

1.2.18.4 Supervisory Controllers

Supervisory Controller is used to coordinate all equipment in a building, input scheduling, and is often used as a connection point for transferring configuration files to the other controllers.

1.2.18.5 Supervisory Building Controller (SBC)

Supervisory Building Controller (SBC) is used to connect the building's DDC system (MS/TP) to [Cherry Point's](#) EMCS (TC/IP). Depending on approvals and capabilities, the SBC and supervisory controller may be combined into the same piece of hardware.

1.2.19 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.2.20 DDC System

A distribution network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

1.2.21 DITSCAP

Department of Defense Information Technology Security Certification and Accreditation Process (DITSCAP). DISCAP and DIACAP are processes that approve IP base equipment that is connected and communicates on the base Ethernet network. All devices using TCP/IP or Ethernet connectivity require prior approval to be listed in the DITSCAP and SSA document.

1.2.22 EMCS

Energy Management & Control System. The EMCS at [Cherry Point](#) is an enterprise system that actively receives energy and building condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjustment and device status of all supervisory building controllers for maintenance personnel. The EMCS receives real time electrical utility pricing data and automatically manages to [Cherry Point's](#) energy target. The existing [Cherry Point](#) EMCS is manufactured by Johnson Controls and incorporates the Metasys extended architecture system that communicates over the MRAN.

1.2.23 EMCS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical support, control parameters, and daily operation. The BAS Owner for this project is Utility Monitoring & Control (UMAC) Director. [The point of contact for existing DDC and EMCS systems at MCAS Cherry Point, FRC East is James Fulcher or Lester Wardlow. Telephone: \(252\) 464-7598 or \(252\) 464 5205.](#)

1.2.24 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media. Base Telephone manages all Ethernet connections to the IP networks.

1.2.25 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

1.2.26 Gateway

Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

1.2.27 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

1.2.28 Hub

A common connection point for devices on a network.

1.2.29 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.2.30 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

1.2.31 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.2.32 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

1.2.33 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.2.34 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.2.35 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. The standard LAN for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.2.36 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

1.2.37 Network

Communication technology for building network data communications. BACnet approved network types are Point to Point (PTP) Ethernet, and MS/TP. BACnet over Internet Protocol is not an approved method for building level controls.

1.2.38 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

1.2.39 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.2.40 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.2.41 Object Properties

Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.2.42 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

1.2.43 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.2.44 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.2.45 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

1.2.46 Points

Physical and virtual inputs and outputs. See also "Input/Output".

1.2.47 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections.

1.2.48 Repeater

A network component that connects two or more physical segments at the physical layer.

1.2.49 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

1.2.50 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.2.51 SSAA

System Security Authorization Agreement. The SSAA is a local document authorizing the use of the IP networks on [Cherry Point](#).

1.2.52 Supervisory Controller

Supervisory Controller is the upper level controller on the building's

MS/TP bus. It provides building wide points, scheduling, and interface with programming tools.

1.2.53 Supervisory Building Controller (SBC)

The Supervisory Building Controller is the point of connection between the **Cherry Point** EMCS network (IP) and the building level control network (MS/TP). The hardware at this location, that provides the connection is referred to as the SBC. Since the EMCS network uses the Marine Air-Ground Task Force Regional Area Network (MRAM) Ethernet network using TCP/IP, any equipment connecting to the **Cherry Point** EMCS must be listed in the approved DITSCAP or DIACAP equipment list and must be Marine Corps DADMS listed and approved.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph entitled "Subcontractor Special Requirements" in Section **01 30 00** ADMINISTRATIVE REQUIREMENTS. The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

- a. The controls sub-contractor for this project shall be regularly engaged in the design and installation of BACnet DDC systems (for building HVAC systems) similar to the size and scope of this project, shall have been a representative of the proposed control system manufacturer for a minimum of two years, have a staffed office within a 50-mile radius of the project location, and shall have performed design and installation of DDC systems for a minimum of 5 years.
- b. The controls sub-contractor shall ensure that their installing electricians have a copy of, read, and understand the mechanical sheets of the contract's design construction drawings, in addition to the control drawings prepared by the sub-contractor. Provide the DDC programming and graphics using Standard English units of measure, not metric.

1.4 **BACnet DIRECT DIGITAL CONTROL SYSTEMS** FOR HVAC DESCRIPTION

- a. Provide new DDC systems including associated equipment and accessories. Manufacturer's products, including design materials, fabrication, assembly, erection, examination, inspections, and testing shall be in accordance with **ASME B31.1** and **NFPA 70**, except as modified herein or indicated otherwise. The new DDC system shall interface and communicate with the existing Energy Management and Control System (EMCS) at MCAS Cherry Point, Building 137. The new DDC system shall use Cherry Point's Point Naming Nomenclature and Graphical Standards attached at the end of this section. The new DDC system via the site building controller shall be capable of upload/download from the central service at Building 137. All DDC points whether physical or pseudo, shall be exposed as BACnet objects and accessible by the Metasys server in Building 137 for purposes of monitoring status, controlling operation, or modifying values. The new DDC system shall have the capability of managing its loads using the existing EMCS Johnson Control load management programming.
- b. The Energy Management and Control System (EMCS) at MCAS Cherry Point is an enterprise system that actively receives energy and building

condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjusting, device communications status of all SBC and TCU for maintenance personnel. The existing EMCS system is Johnson Controls and incorporates the Metasys System that communicates over the Ethernet communications network to the site building controllers. The existing EMCS central server is located at Building 137.

- c. Provide a site building controller (SBC) for the new DDC system. Provide all necessary hardware, drivers, software, material, and equipment, which shall allow communication between the SBC and the existing EMCS system via the UMAC Ethernet network. The SBC shall act as the interface between the existing EMCS system and the new DDC system. The SBC shall perform closed-loop, modulating control of building equipment, provide all programming and communication with the DDC system such that it shall maintain stable temperature control and all other conditions as indicated. The end-to-end accuracy of the system, including temperature sensor error, wiring error, A/D conversion, and display, shall be 1 degree F or less.
- d. Provide a complete fully BACnet Open Protocol compatible Direct Digital Control (DDC) system. The system shall have stand-alone digital controllers that are connected to the SBC. All BACnet devices shall be BACnet Testing Laboratories (BTL) certified and listed. The DDC system shall be capable of controlling and monitoring all spaces and all HVAC systems. The manufacturer's control system shall have a successful, proven, in use history of at least 2 years. The DDC control system object configuration and communication - shall be totally native BACnet Open protocol with no other programming language protocol, interface, or gateways utilized, except as required by the Project documents.
- e. The contractor shall update the existing Johnson Controls server, ADX-1, located in Building 137 to incorporate and integrate the new DDC system. The update requirements include, but are not limited to the EMCS server database, graphics for the new DDC system and programming of all load management functions.
- f. The contractor shall fully test and verify all levels of control and communication of all the DDC system controllers from the existing Johnson Controls ECMS server in Building 137. The contractor shall also test and verify all levels of control and communication of the new DDC system.

1.4.1 Design Requirements

1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range,

point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. All points shall adhere to the [Cherry Point](#) standard naming conventions.

1.4.1.3 [Control System Components List](#)

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number. For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

1.4.1.4 [Control System Schematics](#)

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

- a. Location of each input and output device
- b. Flow diagram for each piece of HVAC equipment
- c. Name or symbol for each control system component, such as V-1 for a valve
- d. Setpoints, with differential or proportional band values
- e. Written sequence of operation for the HVAC equipment
- f. Valve and Damper Schedules, with normal (power fail) position

1.4.1.5 [HVAC Equipment Electrical Ladder Diagrams](#)

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

1.4.1.6 [Component Wiring Diagrams](#)

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

1.4.1.7 [Terminal Strip Diagrams](#)

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.4.1.8 [BACnet Communication Architecture Schematic](#)

Provide a schematic showing the project's entire BACnet communication

network, including addressing used for LANs, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks. [Show bus routing and component locations on a separate floor plan.](#)

1.5 SUBMITTALS

Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications.

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 Section [01 33 00 SUBMITTAL PROCEDURES](#):

[SD-02 Shop Drawings](#)

Include the following in the project's control system drawing set:

[Control system drawings title sheet; G](#)

[List of I/O Points; G](#)

[Control System Components List; G](#)

[Control system schematics; G](#)

[HVAC Equipment Electrical Ladder diagrams; G](#)

[Component wiring diagrams; G](#)

[Terminal strip diagrams; G](#)

[BACnet communication architecture schematic; G](#)

[SD-03 Product Data](#)

[Direct Digital Controllers; G](#)

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

[BACnet Gateways; G](#)

Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

[Notebook Computer; G](#)

[Sensors and Input Hardware; G](#)

[Output Hardware; G](#)

[Surge and transient protection; G](#)

Duct smoke detectors; G

Variable frequency (motor) drives; G

SD-05 Design Data

Performance Verification Testing Plan; G

Pre-Performance Verification Testing Checklist; G

SD-06 Test Reports

Performance Verification Testing Report; G

SD-07 Certificates

Contractor's Qualifications; G

SD-09 Manufacturer's Field Reports

Pre-PVT Checklist; G

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in Section 01 78 23 OPERATION AND MAINTENANCE DATA and 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI), except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4; G

Controls System Operators Manuals, Data Package 4; G

VFD Service Manuals, Data Package 4; G

SD-11 Closeout Submittals

DDC Software; G

Training documentation; G

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them

within the manufacturer's limits.

1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 3000 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years. Submit the name of the technician proposed to make additions/alterations to the EMCS servers. Submit supporting documentation demonstrating their qualifications.

1.6.7 Modification of References

The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

- a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."
- b. Perform the control system installation work, including all field check-outs and tuning.
- c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."
- d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."
- e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."
- f. Perform the Performance Verification Testing.
- g. Submit and receive approval on the PVT Report.

- h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL" and "VFD Service Support". Submit at least 30 days before training.
- i. Deliver the final Controls System Operators Manuals and VFD Service Manuals.
- j. Conduct the Phase I Training and VFD on-site/hands-on training.
- k. Conduct the Phase II Training.
- l. Submit and receive approval of Closeout Submittals.

PART 2 PRODUCTS

2.1 DDC SYSTEM

Provide a networked DDC system for stand-alone control in compliance with the latest revision of the [ASHRAE 135](#) BACnet standard. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet MSTP communications between the DDC system and native BACnet devices furnished with HVAC equipment, and plant equipment such as boilers, and chillers when provided with BACnet MSTP communications. DDC controllers provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing. BACnet over IP is not permitted.

2.1.1 Supervisory Building Controller (SBC)

Provide an SBC that communicates between the DDC system and the [Cherry Point](#) EMCS server. Provide all necessary hardware, drivers, software, material and equipment which shall allow communication and control between the SBC and the field DDC controllers using BACnet on the MS/TP bus. The SBC shall be capable of upload/download to and from the EMCS server. All SBC information shall transfer back to the EMCS system via the Ethernet TCP/IP level 1 network. All IP addresses and network drops shall be furnished by base telephone. Supervisory Building Controllers (SBC) must be listed and approved on the Marine Corps DADMS and listed in the sites DITSCAP SSAA documents. When the SBC is disconnected from the enterprise system for maintenance, access to the SBC shall be via a laptop computer with Internet Explorer and not require any proprietary licensed software or license key.

2.1.2 Direct Digital Controllers

Where there is an existing Johnson Controls N2 system in place, reuse the existing N2 bus and equipment, unless there is a compelling reason not to do so. All new direct digital controllers shall be native BACnet and [UL 916](#) rated.

2.1.2.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64. Place I/O expansion units in the same cabinet as the digital controller.

2.1.2.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures

suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

2.1.2.3 Stand-Alone Control

Provide stand-alone digital controllers capable of meeting the complete sequence of operation with and without network connectivity (being connected to the EMCS).

2.1.2.4 Internal Clock

Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.2.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

2.1.2.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.2.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.2.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

2.1.2.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

- a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.
- b. Binary Inputs: Binary inputs shall monitor two state devices.

- c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.
- d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.
- e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.
- f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.
- g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

2.1.2.10 Digital Controller Cabinet

Provide each digital controller as factory mounted or in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Mechanical rooms that contain steam service or equipment are considered damp environments. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

2.1.2.11 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.1.2.12 DSL Modems

DSL modems and Rate Adaptive Asymmetric Digital Subscriber Line (RADSL) modems are provided by the government. Telephone modems are not permitted for any other communication with the DDC system.

2.1.2.13 BACnet Gateways

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Communication shall be MS/TP. Communication using IP is not permitted. Provide with each gateway an interoperability schedule, showing each point

or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

The following minimum capabilities are required:

- a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.
- b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.
- c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.
- d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with [ASHRAE 135](#).
- e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.1.1.3 Notebook Computer

Provide a notebook computer, complete with the project's installed DDC software, configuration files and, applications database, to fully troubleshoot and program the project's devices. Provide the notebook computer with ballistic nylon carrying case with shoulder strap with all necessary cables and interface hardware needed for setup and communication with the controllers and control system components.

At a minimum the notebook computer shall include: Common Access Card reader, a Microsoft Windows 7 operating system, processor with capability and speed required by application software, 40 giga-byte hard drive, 512 mega-byte RAM, 2 USB 2.0 ports, 10/100 network interface card, internal V.92 modem, 15-inch display, keyboard, 3-hour battery with charger, 52X internal CD-RW drive with CD creator software, and Microsoft Office bundled software. Provide all original licenses, installation media, documentation, and recovery CDs capable of restoring the original configuration. Provide the manufacturer's 3-year next business day on-site warranty with the Government listed as the warranty owner. Provide a CAC card access port.

2.1.1.4 2.1.4 Interface to Base EMCS System

All interface to the DDC system shall be provided through the existing EMCS workstation at Building 137. Workstation interface shall consist of monitoring, troubleshooting, and making adjustments to the program or operating parameters of all DDC controllers, including TCU's. The workstation at Building 137 shall also be capable of programming all controllers, including TCU's. The contractor shall provide a temporary

workstation for system interface and start-up until the connection to the EMCS at Building 137 is completed, tested, and verified.

The building DDC system shall routinely operate continuously without connection to the workstation. Information at the workstation is not required for day to day operations of the direct digital controllers.

2.1.4.1 2.1.4.1 Software

Modify and update the existing workstation associated with the existing EMCS at Building 137 as necessary for proper interface with the new DDC system. Workstation software shall be configured to operate according to the DDC system manufacturer's specifications. Software shall be installed in the workstation computer and permit monitoring and troubleshooting of the DDC system. Workstation software permits modification of controller parameters and control for all controllers, both high level and low level application specific. Operations shall be menu selected. Menu selections shall be made with a mouse.

- a. Menu System: Menu system shall allow an operator to select a particular function or access a particular screen through successive menu penetration.
- b. Controller Parameter Modification: The workstation software shall be an interface for performance specified in paragraph entitled "Parameter Modification" and available through direct connection of a computer to a digital controller. Parameter modification shall require only that an operator "fill in the blank" for a parameter on a screen requesting the information in plain language. Parameter modifications shall download to the appropriate controllers at the operator request.
- c. Program modification: For systems using a line-by-line programming language, provide an off-line text editor, similar to a BASIC program editor, permitting modification of controller resident control programs. For systems using block programming languages provide a capability for linking blocks together to create new programs or modify existing.

2.1.4.2 2.1.4.2 Graphic-Based Software

Update the existing EMCS system and Johnson Controls server in Building 137 to incorporate and integrate the new DDC system. Update work includes graphics control package. The graphic-based software in the existing EMCS system shall be updated to provide a user-friendly interface to the DDC system. Graphic-based software shall provide graphical representation of the building, the building mechanical systems, and the DDC system. The current value and point name of every I/O point shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

- a. Graphic shall closely follow the style of the control drawings in representing mechanical systems, sensors, controlled devices and point names.
- b. Graphic Title: Graphics shall have an identifying title visible when the graphic is viewed.
- c. Dynamic Update: When the workstation is on-line with the control system, point data shall update dynamically on the graphic images.

- d. Graphic Penetration: Provide graphic penetration when the capability exists. For systems without graphic penetration, provide menu penetration for selection of individual graphics to give same hierarchical affect provided by graphic penetration.
- e. Graphic Types: Graphic-based software shall have graphics of the building exterior, building section, floor plans, and mechanical systems. Provide the following graphics:
 - 1. Building Exterior Graphic: Show exterior architecture, major landmarks, and building number.
 - 2. Building Section Graphic: Show floors in section graphic with appropriate floor name on each floor.
 - 3. Floor Plan Graphics: Provide a single graphic for each floor, unless the graphic will contain more information than can reasonably be shown on a single graphic. Each heating or cooling zone within a floor plan shall have a zone name and its current temperature displayed within the zone outline. show each controlled variable in the zone. Provide visual warning for each point in alarm.
 - 4. Mechanical System Graphics: Provide two-dimensional drawings to symbolize mechanical equipment; do not use line drawings. show controlled or sensed mechanical equipment. Each graphic shall consist of a single mechanical system; examples are a graphic for an air handling unit, a graphic for a VAV box, a graphic for a heating water system and a graphic for a chiller system. Place point name and point value adjacent to sensor or controlled device. Provide visual warning of each point in alarm. Point values shall update dynamically on the graphic.
- f. Graphic Editing: Full capacity as provided by a draw software package shall be included for operator editing of graphics. graphics may be created, deleted, modified, and text added. Provide capability to store graphic symbols in a symbol directory and import these symbols into graphics. A minimum of 256 colors shall be available.
- g. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on graphics.
- h. Trending: Trend data shall be displayed graphically, with control variable and process variable plotted as functions of time on the same chart. Graphic display of trend data shall be internal to the workstation software and not resulting from download of trend data into a third-party spreadsheet program such as Excel, unless such transfer is automatic and transparent to the operator, and the third-party software is included with the workstation software package. At the operator's discretion, trend data shall be plotted real time.

2.1.5 DDC Software

2.1.5.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming, programming software tools, and programming hardware tools to configure and program all controllers. If the laptop

computer provided elsewhere is used as a programming tool, provide all necessary accessories for full functionality. All software shall be licensed to Marine Corps Air Station, Cherry Point Complex for unrestricted use on Cherry Point Complex and reproduction for use on Cherry Point Complex. Software keys and "dongles" are not permitted. Provide sequence of operation routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

- a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.
- b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.
- c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.
- d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

2.1.5.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

2.1.5.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.5.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

2.1.5.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

2.1.5.6 Timed Local Override

Provide a non-cumulative adjustable override time for the push of a local

override button.

2.1.5.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.5.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

2.1.5.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out Of Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

2.1.5.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. All alarms/events shall report to the EMCS server. Alarms/events shall be stored within the Site Building Controller (SBC). Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

2.1.5.11 Trending

Provide BACnet trend services capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The SBC shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

2.1.5.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

2.1.5.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.5.14 Access Control

Provide at least five levels of password protection for operator interfaces. The lowest level only allowing viewing of graphics. The second level allows viewing graphics and changing space temperature setpoints. The third level allows the previous level's capability, plus changing operating schedules. The fourth level allows access to all functions except passwords. The highest level provides all administrator rights and allows full access to all programming, including setting new passwords and access levels. Provide the BAS Owner with the highest level password access. Provide automatic log out if no keyboard or mouse activity is detected after a user-defined time delay.

2.1.5.15 Configuration Tool

Provide the software with the manufacturer's installation CDs and licenses. Licenses shall allow unrestricted use and reproduction for use at the [Cherry Point](#) Complex. Software shall not require the use of software keys or "dongles". Configure the software according to the DDC system manufacturer's specifications and in agreement with BACnet standards found in ASHRAE 135, Annex L.

The software shall permit complete monitoring, modification, and troubleshooting interface with the DDC system. The operator interface with the software shall be menu-driven with appropriate displays and menu commands to manipulate the DDC system's objects, point data, operating schedules, control routines, system configuration, trends, alarms, messages, graphics, and reports. Trends shall be capable of graphic display in real time, with variables plotted as functions of time. Each alarmed point shall be capable of displaying its alarm history, showing when it went into alarm, if and when it was acknowledged, and when it went out of alarm. The modification of DDC system parameters and object properties shall be accomplished with "fill in the blank" and/or "point and drag" methods. Modifications shall download to the appropriate controllers at the operator's request.

2.1.5.16 Graphics Software

Provide web-based system graphics viewable on browsers compatible with MS Internet Explorer 6.X or greater using an industry-standard file format such as HTML, BMP, JPEG, or GIF. Graphics for new projects must be consistent with base standards including layout and device naming. Contractor shall install this graphics package on the EMCS Server, bind all points, and demonstrate operability.

Graphic displays shall have full-screen resolution when viewed on the workstation and notebook computers. Dynamic data on graphics pages shall refresh within 10 seconds using an Internet connection, or 30 seconds using a dial-up modem connection. Graphics viewing shall not require additional "plug-in" software like Java, Shockwave and Flash applications unless the software is readily available for free over the Internet, and certified for use with Government provided personal computers.

The graphics shall show the present value and object name for each of the

project's I/O points on at least one graphic page. Arrange point values and names on the graphic displays in their appropriate physical locations with respect to the floor plan or equipment graphic displayed. Graphics shall allow the operator to monitor current status, view zone and equipment summaries, use point-and-click navigation between graphic pages, and edit setpoints and parameters directly from the screens. Items in alarm shall be displayed using a different color or other obvious visual indicator. Provide graphics with the following:

- a. **Graphic Types:** Provide at least one graphic display for each piece of HVAC equipment, building floor, and controlled zone. Indicate dynamic point values, operating statuses, alarm conditions, and control setpoints on each display. Provide summary pages where appropriate.
 - (1) **Building Floor Plans:** Provide a floor plan graphic for each of the building's floors and roof with dynamic display of space temperature and other important data. If used, indicate and provide links to sub-plan areas. If possible, use the project's electronic drawing files for the graphic backgrounds. Provide clear names for important areas, such as "Main Conference Room." Include room names and numbers where applicable. Include features such as stairwells, elevators, and main entrances. Where applicable, include the mechanical room, HVAC equipment, and control component locations, with corresponding links to the equipment graphics.
 - (2) **Sub-plan Areas:** Where a building's floor plan is too large to adequately display on the screen, sub-divide the plan into distinct areas, and provide a separate graphic display for each area. Provide same level of detail requested in building floor plan section above.
 - (3) **HVAC Equipment:** Provide a graphic display for each piece of HVAC equipment, such as a fan coil unit, VAV terminal, or air handling unit. Equipment shall be represented by a two or three-dimensional drawing. Where multiple pieces of equipment combine to form a system, such as a central chiller plant or central heating plant, provide one graphic to depict the entire plant. Indicate the equipment, piping, ductwork, dampers, and control valves in the installed location. Include labels for equipment, piping, ductwork, dampers, and control valves. Show the direction of air and water flow. Include dynamic display of applicable object data with clear names in appropriate locations.
 - (4) **Sequence of Operation:** Provide a graphic screen displaying the written out full sequence of operation for each piece of HVAC equipment. Provide a link to the sequence of operation displays on their respective equipment graphics. Include dynamic real-time data within the text for setpoints and variables.
- b. **Graphic Title:** Provide a prominent, descriptive title on each graphic page.
- c. **Dynamic Update:** When the workstation is on-line, all graphic I/O object values shall update with change-of-value services, or by operator selected discrete intervals.
- d. **Graphic Linking:** Provide forward and backward linking between floor plans, sub-plans, and equipment.

- e. Graphic Editing: Provide installed software to create, modify, and delete the DDC graphics. Include the ability to store graphic symbols in a symbol directory and import these symbols into the graphics.
- f. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on the graphics.

2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F. Allow an additional 0.5 percent accuracy for averaging sensors.

2.2.1.3 Temperature Sensor Details

- a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button, setpoint adjustment lever, digital temperature display. Provide a communication port for a portable operator interface like a notebook computer or PDA.
- b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
- c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.
- d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the

sensor well with a heat-sensitive transfer agent between the sensor and the well interior.

- e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.2.2 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

2.2.2.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 2 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

2.2.2.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

2.2.3 Current Transducers

Provide current transducers to monitor motor amperage. Current switches may be used to indicate on/off status.

2.2.4 Air Quality Sensors

Provide power supply for each sensor.

2.2.4.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

2.2.4.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.2.5 Input Switches

2.2.5.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.2.6 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet in length for coil face areas up to 40 square feet. Provide additional thermostats for larger coils. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.2.7 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.1 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 2500 fpm, and a temperature range of 0 to 140 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.2.8 Air Flow Measurement For Terminal Devices

Air flow measurement for terminal devices such as variable air volume boxes, with or without fan power shall have an array of pressure sensing elements that sense total pressure and static pressure. The flow measurement shall be integral to the device controller and shall be by differential pressure sensor. The air flow shall measure flows down to 300 fpm with an accuracy of 5 percent of reading.

2.2.9 Energy Metering

Provide energy meters to collect steam and water consumption, and hot water solar collector generation for the facility and report to the EMCS database.

2.2.9.1 Steam Meters

Steam meters shall be the vortex type, with pressure compensation, a minimum turndown ratio of 10 to 1. Output signal shall be 4-20 ma, pulsed, or BACnet (MS/TP), all compatible with installed DDC system.

2.2.9.2 Water meters

Water meters 1" and smaller shall be positive displacement nutating disk. Water meters larger than 1" shall be compound type. Output signal shall be 4-10 ma, pulse, or BACnet (MS/TP).

2.2.9.3 Hot Water Solar Collector Meters

Meters for hot water solar collectors may be an integrated BTU meter with a BACnet output or may be a combination of temperature sensors and water flow meter monitored by a DDC controller with the DDC system calculating the BTU transfer. Water flow can be measured by orifice or venturi meter selected for the anticipated system flow rate. Temperature sensors shall be placed in both the supply to and the return from the solar collector array.

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured aluminum blade/galvanized steel frame dampers where indicated. Control dampers shall comply with [SMACNA 1966](#) except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with [AMCA 500-D](#) requirements.

Provide damper assembly frames constructed of [13 gauge](#) minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be [0.5 inches](#) minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than [2000 fpm](#) air velocity. The pressure drop through each damper when full-open shall not exceed [0.04 inches water gage at 1000 fpm](#) face velocity. Damper assemblies in ductwork subject to above [3-inch](#) water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than [48 inches](#) and no higher than [72 inches](#). The maximum damper blade width shall be [12 inches](#). Larger sized dampers shall be built using a combination of sections.

Frames shall be at least [2 inches](#) wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of [minus 40 degrees F to 200 degrees F](#).

The leakage rate of each damper when full-closed shall be no more than 3 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.3.2 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

2.3.2.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Actuators without spring-return may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

2.3.3 Output Signal Conversion

2.3.4 Output Switches

2.3.4.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.4 ELECTRICAL POWER AND DISTRIBUTION

2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

2.4.2 Surge and Transient Protection

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with [UL 1449](#), have a fault indicating light, and conform to the following:

- a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
- b. The device shall react within 5 nanoseconds and automatically reset.
- c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
- d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
- e. The primary suppression system components shall be pure silicon avalanche diodes.
- f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
- g. The device shall have an indication light to indicate the protection components are functioning.
- h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
- i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.
- j. The device shall comply with [IEEE C62.41.1](#) and [IEEE C62.41.2](#), Class "B" requirements and be tested according to [IEEE C62.45](#).
- k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Section [26 20 00](#), INTERIOR DISTRIBUTION SYSTEM. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in concealed accessible spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork. All wiring in mechanical rooms and mezzanines shall be run in conduit.

2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

- a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
- b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be in accordance with manufacturer's installation instructions. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

2.5 FIRE PROTECTION DEVICES

2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

Furnish detectors under Section 28 31 63.00 20 ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM and install under this section. Connect new detectors to the building fire alarm panel.

2.6 VARIABLE FREQUENCY (MOTOR) DRIVES

Provide variable frequency drives (VFDs) as indicated. VFDs shall convert 240 or 460 volt (plus or minus 10 percent), three phase, 60 hertz (plus or minus 2Hz), utility grade power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5 percent to 105 percent of base speed. VFDs shall be UL listed as delivered to the end user. The VFD shall meet the requirements specified in the most current National Electrical Code. Each VFD shall also meet the following:

- a. The VFD shall use sine coded Pulse Width Modulation (PWM) technology. PWM calculations shall be performed by the VFD microprocessor.
- b. The VFD shall be capable of automatic control by a remote 4-20 mA 0 to 10 VDC signal, BACnet interface, or manually by the VFD control panel.

2.6.1 VFD Quality Assurance

VFDs shall be the manufacturer's current standard production unit with at least 10 identical units successfully operating in the field.

2.6.2 VFD Service Support

- a. Warranty: Provide the VFDs with a minimum 24-month full parts and labor warranty. The warranty shall start when the contract's HVAC system is accepted by the Government. Include warranty documentation, dates, and contact information with the VFD on-site service manuals.
- b. VFD Service Manuals: Provide the VFDs with all necessary installation, operation, maintenance, troubleshooting, service, and repair manuals in

English including related factory technical bulletins. Provide the documents factory bound, in sturdy 3-ring binders, or hard bound covers. Provide a title sheet on the outside of each binder indicating the project title, project location, installing contractor, contract number, and the VFD manufacturer, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. The documentation provided shall be specifically applicable to this project, shall be annotated to reflect the actual project conditions, and shall provide a complete and concise depiction of the installed work. Provide a storage cabinet on or near the VFD large enough to hold all of the documentation. Have the cabinet's proposed installation site approved in advance by the Contracting Officer. Prominently label the cabinet "VFD OPERATION AND MAINTENANCE MANUALS." Clearly label each manual with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE".

- c. Technical Support: Provide the VFDs with manufacturer's technical telephone support in English, readily available during normal working hours, and free of charge for the life of the equipment.
- d. Initial Start-Up: Provide the VFDs with factory-trained personnel for the on-site start-up of the HVAC equipment and associated VFD. The personnel shall be competent in the complete start-up, operation, and repair of the particular model VFD installed. The factory start-up representative shall perform the factory's complete recommended start-up procedures and check-out tests on the VFD. Include a copy of the start-up test documentation with the VFD on-site service manuals.
- e. Provide the VFDs with on-site/hands-on training for the user and maintenance personnel. Provide a capable and qualified instructor with minimum two years field experience with the operation and maintenance of similar VFDs. The training shall occur during normal working hours and last not less than 2 hours. Coordinate the training time with the Contracting Officer and the end user. The VFD service manuals shall be used during the training. The contractor shall ensure the manuals are on-site before the start of training. The training shall cover all operational aspects of the VFD.

2.6.3 VFD Features

VFDs shall have the following features:

- a. A local operator control keypad capable of:
 - (1) Remote/Local operator selection with password access.
 - (2) Run/Stop and manual speed commands.
 - (3) All programming functions.
 - (4) Scrolling through all display functions.
- b. Digital display capable of indicating:
 - (1) VFD status.
 - (2) Frequency.
 - (3) Motor RPM.

- (4) Phase current.
- (5) Fault diagnostics in descriptive text.
- (6) All programmed parameters.
- c. Standard PI loop controller with input terminal for controlled variable and parameter settings.
- d. User interface terminals for remote control of VFD speed, speed feedback, and an isolated form C SPDT relay, which energizes on a drive fault condition.
- e. An isolated form C SPDT auxiliary relay which energizes on a run command.
- f. A metal NEMA 1 enclosure for indoors, NEMA 4 with heater for outdoors.
- g. An adjustable carrier frequency with 16 KHz minimum upper limit.
- h. A built in or external line reactor with 3 percent minimum impedance to protect the VFDs DC buss capacitors and rectifier section diodes.

2.6.4 Programmable Parameters

VFDs shall include the following operator programmable parameters:

- a. Upper and lower limit frequency.
- b. Acceleration and Deceleration rate.
- c. Variable torque volts per Hertz curve.
- d. Starting voltage level.
- e. Starting frequency level.
- f. Display speed scaling.
- g. Enable/disable auto-restart feature.
- h. Enable/disable soft stall feature.
- i. Motor overload level.
- j. Motor stall level.
- k. Jump frequency and hysteresis band.
- l. PWM carrier frequency.

2.6.5 Protective Features

VFDs shall have the following protective features:

- a. An electronic adjustable inverse time current limit with consideration for additional heating of the motor at frequencies below 45Hz, for the protection of the motor.

- b. An electronic adjustable soft stall feature, allowing the VFD to lower the frequency to a point where the motor will not exceed the full-load amperage when an overload condition exists at the requested frequency. The VFD will automatically return to the requested frequency when load conditions permit.
- c. A separate electronic stall at 110 percent VFD rated current, and a separate hardware trip at 190 percent current.
- d. Ground fault protection that protects the output cables and motor from grounds during both starting and continuous running conditions.
- e. The ability to restart after the following faults:
 - (1) Overcurrent (drive or motor).
 - (2) Power outage.
 - (3) Phase loss.
 - (4) Over voltage/Under voltage.
- f. The ability shut down if inadvertently started into a rotating load without damaging the VFD or the motor.
- g. The ability to keep a log of a minimum of four previous fault conditions, indicating the fault type and time of occurrence in descriptive text.
- h. The ability to sustain 110 percent rated current for 60 seconds
- i. The ability to shutdown safely or protect against and record the following fault conditions:
 - (1) Over current (and an indication if the over current was during acceleration, deceleration, or running).
 - (2) Over current internal to the drive.
 - (3) Motor overload at start-up.
 - (4) Over voltage from utility power.
 - (5) Motor running overload.
 - (6) Over voltage during deceleration.
 - (7) VFD over heat.
 - (8) Load end ground fault.
 - (9) Abnormal parameters or data in VFD EEPROM.

2.6.6 Minimum Operating Conditions

VFDs shall be designed and constructed to operate within the following service conditions:

- a. Ambient Temperature Range, 0 to 120 degrees F.
- b. Non-condensing relative humidity to 90 percent.

2.6.7 Additional Features

Provide VFDs with the following additional features:

- a. BACnet MS/TP communication interface port
- b. RFI/EMI filters
- c. One spare VFD of each model provided, fully programmed and ready for back-up operation when connected.

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1 BACnet Naming and Addressing

Coordinate with the EMCS Owner and provide naming and addressing consistent with existing buildings already loaded on the EMCS server. All DDC controllers shall have a [Cherry point](#) unique instance number and all Site Building Controllers shall have a [Cherry Point](#) unique name. See ["EMCS Equipment and Points Nomenclature for Cherry Point"](#), ["EMCS Point Naming Convention for Cherry Point"](#) and ["EMCS Graphic Conventions for Cherry Point"](#) attached at the end of this specification section.

a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 4 to 128.

b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device

For example, the Device Object Name for the device controlling the first floor air handler unit at Building 3408 would be:

Device Object_Name = CW System B3408

A Device Object Name for a VAV box controller might be:

Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

3.1.1.2 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects in accordance with existing Cherry Point standards

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:
all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device_Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

Support and provide Inactive_Text and Active_Text property descriptions matching conditions shown on the points list.

e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

3.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

<u>Priority Level</u>	<u>Application</u>
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

- (1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.
- (2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.
- (3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

3.1.1.4 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks. Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

3.1.1.5 BACnet Routers, Bridges, and Switches

Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an MS/TP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment. All switches provided by the contractor shall be approved by base telephone.

3.1.1.6 Wiring Criteria

- a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.
- b. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.
- c. Provide circuit and wiring protection required by NFPA 70.
- d. Run all wiring located inside mechanical rooms in conduit.
- e. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.
- f. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination. Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.
- g. For controller power, provide new 120 VAC circuits, with ground, if not defined on the electrical drawings. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.
- h. Surge Protection: Install surge protection according to manufacturer's

instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.

- i. Grounding: Ground controllers and cabinets to a good earth ground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.
- j. The Contractor shall be responsible for correcting all associated ground loop problems.
- k. Run wiring in panel enclosures in covered wire track.

3.1.7 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

3.1.8 Digital Controllers

- a. Install as stand alone control devices (see definitions).
- b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

3.1.9 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

3.1.10 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

3.1.10.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 5 feet above the finished floor.

3.1.10.2 Duct Temperature Sensors

- a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.
- b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct

or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.10.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.1.10.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

3.1.11 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.12 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.13 Thermometers and Gages

Mount devices to allow reading while standing on the floor or ground, as applicable.

3.1.14 Pressure Sensors

Locate pressure sensors as indicated.

3.1.15 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

3.1.16 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required,

provide the Contracting Officer at least 60 days advance notice of need. Provide 1 inch conduit and Cat 5 cable from the Supervisory Building controller (SBC) to the network connection (most likely in the telephone equipment room).

3.2 INTERFACE WITH EXISTING EMCS

Interface the new DDC system with **Cherry Point's** existing EMCS. Obtain Government approval before connecting new DDC system to the EMCS. Any device connected directly to the EMCS must be approved by the Designated Approving Authority by following procedures listed in the DIACAP instruction. Complete installation and programming includes graphic creation, scheduling, alarming, load management scheduling and trending. The server is located in Building **87**; workstations are located at Buildings **87 and 159**. Only Johnson Controls factory trained technicians, approved by the EMCS Engineer will be allowed to program the EMCS.

3.3 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under Section **23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC**. This support shall include:

- a. On-site operation and manipulation of control systems during the testing and balancing.
- b. Control setpoint adjustments for balancing all relevant mechanical systems, including VAV boxes.
- c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.4 **CONTROLS SYSTEM OPERATORS MANUALS**

Provide five electronic and three printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. Provide CDs in jewel case with printed and dated project-specific labels on both the CD and the case. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

- a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.

- b. A copy of the project's mechanical design drawings, including any official modifications and revisions.
- c. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."
- d. A copy of the project's approved Performance Verification Testing Plan and Report. Test report will be a 48 hour trend report verifying all temperature setpoints listed in the sequence of operation. The trend report should be printed from the EMCS server. All systems (AHU's, ERV's, CHWS, HWS) should be part of this section.
- e. A copy of the project's approved final TAB Report. (Added by the Mechanical Contractor (Division 23)).
- f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.
- g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.
- h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
- i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.
- j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
- k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.
- l. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.4.1 Storage Cabinets

In one project mechanical room, provide a wall-mounted metal storage cabinet with hinged doors. Provide cabinets large enough to hold the entire set of Controls System Operators Manuals, and the HVAC operation and maintenance manuals provided under Division 23 HVAC. Locate cabinets

adjacent to DDC control panels where applicable. Have each cabinet's proposed installation site approved in advance by the Contracting Officer and the BAS Owner. Prominently label each cabinet with the wording "OPERATION AND MAINTENANCE MANUALS." Place one of the three hard copies of the Operators Manual in this cabinet. Prominently label each binder with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE."

3.5 PERFORMANCE VERIFICATION TESTING (PVT)

3.5.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the [Pre-PVT Checklist](#) is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the EMCS Owner.

3.5.2 [Performance Verification Testing Plan](#)

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be a clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the EMCS Owner to acknowledge successful completion.

3.5.3 PVT Sample Size

Test all central plant equipment, primary air handling unit controllers, and fan coil unit controllers unless otherwise directed. Use the DDC system to verify all VAV boxes are controlling as specified. The Government may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

The Government may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Government may choose which ones.

3.5.4 [Pre-Performance Verification Testing Checklist](#)

Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

- a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

- b. Verify HVAC motors operate below full-load amperage ratings.
- c. Verify all required control system components, wiring, and accessories are installed.
- d. Verify the installed control system architecture matches approved drawings.
- e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.
- f. Verify all required surge protection is installed.
- g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.
- h. Verify all DDC network communications with the EMCS function properly, including commanding set points, and load shedding.
- i. Verify air handling unit and VAV box coil performance by commanding all valves 100 percent open in both heating and cooling. Record the entering and leaving air temperatures. Record the entering water temperature. This data shall be printed, stored, and saved for future reference.
- j. Verify each digital controller's programming is backed up.
- k. Verify all wiring, components, and panels are properly labeled.
- l. Verify all required points are programmed into devices.
- m. Verify all TAB work affecting controls is complete.
- n. Verify all valve and actuator zero and span adjustments are set properly.
- o. Verify all sensor readings are accurate and calibrated.
- p. Verify each control valve and actuator goes to normal position upon loss of power.
- q. Provide 48 hours of trend data to verify all systems are functioning as specified. Trend reports will verify control set point adjustment per the temperature re-set schedules (as required by sequence of operation).

Provide the following Trends:

- (1) Chilled water System: supply temperature (actual), return temperature (actual)
- (2) Hot Water System: supply temperature (actual), return temperature (actual), supply temperature set point.
- (3) Air Handling Unit: discharge air temperature set point, return air temperature set point, discharge air temperature (actual), return air temperature (actual), valve command position.
- (4) VAV Box (10 percent of VAV's): room temperature set point, room

temperature (actual), associated AHU discharge air temperature (actual).

(5) Energy Recovery Unit: Wheel status, wheel discharge air temperature (actual), wheel discharge air humidity (actual), unit discharge air temperature set point, unit discharge air temperature (actual).

(6) Fan Coil Unit: valve command position, room temperature set point, room temperature (actual).

- r. Verify each controller works properly in stand-alone mode.
- s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.
- t. Verify all electrical interlocks work properly.
- u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each device controlled by the DDC system.
- v. Verify the as-built (shop) control drawings are completed.
- w. Verify all required alarms are identified at the EMCS server and proper notification is setup for each alarm condition.

3.5.5 Conducting Performance Verification Testing

- a. Provide trend report for each HVAC system that is part of the buildings DDC system. The trend report shall include a value for each set point listed in the sequence of operation.
- b. Identify any values that do not meet the sequence of operation requirements, make repairs (re-program) and run a new trend for the system. Document each deficiency and corrective action taken.
- c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

3.5.6 Controller Capability and Labeling

Test the following for each controller:

- a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.
- b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.
- c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network. Building DDC system shall function to the project's specifications if connection to the EMCS

server is lost.

- d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.
- e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

3.5.7 EMCS Server Operation

- a. Show points lists agree with naming conventions.
- b. Show that graphics are complete.
- c. Show the UPS operates as specified.

3.5.8 BACnet Communications and Interoperability at the EMCS Server

Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

- a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.
- b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.
- c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
- d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.
- e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).
- f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the

sequence of operations.

- g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.
- h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.
- i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.
- j. Device and Network Management: Show the following capabilities:
 - (1) Display of Device Status Information
 - (2) Display of BACnet Object Information
 - (3) Silencing Devices that are Transmitting Erroneous Data
 - (4) Time Synchronization
 - (5) Remote Device Reinitialization
 - (6) Backup and Restore Device Programming and Master Database(s)
 - (7) Configuration Management of Half-Routers, Routers and BBMDs
 - (8) Demonstrate load shed operations if commanded by the EMCS.

3.5.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

3.5.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

3.5.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of

the contract's requirements.

3.6 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

3.6.1 Training Documentation

Submit training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopsis of each lesson, and the instructor's background and qualifications. The training documentation can be submitted at the same time as the project's Controls System Operators Manual.

3.6.2 Phase I Training - Fundamentals

The Phase I training session shall last one day and be conducted in a classroom environment with complete audio-visual aids provided by the contractor. Provide each trainee a printed 8.5 by 11 inch hard-copy of all visual aids used. Upon completion of the Phase I Training, each trainee should fully understand the project's DDC system fundamentals. The training session shall include the following:

a. Review of O&M Manual

1. Network Drawing
2. Equipment
3. Flow Diagram
4. Sequence of Operation
5. Wiring
6. Valve Schedule
7. Damper Schedule
8. Bill of Material

b. Network

1. Communication Equipment
2. Configuration Setup of Program
3. Backup Procedures

c. Mechanical Equipment

1. Flow Diagram
2. Wiring & Terminations
3. Hardware Interlocks
4. Sequence of Operation
5. Program Decisions and Illustrations of How Program Meets the Sequence of Operation

6. Global Programming Affecting Each Piece of Equipment

d. Building Data Base

1. Alarm Management
2. Trend Management
3. Building Global Interlocks
4. System Load Shedding & Demand Limiting
5. Utility Data (Water, Steam, Solar)

e. System Tools

1. Network Equipment
2. Supervisory Controllers
3. Equipment Controllers
4. Archives

3.6.3 Phase II Training - Operation

Provide Phase II Training shortly after completing Phase I Training. The Phase II training session shall last one day and be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary. Upon completion of the Phase II Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:

- a. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)
- b. Adding and removing network devices

-- End of Section --

This page is intentionally left blank.

EMCS Equipment and Points Nomenclature for Cherry Point		
No.	Nomenclature	Description
EQUIPMENT		
1	AHU	Air-Handling Unit
2	BLR	Steam/Heating Water Boiler
3	CH	Chiller
4	CCC	Closed Circuit Cooler
5	CCT	Closed Circuit Tower
6	COM RM	Communication Room
7	CP	Condenser Water Pump
8	CRAC	Computer Room AC
9	CT	Cooling Tower
10	CTP	Cooling Tower Pump
11	CTRL PNL	Control Panel
12	CU	Air Cooled Condensing Unit
13	CWP	Chilled Water Supply Pump
14	DECAHP	Defense Commissary Agency HP
15	DHW	Domestic Hot Water
16	DPR	Damper
17	DTS	Dual Temperature System
18	DWP	Domestic Hot Water Pump
19	ECT	Evaporative Cooling Tower
20	EF	Exhaust Fan
21	EST	Elevated Storage Tank
22	FCU	Fan Coil Unit
23	FLTR	Filter
24	GLBT	Ground Level Booster tank
25	HP	Heat Pump (On Ground)
26	HWP	Hot Water Pump
27	HWT	Hot Water Tank
28	HV	Heating Ventilating Unit
29	HX	Steam HW Converter
30	LS	Lift Station
31	LP-PMP	Loop Pump
32	MAD	Mixed Air Damper
33	MAU	Make-up Air Unit
34	MZ	Multizone Unit
35	OA	Outside Air
36	PACU	Packaged Unit
37	PHP	Packaged Heat Pump (On Ground)
38	PX	Plate Exchanger
39	RA	Return Air
40	RAF	Return Air Fan
41	RTHP	(RTU) Packaged Rooftop Heat Pump Unit
42	RTMZ	Roof Top Multizone Unit

EMCS Equipment and Points Nomenclature for Cherry Point		
No.	Nomenclature	Description
EQUIPMENT		
43	RTU	Roof Top Unit (Packaged DX)
44	RVS-VLV	Reversing Valve
45	SA	Supply Air
46	SV	Solenoid Valve/Steam Valve
47	TS	Temperature Sensor
48	TWAC	Thru-Wall Air Conditioner
49	TWHP	Thru-Wall Heat Pump
50	UH	Unit Heater
51	VAV	Variable Air Volume
52	WAC	Window Air Conditioner
53	WS	Work Station
54	WSHP	Water Source Heat Pump
55	WTP	Water Treatment Plant
56	WP	Well Pump
57	ZD	Zone Mixing Damper

EMCS Equipment and Points Nomenclature for Cherry Point		
No.	Nomenclature	Description
POINTS		
58	AHU-DHUM	Air Handling Unit Dehumidifier
59	AHU-OVRRD	Air Handling Unit Override
60	ALM-CMD	Alarm Command
61	ALM-HORN	Alarm Horn
62	ALM-RST	Alarm Reset
63	ALM-SIL	Alarm Silence
64	BLR-A	Boiler Alarm
65	BLR-C	Boiler Command
66	BLR-S	Boiler Start
67	BLR-EN	Boiler Enable
68	BYPD-C	Bypass Damper Command
69	CH-S	Chiller Status
70	CD-T	Cold Deck Temperature
71	CH-CMD	Chiller Command
72	CH-OVR	Chiller Override
73	CH-ALM	Chiller Alarm
74	CH-DP	Chiller Differential Pressure
75	CH-FLO-S	Chiller Flow Switch
76	CH-EN	Chiller Enable
77	CHS-T	Chiller Supply Temperature
78	CHW-DP	Chilled Water Differential Pressure
79	CHW-FLOW	Chilled Water Flow
80	CHW-SYS EN	Chilled Water System Enable
81	CLG-C	Cooling Command
82	CLGMAX	Cooling Maximum
83	CLG-SP	Cooling Set Point
84	CLG-VLV	Chilled Water Valve Status
85	COND1-S	Condenser 1 Status
86	COND2-S	Condenser 2 Status
87	CLG1-C	Cooling Stage 1 Command
88	CLG2-C	Cooling Stage 2 Command
89	CTF-C	Cooling Tower Fan Command
90	CTF-S	Cooling Tower Fan Status
91	CWR-T	Chilled Water Return Temperature
92	CWS-GPM	Chilled Water Supply GPM
93	CWS-T	Chilled Water Supply Temperature
94	DHW-SET	Domestic Hot Water Set Point
95	DHWS-T	Domestic Hot Water Supply Temperature
96	DHW-TANK	Domestic Hot water Tank Temperature
97	DHW-VLV	Domestic Hot Water Steam Valve
98	ELEC-HEAT	Electric Heat
99	FLTR-DP	Filter Differential Pressure
100	FLTR-S	Air Filter Differential

EMCS Equipment and Points Nomenclature for Cherry Point		
No.	Nomenclature	Description
POINTS		
101	HD-T	Hot Deck Temperature
102	HTG1-C	Heating Stage 1 Command
103	HTG2-C	Heating Stage 2 Command
104	HTGMAX	Heating Maximum Set Point
105	HTG-SP	Heating Set Point
106	HTG-CMD	Heating Command
107	HTG-VLV	Heating Valve
108	HUM-SPT	Humidity Set Point
109	HW-EN	Hot water Enable
110	HWP-1-C	Hot Water Pump 1 Command
111	HWP-SP	Hot Water Pump set Point
112	HWP-S	Hot Water Pump Status
113	HWR-T	Hot Water Return Temperature
114	HW-SP	Hot Water Reset Set Point
115	HWS-FL	Hot Water Supply Flow
116	HWS-P	Hot Water Supply Pressure
117	HWS-SP	Hot Water Supply Set Point
118	HWS-T	Hot Water Supply Temperature
119	HW-SYS EN	Hot Water System Enable
120	HWVLV-C	Hot Water Valve Command
121	HX-VLV	Heat Exchanger Valve
122	IA-H	Indoor Humidity Sensor
123	INST-DMD	Instantaneous Demand
124	INTV-DMD	Interval Demand
125	LOOPR-T	Loop Return Temperature
126	LOOPS-T	Loop Supply Temperature
127	LPMP-1-C	Loop Pump 1 Command
128	MAD-CMD	Mixed Air Damper Command
129	MA-T	Mixed Air Temperature
130	MAX-CLG	Maximum Cooling Set Point
131	MAX-HTG	Maximum Heating Set Point
132	MIN-HTG	Minimum Heating Set Point
133	MIN-OAD	Minimum Outside Air Damper
134	OA-CFM	Outside Air Cubic Feet Per Minute
135	OAD-C	Outside Air Damper Position
136	OAD-SP	Outside Air Damper Set Point
137	OAF-C	Outside Air fan Command
138	OAF-S	Outside Air Fan Status
139	OA-H	Outside Humidity Sensor
140	OA-RH	Outside Air Relative Humidity
141	OA-T	Outside Air Temperature
142	OCC-CLG	Occupied Cooling
143	OCC-HTG	Occupied Heating

EMCS Equipment and Points Nomenclature for Cherry Point		
No.	Nomenclature	Description
POINTS		
144	OCCTIME	Occupied Time (Schedule)
145	OCCTIMER	Occupied Timer (Schedule)
146	OCLG-SP	Occupied Cooling Set Point
147	OHTG-SP	Occupied Heating Set Point
148	OHWP-SP	Occupied Hot Water Pump Set Point
149	PH-LEV	PH Level
150	PH-SP	PH Set Point
151	PWR-FAIL	Power Fail
152	PWR-MTR	Power Meter
153	RAD-C	Return Air Damper Position
154	RAF-C	Return Air Fan Command
155	RAF-S	Return Air Fan Status
156	RA-T	Return Air Temperature
157	REV-VLV	Reversing Valve
158	RM-T	Room Temperature
159	SA-SMK-S	Smoke Detector Status
160	SA-SP	Supply Air Set Point
161	SA-T	Supply Air Temperature
162	SF-C	Supply Fan Command
163	SF-S	Supply Fan Status
164	SF-VFD	Supply Fan Variable Frequency Drive
165	SHDN-CMD	Shutdown Command
166	SMK-S	Duct Smoke Detector
167	STM-C	Steam Command
168	STM-S	Steam Pressure
169	STM-T	Steam Temperature
170	STM-VLV	Steam Valve Operation
171	STM-VLV	Steam Valve Status
172	SUMMER	Summer Mode
173	SUMWIN-C	Summer/winter Command
174	TANK-LVL	Tank Level
175	TOTAL-KW	Total Kilowatt
176	TOTFLOW	Total Flow
177	TRIPLOCK	Trip Lock Out
178	TWR-CMD	Tower Command
179	UH-EN	Unit Heater Enable
180	UH-SPT	Unit Heater Set Point
181	UNOCC-CLG	Unoccupied Cooling
182	UNOCC-HTG	Unoccupied Heating
183	VFD-S	Variable Frequency Drive Status
184	WINDO-AC	Window Air Conditioner
185	WINTER	Winter Mode
186	WSHP-SP	Water Source Heat Pump Set Point

EMCS Equipment and Points Nomenclature for Cherry Point		
No.	Nomenclature	Description
POINTS		
187	ZNHTG-SP	Zone Heating Set Point
188	ZN-T	Space/Zone Temperature

EMCS Graphic Conventions

Any deviations from these conventions shall be approved in advance.

All graphics: All new graphics should match the appearance of existing graphics.

Sample of current graphics will be made available.

Background images are Visio 2003 SVGZ files.

Data values should be shown as black text in a white box and a black border.

Text should be black with a transparent background with no border. Some graphics use blue text for contrast for special items such as names of devices.

Buttons to select other graphics are gray with white text in a vertical column on the right side of the page.

Attention should be given to the general alignment and centering of objects.

Floor Plans – should come from CAD drawings if available.

- Display against a light pale yellow background.
- Show Temperature sensors on the floor plan in their true location and source reference
- Zone temp backgrounds should turn red when in alarm state.
- Show all communication equipment locations and bus routing.
- Show location of all controllers and their status.
- Include a legend as appropriate.

Systems

- Information such as set points, modes & other data not specifically shown as a point on the system graphic should be in a gray framed box in the bottom left portion of the page. This box should include outside air temp and humidity for all systems.
- The status of dynamic values such as running, alarm, etc should be indicated both with text and color or moving dynamic symbols. Color preferences used:

Alarms: Normal- green or white for temperature background , Alarm – red

Run status: On/running – green,

Off/stopped – red for moving symbols / white for text backgrounds.

Load Shed: Shedding – Red, Not Shedding – white

(See Table 1 below for RGB color specifications)

- All system graphics should include a framed box in the lower right corner showing controller and load shedding status.
- Include a legend as appropriate.

Table 1: Common Colors Used In Graphics

Use	Description	RGB Color Composition
Floor Plan Background	Pale Yellow	255,255,153
Main Background on most graphics.	Violet	146,132,255
Gray Background for framed boxes	Gray	193,193,193
Alternant Gray (System gray preference)	Lighter Gray	204,204,204
Run status Off, Alarm Condition, Load being shed	RED	255 , 0 , 0
Run Status On, Normal condition, Com. Ok	Green	0 , 255 , 0

Modify any existing graphic or add to an existing common graphic if affected by the project.

Existing common graphics include but not limited to:

Station map showing building location with a link to the buildings floor plan.

Load shedding status.

Network communications page for NAEs, etc.

Power meter summary pages.

Special pages for Well and Lift Station data.

Point Naming Convention

Supervisory Controller/Application Specific Controller . Point Type

Supervisory Controller Server: NAE-XXXX-X

Example - **adx-1:NAE-0298-1**

ASC Controllers (Insert field device)

Identifier (Item reference) *Server: NAE name/bus.N2* **address controller type**

Example - *adx-1:NAE-0298-1/N2-1.011047UN*

N2 controller **Name** **4 digit bldg #. 011XXXYY** Where X=N2 address & Y in type identifier

Use **011** for bus #1 and **012** for bus #2

Example - **0298.011047UN** (bldg 298 bus #1 N2 address 047 UNT)

Note: (use **FE** for FEC controllers.)

Points (Insert field point) See separate list for point type nomenclatures.

Identifier (Item reference) *Server: NAE name/bus.N2 address & controller type . point type*

Example - *adx-1:NAE-0298-1/N2-1.011047UN.ZN-T*

Note: (use **FC-x** for bus for FEC controllers.)

(Shows up with mouse over on graphics.)

Point Name **bldg#.controller name.point type** (*Shows up as Item in event viewer*)

Example - **0298.AHU-8.ZN-T**

<u>Description</u>	Description of point
1. The first point is the origin (0,0).	0
2. The second point is the point (1,1).	1
3. The third point is the point (2,4).	2
4. The fourth point is the point (3,9).	3
5. The fifth point is the point (4,16).	4
6. The sixth point is the point (5,25).	5
7. The seventh point is the point (6,36).	6
8. The eighth point is the point (7,49).	7
9. The ninth point is the point (8,64).	8
10. The tenth point is the point (9,81).	9
11. The eleventh point is the point (10,100).	10
12. The twelfth point is the point (11,121).	11
13. The thirteenth point is the point (12,144).	12
14. The fourteenth point is the point (13,169).	13
15. The fifteenth point is the point (14,196).	14
16. The sixteenth point is the point (15,225).	15
17. The seventeenth point is the point (16,256).	16
18. The eighteenth point is the point (17,289).	17
19. The nineteenth point is the point (18,324).	18
20. The twentieth point is the point (19,361).	19
21. The twenty-first point is the point (20,400).	20
22. The twenty-second point is the point (21,441).	21
23. The twenty-third point is the point (22,484).	22
24. The twenty-fourth point is the point (23,529).	23
25. The twenty-fifth point is the point (24,576).	24
26. The twenty-sixth point is the point (25,625).	25
27. The twenty-seventh point is the point (26,676).	26
28. The twenty-eighth point is the point (27,729).	27
29. The twenty-ninth point is the point (28,784).	28
30. The thirtieth point is the point (29,841).	29
31. The thirty-first point is the point (30,900).	30
32. The thirty-second point is the point (31,961).	31
33. The thirty-third point is the point (32,1024).	32
34. The thirty-fourth point is the point (33,1089).	33
35. The thirty-fifth point is the point (34,1156).	34
36. The thirty-sixth point is the point (35,1225).	35
37. The thirty-seventh point is the point (36,1296).	36
38. The thirty-eighth point is the point (37,1369).	37
39. The thirty-ninth point is the point (38,1444).	38
40. The fortieth point is the point (39,1521).	39
41. The forty-first point is the point (40,1600).	40
42. The forty-second point is the point (41,1681).	41
43. The forty-third point is the point (42,1764).	42
44. The forty-fourth point is the point (43,1849).	43
45. The forty-fifth point is the point (44,1936).	44
46. The forty-sixth point is the point (45,2025).	45
47. The forty-seventh point is the point (46,2116).	46
48. The forty-eighth point is the point (47,2209).	47
49. The forty-ninth point is the point (48,2304).	48
50. The fiftieth point is the point (49,2401).	49
51. The fifty-first point is the point (50,2500).	50
52. The fifty-second point is the point (51,2601).	51
53. The fifty-third point is the point (52,2704).	52
54. The fifty-fourth point is the point (53,2809).	53
55. The fifty-fifth point is the point (54,2916).	54
56. The fifty-sixth point is the point (55,3025).	55
57. The fifty-seventh point is the point (56,3136).	56
58. The fifty-eighth point is the point (57,3249).	57
59. The fifty-ninth point is the point (58,3364).	58
60. The sixtieth point is the point (59,3481).	59
61. The sixty-first point is the point (60,3600).	60
62. The sixty-second point is the point (61,3721).	61
63. The sixty-third point is the point (62,3844).	62
64. The sixty-fourth point is the point (63,3969).	63
65. The sixty-fifth point is the point (64,4096).	64
66. The sixty-sixth point is the point (65,4225).	65
67. The sixty-seventh point is the point (66,4356).	66
68. The sixty-eighth point is the point (67,4489).	67
69. The sixty-ninth point is the point (68,4624).	68
70. The seventieth point is the point (69,4761).	69
71. The seventy-first point is the point (70,4900).	70
72. The seventy-second point is the point (71,5041).	71
73. The seventy-third point is the point (72,5184).	72
74. The seventy-fourth point is the point (73,5329).	73
75. The seventy-fifth point is the point (74,5476).	74
76. The seventy-sixth point is the point (75,5625).	75
77. The seventy-seventh point is the point (76,5776).	76
78. The seventy-eighth point is the point (77,5929).	77
79. The seventy-ninth point is the point (78,6084).	78
80. The eightieth point is the point (79,6241).	79
81. The eighty-first point is the point (80,6400).	80
82. The eighty-second point is the point (81,6561).	81
83. The eighty-third point is the point (82,6724).	82
84. The eighty-fourth point is the point (83,6889).	83
85. The eighty-fifth point is the point (84,7056).	84
86. The eighty-sixth point is the point (85,7225).	85
87. The eighty-seventh point is the point (86,7396).	86
88. The eighty-eighth point is the point (87,7569).	87
89. The eighty-ninth point is the point (88,7744).	88
90. The ninetieth point is the point (89,7921).	89
91. The ninety-first point is the point (90,8100).	90
92. The ninety-second point is the point (91,8281).	91
93. The ninety-third point is the point (92,8464).	92
94. The ninety-fourth point is the point (93,8649).	93
95. The ninety-fifth point is the point (94,8836).	94
96. The ninety-sixth point is the point (95,9025).	95
97. The ninety-seventh point is the point (96,9216).	96
98. The ninety-eighth point is the point (97,9409).	97
99. The ninety-ninth point is the point (98,9604).	98
100. The hundredth point is the point (99,9801).	99

Examples - **Zone Temp** , Sup Fan Status, Hot Water Pump Status

This page is intentionally left blank.

SECTION 23 11 25

FACILITY GAS PIPING
11/08

PART 1 GENERAL

1.1 SUMMARY

This specification section applies to gas piping installed within buildings incidental underground piping under building, above ground steel piping and corrugated stainless steel tubing (CSST) both outside (up to 5 feet beyond exterior walls) and within buildings in compliance with , "National Fuel Gas Code" NFPA 58, "Fuel Gas Piping".

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 GAS ASSOCIATION (AGA)

AGA XR0603 (2006; 8th Ed) AGA Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.15/CSA 9.1 (2009; Addenda A 2012, Addenda B 2013; R 2014) Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves

ANSI Z21.80/CSA 6.22 (2011; Addenda A 2012; R 2016) Line Pressure Regulators

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1110 (2013) Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide

API RP 2009 (2002; R 2007; 7th Ed) Safe Welding, Cutting, and Hot Work Practices in Refineries, Gasoline Plants, and Petrochemical Plants

API Std 598 (2009) Valve Inspecting and Testing

API Std 607 (2016) Testing of Valves: Fire Test for Soft-Seated Quarter-Turn Valves

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding

AWS WHB-2.9 (2004) Welding Handbook; Volume 2, Welding Processes, Part 1

ASME INTERNATIONAL (ASME)

ASME A13.1 (2015) Scheme for the Identification of Piping Systems

ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B1.20.1 (2013) Pipe Threads, General Purpose (Inch)

ASME B16.11 (2011) Forged Fittings, Socket-Welding and Threaded

ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.33 (2012) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psi, Sizes NPS 1/2 - NPS 2

ASME B16.39 (2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B16.9 (2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B31.8 (2014; Supplement 2014) Gas Transmission and Distribution Piping Systems

ASME B31.9 (2014; Errata 2015) Building Services Piping

ASME BPVC SEC IX (2010) BPVC Section IX-Welding and Brazing Qualifications

ASME BPVC SEC VIII D1 (2015) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A193/A193M (2016) Standard Specification for

Alloy-Steel and Stainless Steel Bolting
Materials for High-Temperature Service and
Other Special Purpose Applications

ASTM A194/A194M

(2017) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

ASTM A53/A53M

(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-25

(2013) Standard Marking System for Valves, Fittings, Flanges and Unions

MSS SP-58

(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54

(2015) National Fuel Gas Code

NFPA 58

(2017; ERTA 17-1) Liquefied Petroleum Gas Code

NFPA 70

(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101

(2014; Rev C) Color Code for Pipelines and for Compressed Gas Cylinders

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

49 CFR 192

Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

UNDERWRITERS LABORATORIES (UL)

UL FLAMMABLE & COMBUSTIBLE

(2012) Flammable and Combustible Liquids and Gases Equipment Directory

1.3 SYSTEM DESCRIPTION

The gas piping system includes liquid petroleum piping and appurtenances from point of connection with supply system, as indicated, to gas operated equipment within the facility. Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA, in three separate packages. Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section, with additions and modifications specified herein.

1.3.1 Gas Facility System and Equipment Operation

Include shop drawings showing piping layout, locations of system valves, gas line markers; step-by-step procedures for system start up, operation and shutdown (index system components and equipment to the system drawings); isolation procedures including valve operation to shutdown or isolate each section of the system (index valves to the system maps and provide separate procedures for normal operation and emergency shutdown if required to be different). Submit Data package No. 4.

1.3.2 Gas Facility System Maintenance

Include maintenance procedures and frequency for system and equipment; identification of pipe materials and manufacturer by locations, pipe repair procedures, and jointing procedures at transitions to other piping material or material from a different manufacturer. Submit Data Package No.4.

1.3.3 Gas Facility Equipment Maintenance

Include identification of valves, shut-offs, disconnects, and other equipment by materials, manufacturer, vendor identification and location; maintenance procedures and recommended tool kits for valves and equipment; recommended repair methods (i.e., field repair, factory repair, or replacement) for each valve and piece of equipment; and preventive maintenance procedures, possible failure modes and troubleshooting guide. Submit Data Package No. 3.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gas Piping System; G

SD-03 Product Data

Gas Piping System; G

Pipe Coating Materials; G

Pressure Regulators; G

Valves; G

SD-06 Test Reports

Testing; G

Pressure Tests; G

Pressure Tests for Liquified Petroleum Gas; G

Test with Gas; G

SD-07 Certificates

Welders Procedures and Qualifications; G

Assigned Number, Letter, or Symbol; G

SD-08 Manufacturer's Instructions

Pipe Coating Materials; G

SD-10 Operation and Maintenance Data

Gas Facility System and Equipment Operation; G

Gas Facility System Maintenance; G

Gas Facility Equipment Maintenance; G

1.5 QUALITY ASSURANCE

Submit manufacturer's descriptive data and installation instructions for approval for compression-type mechanical joints used in joining dissimilar materials and for insulating joints. Mark all valves, flanges and fittings in accordance with **MSS SP-25**.

1.5.1 Welding Qualifications

- a. Weld piping in accordance with qualified procedures using performance qualified welders and welding operators in accordance with **API RP 2009**, **ASME BPVC SEC IX**, and **ASME B31.9**. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by **ASME B31.9**. Notify the Contracting Officer at least 24 hours in advance of tests, and perform at the work site if practicable.
- b. Submit a certified copy of **welders procedures and qualifications** metal and PE in conformance with **ASME B31.9** for each welder and welding operator. Submit the **assigned number, letter, or symbol** that will be used in identifying the work of each welder to the Contracting Officer. Weld all structural members in conformance with **AWS A5.8/A5.8M**, and **AWS WHB-2.9**.

1.5.2 Shop Drawings

Submit drawings for complete [Gas Piping System](#), within 30 days of contract award, showing location, size and all branches of pipeline; location of all required shutoff valves; and instructions necessary for the installation of [gas equipment connectors](#) and supports. [Include LP storage tank, pad, and mounting details.](#)

1.6 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of the products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos are not allowed. Submit catalog data and installation instructions for pipe, valves, all related system components, [pipe coating materials](#) and application procedures. Conform to [NFPA 58](#) and with requirements specified herein. Provide supply piping to appliances or equipment at least as large as the inlets thereof.

2.2 [GAS PIPING SYSTEM](#) AND FITTINGS

2.2.1 Steel Pipe, Joints, and Fittings

- a. Pipe: Black carbon steel in accordance with [ASTM A53/A53M](#), Schedule 40 , threaded ends for sizes 2 inches and smaller; otherwise, plain end beveled for butt welding.
- b. Threaded Fittings: [ASME B16.3](#), black malleable iron.
- c. Socket-Welding Fittings: [ASME B16.11](#), forged steel.
- d. Butt-Welding Fittings: [ASME B16.9](#), with backing rings of compatible material.
- e. Unions: [ASME B16.39](#), black malleable iron.
- f. Flanges and Flanged Fittings: [ASME B16.5](#) steel flanges or convoluted steel flanges conforming to [ASME BPVC SEC VIII D1](#), with flange faces having integral grooves of rectangular cross sections which afford containment for self-energizing gasket material.

2.2.2 Sealants for Steel Pipe Threaded Joints

Provide joint sealing compound as listed in [UL FLAMMABLE & COMBUSTIBLE](#), Class 20 or less. For taping, use tetrafluoroethylene tape conforming to [UL FLAMMABLE & COMBUSTIBLE](#).

2.2.3 Flange Gaskets

Provide gaskets of nonasbestos compressed material in accordance with [ASME B16.21](#), [1/16 inch](#) thickness, full face or self-centering flat ring type, containing aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR) suitable for a maximum [600 degree F](#) service, to be used for hydrocarbon service.

2.2.4 Pipe Threads

Provide pipe threads conforming to [ASME B1.20.1](#).

2.2.5 Escutcheons

Provide chromium-plated steel or chromium-plated brass escutcheons, either one piece or split pattern, held in place by internal spring tension or set screw.

2.2.6 Insulating Pipe Joints

2.2.6.1 Insulating Joint Material

Provide insulating joint material between flanged or threaded metallic pipe systems where shown to control galvanic or electrical action.

2.2.6.2 Threaded Pipe Joints

Provide threaded pipe joints of steel body nut type dielectric unions with insulating gaskets.

2.2.6.3 Flanged Pipe Joints

Provide joints for flanged pipe consisting of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts, and insulating washers for flange nuts.

2.3 VALVES

Provide lockable shutoff or service isolation valves as indicated in the drawings conforming to the following:

2.3.1 Valves 2 Inches and Smaller

Provide valves 2 inches and smaller conforming to [ASME B16.33](#) of materials and manufacture compatible with system materials used.

2.4 PIPE HANGERS AND SUPPORTS

Provide pipe hangers and supports conforming to [MSS SP-58](#).

2.5 LINE AND APPLIANCE REGULATORS AND SHUTOFF VALVES

Provide regulators conforming to [ANSI Z21.80/CSA 6.22](#) for line [pressure regulators](#). Provide shutoff valves conforming to [ANSI Z21.15/CSA 9.1](#) for manually controlled gas shutoff valves .

2.6 BOLTING (BOLTS AND NUTS)

Stainless steel bolting; [ASTM A193/A193M](#), Grade B8M or B8MA, Type 316, for bolts; and [ASTM A194/A194M](#), Grade 8M, Type 316, for nuts. Dimensions of bolts, studs, and nuts must conform with [ASME B18.2.1](#) and [ASME B18.2.2](#) with coarse threads conforming to [ASME B1.1](#), with Class 2A fit for bolts and studs and Class 2B fit for nuts. Bolts or bolt-studs must extend through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Bolts must have American Standard regular square or heavy hexagon heads; nuts must be American Standard heavy

semifinished hexagonal.

2.7 GASKETS

Fluorinated elastomer, compatible with flange faces.

2.8 IDENTIFICATION FOR ABOVEGROUND PIPING

MIL-STD-101 for legends and type and size of characters. For pipes 3/4 inch od and larger, provide printed legends to identify contents of pipes and arrows to show direction of flow. Color code label backgrounds to signify levels of hazard. Make labels of plastic sheet with pressure-sensitive adhesive suitable for the intended application. For pipes smaller than 3/4 inch od, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black-filled characters.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy or areas of conflict before performing the work.

3.2 EXCAVATION AND BACKFILLING

Provide required excavation, backfilling, and compaction as specified in Section 31 23 00.00 20 EXCAVATION AND FILL.

3.3 GAS PIPING SYSTEM

Provide a gas piping system from the point of delivery, defined as the outlet of the shutoff valve, as specified under "Gas Service" within this specification, to the connections to each gas utilization device that is in compliance with NFPA 54NFPA 58..

3.3.1 Protection and Cleaning of Materials and Components

Protect equipment, pipe, and tube openings by closing with caps or plugs during installation. At the completion of all work, thoroughly clean the entire system.

3.3.2 Workmanship and Defects

Piping, tubing and fittings must be clear and free of cutting burrs and defects in structure or threading and must be thoroughly brushed and chip-and scale-blown. Repair of defects in piping, tubing or fittings is not allowed; replace defective items when found.

3.4 PROTECTIVE COVERING

3.4.1 Aboveground Metallic Piping Systems

3.4.1.1 Ferrous Surfaces

Touch up shop primed surfaces with ferrous metal primer. Solvent clean surfaces that have not been shop primed . Mechanically clean surfaces that contain loose rust, loose mill scale and other foreign substances by power wire brushing and prime with ferrous metal primer . Finish primed surfaces

with two coats of exterior oil paint or vinyl paint.

3.5 INSTALLATION

Install the gas system in conformance with the manufacturer's recommendations and applicable provisions of NFPA 58 and AGA XR0603, and as indicated. Perform all pipe cutting without damage to the pipe, with an approved type of mechanical cutter, unless otherwise authorized. Use wheel cutters where practicable. On steel pipe 6 inches and larger, an approved gas cutting and beveling machine may be used. Cut thermoplastic and fiberglass pipe in accordance with AGA XR0603.

3.5.1 Metallic Piping Installation

Bury underground piping a minimum of 18 inches below grade. Make changes in direction of piping with fittings only; mitering or notching pipe to form elbows and tees or other similar type construction is not permitted. Branch connection may be made with either tees or forged branch outlet fittings. Provide branch outlet fittings which are forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Do not use aluminum alloy pipe in exterior locations or underground.

3.5.2 Aboveground Piping

Run aboveground piping as straight as practicable along the alignment and elevation indicated, with a minimum of joints, and separately supported from other piping system and equipment. Install exposed horizontal piping no farther than 6 inches from nearest parallel wall and at an elevation which prevents standing, sitting, or placement of objects on the piping.

3.5.3 Final Gas Connections

Unless otherwise specified, make final connections with rigid metallic pipe and fittings. Provide accessible gas shutoff valve and coupling for each gas equipment item.

3.6 PIPE JOINTS

Design and install pipe joints to effectively sustain the longitudinal pull-out forces caused by contraction of the piping or superimposed loads.

3.6.1 Threaded Metallic Joints

Provide threaded joints in metallic pipe with tapered threads evenly cut and made with UL approved graphite joint sealing compound for gas service or tetrafluoroethylene tape applied to the male threads only. Threaded joints up to 1-1/2 inches in diameter may be made with approved tetrafluoroethylene tape. Threaded joints up to 2 inches in diameter may be made with approved joint sealing compound. After cutting and before threading, ream pipe and remove all burrs. Caulking of threaded joints to stop or prevent leaks is not permitted.

3.6.2 Welded Metallic Joints

Conform beveling, alignment, heat treatment, and inspection of welds to NFPA 54. Remove weld defects and make repairs to the weld, or remove the weld joints entirely and reweld. After filler metal has been removed from its original package, protect and store so that its characteristics or

welding properties are not affected adversely. Do not use electrodes that have been wetted or have lost any of their coating.

3.7 ESCUTCHEONS

Provide escutcheons for all finished surfaces where gas piping passes through floors, walls, or ceilings except in boiler, utility, or equipment rooms.

3.8 SPECIAL REQUIREMENTS

Provide drips, grading of the lines, freeze protection, and branch outlet locations as shown and conforming to the requirements of NFPA 58.

3.9 BUILDING STRUCTURE

Do not weaken any building structure by the installation of any gas piping. Do not cut or notch beams, joists or columns. Attach piping supports to metal decking. Do not attach supports to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer.

3.10 PIPING SYSTEM SUPPORTS

Support gas piping systems in buildings with pipe hooks, metal pipe straps, bands or hangers suitable for the size of piping or tubing. Do not support any gas piping system by other piping. Conform spacing of supports in gas piping and tubing installations to the requirements of NFPA 58. Conform the selection and application of supports in gas piping and tubing installations to the requirements of MSS SP-58. 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 is not to exceed the hanger and support spacing required for any of the individual pipes in the multiple pipe run. Rigidly connect the clips or clamps to the common base member. Provide a clearance of 1/8 inch between the pipe and clip or clamp for all piping which may be subjected to thermal expansion.

3.11 ELECTRICAL BONDING AND GROUNDING

Provide a gas piping system within the building that is electrically continuous and bonded to a grounding electrode as required by NFPA 54, NFPA 58, and NFPA 70.

3.12 SHUTOFF VALVE

Install the main gas shutoff valve controlling the gas piping system to be easily accessible for operation, as indicated, protected from physical damage, and marked with a metal tag to clearly identify the piping system controlled. Install valves approximately at locations indicated. Orient stems vertically, with operators on top, or horizontally. Provide stop valve on service branch at connection to main and shut-off valve on riser outside of building.

3.13 LINE AND APPLIANCE PRESSURE REGULATORS

Install line pressure regulators and appliance regulators in accordance with the manufacturer's requirements and in accordance with NFPA 54NFPA 58. Install each regulator in an accessible location and install shutoff valves

ahead of each line and appliance regulator to allow for maintenance. Where vent limiting devices are not included in the regulators, install a vent pipe to the exterior of the building. Terminate all service regulator vents and relief vents in the outside air in rain and insect resistant fittings. Locate the open end of the vent where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

3.14 GAS SERVICE INSTALLATION

Installations must be in accordance with 49 CFR 192 and ASME B31.8. Contractor must submit and use only tested and approved work procedures. Contractor must use only welders and jointers who have been recently qualified by training and test for joining and installing the gas pipe material used on this job. The finished product must be inspected by a person qualified to inspect joints made by the particular procedures used to make joints.

3.14.1 Gas Meter

Install shutoff valve, meter set assembly, and service regulator on the service line inside the building, a minimum of 3 feet from any potential ignition source, 18 inches above the finished floor on the riser. An insulating joint (dielectric connection) must be installed on the inlet side of the meter set assembly and service regulator and must be constructed to prevent flow of electrical current.

3.15 TESTING

Submit test procedures and reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Test entire gas piping system to ensure that it is gastight prior to putting into service. Prior to testing, purge the system, clean, and clear all foreign material. Test each joint with an approved gas detector, soap and water, or an equivalent nonflammable solution. Inspect and test each valve in conformance with API Std 598 and API Std 607. Complete testing before any work is covered, enclosed, or concealed, and perform with due regard for the safety of employees and the public during the test. Install bulkheads, anchorage and bracing suitably designed to resist test pressures if necessary, and as directed and or approved by the Contracting Officer. Do not use oxygen as a testing medium.

3.15.1 Pressure Tests

Submit test procedures and reports in booklet form tabulating test and measurements performed; dated after award of this contract, and stating the Contractor's name and address, the project name and location, and a list of the specific requirements which are being certified. Before appliances are connected, test by filling the piping systems with air or an inert gas to withstand a minimum pressure as specified in NFPA 58 without showing any drop in pressure. Do not use Oxygen for test. Measure pressure with a mercury manometer, slope gauge, or an equivalent device calibrated to be read in increments of not greater than 0.1 pound. Isolate the source of pressure before the pressure tests are made.

3.15.2 Pressure Tests for Liquified Petroleum Gas

Pressure test system as described above. When appliances are connected to the piping system, use fuel gas for testing appliances to withstand a pressure of not less than 10.0 inches nor more than 14.0 inches water column (0.36 nor more than 0.51 pounds per square inch) for a period of not less than 10 minutes without showing any drop in pressure. Measure pressure with a water manometer or an equivalent device calibrated to be read in increments of not greater than 0.1 inch water column. Isolate the source of pressure before the pressure tests are made.

3.15.3 Test With Gas

Before turning on gas under pressure into any piping, close all openings from which gas can escape. Immediately after turning on the gas, check the piping system for leakage by using a laboratory-certified gas meter, an appliance orifice, a manometer, or equivalent device. Conform all testing to the requirements of NFPA 58. If leakage is recorded, shut off the gas supply, repair the leak , and repeat the tests until all leaks have been stopped.

3.15.4 Purging

After testing is completed, and before connecting any appliances, fully purge all gas piping. LPG piping tested using fuel gas with appliances connected does not require purging. Conform testing procedures to API RP 1110. Do not purge piping into the combustion chamber of an appliance. Do not purge the open end of piping systems into confined spaces or areas where there are ignition sources unless the safety precautions recommended in NFPA 58 are followed.

3.15.5 Labor, Materials and Equipment

Furnish all labor, materials and equipment necessary for conducting the testing and purging.

3.16 PIPE COLOR CODE MARKING

Provide color code marking of piping as specified in Section 09 90 00 PAINTS AND COATINGS, conforming to ASME A13.1.

-- End of Section --

SECTION 23 23 00

REFRIGERANT PIPING
10/07

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

- | | |
|---------------|---------------------------------------------------------------------------------|
| AHRI 710 I-P | (2009) Performance Rating of Liquid-Line Driers |
| AHRI 720 | (2002) Refrigerant Access Valves and Hose Connectors |
| AHRI 750 I-P | (2016) Performance Rating of Thermostatic Refrigerant Expansion Valves |
| ANSI/AHRI 760 | (2007) Performance Rating of Solenoid Valves for Use With Volatile Refrigerants |

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

- | | |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASHRAE 15 & 34 | (2013; Addenda A 2014; ERTA 1 2014; Addenda A-T AND SUPP 2015; ERTA 2 2015; INT 1 2015; ERTA 3 2015; ERTA 4 2016; INT 2-3 2016) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants |
| ASHRAE 17 | (2008) Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves |

AMERICAN WELDING SOCIETY (AWS)

- | | |
|----------------|--------------------------------------------------------------------------------------|
| AWS A5.8/A5.8M | (2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding |
| AWS BRH | (2007; 5th Ed) Brazing Handbook |
| AWS Z49.1 | (2012) Safety in Welding and Cutting and Allied Processes |

ASME INTERNATIONAL (ASME)

- | | |
|-------------|------------------------------------------------------------------------------------|
| ASME B16.22 | (2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings |
| ASME B16.26 | (2013) Standard for Cast Copper Alloy |

Fittings for Flared Copper Tubes

ASME B31.1	(2016; Errata 2016) Power Piping
ASME B31.5	(2016) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2015; E 2016) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B280	(2016) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B32	(2008; R 2014) Standard Specification for Solder Metal
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B813	(2016) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM D3308	(2012) PTFE Resin Skived Tape
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E84	(2016) Standard Test Method for Surface Burning Characteristics of Building Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58	(1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
-----------	---------------------------------------------------------------------------------------------------------------------------------

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Refrigerant Piping System; G

SD-03 Product Data

Refrigerant Piping System

Qualifications

Refrigerant Piping Tests

Verification of Dimensions

SD-06 Test Reports

Refrigerant Piping Tests

SD-07 Certificates

Service Organization

SD-10 Operation and Maintenance Data

Maintenance; G

Operation and Maintenance Manuals; G

Demonstrations; G

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

Submit 6 copies of qualified procedures, and list of names and identification symbols of qualified welders and welding operators, prior to non-factory welding operations.

1.3.2 Contract Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. 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.

1.4 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 is the Contractor's

responsibility. Replace any materials found to be damaged at the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter.

1.5 MAINTENANCE

1.5.1 General

Submit Data Package 2 plus operation and maintenance data complying with the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

- a. Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship and that have been in satisfactory commercial or industrial use for 2 years prior to bid opening.
- b. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall 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. 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 manufacturer's factory tests, can be shown.
- c. Products shall be supported by a [service organization](#). System components shall be environmentally suitable for the indicated locations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
- d. Exposed equipment moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall 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. Welding and cutting safety requirements shall be in accordance with [AWS Z49.1](#).
- e. Manufacturer's standard catalog data, at least 5 weeks prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Include in the data manufacturer's recommended installation instructions and procedures. Provide data for the following components as a minimum:
 - (1) Piping and Fittings
 - (2) Valves
 - (3) Piping Accessories

(4) Pipe Hangers, Inserts, and Supports

2.2 ELECTRICAL WORK

Electrical equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Field wiring shall be in accordance with manufacturer's instructions.

2.3 REFRIGERANT PIPING SYSTEM

Refrigerant piping, valves, fittings, and accessories shall be in accordance with ASHRAE 15 & 34 and ASME B31.5, except as specified herein. Refrigerant piping, valves, fittings, and accessories shall be compatible with the fluids used and capable of withstanding the pressures and temperatures of the service. Refrigerant piping, valves, and accessories used for refrigerant service shall be cleaned, dehydrated, and sealed (capped or plugged) prior to shipment from the manufacturer's plant. Submit drawings, at least 5 weeks prior to beginning construction, provided in adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

- a. Piping layouts which identify all valves and fittings.
- b. Plans and elevations which identify clearances required for maintenance and operation.

2.4 PIPE, FITTINGS AND END CONNECTIONS (JOINTS)

2.4.1 Copper Tubing

Copper tubing shall conform to ASTM B280 annealed or hard drawn as required. Copper tubing shall be soft annealed where bending is required and hard drawn where no bending is required. Soft annealed copper tubing shall not be used in sizes larger than 1-3/8 inches. Joints shall be brazed except that joints on lines 7/8 inch and smaller may be flared. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62. Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B75/B75M. Joints and fittings for brazed joint shall be wrought-copper or forged-brass sweat fittings. Cast sweat-type joints and fittings shall not be allowed for 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.

2.4.2 Solder

Solder shall conform to ASTM B32, grade Sb5, tin-antimony alloy for service pressures up to 150 psig. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B813.

2.4.3 Brazing Filler Metal

Filler metal shall 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.

2.5 VALVES

Valves shall be designed, manufactured, and tested specifically for refrigerant service. Valve bodies shall be of brass, bronze, steel, or

ductile iron construction. Valves 1 inch and smaller shall have brazed or socket welded connections. Valves larger than 1 inch shall have butt welded end connections. Threaded end connections shall not be used, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections. Valve stems exposed to the atmosphere shall be stainless steel or corrosion resistant metal plated carbon steel. Direction of flow shall be legibly and permanently indicated on the valve body. Control valve inlets shall be fitted with integral or adapted strainer or filter where recommended or required by the manufacturer. Purge, charge and receiver valves shall be of manufacturer's standard configuration.

2.5.1 Refrigerant Stop Valves

Valve shall be the globe or full-port ball type with a back-seating stem especially packed for refrigerant service. Valve packing shall be replaceable under line pressure. Valve shall be provided with a wrench operator and a seal cap. Valve shall be the straight or angle pattern design as indicated.

2.5.2 Check Valves

Valve shall be the swing or lift type as required to provide positive shutoff at the differential pressure indicated. Valve shall be provide with resilient seat.

2.5.3 Liquid Solenoid Valves

Valves shall comply with ANSI/AHRI 760 and be suitable for continuous duty with applied voltages 15 percent under and 5 percent over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions. Valves shall be direct-acting or pilot-operating type, packless, except that packed stem, seal capped, manual lifting provisions shall be furnished. Solenoid coils shall be moisture-proof, UL approved, totally encapsulated or encapsulated and metal jacketed as required. Valves shall have safe working pressure of 400 psi and a maximum operating pressure differential of at least 200 psi at 85 percent rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used.

2.5.4 Expansion Valves

Valve shall conform to AHRI 750 I-P and ASHRAE 17. Valve shall be the diaphragm and spring-loaded type with internal or external equalizers, and bulb and capillary tubing. Valve shall be provided with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 2 degrees F of saturated suction temperature at evaporator conditions. Bulb charge shall be determined by the manufacturer for the application and such that liquid will remain in the bulb at all operating conditions. Gas limited liquid charged valves and other valve devices for limiting evaporator pressure shall not be used without a distributor or discharge tube or effective means to prevent loss of control when bulb becomes warmer than valve body. Pilot-operated valves shall have a characterized plug to provide required modulating control. A de-energized solenoid valve may be used in the pilot line to close the main valve in lieu of a solenoid valve

in the main liquid line. An isolatable pressure gauge shall be provided in the pilot line, at the main valve. Automatic pressure reducing or constant pressure regulating expansion valves may be used only where indicated or for constant evaporator loads.

2.5.5 Safety Relief Valves

Valve shall be the two-way type, unless indicated otherwise. Valve shall bear the ASME code symbol. Valve capacity shall be certified by the National Board of Boiler and Pressure Vessel Inspectors. Valve shall be of an automatically reseating design after activation.

2.5.6 Evaporator Pressure Regulators, Direct-Acting

Valve shall include a diaphragm/spring assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve shall maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring load. Pressure drop at system design load shall not exceed the pressure difference corresponding to a 2 degrees F change in saturated refrigerant temperature at evaporator operating suction temperature. Spring shall be selected for indicated maximum allowable suction pressure range.

2.5.7 Refrigerant Access Valves

Refrigerant access valves and hose connections shall be in accordance with AHRI 720.

2.6 PIPING ACCESSORIES

2.6.1 Filter Driers

Driers shall conform to AHRI 710 I-P. Sizes 5/8 inch and larger shall be the full flow, replaceable core type. Sizes 1/2 inch and smaller shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant. Filter driers shall be constructed so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure shall be 1,500 psi.

2.6.2 Sight Glass and Liquid Level Indicator

2.6.2.1 Assembly and Components

Assembly shall be pressure- and temperature-rated and constructed of materials suitable for the service. Glass shall be borosilicate type. Ferrous components subject to condensation shall be electro-galvanized.

2.6.2.2 Gauge Glass

Gauge glass shall include top and bottom isolation valves fitted with automatic checks, and packing followers; red-line or green-line gauge glass; elastomer or polymer packing to suit the service; and gauge glass guard.

2.6.2.3 Bull's-Eye and Inline Sight Glass Reflex Lens

Bull's-eye and inline sight glass reflex lens shall be provided for dead-end liquid service. For pipe line mounting, two plain lenses in one

body suitable for backlighting viewing shall be provided.

2.6.2.4 Moisture Indicator

Indicator shall be a self-reversible action, moisture reactive, color changing media. Indicator shall be furnished with full-color-printing tag containing color, moisture and temperature criteria. Unless otherwise indicated, the moisture indicator shall be an integral part of each corresponding sight glass.

2.6.3 Vibration Dampeners

Dampeners shall be of the all-metallic bellows and woven-wire type.

2.6.4 Strainers

Strainers used in refrigerant service shall have brass or cast iron body, Y-or angle-pattern, cleanable, not less than 60-mesh noncorroding screen of an area to provide net free area not less than ten times the pipe diameter with pressure rating compatible with the refrigerant service. Screens shall be stainless steel or monel and reinforced spring-loaded where necessary for bypass-proof construction.

2.6.5 Pressure and Vacuum Gauges

Gauges shall conform to ASME B40.100 and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 3-1/2 inches in diameter with a range from 0 psig to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.6.6 Temperature Gauges

Temperature gauges shall be the industrial duty type and be provided for the required temperature range. Gauges shall have Fahrenheit scale in 2 degrees graduations scale (black numbers) on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 5 feet of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 5 to 7 feet above the finished floor. Remote element type temperature gauges shall be provided in thermal wells located 7 feet above the finished floor.

2.6.6.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.6.6.2 Bimetallic Dial

Bimetallic dial type case shall be not less than 3-1/2 inches, stainless steel, and shall be hermetically sealed with clear acrylic lens. Bimetallic element shall be silicone dampened and unit fitted with external calibrator adjustment. Accuracy shall be one percent of dial range.

2.6.6.3 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than $3\text{-}1/2$ inches, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing shall be double-braided bronze.

2.6.6.4 Thermal Well

Thermal well shall be 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. Mercury shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 1 inch.

2.6.7 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, guides, and supports shall conform to MSS SP-58.

2.6.8 Escutcheons

Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screws.

2.7 FABRICATION

2.7.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 2000 hours exposure to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall 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. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D520, Type I.

2.7.2 Factory Applied Insulation

Refrigerant suction lines between the cooler and each compressor shall be insulated with not less than $3/4$ inch thick unicellular plastic foam. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 75 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 shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E84. Insulation shall be tested 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 shall be tested as a composite material. Jackets, facings, and adhesives shall 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.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, perform a [verification of dimensions](#) in the field. Submit a letter, at least 2 weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found before performing any work.

3.2 INSTALLATION

Pipe and fitting installation shall conform to the requirements of [ASME B31.1](#). 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 are not permitted without written approval. Cut pipe or tubing square, remove removed by reaming, and permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

3.2.1 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 wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted.

3.2.2 Functional Requirements

Piping shall be installed [1/2 inch/10 feet](#) of pipe in the direction of flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the contract drawings. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

3.2.3 Fittings and End Connections

3.2.3.1 Threaded Connections

Make threaded connections with tapered threads and make tight with PTFE tape complying with [ASTM D3308](#) or equivalent thread-joint compound applied to the male threads only. Show not more than three threads after the joint is made.

3.2.3.2 Brazed Connections

Perform brazing in accordance with [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. Paint joints in steel tubing with the same material as the baked-on coating within 8 hours after joints are made. Protect tubing against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. Support piping prior to brazing and do not spring or force.

3.2.4 Valves

3.2.4.1 General

Refrigerant stop valves shall be installed on each side of each piece of equipment such as compressors condensers, evaporators, receivers, and other similar items in multiple-unit installation, to provide partial system isolation as required for maintenance or repair. Stop valves shall be installed with stems horizontal unless otherwise indicated. Ball valves shall be installed with stems positioned to facilitate operation and maintenance. Isolating valves for pressure gauges and switches shall be external to thermal insulation. Safety switches shall not be fitted with isolation valves. Filter dryers having access ports may be considered a point of isolation. Purge valves shall be provided at all points of systems where accumulated noncondensable gases would prevent proper system operation. Valves shall be furnished to match line size, unless otherwise indicated or approved.

3.2.4.2 Expansion Valves

Expansion valves shall be installed with the thermostatic expansion valve bulb located on top of the suction line when the suction line is less than $2\text{-}1/8$ inches in diameter and at the 4 o'clock or 8 o'clock position on lines larger than $2\text{-}1/8$ inches. The bulb shall be securely fastened with two clamps. The bulb shall be insulated. The bulb shall be installed in a horizontal portion of the suction line, if possible, with the pigtail on the bottom. If the bulb must be installed in a vertical line, the bulb tubing shall be facing up.

3.2.4.3 Valve Identification

Each system valve, including those which are part of a factory assembly, shall be tagged. Tags shall be in alphanumeric sequence, progressing in direction of fluid flow. Tags shall be embossed, engraved, or stamped plastic or nonferrous metal of various shapes, sized approximately $1\text{-}3/8$ inch diameter, or equivalent dimension, substantially attached to a component or immediately adjacent thereto. Tags shall be attached with nonferrous, heavy duty, bead or link chain, 14 gauge annealed wire, nylon cable bands or as approved. Tag numbers shall be referenced in Operation and Maintenance Manuals and system diagrams.

3.2.5 Vibration Dampers

Vibration damper shall be provided in the suction and discharge lines on spring mounted compressors. Vibration dampers shall be installed parallel with the shaft of the compressor and shall be anchored firmly at the upstream end on the suction line and the downstream end in the discharge line.

3.2.6 Strainers

Strainers shall be provided immediately ahead of solenoid valves and expansion devices. Strainers may be an integral part of an expansion valve.

3.2.7 Filter Dryer

A liquid line filter dryer shall be provided on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. Dryers shall be sized in accordance with the manufacturer's recommendations for the system in which it is installed. Dryers shall be installed such that it can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Dryers shall be installed in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

3.2.8 Sight Glass

A moisture indicating sight glass shall be installed in all refrigerant circuits down stream of all filter dryers and where indicated. Site glasses shall be full line size.

3.2.9 Discharge Line Oil Separator

Discharge line oil separator shall be provided in the discharge line from each compressor. Oil return line shall be connected to the compressor as recommended by the compressor manufacturer.

3.2.10 Accumulator

Accumulators shall be provided in the suction line to each compressor.

3.2.11 Flexible Pipe Connectors

Connectors shall be installed perpendicular to line of motion being isolated. Piping for equipment with bidirectional motion shall be fitted with two flexible connectors, in perpendicular planes. Reinforced elastomer flexible connectors shall be installed in accordance with manufacturer's instructions. Piping guides and restraints related to flexible connectors shall be provided as required.

3.2.12 Temperature Gauges

Temperature gauges shall be located specifically on, but not limited to the following: the sensing element of each automatic temperature control device where a thermometer is not an integral part thereof the liquid line leaving a receiver and the suction line at each evaporator or liquid cooler. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 1 inch.

3.2.13 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58, except as modified herein. Pipe hanger types 5, 12, and 26 shall not be used. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.2.13.1 Hangers

Do not use Type 3 on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.2.13.2 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.

3.2.13.3 C-Clamps

Torque Type 19 and 23 C-clamps in accordance with 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.

3.2.13.4 Angle Attachments

Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

3.2.13.5 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, shall be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall 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 shall be used under the Type 40 shield for piping 2 inches and larger.

3.2.13.6 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in MSS SP-58 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced 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 shall have the excess hanger loads suspended from panel points.

3.2.13.7 Vertical Pipe Supports

Vertical pipe shall be supported 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.

3.2.13.8 Pipe Guides

Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.2.13.9 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 shall 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.

3.2.13.10 High Temperature Guides with Cradles

Where there are high system temperatures and welding to piping is not desirable, then the Type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches, or by an amount adequate for the insulation, whichever is greater.

3.2.13.11 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.2.13.12 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material used for support shall be as specified under Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.2.14 Pipe Alignment Guides

Pipe alignment guides shall be provided 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.

3.2.15 Pipe Anchors

Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached 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, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal. Detailed drawings of pipe anchors shall be submitted for approval before installation.

3.2.16 Building Surface Penetrations

Sleeves shall not be installed in structural members except where indicated or approved. Sleeves in nonload bearing surfaces shall be galvanized sheet

metal, conforming to **ASTM A653/A653M**, Coating Class G-90, **20 gauge**. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to **ASTM A53/A53M**, Schedule 20 . Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than **1/2 inch** depth. Sleeves shall not be installed in structural members.

3.2.16.1 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall 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 shall be sealed in accordance with Section **07 92 00 JOINT SEALANTS**.

3.2.16.2 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a **17 ounce** copper sleeve, or a **0.032 inch** thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and skirt or flange shall 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. The flashing sleeve shall extend up the pipe a minimum of **2 inches** above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

3.2.16.2.1 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. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.2.16.2.2 Modular Mechanical Type Sealing Assembly

In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Seals shall consist 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. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.2.16.3 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.2.17 Access Panels

Access panels shall be provided for all concealed valves, vents, controls, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.2.18 Field Applied Insulation

Field installed insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as defined differently herein.

3.2.19 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

3.2.19.1 Color Coding

Color coding for piping identification is specified in Section 09 90 00 PAINTS AND COATINGS.

3.2.19.2 Color Coding Scheme

A color coding scheme for locating hidden piping shall be in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2.20 Identification Tags

Provide identification tags made of brass, engraved laminated plastic or engraved anodized aluminum indicating service and item number on all valves and dampers. Tags shall be 1-3/8 inch minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.3 CLEANING AND ADJUSTING

Clean uncontaminated system(s) by evacuation and purging procedures currently recommended by refrigerant and refrigerant equipment manufacturers, and as specified herein, to remove small amounts of air and moisture. Systems containing moderate amounts of air, moisture, contaminated refrigerant, or any foreign matter shall be considered contaminated systems. Restoring contaminated systems to clean condition including disassembly, component replacement, evacuation, flushing, purging, and re-charging, shall be performed using currently approved refrigerant and refrigeration manufacturer's procedures. Restoring contaminated systems shall be at no additional cost to the Government as

determined by the Contracting Officer. Water shall not be used in any procedure or test.

3.4 TRAINING COURSE

- a. Submit a schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training. Conduct a training course for 6 members of the operating staff as designated by the Contracting Officer. The training period shall consist of a total 8 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests.
- b. The field posted instructions shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.
- c. Submit 6 complete copies of an operation manual in bound 8 1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.
- d. Submit 6 complete copies of maintenance manual in bound 8 1/2 x 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping layouts and simplified wiring and control diagrams of the system as installed.

3.5 REFRIGERANT PIPING TESTS

After all components of the refrigerant system have been installed and connected, subject the entire refrigeration system to pneumatic, evacuation, and startup tests as described herein. Submit a schedule, at least 2 weeks prior to the start of related testing, for each test. Identify the proposed date, time, and location for each test. Conduct tests in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Provide all material, equipment, instruments, and personnel required for the test. Provide the services of a qualified technician, as required, to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Submit 6 copies of the tests report in bound 8 1/2 by 11 inch booklets documenting all phases of the tests performed. The report shall include initial test summaries, all repairs/adjustments made, and the final test results.

3.5.1 Preliminary Procedures

Prior to pneumatic testing, equipment which has been factory tested and refrigerant charged as well as equipment which could be damaged or cause personnel injury by imposed test pressure, positive or negative, shall be isolated from the test pressure or removed from the system. Safety relief valves and rupture discs, where not part of factory sealed systems, shall be removed and openings capped or plugged.

3.5.2 Pneumatic Test

Pressure control and excess pressure protection shall be provided at the source of test pressure. Valves shall be wide open, except those leading to the atmosphere. Test gas shall be dry nitrogen, with minus 70 degree F dewpoint and less than 5 ppm oil. Test pressure shall be applied in two stages before any refrigerant pipe is insulated or covered. First stage test shall be at 10 psi with every joint being tested with a thick soap or color indicating solution. Second stage tests shall raise the system to the minimum refrigerant leakage test pressure specified in ASHRAE 15 & 34 with a maximum test pressure 25 percent greater. Pressure above 100 psig shall be raised in 10 percent increments with a pressure acclimatizing period between increments. The initial test pressure shall be recorded along with the ambient temperature to which the system is exposed. Final test pressures of the second stage shall be maintained on the system for a minimum of 24 hours. At the end of the 24 hour period, the system pressure will be recorded along with the ambient temperature to which the system is exposed. A correction factor of 0.3 psi will be allowed for each degree F change between test space initial and final ambient temperature, plus for increase and minus for a decrease. If the corrected system pressure is not exactly equal to the initial system test pressure, then the system shall be investigated for leaking joints. To repair leaks, the joint shall be taken apart, thoroughly cleaned, and reconstructed as a new joint. Joints repaired by caulking, remelting, or back-welding/brazing shall not be acceptable. Following repair, the entire system shall be retested using the pneumatic tests described above. The entire system shall be reassembled once the pneumatic tests are satisfactorily completed.

3.5.3 Evacuation Test

Following satisfactory completion of the pneumatic tests, the pressure shall be relieved and the entire system shall be evacuated to an absolute pressure of 300 micrometers. During evacuation of the system, the ambient temperature shall be higher than 35 degrees F. No more than one system shall be evacuated at one time by one vacuum pump. Once the desired vacuum has been reached, the vacuum line shall be closed and the system shall stand for 1 hour. If the pressure rises over 500 micrometers after the 1 hour period, then the system shall be evacuated again down to 300 micrometers and let set for another 1 hour period. The system shall not be charged until a vacuum of at least 500 micrometers is maintained for a period of 1 hour without the assistance of a vacuum line. If during the testing the pressure continues to rise, check the system for leaks, repair as required, and repeat the evacuation procedure. During evacuation, pressures shall be recorded by a thermocouple-type, electronic-type, or a calibrated-micrometer type gauge.

3.5.4 System Charging and Startup Test

Following satisfactory completion of the evacuation tests, the system shall be charged with the required amount of refrigerant by raising pressure to normal operating pressure and in accordance with manufacturer's procedures. Following charging, the system shall operate with high-side and low-side pressures and corresponding refrigerant temperatures, at design or improved values. The entire system shall be tested for leaks. Fluorocarbon systems shall be tested with halide torch or electronic leak detectors.

3.5.5 Refrigerant Leakage

If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. Under no circumstances shall the refrigerant be discharged into the atmosphere.

3.5.6 Contractor's Responsibility

At all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time shall more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

-- End of Section --

This page is intentionally left blank.

SECTION 23 81 00.00 20

UNITARY AIR CONDITIONING EQUIPMENT

11/09

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI DCUP (Online) Directory of Certified Unitary Products

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

ANSI/ASHRAE 15 & 34 (2016) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants

ASHRAE 52.2 (2017) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

ASHRAE 55 (2013; Addenda C 2017) Thermal Environmental Conditions for Human Occupancy

ASHRAE 62.1 (2013) Ventilation for Acceptable Indoor Air Quality

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2011; Amendment 2012) Specification for Filler Metals for Brazing and Braze Welding

ASME INTERNATIONAL (ASME)

ASME B16.22 (2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B31.5 (2016) Refrigeration Piping and Heat Transfer Components

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2015) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B117 (2016) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B280 (2016) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B88 (2016) Standard Specification for Seamless Copper Water Tube

ASTM C534/C534M (2016) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

ASTM D1654 (2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58 (1993; Reaffirmed 2010) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-69 (2003; Notice 2012) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA MG 1 (2016; SUPP 2016) Motors and Generators

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-5541 (2006; Rev F) Chemical Conversion Coatings on Aluminum and Aluminum Alloys

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-50502 (Basic) Air Conditioners, (Unitary Heat Pump), Air to Air (3,000 to 300,000 BTU)

UNDERWRITERS LABORATORIES (UL)

UL 109	(1997; Reprint Aug 2013) Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use
UL 873	(2007; Reprint Feb 2015) Standard for Temperature-Indicating and -Regulating Equipment
UL 900	(2015) Standard for Air Filter Units

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Field-Assembled Refrigerant Piping

Control System Wiring Diagrams

SD-03 Product Data

Heat Pumps, air to air

Ductless Air Conditioners

Include documentation for Energy Star qualifications or meeting FEMP requirements. Indicate Energy Efficiency Rating.

Filters

Thermostats

Refrigerant: Provide SDS sheets for all refrigerants

Refrigerant Piping and Accessories

Coatings for Finned Tube Coils

For packaged terminal units, include indoor noise rating.

SD-06 Test Reports

Salt-Spray Tests

Start-Up and Initial Operational Tests

SD-08 Manufacturer's Instructions

Heat Pumps, air to air

Ductless Air Conditioners

Filters

Thermostats

Refrigerant Piping and Accessories

SD-10 Operation and Maintenance Data

, Data Package 3

, Data Package 3

Heat Pumps, air to air, Data Package 3

DuctlessAir Conditioners, Data Package 3

Filters, Data Package 2

Thermostats, Data Package 2

Submit in accordance with Section 01 78 23 OPERATION AND
MAINTENANCE DATA.

SD-11 Closeout Submittals

Posted Operating Instructions

Energy Efficient Equipment for Unitary Air Conditioning Equipment;
S

Ozone Depleting Substances; S

Indoor Air Quality During Construction; S

1.4 QUALITY ASSURANCE

1.4.1 Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting

Officer.

1.4.2 Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit [control system wiring diagrams](#).

1.4.3 Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to [ANSI/ASHRAE 15 & 34](#).

1.4.4 [Posted Operating Instructions](#)

Submit posted operating instructions for each packaged air conditioning unit.

1.4.5 Sizing

Size equipment based on Design Manual CS from the Air Conditioning Contractors of America; do not oversize.

1.5 [REFRIGERANTS](#)

Refrigerants shall have an Ozone Depletion Potential (ODP) of 0.0. The ODP shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Programme. CFCs shall not be permitted. Refrigerant shall be an approved alternative refrigerant per EPA's Significant New Alternative Policy (SNAP) listing.

1.6 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain positive pressure within the building. Ventilation shall meet or exceed [ASHRAE 62.1](#) and all published addenda. Meet or exceed filter media efficiency as tested in accordance with [ASHRAE 52.2](#). Thermal comfort shall meet or exceed [ASHRAE 55](#).

1.7 [SALT SPRAY PROTECTIONS](#)

All outdoor equipment exposed to outdoor air furnished under this project shall pass the ASTM B117 salt spray resistant test. Split system Heat Pumps, as specified in this section, shall pass a three thousand (3000) hour salt spray test. Ductless Air Conditioners, as specified in this section, shall pass a one thousand (1000) hour salt spray test. The specified capacities on the plans and specifications shall be the capacities after the required corrosion protection coatings are applied.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 [Energy Efficient Equipment for Unitary Air Conditioning Equipment](#)

Provide unitary air conditioning equipment meeting the efficiency

requirements as stated within this section and provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph ENERGY EFFICIENT EQUIPMENT.

2.1.2 Ozone Depleting Substances

Unitary air conditioning equipment must not use CFC-based refrigerants, and must have an Ozone Depletion Potential (ODP) no greater than 0.0, with exception to R-123, in conformance with this section. Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph OZONE DEPLETING SUBSTANCES.

2.2 HEAT PUMPS, AIR TO AIR

CID A-A-50502, except as modified in this article; Type II, Class 1. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the AHRI Directory, a letter of certification from AHRI that the units have been certified and will be listed in the next Directory will be acceptable. Provide factory assembled units complete with accessories, wiring, piping, and controls. Provide units with supplemental electric heaters and air filters as specified in the paragraph FILTERS.

2.2.1 Energy Performance

Heat pumps shall have a minimum energy efficiency ratio (EER) of 11, and a minimum COP of 3.3.

2.2.2 Air Coils

Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a coating on outdoor air and indoor air coils as specified in the paragraph COATINGS FOR FINNED TUBE COILS. Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.2.3 Supplemental Electric Heaters

Provide electrical resistance heaters integral with the unit. Heaters shall have a total capacity as indicated. Provide internal fusing for heaters.

2.2.4 Compressors

For compressors above 20 tons, compressor speed shall not exceed 3450 rpm. For equipment over 10 tons, provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have a means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Provide reciprocating compressors with crankcase heaters, and vibration isolators.

2.2.5 Mounting Provisions

Provide units that permit mounting as indicated.

2.2.6 Temperature Controls

Provide controls as specified in **CID A-A-50502** and as modified herein. Provide indoor thermostats of the adjustable type that conform to applicable requirements of **UL 873**. Provide manual means for temperature set-back. Provide thermostats capable of controlling supplemental heat as specified in **CID A-A-50502**. Provide a manual selector switch or other means to permit the supplementary heater to be energized when the heat pump compressor and associated equipment are inoperative. Control supplementary heater with the room thermostat while bypassing the outdoor thermostat. Locate switch adjacent to or as an integral part of the room thermostat. An indicator light on the room thermostat or manual heat switch shall indicate when supplementary heaters are operating.

2.2.7 Accessories

In addition to accessories specified in **CID A-A-50502**, provide the following accessories for heat pump units.

- a. Protective grille around outside unit coils
- b. Start capacitor kit

2.3 DUCTLESS AIR CONDITIONERS

2.3.1 Split-System Type

Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Provide performance diagrams for units with capacities not certified by AHRI to verify that components of the air conditioning system furnished will satisfy the capacity requirement specified or indicated. List units with capacities smaller than 135,000 Btu/hr in the **AHRI DCUP**; in lieu of listing in the AHRI Directory, a letter of certification from AHRI that units have been certified and will be listed in the next Directory will be acceptable. Provide capacity, electrical characteristics and operating conditions as indicated. **Provide corrosion protection on the entire exterior Ductless Air Conditioner condensing unit that shall meet or exceed the requirements of a 1000 hour salt spray test in accordance with ASTM B117. The specified capacities on the plans and specifications shall be the capacities after the required corrosion protection coatings are applied.**

2.3.2 Single Zone Units

Provide single zone type units arranged to blow through coil sections.

2.3.3 Compressors

Capacity reduction shall be accomplished by variable speed compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes.

2.3.4 Coils

On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. Provide a coating on condenser coils and fins as specified in the paragraph COATINGS FOR FINNED TUBE COILS. Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.3.5 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to 0 degrees F.

2.3.6 Fans

Provide belt-driven evaporator fans with adjustable pitch pulleys; except for units less than 5 ton capacity, direct drive with at least two speed taps may be used. Select pulleys at approximately midpoint of the adjustable range.

2.3.7 Filters

Provide filters of the type specified in this section.

2.3.8 Thermostats

Provide self-contained controls, with wall mounted wired thermostat, that can communicate through a BACnet interface to the building controls system specified in 23 09 23.13 22 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC and on the drawings.

2.4 FILTERS

Provide filters to filter outside air and return air and locate inside air conditioners . Provide replaceable (throw-away) type for Heat Pumps and cleanable (reusable) type for Ductless Split Systems. Filters shall conform to UL 900, Class 1 . Polyurethane filters shall not be used on units with multiframe filters.

2.4.1 Replaceable Type Filters

Throw-away frames and media, standard dust holding capacity, 350 fpm maximum face velocity, and one inch thick. Filters shall have a minimum efficiency reporting value (MERV) of 8 when tested in accordance with ASHRAE 52.2.

2.4.2 Cleanable Type Filters

Provide sufficient oil to coat filters six times based on one pint of oil per each 10 square feet of filter area. Provide washing and charging tanks for cleaning and coating filters. Filters shall have a MERV of 8 when tested in accordance with ASHRAE 52.2.

2.5 COATINGS FOR FINNED TUBE COILS

Where stipulated in equipment specifications of this section, coat finned

tube coils of the affected equipment as specified below. Apply coating at the premises of a company specializing in such work. Degrease and prepare for coating in accordance with the coating applicator's procedures for the type of metals involved. Completed coating shall show no evidence of softening, blistering, cracking, crazing, flaking, loss of adhesion, or "bridging" between the fins. Corrosion protection shall meet or exceed the requirements of ASTM B117. Split system Heat Pumps, as specified in this section, shall pass a three thousand (3000) hour salt spray test. Ductless Air Conditioners, as specified in this section, shall pass a one thousand (1000) hour salt spray test. The specified capacities on the plans and specifications shall be the capacities after the required corrosion protection coatings are applied.

2.5.1 Phenolic Coating

Provide a resin base thermosetting phenolic coating. Apply coating by immersion dipping of the entire coil. Provide a minimum of two coats. Bake or heat dry coils following immersions. After final immersion and prior to final baking, spray entire coil with particular emphasis given to building up coating on sheared edges. Total dry film thickness shall be 2.5 to 3.0 mils.

2.5.2 Chemical Conversion Coating with Polyelastomer Finish Coat

Dip coils in a chemical conversion solution to molecularly deposit a corrosion resistant coating by electrolysis action. Chemical conversion coatings shall conform to MIL-DTL-5541, Class 1A. Cure conversion coating at a temperature of 110 to 140 degrees F for a minimum of 3 hours. Coat coil surfaces with a complex polymer primer with a dry film thickness of 1 mil. Cure primer coat for a minimum of 1 hour. Using dip tank method, provide three coats of a complex polyelastomer finish coat. After each of the first two finish coats, cure the coils for 1 hour. Following the third coat, spray a fog coat of an inert sealer on the coil surfaces. Total dry film thickness shall be 2.5 to 3.0 mils. Cure finish coat for a minimum of 3 hours. Coating materials shall have 300 percent flexibility, operate in temperatures of minus 50 to plus 220 degrees F, and protect against atmospheres of a pH range of 1 to 14.

2.5.3 Vinyl Coating

Apply coating using an airless fog nozzle. For each coat, make at least two passes with the nozzle. Materials to be applied are as follows:

Total dry film thickness, 6.5 mils maximum.

Vinyl Primer, 24 percent solids by volume: One coat 2 mils thick

Vinyl Copolymer, 30 percent solids by volume: One coat 4.5 mils thick.

2.6 MOTORS AND STARTERS

NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Variable speed. Motors less than 1 hp shall meet NEMA High Efficiency requirements. Motors 1 hp and larger shall meet NEMA Premium Efficiency requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is

operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide weather-resistant type starter enclosures in accordance with [NEMA ICS 6](#).

2.7 REFRIGERANT PIPING AND ACCESSORIES

Provide accessories as specified in [CID A-A-50502](#) and this section. Provide suction line accumulators as recommended by equipment manufacturer's installation instructions. Provide a filter-drier in the liquid line.

2.7.1 Factory Charged Tubing

Provide extra soft, deoxidized, bright annealed copper tubing conforming to [ASTM B280](#), factory dehydrated and furnished with a balanced charge of refrigerant recommended by manufacturer of equipment being connected. Factory insulate suction line tubing with [3/8 inch](#) minimum thickness of closed cell, foamed plastic conforming to [ASTM C534/C534M](#) with a permeance rating not to exceed 1.0. Provide quick-connectors with caps or plugs to protect couplings. Include couplings for suction and liquid line connections of the indoor and outdoor sections.

2.7.2 Field-Assembled Refrigerant Piping

Material and dimensional requirements for field-assembled refrigerant piping, valves, fittings, and accessories shall conform to [ANSI/ASHRAE 15 & 34](#) and [ASME B31.5](#), except as herein specified. Factory clean, dehydrate, and seal piping before delivery to the project location. Provide seamless copper tubing, hard drawn, Type K or L, conforming to [ASTM B88](#), except that tubing with outside diameters of [1/4 inch](#) and [3/8 inch](#) shall have nominal wall thickness of not less than [0.030 inch](#) and [0.032 inch](#), respectively. Soft annealed copper tubing conforming to [ASTM B280](#) may be used where flare connections to equipment are required only in nominal sizes less than one inch outside diameter.

2.7.3 Fittings

[ASME B16.22](#) for solder-joint fittings. [UL 109](#) for flared tube fittings.

2.7.4 Brazing Filler Material

[AWS A5.8/A5.8M](#).

2.7.5 Pipe Hangers and Supports

[MSS SP-69](#) and [MSS SP-58](#), Type [II](#), except as indicated otherwise.

2.7.6 Pipe Sleeves

Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than [0.25 inch](#) space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable

mass, or provide a segmented elastomeric seal.

2.7.6.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs

Provide Schedule 40 or Standard Weight zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above finished floor.

2.7.6.2 Sleeves in Partitions and Non-Masonry Structures

Provide zinc-coated steel sheet sleeves having a nominal weight of not less than 0.90 pound per square foot, in partitions and other than masonry and concrete walls, floors, and roofs.

2.8 FINISHES

Provide steel surfaces of equipment including packaged terminal units, heat pumps, and air conditioners, that do not have a zinc coating conforming to ASTM A123/A123M, or a duplex coating of zinc and paint, with a factory applied coating or paint system. Provide a coating or paint system on actual equipment identical to that on salt-spray test specimens with respect to materials, conditions of application, and dry-film thickness.

2.9 SOURCE QUALITY CONTROL

2.9.1 Salt-Spray Tests

Salt-spray test the factory-applied coating or paint system of equipment including packaged terminal units, heat pumps, and air conditioners in accordance with ASTM B117. Conduct test for 3000 hours for split system Heat Pump equipment and 1000 hours for Ductless Air conditioners installed outdoors, or 125 hours for equipment installed indoors. Test specimens shall have a standard scribe mark as defined in ASTM D1654. Upon completion of exposure, evaluate and rate the coating or paint system in accordance with procedures A and B of ASTM D1654. Rating of failure at the scribe mark shall not be less than six, average creepage not greater than 1/8 inch. Rating of the unscribed area shall not be less than 10, no failure.

PART 3 EXECUTION

3.1 CONSTRUCTION-RELATED SUSTAINABILITY CRITERIA

Perform and document the following:

3.1.1 Indoor Air Quality During Construction

Provide documentation showing that after construction ends, and prior to occupancy, new filters were installed in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph INDOOR AIR QUALITY DURING CONSTRUCTION.

3.2 EQUIPMENT INSTALLATION

Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment

shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.3 PIPING

Brazing, bending, forming and assembly of refrigerant piping shall conform to [ASME B31.5](#).

3.3.1 Pipe Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to [MSS SP-58](#). Installation of hanger types and supports for bare and covered pipes shall conform to [MSS SP-69](#) for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to [MSS SP-58](#).

3.3.2 Refrigerant Piping

Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but shall be located where they may be readily inspected. Install piping to be insulated with sufficient clearance to permit application of insulation. Install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines will not be permitted except where indicated. Provide sleeves of suitable size for lines passing through building structure. Braze refrigerant piping with silver solder complying with [AWS A5.8/A5.8M](#). Inside of tubing and fittings shall be free of flux. Clean parts to be jointed with emery cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems. Installation of piping shall comply with [ASME B31.5](#).

3.3.3 Returning Oil From Refrigerant System

Install refrigerant lines so that gas velocity in the evaporator suction line is sufficient to move oil along with gas to the compressor. Where equipment location requires vertical risers, line shall be sized to maintain sufficient velocity to lift oil at minimum system loading and corresponding reduction of gas volume. Install a double riser when excess velocity and pressure drop would result from full system loading. Larger riser shall have a trap, of minimum volume, obtained by use of 90- and 45-degree ells. Arrange small riser with inlet close to bottom of

horizontal line, and connect to top of upper horizontal line. Do not install valves in risers.

3.3.4 Refrigerant Driers, Sight Glass Indicators, and Strainers

Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping in accordance with [CID A-A-50502](#) when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valved bypass line the same size as liquid line in which dryer is installed. Size of driers shall be determined by piping and installation of the unit on location. Install dryers of [50 cubic inches](#) and larger vertically with the cover for removing cartridge at the bottom. Install moisture indicators in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed.

3.3.5 Strainer Locations and Installation

Locate strainers close to equipment they are to protect. Provide a strainer in common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on strainer's body.

3.3.6 Solenoid Valve Installation

Install solenoid valves in horizontal lines with stem vertical and with flow in direction indicated on valve. If not incorporated as integral part of the valve, provide a strainer upstream of the solenoid valve. Provide service valves upstream of the solenoid valve, upstream of the strainer, and downstream of the solenoid valve. Remove the internal parts of the solenoid valve when brazing the valve.

3.4 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES

Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section [22 00 00 PLUMBING, GENERAL PURPOSE](#).

3.5 ACCESS PANELS

Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.6 AIR FILTERS

Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.

3.7 IDENTIFICATION TAGS AND PLATES

Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of [1/8 inch](#) high.

3.8 FIELD QUALITY CONTROL

3.8.1 Leak Testing

Upon completion of installation of air conditioning equipment, test factory- and field-installed refrigerant piping with an electronic-type leak detector. Use same type of refrigerant to be provided in the system for leak testing. When nitrogen is used to boost system pressure for testing, ensure that it is eliminated from the system before charging. Minimum refrigerant leak field test pressure shall be as specified in ANSI/ASHRAE 15 & 34, except that test pressure shall not exceed 150 psig on hermetic compressors unless otherwise specified as a low side test pressure on the equipment nameplate. If leaks are detected at time of installation or during warranty period, remove the entire refrigerant charge from the system, correct leaks, and retest system.

3.8.2 Evacuation, Dehydration, and Charging

After field charged refrigerant system is found to be without leaks or after leaks have been repaired on field-charged and factory-charged systems, evacuate the system using a reliable gage and a vacuum pump capable of pulling a vacuum of at least one mm Hg absolute. Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturer's printed instructions and recharge system.

3.8.3 Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

3.8.4 Performance Tests

Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance. Record the following readings:

Outside Air Temp, degrees F (DB) (WB)
Return Air Temp, degrees F (DB) (WB)
Supply Air Temp, degrees F (DB) (WB)
Space Zone Temp, degrees F (DB) (WB)
-- End of Section --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

07/06

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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709 (2016) Standard Specification for
Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative
Dictionary of IEEE Standards Terms

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017)
National Electrical Safety Code

IEEE C57.12.28 (2014) Standard for Pad-Mounted Equipment
- Enclosure Integrity

IEEE C57.12.29 (2014) Standard for Pad-Mounted Equipment
- Enclosure Integrity for Coastal
Environments

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2014) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections. This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 12 19.10 THREE-PHASE PAD MOUNTED TRANSFORMERS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM

Section 26 56 00 EXTERIOR LIGHTING

Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION

Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be as indicated on drawings. Final connections to the power distribution system at the existing manhole shall be made by the Contractor as directed by the Contracting Officer.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 Shop Drawings (SD-02)

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.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 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.

1.6.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 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. 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 the technical section.

1.6.2.1 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 furnished.

1.6.2.2 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.

1.7 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.

1.8 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.9 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.

1.10 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections 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.

1.11 WARNING SIGNS

Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

- a. When the enclosure integrity of such equipment is specified to be in accordance with **IEEE C57.12.28** or **IEEE C57.12.29**, such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal dimensions of **7 by 10 inches** with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal **2 inch** high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPS0710D72 or approved equal.

1.12 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to **IEEE C2**, **NFPA 70**, and requirements specified herein.

1.13 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which

shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in the section specifying the associated electrical equipment.

3.2 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.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

This page is intentionally left blank.

SECTION 26 08 00

APPARATUS INSPECTION AND TESTING

08/08

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.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2013) Standard for Acceptance Testing
Specifications for Electrical Power
Equipment and Systems

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

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

SD-06 Test Reports

Acceptance tests and inspections; G

SD-07 Certificates

Qualifications of organization, and lead engineering technician; G

Acceptance test and inspections procedure; G

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Contractor shall engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph entitled "Acceptance Tests and Inspections" herein. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. No work required by this section of the specification shall be performed by a second tier subcontractor.

- a. Submit name and qualifications of organization. Organization shall have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization shall have a calibration program, and test instruments

used shall be calibrated in accordance with **NETA ATS**.

- b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician, certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

1.4.2 Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Reports shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

1.4.3 Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization shall perform acceptance tests and inspections. Test methods, procedures, and test values shall be performed and evaluated in accordance with **NETA ATS**, the manufacturer's recommendations, and paragraph entitled "Field Quality Control" of each applicable specification section. Tests identified as optional in **NETA ATS** are not required unless otherwise specified. Equipment shall be placed in service only after completion of required tests and evaluation of the test results have been completed. Contractor shall supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Contracting Officer shall be notified at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

- b. Section **26 12 19.10** THREE-PHASE PAD-MOUNTED TRANSFORMERS

3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion

of acceptance tests and inspections.

3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization shall be present when equipment tested by the organization is initially energized and placed in service.

-- End of Section --

This page is intentionally left blank.

SECTION 26 12 19.10

THREE-PHASE PAD-MOUNTED TRANSFORMERS

02/12

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.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318M (2014) Building Code Requirements for
Structural Concrete & Commentary

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M (2015a) Standard Specification for
Chromium and Chromium-Nickel Stainless
Steel Plate, Sheet, and Strip for Pressure
Vessels and for General Applications

ASTM D117 (2010) Standard Guide for Sampling, Test
Methods, Specifications and Guide for
Electrical Insulating Oils of Petroleum
Origin

ASTM D1535 (2014) Specifying Color by the Munsell
System

ASTM D3487 (2009) Standard Specification for Mineral
Insulating Oil Used in Electrical Apparatus

ASTM D877/D877M (2013) Standard Test Method for Dielectric
Breakdown Voltage of Insulating Liquids
Using Disk Electrodes

ASTM D92 (2012b) Standard Test Method for Flash and
Fire Points by Cleveland Open Cup Tester

ASTM D97 (2012) Pour Point of Petroleum Products

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative
Dictionary of IEEE Standards Terms

IEEE 386 (2006; INT 1 2011) Standard for Separable
Insulated Connector Systems for Power
Distribution Systems Above 600V

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C37.47	(2011) Standard for High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches
IEEE C57.12.00	(2010) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
IEEE C57.12.34	(2009) Standard for Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 5 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15 kV Nominal System Voltage and Below
IEEE C57.12.90	(2010) Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13	(2008; INT 2009) Standard Requirements for Instrument Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests
IEEE C62.11	(2012) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
----------	--------------------------------------------------------------------------------------------------------

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering
ANSI C12.7	(2014) Requirements for Watthour Meter Sockets
NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203 (1992) Fish Acute Toxicity Test

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075 (1998) Fate, Transport and Transformation
Test Guidelines - OPPTS 835.3100- "Aerobic
Aquatic Biodegradation"

EPA 821-R-02-012 (2002) Methods for Measuring the Acute
Toxicity of Effluents and Receiving Waters
to Freshwater and Marine Organisms

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

10 CFR 431 Energy Efficiency Program for Certain
Commercial and Industrial Equipment

UNDERWRITERS LABORATORIES (UL)

UL 467 (2007) Grounding and Bonding Equipment

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms
used in these specifications, and on the drawings, shall be as defined in
IEEE 100.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Pad-mounted transformer drawings; G

SD-03 Product Data

Pad-mounted transformers; G

Submittal shall include manufacturer's information for each
component, device, insulating fluid, and accessory provided with
the transformer.

SD-06 Test Reports

Acceptance checks and tests; G

Submittal shall include acceptance criteria and limits for each
test in accordance with NETA ATS "Test Values".

SD-07 Certificates

Transformer Efficiencies; G

Submit certification, including supporting calculations, from the manufacturer indicating conformance with the paragraph entitled "Specified Transformer Efficiencies."

SD-09 Manufacturer's Field Reports

Pad-mounted transformer design tests; G

Pad-mounted transformer routine and other tests; G

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5; G

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as specified herein.

SD-11 Closeout Submittals

Transformer test schedule; G

Submit report of test results as specified by paragraph entitled "Field Quality Control."

1.3.1 Reduced Submittal Requirements

Transformers designed and manufactured by ABB in Jefferson City, MO; by Cooper Power Systems in Waukesha, WI; by ERMCO in Dyersburg, TN; or by Howard Industries in Laurel, MS need not submit the entire submittal package requirements of this contract. Instead, the following items shall be submitted:

- a. A certification, signed by the manufacturer, stating that the technical requirements of this specification shall be met.
- b. An outline drawing of the transformer with devices identified (paragraph entitled "Pad-Mounted Transformer Drawings", item a).
- c. ANSI nameplate data of the transformer (paragraph entitled "Pad-Mounted Transformer Drawings", item b).
- e. Routine and other tests (in PART 2, see paragraph entitled "Source Quality Control", subparagraph entitled "Routine and Other Tests"), shall be conducted by the manufacturer and may be witnessed by the government. Provide transformer test schedule required by submittal item "SD-11 Closeout Submittals". Provide certified copies of the tests.
- f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".
- g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

1.4 QUALITY ASSURANCE

1.4.1 Pad-Mounted Transformer Drawings

Drawings shall indicate, but not be limited to the following:

- a. An outline drawing, with front, top, and side views.
- b. ANSI nameplate data.
- c. Elementary diagrams and wiring diagrams .
- d. One-line diagram, including switch(es).
- e. Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuses.

1.4.2 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.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 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. 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.

1.4.3.1 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 furnished.

1.4.3.2 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.

1.5 MAINTENANCE

1.5.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the

actual transformer(s) provided:

- a. An instruction manual with pertinent items and information highlighted
- b. An outline drawing, front, top, and side views
- c. Prices for spare parts and supply list
- d. Routine and field acceptance test reports
- e. Fuse curves for primary fuses
- g. Actual nameplate diagram
- h. Date of purchase

1.6 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 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.34, IEEE C57.12.28 and as specified herein.

2.2.1 Compartments

The high- and low-voltage compartments shall be separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment shall contain the incoming line, insulated high-voltage load-break connectors, bushing well inserts, six high-voltage bushing wells configured for loop feed application, load-break switch handle(s), access to oil-immersed bayonet fuses, dead-front surge arresters, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground pad.

- a. Insulated high-voltage load-break connectors: IEEE 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.
- c. Bushing well inserts: IEEE 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.

- d. One-piece bushings: IEEE 386, 200 amperes, 15 kV Class.
- e. Load-break switch

Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch shall be rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handles in the high-voltage compartment. Operation of switches shall be as follows:

ARRANGEMENT NO.	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION					
		LINE A SW.		LINE B SW		XFMR. SW	
		OPEN	CLOSE	OPEN	CLOSE	OPEN	CLOSE
1	Line A connected to Line B and both lines connected to transformer		X		X		X
2	Transformer connected to Line A only		X	X			X
3	Transformer connected to Line B only	X			X		X
4	Transformer open and loop closed		X		X	X	
5	Transformer open and loop open	X		X		X	

- f. Provide bayonet type, oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. Bayonet fuse links shall sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. In order to eliminate or minimize oil spills, the bayonet fuse assembly shall include an oil retention valve inside the housing which closes when the fuse holder is removed and an external drip shield. Warning shall be conspicuously displayed within the high-voltage compartment cautioning against removing or inserting fuses unless the load-break switch is in the open position and the tank pressure has been released.

Bayonet fuse assembly: 150 kV BIL.

Oil-immersed current-limiting fuses: IEEE C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified. Connect current-limiting fuses ahead of the radial-feed load-break switch.

- h. Surge arresters: **IEEE C62.11**, rated 9 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap. Provide six arresters for loop feed circuits.
- i. Parking stands: Provide a parking stand near each bushing. Provide insulated standoff bushings for parking of energized high-voltage connectors on parking stands.
- j. Protective caps: **IEEE 386**, 200 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushings.

2.2.1.2 Low Voltage

Low-voltage compartment shall contain low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

- a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator. Provide a removable 600V Volt rated secondary NEMA spade terminal insulating system to completely insulate and cover these exposed live parts within the secondary compartment.
- c. Metering: **NEMA/ANSI C12.10**. Provide a socket-mounted electronic programmable outdoor watt-hour meter, surface mounted flush against the side of the low-voltage compartment as indicated. Meter shall either be programmed at the factory or shall be programmed in the field. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. Meter shall be coordinated to system requirements.
 - 1. Design: Provide meter designed for use on a 3-phase, 4-wire, 208Y/120/480Y/277 volt system with 3 current transformers. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS)..
 - 2. Coordination: Provide meter coordinated with ratios of current transformers and transformer secondary voltage.
 - 3. Class: 20; Form: 9S; Accuracy: plus or minus 1.0 percent; Finish: Class II
 - 4. Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.
 - 5. Kilowatt-hour Register: five digit electronic programmable type
 - 6. Demand Register:
 - (a) Provide solid state
 - (b) Meter reading multiplier: Indicate multiplier on the meter face.
 - (c) Demand interval length: shall be programmed for 15 minutes with rolling demand up to six subintervals per interval.

7. Meter fusing: Provide a fuse block mounted in the secondary compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.
8. Socket: **ANSI C12.7**. Provide NEMA Type 3R, box-mounted socket having automatic circuit-closing bypass and having jaws compatible with requirements of the meter. Cover unused hub openings with blank hub plates. Paint box Munsell 7GY3.29/1.5 green to match the pad-mounted transformer to which the box-mounted socket is attached. The Munsell color notation is specified in **ASTM D1535**.
9. Current transformers: **IEEE C57.13**. Provide butyl-molded window type current transformers with 600-volt insulation, 10 kV BIL and mount on the low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables to permit current measurements to be taken with hook-on-ammeters. Provide three current transformers per power transformer.

2.2.2 Transformer

- a. Less-flammable liquid-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.
- b. Transformer shall be rated **as indicated on drawings**.
- c. Transformer voltage ratings: **as indicated on drawings**.
- d. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.
- e. Minimum tested percent impedance at 85 degrees C shall not be less than the following values:

2.50 for units rated 75kVA and below
2.87 for units rated 112.5kVA to 300kVA
4.03 for 500kVA rated units
5.32 for units rated 750kVA and above
- f. Audible sound levels shall comply with the following:

<u>kVA</u>	DECIBELS (MAX)
75	51
112.5	55
150	55
225	55
300	55

500	56
750	57
1000	58
1500	60
2000	61
2500	62

- g. Transformer shall include lifting lugs and provisions for jacking under base. The transformer base construction shall be suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed using 3 inch high yellow letters on its enclosure. The transformer shall have an insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

2.2.2.1 Specified Transformer Efficiencies

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. No-load losses (NLL) shall be referenced at 20 degrees C. Load losses (LL) shall be referenced at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. That table is based on requirements contained within 10 CFR 431, Subpart K.

<u>kVA</u>	<u>EFFICIENCY</u> (percent)
15	98.36
30	98.62
45	98.76
75	98.91
112.5	99.01
150	99.08
225	99.17
300	99.23
500	99.25
750	99.32
1000	99.36

1500	99.42
2000	99.46
2500	99.49
above 2500	99.50

2.2.3 Insulating Liquid

- a. Less-flammable transformer liquids: [NFPA 70](#) and [FM APP GUIDE](#) for less-flammable liquids having a fire point not less than 300 degrees C tested per [ASTM D92](#) and a dielectric strength not less than 33 kV tested per [ASTM D877/D877M](#). Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

The fluid shall be a biodegradable electrical insulating and cooling liquid classified by UL and approved by FM as "less flammable" fluids. The fluid shall meet the following fluid properties:

1. Pour point: [ASTM D97](#), less than -15 degree C
 2. Aquatic biodegradation: [EPA 712-C-98-075](#), 100 percent
 3. Trout toxicity: [OECD Test 203](#), zero mortality of [EPA 821-R-02-012](#), pass
- b. Mineral oil: [ASTM D3487](#), Type II, tested in accordance with [ASTM D117](#). Provide identification of transformer as "non-PCB" and "Type II mineral oil" on the nameplate.

2.2.3.1 Liquid-Filled Transformer Nameplates

Distribution transformers shall be provided with nameplate information in accordance with [IEEE C57.12.00](#) and as modified or supplemented by this section.

2.2.4 Corrosion Protection

Bases and cabinets of transformers shall be corrosion resistant and shall be fabricated of stainless steel conforming to [ASTM A240/A240M](#), Type 304 or 304L. Base shall include any part of pad-mounted transformer that is within [3 inches](#) of concrete pad.

Paint entire transformer assembly Munsell 7GY3.29/1.5 green. Paint coating system shall comply with [IEEE C57.12.28](#) and [IEEE C57.12.29](#) regardless of base, cabinet, and tank material. The Munsell color notation is specified in [ASTM D1535](#).

2.3 WARNING SIGNS

Provide warning signs for the enclosures of pad-mounted transformers having a nominal rating exceeding 600 volts.

- a. When the enclosure integrity of such equipment is specified to be in accordance with [IEEE C57.12.28](#), such as for pad-mounted transformers, provide self-adhesive warning signs on the outside of the high voltage compartment door(s). Sign shall be a decal and shall have nominal

dimensions of 7 by 10 inches with the legend "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background. Decal shall be Panduit No. PPS0710D72 or approved equal.

2.4 Arc Flash Warning Label

Provide warning label for the enclosure of pad-mounted transformers. Locate this self-adhesive warning label on the outside of the high voltage compartment door warning of potential electrical arc flash hazards and appropriate PPE required. The label format shall be as indicated.

2.5 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 CAST-IN-PLACE CONCRETE

Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.7 SOURCE QUALITY CONTROL

2.7.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.
4. Dated calibration labels shall be visible on all test equipment.
5. Calibrating standard shall be of higher accuracy than that of the instrument tested.
6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

- (a) Maintain up-to-date instrument calibration instructions and

procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.7.2 Design Tests

IEEE C57.12.00 states that "design tests are made only on representative apparatus to substantiate the ratings assigned to all other apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for each of the specified transformer(s). Design tests shall have been performed in accordance with IEEE C57.12.90 prior to the award of this contract.

- a. Tests shall be certified and signed by a registered professional engineer.
- b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (ONAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.
- c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include the primary windings only of that transformer.
 1. IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.
 2. State test voltage levels.
 3. Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.
- d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with IEEE C57.12.34.
- e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.
- f. Short circuit: "Basically the same design" for the short circuit test means a pad-mounted transformer with the same kVA as the transformer specified.

2.7.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests shall be performed in accordance with IEEE C57.12.90 by the manufacturer on each of the actual transformer(s) prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project

site. Required tests and testing sequence shall be as follows:

- a. Phase relation
- b. Ratio
- c. No-load losses (NLL) and excitation current
- d. Load losses (LL) and impedance voltage
- e. Dielectric
 1. Impulse
 2. Applied voltage
 3. Induced voltage
- f. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to **IEEE C2**, **NFPA 70**, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and **IEEE C2**, except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section **33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION**. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in Section **33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION**.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Meters and Current Transformers

ANSI C12.1.

3.4 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab. Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade shall have 1/2 inch chamfer. Slab shall be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.6.1 Cast-In-Place Concrete

Cast-in-place concrete work shall conform to the requirements of ACI 318M.

3.6.2 Sealing

When the installation is complete, the Contractor shall seal all entries into the equipment enclosure with an approved sealing method. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7 FIELD QUALITY CONTROL

3.7.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.7.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved

shop drawings.

2. Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.
3. Inspect anchorage, alignment, and grounding.
4. Verify the presence of PCB content labeling.
5. Verify the bushings and transformer interiors are clean.
6. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
7. Verify correct liquid level in tanks and bushings.
8. Verify that positive pressure is maintained on gas-blanketed transformers.
9. Perform specific inspections and mechanical tests as recommended by manufacturer.
10. Verify de-energized tap changer position is left as specified.
11. Verify the presence of transformer surge arresters.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter.
2. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.
3. Perform insulation-resistance tests, winding-to-winding and each winding-to-ground. Calculate polarization index.
4. Perform turns-ratio tests at all tap positions.
5. Perform insulation power-factor or dissipation-factor tests on all windings in accordance with test equipment manufacturer's published data.
6. Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap. In the absence of a power-factor/capacitance tap, perform hot-collar tests.
7. Measure the resistance of each high-voltage winding in each de-energized tap-changer position. Measure the resistance of each low-voltage winding in each de-energized tap-changer position, if applicable.
8. Remove and test a sample of insulating liquid for the following: Dielectric breakdown voltage, Acid neutralization number, Specific gravity, Interfacial tension, Color, Visual Condition, Water in insulating liquids (Required on 25 kV or higher voltages and on

all silicone-filled units.), and Power factor or dissipation factor.

9. Perform dissolved-gas analysis (DGA) on a sample of insulating liquid.

3.7.1.2 Current Transformers

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Verify correct connection.
4. Verify that adequate clearances exist between primary and secondary circuit wiring.
5. Verify the unit is clean.
6. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
7. Verify that all required grounding and shorting connections provide good contact.
8. Verify correct operation of transformer withdrawal mechanism and grounding operation.
9. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
2. Perform insulation-resistance test of each current transformer and its secondary wiring.
3. Perform a polarity test of each current transformer.
4. Perform a ratio-verification test.

3.7.1.3 Watthour Meter

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Verify tightness of electrical connections.

b. Electrical tests

1. Calibrate watt-hour meters according to manufacturer's published data.
2. Verify that correct multiplier has been placed on face of meter, where applicable.
3. Verify that current transformer secondary circuits are intact.

3.7.1.4 Grounding System

a. Visual and mechanical inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

1. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.
2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.7.1.5 Surge Arresters, Medium- and High-Voltage

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Inspect anchorage, alignment, grounding, and clearances.
4. Verify the arresters are clean.
5. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
6. Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
2. Perform an insulation-resistance test on each arrester, phase terminal-to-ground.
3. Test grounding connection.

3.7.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

This page is intentionally left blank.

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

02/14

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 B1 (2013) Standard Specification for Hard-Drawn Copper Wire
- ASTM B8 (2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM D709 (2016) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
- IEEE 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

- NETA ATS (2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C80.1 (2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
- ANSI C80.3 (2005) American National Standard for Electrical Metallic Tubing (EMT)
- ANSI C80.5 (2005) American National Standard for Electrical Rigid Aluminum Conduit
- NEMA 250 (2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA FU 1 (2012) Low Voltage Cartridge Fuses

NEMA ICS 1 (2000; R 2015) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 6 (1993; R 2016) Industrial Control and Systems: Enclosures

NEMA KS 1 (2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)

NEMA ST 20 (1992; R 1997) Standard for Dry-Type Transformers for General Applications

NEMA TP 1 (2002) Guide for Determining Energy Efficiency for Distribution Transformers

NEMA VE 1 (2009) Standard for Metal Cable Tray Systems

NEMA WD 1 (1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices

NEMA WD 6 (2012) Wiring Devices Dimensions Specifications

NEMA Z535.4 (2011) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code

NFPA 70E (2015; ERTA 1 2015) Standard for Electrical Safety in the Workplace

NFPA 780 (2014) Standard for the Installation of Lightning Protection Systems

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-569 (2015d) Commercial Building Standard for Telecommunications Pathways and Spaces

TIA-607 (2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

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

29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1 (2005; Reprint Jul 2012) Standard for Flexible Metal Conduit

UL 1283	(2015) Electromagnetic Interference Filters
UL 1449	(2014; Reprint Mar 2015) Surge Protective Devices
UL 1561	(2011; Reprint Dec 2014) Dry-Type General Purpose and Power Transformers
UL 198M	(2003; Reprint Feb 2013) Standard for Mine-Duty Fuses
UL 20	(2010; Reprint Feb 2012) General-Use Snap Switches
UL 4248-1	(2007; Reprint Oct 2013) UL Standard for Safety Fuseholders - Part 1: General Requirements
UL 4248-12	(2007; Reprint Dec 2012) UL Standard for Safety Fuseholders - Part 12: Class R
UL 467	(2007) Grounding and Bonding Equipment
UL 486A-486B	(2013; Reprint Feb 2014) Wire Connectors
UL 486C	(2013; Reprint Feb 2014) Splicing Wire Connectors
UL 489	(2013; Reprint Mar 2014) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 498	(2012; Reprint Oct 2014) Attachment Plugs and Receptacles
UL 50	(2007; Reprint Apr 2012) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 510	(2005; Reprint Jul 2013) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013) Metallic Outlet Boxes
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Dec 2014) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 67	(2009; Reprint Apr 2015) Standard for Panelboards

UL 6A	(2008; Reprint Nov 2014) Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel
UL 797	(2007; Reprint Dec 2012) Electrical Metallic Tubing -- Steel
UL 83	(2014) Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Reprint Nov 2014) Standard for Service-Entrance Cables
UL 869A	(2006) Reference Standard for Service Equipment
UL 943	(2006; Reprint Jun 2012) Ground-Fault Circuit-Interrupters

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.

SD-02 Shop Drawings

Panelboards; G

Transformers; GCable trays; G

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. Identify circuit terminals on wiring diagrams and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate on the drawings adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Marking strips drawings; G

SD-03 Product Data

Receptacles; G

Circuit breakers; G

Switches; G

Transformers; G

Enclosed circuit breakers; G

Manual motor starters; G

Telecommunications Grounding Busbar; G

Surge protective devices; G

Include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test; G

Grounding system test; G

Transformer tests; G

Ground-fault receptacle test; G

SD-07 Certificates

Fuses; G

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" or "must" 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. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

- a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.
- b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
- c. Where two or more items of the same class of equipment are required, provide 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.

1.4.3.1 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 furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 WARRANTY

Provide equipment items supported by service organizations that 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

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment, and devices.

2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

2.2.2 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.3 Flexible Metal Conduit

UL 1.

2.2.4 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.4.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.4.2 Fittings for EMT

Steelcompression type.

2.3 CABLE TRAYS

NEMA VE 1. Provide the following:

- a. Cable trays: form a wireway system, with a nominal depth as indicated.
- b. Cable trays: constructed of aluminum.
- c. Cable trays: include splice and end plates, dropouts, and miscellaneous hardware.
- d. Edges, fittings, and hardware: finished free from burrs and sharp edges.
- e. Fittings: ensure not less than load-carrying ability of straight tray sections and have manufacturer's minimum standard radius.

Radius of bends: as indicated.

2.3.1 Basket-Type Cable Trays

Provide size as indicated with maximum wire mesh spacing of 2 by 4 inch.

2.3.2 Trough-Type Cable Trays

Provide size as indicated.

2.3.3 Ladder-Type Cable Trays

Provide size as indicated with maximum rung spacing of 6 inches.

2.4 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. **UL 514C**, if nonmetallic.

2.4.1 Floor Outlet Boxes

Provide the following:

- a. Boxes: nonadjustable and concrete tight.
- b. Each outlet: consisting of cast-metal body with threaded openings, or sheet-steel body with knockouts for conduits, ring, and cover plate with 2 1/8 inch threaded plug. See drawings for more information.
- c. Telecommunications outlets: consisting of flush, aluminum or stainless steel housing with a receptacle as specified..
- d. Receptacle outlets: consisting of flush aluminum or stainless steel housing with duplex-type receptacle as specified herein.
- e. Provide gaskets where necessary to ensure watertight installation.

2.5 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.6 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

2.6.1 Conductors

Provide the following:

- a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.
- b. Conductors No. 8 AWG and larger diameter: stranded.
- c. Conductors No. 10 AWG and smaller diameter: solid.
- d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: stranded unless specifically indicated otherwise.
- e. All conductors: copper. Conductors indicated to be No. 6 AWG or smaller diameter: copper. Conductors indicated to be No. 4 AWG and larger diameter: either copper or aluminum, unless type of conductor material is specifically indicated, or specified, or required by equipment manufacturer.

2.6.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

2.6.1.2 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

- a. Branch circuits: No. 12 AWG.
- b. Class 1 remote-control and signal circuits: No. 14 AWG.
- c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.
- d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22 AWG.

2.6.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.6.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

- a. Grounding conductors: Green.
- b. Neutral conductors: White.
- c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

2.6.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

- a. 208/120 volt, three-phase
 - (1) Phase A - black
 - (2) Phase B - red
 - (3) Phase C - blue
- b. 480/277 volt, three-phase
 - (1) Phase A - brown
 - (2) Phase B - orange
 - (3) Phase C - yellow
- c. 120/240 volt, single phase: Black and red

2.6.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type THWN/THHN conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.6.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.6.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

2.7 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires: insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing

connector). Provide solderless terminal lugs on stranded conductors.

2.8 DEVICE PLATES

Provide the following:

- a. UL listed, one-piece device plates for outlets to suit the devices installed.
- b. For metal outlet boxes, plates on unfinished walls: zinc-coated sheet steel or cast metal having round or beveled edges.
- c. For nonmetallic boxes and fittings, other suitable plates may be provided.
- d. Plates on finished walls: nylon or lexan, minimum 0.03 inch wall thickness and same color as receptacle or toggle switch with which they are mounted.
- f. Screws: machine-type with countersunk heads in color to match finish of plate.
- g. Sectional type device plates are not be permitted.
- h. Plates installed in wet locations: gasketed and UL listed for "wet locations."

2.9 SWITCHES

2.9.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Include the following:

- a. Handles: thermoplastic.
- b. Wiring terminals: screw-type, side-wired or of the solderless pressure type having suitable conductor-release arrangement.
- c. Contacts: silver-cadmium and contact arm - one-piece copper alloy.
- d. Switches: rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.9.2 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in NEMA 1 or 3R, enclosure as indicated per NEMA ICS 6.

2.10 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective

devices for proper operation. Submit coordination data for approval.
Provide fuses with a voltage rating not less than circuit voltage.

2.10.1 Fuseholders

Provide in accordance with [UL 4248-1](#).

2.10.2 Cartridge Fuses, Current Limiting Type (Class R)

[UL 198M](#), Class RK-1. Provide only Class R associated fuseholders in accordance with [UL 4248-12](#).

2.10.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

[UL 198M](#), Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.10.4 Cartridge Fuses, Current Limiting Type (Class T)

[UL 198M](#), Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.11 [RECEPTACLES](#)

Provide the following:

- a. [UL 498](#), hard use (also designated heavy-duty), grounding-type.
- b. Ratings and configurations: as indicated.
- c. Bodies: as per [NEMA WD 1](#).
- d. Face and body: thermoplastic supported on a metal mounting strap.
- e. Dimensional requirements: per [NEMA WD 6](#).
- f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.
- g. Grounding pole connected to mounting strap.
- h. The receptacle: containing triple-wire power contacts and double or triple-wire ground contacts.

2.11.1 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations". Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, die-cast metal/aluminum cover plate.

2.11.2 Ground-Fault Circuit Interrupter Receptacles

[UL 943](#), duplex type for mounting in standard outlet box. Provide device capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of [UL 943](#) for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.12 PANELBOARDS

Provide panelboards in accordance with the following:

- a. UL 67 and UL 50 having a short-circuit current rating as indicated.
- b. Panelboards for use as service disconnecting means: additionally conform to UL 869A.
- c. Panelboards: circuit breaker-equipped.
- d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.
- e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings.
- f. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise.
- g. Main breaker: "separately" mounted "below" branch breakers.
- h. Where "space only" is indicated, make provisions for future installation of breakers.
- i. Directories: indicate load served by each circuit in panelboard.
- j. Directories: indicate source of service to panelboard (e.g., Panel PA served from Panel MDP).
- l. Type directories and mount in holder behind transparent protective covering.
- m. Panelboards: listed and labeled for their intended use.
- n. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.12.1 Enclosure

Provide panelboard enclosure in accordance with the following:

- a. UL 50.
- b. Cabinets mounted outdoors or flush-mounted: hot-dipped galvanized after fabrication.
- c. Cabinets: painted in accordance with paragraph PAINTING.
- d. Outdoor cabinets: NEMA 3R raintight.
- e. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.
- f. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.

- g. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a [1/2 inch](#) clear space between the back of the cabinet and the wall surface.
- h. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.
- i. Each door: fitted with a combined catch and lock, except that doors over [24 inches](#) long provided with a three-point latch having a knob with a T-handle, and a cylinder lock.
- j. Keys: two provided with each lock, with all locks keyed alike.
- k. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

2.12.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per [UL 67](#) for connecting grounding conductors; bond to steel cabinet.

2.12.2.1 Panelboard Neutrals for Non-Linear Loads

Provide in accordance with the following:.

- a. UL listed, with panelboard type specifically UL heat rise tested for use on non-linear loads.
- b. Panelboard: heat rise tested in accordance with [UL 67](#), except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing.
- c. Verification of the testing procedure: provided upon request.
- d. Two neutral assemblies paralleled together with cable is not acceptable.
- e. Nameplates for panelboard rated for use on non-linear loads: marked "SUITABLE FOR NON-LINEAR LOADS" and in accordance with paragraph FIELD FABRICATED NAMEPLATES.
- f. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.12.3 [Circuit Breakers](#)

[UL 489](#), thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Where indicated on the drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.12.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.12.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater per requirements of UL 943 for Class A ground-fault circuit interrupter.

2.12.3.3 Circuit Breakers for HVAC Equipment

Provide circuit breakers for HVAC equipment having motors (group or individual) marked for use with HACR type and UL listed as HACR type.

2.13 ENCLOSED CIRCUIT BREAKERS

UL 489. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated. Provide solid neutral.

2.14 TRANSFORMERS

Provide transformers in accordance with the following:

- a. NEMA ST 20, general purpose, dry-type, self-cooled, ventilated.
- b. Provide transformers in NEMA 1 enclosure.
- c. Transformer insulation system:
 - (1) 220 degrees C insulation system for transformers 15 kVA and greater, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C.
 - (2) 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 115 degrees C under full-rated load in maximum ambient of 40 degrees C.
- e. Transformer of 115 degrees C temperature rise: capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

2.14.1 Specified Transformer Efficiency

Transformers, indicated and specified with: 480V primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, energy efficient type. Minimum efficiency, based on factory test results: not be less than NEMA Class 1 efficiency as defined by NEMA TP 1.

2.14.2 Transformers With Non-Linear Loads

Provide transformers for non-linear loads in accordance with the following:

- a. Transformer insulation: UL recognized 220 degrees C system. Neither the primary nor the secondary temperature is allowed to exceed 220 degrees C at any point in the coils while carrying their full rating of non-sinusoidal load.
- b. Transformers are to be UL listed and labeled for K-4 in accordance with [UL 1561](#).
- c. Transformers evaluated by the UL K-Factor evaluation: listed for 115 degrees C average temperature rise only.
- d. Transformers with K-Factor ratings with temperature rise of 150 degrees C rise are not acceptable.
- e. K-Factor rated transformers impedance: allowed range of 3 percent to 5 percent, with a minimum reactance of 2 percent to prevent excessive neutral current when supplying loads with large amounts of third harmonic.

2.15 [MANUAL MOTOR STARTERS](#) (MOTOR RATED SWITCHES)

Single pole designed for surface mounting with overload protection.

2.16 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with [29 CFR 1910.147](#). Comply with requirements of Division 23, "Mechanical" for mechanical isolation of machines and other equipment.

2.17 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires cable trays, and other accessories for telecommunications outlets and pathway in accordance with [TIA-569](#) and as specified herein. Additional telecommunications requirements are specified in Section [27 10 00](#), BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.18 GROUNDING AND BONDING EQUIPMENT

2.18.1 Ground Rods

[UL 467](#). Ground rods: copper-clad steel, with minimum diameter of [3/4 inch](#) and minimum length [10 feet](#). Sectional ground rods are permitted.

2.18.2 Ground Bus

Copper ground bus: provided in the electrical equipment rooms as indicated.

2.18.3 Telecommunications [Grounding Busbar](#)

Provide corrosion-resistant grounding busbar suitable for indoor installation in accordance with [TIA-607](#). Busbars: plated for reduced contact resistance. If not plated, clean the busbar prior to fastening the

conductors to the busbar and apply an anti-oxidant to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility and a (TGB) in all other telecommunications rooms and equipment rooms. The telecommunications main grounding busbar (TMGB) and the telecommunications grounding busbar (TGB): sized in accordance with the immediate application requirements and with consideration of future growth. Provide telecommunications grounding busbars with the following:

- a. Predrilled copper busbar provided with holes for use with standard sized lugs,
- b. Minimum dimensions of 0.25 in thick by 4 in wide for the TMGB and 2 in wide for TGBs with length as indicated;
- c. Listed by a nationally recognized testing laboratory.

2.19 MANUFACTURER'S NAMEPLATE

Provide on each item of equipment 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.

2.20 FIELD FABRICATED NAMEPLATES

Provide field fabricated nameplates in accordance with the following:

- a. ASTM D709.
- b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.
- c. Each nameplate inscription: identify the function and, when applicable, the position.
- d. Nameplates: melamine plastic, 0.125 inch thick, white with black center core.
- f. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.
- g. Minimum size of nameplates: one by 2.5 inches.
- h. Lettering size and style: a minimum of 0.25 inch high normal block style.

2.21 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.22 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTOPPING .

2.23 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance . Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

- Phase to phase (L-L)
- Each phase to neutral (L-N)
- Neutral to ground (N-G)
- Phase to ground (L-G)

FOR DELTA CONNECTIONS-

- Phase to phase (L-L)
- Phase to ground (L-G)

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs per NFPA 780 for the lightning protection system.

Maximum L-N, L-G, and N-G Voltage Protection Rating:

600V for 208Y/120V, three phase system

Maximum L-L Voltage Protection Rating:

1,200V for 208Y/120V, three phase system

Provide SPDs. Maximum L-N, L-G, and N-G Voltage Protection Rating:

700V for 208Y/120V, three phase system

Maximum L-L Voltage Protection Rating:

1,200V for 208Y/120V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120% of nominal voltage for 240 volts and below; 115% of nominal voltage above 240 volts to 480 volts.

Provide EMI/RFI filtering per [UL 1283](#) for each mode with the capability to attenuate high frequency noise. Minimum attenuation: 20db.

2.24 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

- a. [NEMA 250](#) corrosion-resistance test and the additional requirements as specified herein.
- b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.
- c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.
- d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.
- e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.
- f. Equipment located indoors: ANSI Light Gray,.
- g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of [NFPA 70](#) and [IEEE C2](#) and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by [NFPA 70](#), label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least [0.25 inch](#) in height, and engrave on black-on-white

matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

3.1.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors in accordance with Section 07 84 00, FIRESTOPPING.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Restrictions Applicable to EMT

- a. Do not install underground.
- b. Do not encase in concrete, mortar, grout, or other cementitious materials.
- c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
- d. Do not use in hazardous areas.
- e. Do not use outdoors.
- f. Do not use in fire pump rooms.
- g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40
Plastic coating: extend minimum 6 inches above floor.

3.1.4.3 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab.

3.1.4.4 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.5 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.6 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.7 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of

conduits, and provide insulating type where required by NFPA 70.

3.1.4.8 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to 7 feet above floors and walkways, and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixtures for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems: minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets: a minimum of 4 11/16 inches square by 2 1/8 inches deep, except for wall mounted telephones. Mount outlet boxes flush in finished walls.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened

covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Wall-mounted telecommunications outlets: mounted at height 60 inches above finished floor. Mount other devices as indicated. Measure mounting heights of receptacle outlet boxes to the bottom of the outlet box.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations. Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.

3.1.7.1 Marking Strips

Provide marking strips in accordance with the following:

- a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.
- b. Use permanent ink for the wire numbers
- c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.
- d. Size marking strips to accommodate the two sets of wire numbers.
- e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.
- f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.
- g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.11 Grounding and Bonding

Provide in accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems.

Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70.

Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system. In addition to the requirements specified herein, provide telecommunications grounding in accordance with TIA-607. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.11.1 Ground Rods

Provide cone pointed ground rods. Measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained with a single rod, additional rods, spaced on center, not less than twice the distance of the length of the rod, . If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.11.2 Grounding Connections

Make grounding connections which are buried or otherwise normally

inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.11.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment.

3.1.11.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.12 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

3.1.13 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet.

3.2 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.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces

or to meet the indicated or specified safety criteria.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

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

3.5.2 600-Volt Wiring Test

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 approximately 500 volts to provide direct reading of resistance. Minimum resistance: 250,000 ohms.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in **NETA ATS**. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

This page is intentionally left blank.

SECTION 26 27 14.00 20

ELECTRICITY METERING

02/11

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.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C2 (2017; Errata 1-2 2017; INT 1 2017)
National Electrical Safety Code
- IEEE C37.90.1 (2012) Standard for Surge Withstand
Capability (SWC) Tests for Relays and
Relay Systems Associated with Electric
Power Apparatus
- IEEE C57.13 (2008; INT 2009) Standard Requirements for
Instrument Transformers
- IEEE Stds Dictionary (2009) IEEE Standards Dictionary: Glossary
of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

- NETA ATS (2013) Standard for Acceptance Testing
Specifications for Electrical Power
Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

- IEC 60687 (1992) Alternating Current Static
Watt-Hour Meters for Active Energy
(Classes 0,2 S and 0,5 S)
- IEC 62053-22 (2003; ED 1.0) Electricity Metering
Equipment (a.c.) - Particular Requirements
- Part 22: Static Meters for Active Energy
(Classes 0,2 S and 0,5 S)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C12.1 (2008) Electric Meters Code for
Electricity Metering
- ANSI C12.18 (2006) Protocol Specification for ANSI
Type 2 Optical Port
- ANSI C12.20 (2010) Electricity Meters - 0.2 and 0.5
Accuracy Classes
- ANSI C12.7 (2014) Requirements for Watthour Meter

Sockets

NEMA C12.19

(2012) Utility Industry End Device Data
Tables

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Stds Dictionary.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

SD-03 Product Data

Electricity meters; G

Current transformer; G

Potential transformer; G

External communications devices; G

SD-06 Test Reports

Acceptance checks and tests; G

System functional verification; G

Building meter installation sheet, per building; G

Completed meter installation schedule; G

Completed meter data schedule; G

Meter configuration template; G

Contractor shall fill in the meter configuration template and submit to the Activity for concurrence.

Meter configuration report; G

The meter configuration report shall be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Electricity Meters and Accessories, Data Package 5; G

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

System functional verification; G

1.4 QUALITY ASSURANCE

1.4.1 Installation Drawings

Drawings shall be provided in hard-copy and electronic format, and shall include but not be limited to the following:

- a. Wiring diagrams with terminals identified of advanced meter, current transformers, potential transformers, protocol modules, communications interfaces, Ethernet connections, telephone lines. For each typical meter installation, provide a diagram.
- b. One-line diagram, including meters, switch(es), current transformers, potential transformers, protocol modules, communications interfaces, Ethernet connections, telephone outlets, and fuses. For each typical meter installation, provide a diagram.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 1 year prior to bid opening. The 1-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product, or an earlier release of the product, shall have been on sale on the commercial market through advertisements, manufacturers catalogs, or brochures during the prior 1-year period. 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.

1.4.3 Material and Equipment Manufacturing Data

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

1.5.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual electricity meters and accessories provided:

- a. A condensed description of how the system operates

- b. Block diagram indicating major assemblies
- c. Troubleshooting information
- d. Preventive maintenance
- e. Prices for spare parts and supply list

1.6 WARRANTY

The equipment items and software shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment and software on a regular and emergency basis during the warranty period of the contract.

1.7 SYSTEM DESCRIPTION

1.7.1 System Requirements

Electricity metering, consisting of meters and associated equipment, will be used to record the electricity consumption and other values as described in the requirements that follow and as shown on the drawings. Communication system requirements are contained in a separate specification section as identified in paragraph entitled "Communications Interfaces".

1.7.2 Selection Criteria

Metering components and software are part of a system that includes the physical meter, data recorder function and communications method. Every building site identified shall include sufficient metering components to measure the electrical parameters identified and to store and communicate the values as required.

Contractor shall verify that the electricity meter installed on any building site is compatible with the base-wide metering system with respect to the types of meters selected and the method used to program the meters for initial use. Software and meter programming tools are necessary to set up the meters described by this specification. New software tools different from the meter programming methods currently used by base personnel will require separate approval for use.

PART 2 PRODUCTS

2.1 ELECTRICITY METERS AND ACCESSORIES

Provide meter(s) and connect the meter(s) to the existing AMI DAS. The contractor shall use the existing government laptop computers to configure the meter using existing software loaded on the computer. The contractor will not be allowed to modify any software or add any additional software to the computer. Alternatively, the government will configure the meter(s), which must be compatible with the existing system, using existing software. Contract shall insure that the meter(s) will transmit the specified data to the DAS.

2.1.1.1 Physical and Common Requirements

- a. Provide metering system components in accordance with the Metering System Schedule to comply with base standards. Provide Meter configuration template.
- b.
- c. Meter shall have NEMA 3R enclosure for surface mounting with bottom or rear penetrations.
- d. Surge withstand capability shall conform to IEEE C37.90.1.
- e. Use #12 SIS (XHHW, or equivalent) wiring with ring lugs for all meter connections. Color code and mark the conductors as follows:
 - (1) Red - Phase A CT - C1
 - (2) Orange - Phase B CT - C2
 - (3) Brown - Phase C CT - C3
 - (4) Gray with white stripe - neutral current return - C0
 - (5) Black - Phase A voltage - V1
 - (6) Yellow - Phase B voltage - V2
 - (7) Blue - Phase C voltage - V3
 - (8) White - Neutral voltage

2.1.1.2 Potential Transformer Requirements

- a. Meter shall be capable of connection to the service voltage phases and magnitude being monitored. If the meter is not rated for the service voltage, provide suitable potential transformers to send an acceptable voltage to the meter.
- b. Voltage input shall be optically isolated to 2500 volts DC from signal and communications outputs. Components shall meet or exceed IEEE C37.90.1.
- c. Provide a pull-out type fuse block containing one fuse per phase, Class RK type, to protect the voltage input to the meter. Size fuses as recommended by the meter manufacturer. Fusing shall either be inside the secondary compartment of the transformer or inside the same enclosure as the CT shorting device.
- d. Potential transformers will be used to convert 480 volt inputs to 120 volts for the locations shown on the metering schedule. Potential transformers shall be rated indoor or outdoor, as required for the specific application. Voltage rating shall provide 120 volts, wye-connected, 3 phase, 4 wire, 60 Hz, insulation class, 600 volts. Potential transformers BIL shall be 10 kV and shall have an accuracy class of 0.3 at burdens w, x, and y. Thermal rating shall be 500 VA.
- e. The Contractor shall be responsible for determining the actual voltage ratio of each potential transformer for medium voltage applications. Transformer shall conform to IEEE C57.13 and the following requirements.
 - (1) Type: Dry type, of two-winding construction.
 - (2) Weather: Outdoor or indoor rated for the application.

(3) Frequency: Nominal 60 Hz.

(4) Accuracy: Plus or minus 0.3 percent at 60 Hz.

- f. Potential transformers installed inside switchgear and panels shall be rated for interior use. Voltage rating shall provide 120 volts, wye-connected, 3 phase, 4 wire, 60 Hz, insulation class, 600 volts. Potential transformers BIL shall be a minimum of 10 kV, and have an insulation class and BIL rating that equals or exceeds the ratings of the associated switchgear. Potential transformers shall have an accuracy class of 0.3 at burdens w, x, and y. Thermal rating shall be 500 VA. Potential transformers shall be accessed from the front and mounted in a metering section.

2.1.3 Current Transformer Requirements

- a. Current transformer shall be installed with a rating as shown in the schedule.
- b. Current transformers shall have an Accuracy Class of 0.3 (with a maximum error of plus/minus 0.3 percent at 5.0 amperes) when operating within the specified rating factor.
- c. Current transformers shall be solid-core, bracket-mounted for new installations using ring-tongue lugs for electrical connections. Current transformers shall be accessible and the associated wiring shall be installed in an organized and neat workmanship arrangement. Current transformers that are retrofitted onto existing switchgear busbar can be a busbar split-core design.
- d. Current transformers shall have:
- (1) Insulation Class: All 600 volt and below current transformers shall be rated 10 KV BIL.
 - (2) Frequency: Nominal 60 Hz.
 - (3) Burden: Burden class shall be selected for the load.
 - (4) Phase Angle Range: 0 to 60 degrees.
- e. Meter shall accept current input from standard instrument transformers (5A secondary current transformers).
- f. Current inputs shall have a continuous rating in accordance with IEEE C57.13.
- g. Provide one single-ratio current transformer for each phase per power transformer with characteristics listed in the following table.

Single-Ratio Current Transformer Characteristics				
kVA	Sec. Volt	CT Ratio	RF	Meter Acc. Class
500	208Y/120	1200/5	1.33	0.3 thru B0.05

Single-Ratio Current Transformer Characteristics				
kVA	Sec. Volt	CT Ratio	RF	Meter Acc. Class
750	480Y/277	800/5	1.33	0.3 thru B0.05

2.1.1.4 Meter Requirements

Electricity meters shall include the following features:

- a. Meter shall comply with ANSI C12.1, NEMA C12.19, and ANSI C12.20.
- b. Meter sockets shall comply with ANSI C12.7.
- c. Meter shall comply with IEC 62053-22, certified by a qualified third party test laboratory.
- d. Meter shall comply with IEC 60687 certified by a qualified 3rd party test laboratory.
- e. Provide socket-mounted or panel mounted meters as indicated on the meter schedule.
- f. Meter shall be a Class 20, transformer rated design.
- g.
- h. Meter shall be rated for use at temperature from minus 40 degrees Centigrade to plus 70 degrees Centigrade.
- i. The meters shall have an electronic demand recording register and shall be secondary reading as indicated. The register shall be used to indicate maximum kilowatt demand as well as cumulative or continuously cumulative demand. Demand shall be measured on a block-interval basis and shall be capable of a 5 to 60 minute interval and initially set to a 15-minute interval. It shall have provisions to be programmed to calculate demand on a rolling interval basis. Meter readings shall be true RMS.
- j. The meter electronic register shall be of modular design with non-volatile data storage. Downloading meter stored data shall be capable via an optical port. Recording capability of data storage with a minimum capability of 89 days of 15 minute, 2 channel interval data. The meter shall be capable of providing at least 2 KYZ pulse outputs (dry contacts). Default initial configuration (unless identified otherwise by base personnel) shall be:
 - (1) First channel - kWh
 - (2) Second channel - kVARh
 - (3) KYZ output #1 - kWh
 - (4) KYZ output #2 - kVARh
- k. All meters shall have identical features available in accordance with this specification. The meter schedule identifies which features shall

be activated at each meter location.

- l. Enable switches for Time of Use (TOU), pulse and load profile measurement module at the factory.
- m. Meter shall have an optical port on front of meter capable of speeds from 9600 to a minimum of 19.2k baud, and shall be initially set at 9600 baud. Optical device shall be compatible with ANSI C12.18.
- n. Meters shall be 120-480 volts auto ranging.
- o. Provide blank tag fixed to the meter faceplate for the addition of the meter multiplier, which will be the product of the current transformer and potential transformer ratio and will be filled in by base personnel on the job site. The meter's nameplate shall include:
 - (1) Meter ID number.
 - (2) Rated voltage.
 - (3) Current class.
 - (4) Metering form.
 - (5) Test amperes.
 - (6) Frequency.
 - (7) Catalog number.
 - (8) Manufacturing date.
- p. On switchboard style installations, provide switchboard case with disconnect means for meter removal incorporating short-circuiting of current transformer circuits.
- q. Meter covers shall be polycarbonate resins with an optical port and reset. Backup battery shall be easily accessible for change-out after removing the meter cover.
- r. The normal billing data scroll shall be fully programmable. Data scroll display shall include the following.
 - (1) Number of demand resets.
 - (2) End-of-interval indication.
 - (3) Maximum demand.
 - (4) New maximum demand indication.
 - (5) Cumulative or continuously cumulative.
 - (6) Time remaining in interval.
 - (7) Kilowatt hours.
- s. The register shall incorporate a built-in test mode that allows it to be tested without the loss of any data or parameters. The following quantities shall be available for display in the test mode:
 - (1) Present interval's accumulating demand.
 - (2) Maximum demand.
 - (3) Number of impulses being received by the register.
- t. Pulse module simple I/O board with programmable ratio selection.
- u. Meters shall be programmed after installation via an optical port. Optical display shall show TOU data, peak kWh, semi-peak kWh, off peak kWh, and phase angles.
- v. Self-monitoring to provide for:

- (1) Unprogrammed register.
 - (2) RAM checksum error.
 - (3) ROM checksum error.
 - (4) Hardware failure.
 - (5) Memory failure.
 - (6) EPROM error.
 - (7) Battery status (fault, condition, or time in service).
- w. Liquid crystal alphanumeric displays, 9 digits, blinking squares confirm register operation. 6 Large digits for data and smaller digits for display identifier.
- x. Display operations, programmable sequence with display identifiers. Display identifiers shall be selectable for each item. Continually sequence with time selectable for each item.
- y. The meters shall support three modes of registers: Normal Mode, Alternate Mode, and Test Mode. The meter also shall support a "Toolbox" or "Service Information" (accessible in the field) through an optocom port to a separate computer using the supplied software to allow access to instantaneous service information such as voltage, current, power factor, load demand, and the phase angle for individual phases.
- z. Meter shall have a standard 4 -year warranty.

2.1.5 Disconnect Method

- a. Provide a 10-pole safety disconnect complete with isolation devices for the voltage and current transformer inputs, including a shorting means for the current transformers.
- b. Disconnecting wiring blocks shall be provided between the current transformer and the meter. A shorting mechanism shall be built into the wiring block to allow the current transformer wiring to be changed without removing power to the transformer. The wiring blocks shall be located where they are accessible without the necessity of disconnecting power to the transformer.
- c. Voltage monitoring circuits shall be equipped with disconnect switches to isolate the meter base or socket from the voltage source. Provide fuse protection in accordance with paragraph entitled "Voltage Requirements"

2.1.6 Installation Methods

- a. Transformer Mounted ("XFMR" in Metering Systems Schedule). Meter base shall be located outside on the secondary side of the pad-mounted transformer.
- b. Stand Mounted Adjacent to Transformer ("STAND" in Metering Systems Schedule). Meter base shall be mounted on a structural steel pole approximately 4 feet from the transformer pad. This can be used for multiple meters associated with a single transformers.
- c. Building Mounted ("BLDG" in Metering Systems Schedule). Meter base shall be mounted on the side of the existing building near the service entrance.

- d. Panel Mounted. ("PNL" in Metering Systems Schedule). Meter shall be mounted where directed.
- e. Commercial meter pedestal ("PED" in Metering Systems Schedule).

2.2 COMMUNICATIONS INTERFACES

Meter shall have two-way communication with the existing data acquisition system (DAS). Provide a communications interface utilizing .

Provide interfacing software if a meter is used that is different than the existing meters at the Activity to ensure compatibility within the metering system.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70 (National Electrical Code), and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.1.1 Scheduling of Work and Outages

The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

3.2 FIELD QUALITY CONTROL

Perform the following acceptance checks and tests on all installed meters.

3.2.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

a. Meter Assembly

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specifications and approved shop drawings.

(b) Inspect physical and mechanical condition. Confirm the meter is firmly seated in the socket, the socket is not abnormally heated, the display is visible, and the ring and seal on the cover are intact.

(c) Inspect all electrical connections to ensure they are tight. For Class 200 services, verify tightness of the service conductor terminations for high resistance using low-resistance ohmmeter, or by verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

(d) Record model number, serial number, firmware revision,

software revision, and rated control voltage.

(e) Verify operation of display and indicating devices.

(f) Record password and user log-in for each meter.

(g) Verify grounding of metering enclosure.

(h) Set all required parameters including instrument transformer ratios, system type, frequency, power demand methods/intervals, and communications requirements. Verify that the CT ratio and the PT ratio are properly included in the meter multiplier or the programming of the meter. Confirm that the multiplier is provided on the meter face or on the meter.

(i) Provide [building meter installation sheet, per building](#) for each facility. See example Graphic E-S1.

(j) Provide the [completed meter installation schedule](#) for the installation. See example Graphic E-S2

(k) Provide the [completed meter data schedule](#) for the installation. See example Graphic E-S3.

(2) Electrical tests.

(a) Apply voltage or current as appropriate to each analog input and verify correct measurement and indication.

(b) Confirm correct operation and setting of each auxiliary input/output feature including mechanical relay, digital, and analog.

(c) After initial system energization, confirm measurements and indications are consistent with loads present.

(d) Make note of, and report, any "Error-Code" or "Caution-Code" on the meter's display.

(3) Provide [meter configuration report](#).

b. Current Transformers

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specification and approved shop drawings.

(b) Inspect physical and mechanical condition.

(c) Verify correct connection, including polarity.

(d) Inspect all electrical connections to ensure they are tight.

(e) Verify that required grounding and shorting connections provide good contact.

(2) Electrical Tests.

Verify proper operation by reviewing the meter configuration report.

c. Potential Transformers

(1) Visual and mechanical inspection.

(a) Verify potential transformers are rigidly mounted.

(b) Verify potential transformers are the correct voltage.

(c) Verify that adequate clearances exist between the primary and secondary circuit.

(2) Electrical Tests.

(a) Verify by the meter configuration report that the polarity and phasing are correct.

3.2.2 System Functional Verification

Verify that the installed meters are working correctly in accordance with the meter configuration report:

a. The correct meter form is installed.

b. All voltage phases are present.

c. Phase rotation is correct.

d. Phase angles are correct.

e. The new meter accurately measures power magnitude and direction, and can communicate as required by paragraph entitled "Communications Interfaces".

-- End of Section --

SECTION 26 51 00.00 22

INTERIOR LIGHTING

03/16

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.

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

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings
Except Low-Rise Residential Buildings

ASHRAE 189.1 (2014) Standard for the Design of
High-Performance Green Buildings Except
Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2016) Standard Specification for Steel,
Sheet, Cold-Rolled, Carbon, Structural,
High-Strength Low-Alloy, High-Strength
Low-Alloy with Improved Formability,
Solution Hardened, and Bake Hardenable

ASTM A580/A580M (2016) Standard Specification for
Stainless Steel Wire

ASTM A641/A641M (2009a; R 2014) Standard Specification for
Zinc-Coated (Galvanized) Carbon Steel Wire

ASTM A653/A653M (2015; E 2016) Standard Specification for
Steel Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM B164 (2003; R 2014) Standard Specification for
Nickel-Copper Alloy Rod, Bar, and Wire

ASTM B633 (2015) Standard Specification for
Electrodeposited Coatings of Zinc on Iron
and Steel

ASTM D4674 (2002; R 2010) Standard Practice for
Accelerated Testing for Color Stability of
Plastics Exposed to Indoor Office
Environments

CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24 (2008; Effective Jan 2010) California's
Energy Efficiency Standards for

Residential and Nonresidential Buildings

ILLUMINATING ENGINEERING SOCIETY (IES)

IES HB-10	(2011; Errata 2015) IES Lighting Handbook
IES LM-79	(2008) Electrical and Photometric Measurements of Solid-State Lighting Products
IES LM-80	(2015) Measuring Lumen Maintenance of LED Light Sources
IES RP-16	(2010; Addendum A 2008; Addenda B & C 2009) Nomenclature and Definitions for Illuminating Engineering
IES TM-21	(2011) Projecting Long Term Lumen Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA SSL 1	(2010) Electronic Drivers for LED Devices, Arrays, or Systems
NEMA SSL 3	(2011) High-Power White LED Binning for General Illumination
NEMA SSL 7A	(2015) Phase-Cut Dimming for Solid State Lighting: Basic Compatibility
ANSI C78.901	(2005) American National Standard for Electric Lamps - Single Base Fluorescent Lamps--Dimensional and Electrical Characteristics
NEMA ANSLG C78.81	(2014) American National Standard for Electric Lamps--Double-Capped Fluorescent Lamps--Dimensional and Electrical

Characteristics

NEMA C78.376	(2014) Electric Lamps - Specifications for the Chromaticity of Fluorescent Lamps
NEMA ANSLG C78.377	(2017) Electric Lamps- Specifications for the Chromaticity of Solid State Lighting Products
NEMA ANSLG C82.11	(2011) Lamp Ballasts - High-Frequency Fluorescent Lamp Ballasts
ANSI/NEMA C78.LL 1256	(2003) Procedures for Fluorescent Lamp Sample Preparation and the Toxicity Characteristic Leaching Procedure (TCLP)
NEMA 250	(2014) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C82.77	(2002) Harmonic Emission Limits - Related Power Quality Requirements for Lighting Equipment
NEMA WD 1	(1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices
NEMA WD 7	(2011) Occupancy Motion Sensors Standard

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2015; ERTA 2015) Life Safety Code
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)
-------------	---------------------------------------------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 1472	(2015) Standard For Safety - Solid-State Dimming Controls
UL 1598	(2008; Reprint Oct 2012) Luminaires
UL 20	(2010; Reprint Feb 2012) General-Use Snap Switches
UL 2043	(2013) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 508	(1999; Reprint Oct 2013) Industrial Control Equipment

UL 844	(2012) Standard for Luminaires for Use in Hazardous (Classified) Locations
UL 8750	(2009; Reprint May 2014) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products
UL 916	(2007; Reprint Aug 2014) Standard for Energy Management Equipment
UL 924	(2006; Reprint Dec 2015) Standard for Emergency Lighting and Power Equipment
UL 935	(2001; Reprint Aug 2014) Standard for Fluorescent-Lamp Ballasts
UL 94	(2013; Reprint Mar 2016) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8500.01	(2014) Cybersecurity
DOD 8510.01	(2014) Risk Management Framework (RMF) for DoD Information Technology (IT)

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires or luminaire accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Luminaires and accessories mounted on exterior surfaces of buildings are specified in Section 26 56 00 EXTERIOR LIGHTING.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, must be as defined in IEEE 100 and IES RP-16.
- b. For fluorescent, "Average Rated Life" is the time after which 50 percent of a large group of light sources will have failed and 50 percent will have survived under normal conditions.
- c. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also know as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.
- d. For fluorescent, "Luminaire Efficacy Rating" (LER) is the appropriate measure of energy efficiency, measured in lumens/watt. Specifically it is the luminaire's efficiency multiplied by the total rated light source lumens and the ballast factor, divided by the luminaire input watts.
- e. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is

gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.

- f. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES HB-10 as applicable, for the lighting system specified. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G

Occupancy/Vacancy Sensor Coverage Layout; G

SD-03 Product Data

Luminaires; G

Light Sources; G

Drivers; G

Ballasts; G

LED Luminaire Warranty; G

Luminaire Design Data; G

Vacancy Sensors; G

Dimming Switches; G

Exit Signs; G

Emergency Lighting Unit (EBU); G

LED Emergency Drivers; G

Occupancy Sensors; G

Ambient Light Level Sensor ; G

Lighting Control Panel; G

SD-06 Test Reports

LED Luminaire - IES LM-79 Test Report; G

LED Light Source - IES LM-80 Test Report; G

LED Light Source - IES TM-21 Test Report; G

Occupancy/Vacancy Sensor Verification Tests; G

Energy Efficiency; G

SD-07 Certificates

Luminaire Useful Life Certificate; G

LED Driver and Dimming Switch Compatibility Certificate; G

1.5 QUALITY CONTROL

1.5.1 Luminaire Drawings

Include dimensions, accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data must accompany shop drawings.

1.5.2 Occupancy/Vacancy Sensor Coverage Layout

Provide floor plans showing coverage layouts of all devices using manufacturer's product information.

1.5.3 LED Driver and Dimming Switch Compatibility Certificate

Submit certification from the luminaire, driver, or dimmer switch manufacturer that ensures compatibility and operability between devices.

1.5.4 Luminaire Design Data

- a. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification per NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).
- b. Provide long term lumen maintenance projections for each LED luminaire in accordance with IES TM-21. Data used for projections must be obtained from testing in accordance with IES LM-80.

1.5.5 LED Luminaire - IES LM-79 Test Report

Submit test report on manufacturer's standard production model luminaire. Include all applicable and required data as outlined under "14.0 Test Report" in IES LM-79.

1.5.6 LED Light Source - IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source (package, array, or module). Include all applicable and required data as outlined under "8.0 Test Report" in IES LM-80.

1.5.7 LED Light Source - IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array or module). Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in IES TM-21.

1.5.8 Occupancy/Vacancy Sensor Verification Tests

Submit test report outlining post-installation coverage and operation of sensors.

1.5.9 Test Laboratories

Test laboratories for the IES LM-79 and IES LM-80 test reports shall be one of the following:

- a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.
- b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.
- c. A manufacturer's in-house lab that meets the following criteria:
 - (1) Manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires and the manufacturer's lab has been successfully certifying these fixtures for a minimum of 15 years.
 - (2) Annual equipment calibration including photometer calibration in accordance with National Institute of Standards and Technology.

1.5.10 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "must" 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 must be in accordance with the mandatory and advisory provisions of NFPA 70, unless more stringent requirements are specified or indicated.

1.5.11 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must 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.

1.5.11.1 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 furnished.

1.5.11.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site must not be used, unless specified otherwise.

1.5.11.3 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit data indicating lumens per watt efficacy and color rendering index of light source.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient (within 25 mile radius) 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.

1.6.1 LED Luminaire Warranty

- a. Provide a written 5 year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.
 1. Include finish warranty to include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.
 2. Material warranty must include:
 - (a) All drivers.
 - (b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.
- b. Warranty period must begin on date of beneficial occupancy. Provide the Contracting Officer with signed warranty certificates prior to final payment.

1.6.1.1 Provide Luminaire Useful Life Certificate

Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life must be directly correlated from the IES LM-80 test data using procedures outlined in IES TM-21. Thermal properties of the specific luminaire and local ambient operating temperature and conditions must be taken into consideration.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be luminaires, luminaire controls, or associated equipment are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Luminaires, luminaire controls, and associated equipment for exterior applications are specified in Section 26 56 00 EXTERIOR LIGHTING.

2.2 LUMINAIRES

UL 1598, NEMA C82.77, and UL 8750. Provide luminaires as indicated in luminaire schedule and NL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. Provide all luminaires of the same type by the same manufacturer. Luminaires must be specifically designed for use with the driver or ballast and light source provided.

2.2.1 LED Luminaires

Provide luminaires complete with power supplies (drivers) and light sources. Provide design information including lumen output and design life in luminaire schedule on project plans for LED luminaires. LED luminaires must meet the minimum requirements in the following table:

<u>LUMINAIRE TYPE</u>	<u>MINIMUM LUMINAIRE EFFICACY (LE)</u>	<u>MINIMUM COLOR RENDERING INDEX (CRI)</u>
LED TROFFER - 1 x 4 2 x 2 2 x 4	90 LPW	80
LED Downlight	50 LPW	90
LED Track or Accent	40 LPW	80
LED Low Bay/High Bay	80 LPW	70
LED Linear Ambient	80 LPW	80

LED luminaires must also meet the following minimum requirements:

- Luminaires must have a minimum 5 year manufacturer's warranty.
- Luminaires must have a minimum L70 lumen maintenance value of 50,000 hours as calculated by IES TM-21, with data obtained per IES LM-80 requirements.
- Luminaire drive current value must be identical to that provided by test data for luminaire in question.
- Luminaires must be tested to IES LM-79 and IES LM-80 standards, with the results provided as required in the Submittals paragraph of this specification.
- Luminaires must be listed with the DesignLights Consortium 'Qualified Products List' when falling into category of "General Application" luminaires, i.e. Interior Directional, Display Case, Troffer, Linear Ambient, or Low/High Bay. Requirements are shown in the DesignLights

Consortium "Technical Requirements Table".

- f. Provide Department of Energy 'Lighting Facts' label for each luminaire.

2.2.2 Fluorescent Luminaires

UL 1598. Provide linear and compact fluorescent luminaires complete with housing, ballast and light source. All fluorescent luminaires must be equipped with electronic ballasts.

2.2.3 Luminaires for Hazardous Locations

In addition to requirements stated herein, provide LED luminaires for hazardous locations which conform to **UL 844** or which have Factory Mutual certification for the class and division indicated.

2.3 DRIVERS and BALLASTS

2.3.1 LED Drivers

NEMA SSL 1, UL 8750. LED drivers must be electronic, UL Class 1, constant-current type and comply with the following requirements:

- a. Output power (watts) and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.
- b. Power Factor (PF) greater than or equal to 0.9.
- c. Current draw Total Harmonic Distortion (THD) of less than 20%.
- d. Class A sound rating.
- e. Operable at input voltage of 120-277 volts at 60 hertz.
- f. Minimum 10 year manufacturer's warranty.
- g. RoHS compliant.
- h. Integral thermal protection that reduces output power if case temperature exceeds **185 degrees F**.
- i. UL listed for dry or damp locations typical of interior installations.
- j. Non-dimmable, step-dimmable to 50 percent output, or fully-dimmable using 0-10V control as indicated in luminaire schedule.

2.3.2 Fluorescent Electronic Ballasts

NEMA ANSLG C82.11, UL 935, CEC Title 24. Fluorescent ballasts must not contain any magnetic core and coil components, and must meet the following requirements:

- a. Provide with transient protection as recommended by **IEEE C62.41.1** and **IEEE C62.41.2**.
- b. Provide UL listed Class P, "A" sound rating, and minimum power factor rating of 0.98.

- c. Be designed for the wattage and type of light source provided in the luminaire specified, and have circuit diagrams and light source connection information printed on the exterior of the ballast housing.
- d. Contain no PCB's and be RoHS compliant.
- e. Be manufactured in an ISO 9001 certified facility.
- f. Operate at a frequency greater than 20 kHz, preferably greater than 40 kHz, and have a Lamp Current Crest Factor less than 1.7.
- g. Have a light regulation of plus or minus 10 percent of lumen output when operating within a plus or minus 10 percent range of input voltage.
- h. Have a full replacement warranty of five years from date of manufacture.
- i. Provide all fluorescent ballasts as NEMA Premium type.

2.3.2.1 T8 Programmed-Start Fluorescent Ballasts

Provide programmed-start T8 electronic fluorescent ballasts with the following characteristics:

- a. Total harmonic distortion (THD): Must be 20 percent (maximum).
- b. Input wattage.
 - 1. 32 watts (maximum) when operating one F32T8 light source
 - 2. 62 watts (maximum) when operating two F32T8 light sources
 - 3. 92 watts (maximum) when operating three F32T8 light sources
 - 4. 114 watts (maximum) when operating four F32T8 light sources
- c. Provide three and four light source luminaires with two ballasts per luminaire where multilevel switching is indicated.

2.3.2.2 T5 (long twin tube) and T5HO Fluorescent Ballasts

- a. Total harmonic distortion (THD): Not greater than 25 percent when operating one light source, 15 percent when operating two light sources, and 20 percent when operating three light sources.
- b. Input wattage:
 - 1. 45 watts (maximum) when operating one F40 T-5 light source
 - 2. 74 watts (maximum) when operating two F40 T-5 light sources
 - 3. 105 watts (maximum) when operating three F40 T-5 light sources
- c. Provide three and four light source luminaires with two ballasts per luminaire where multilevel switching is indicated.

2.3.2.3 Compact Fluorescent Ballasts

Provide programmed-start ballasts for compact fluorescent luminaires.

2.3.2.4 Fluorescent Electronic Dimming Ballasts

Provide fluorescent electronic dimming ballasts with the following characteristics:

- a. Comply with **NEMA ANSLG C82.11**, **UL 935**, and **NFPA 70**, unless specified otherwise. Provide ballast with transient immunity as recommended by **IEEE C62.41.1** and **IEEE C62.41.2**. Provide dimming capability range from 100 to 5 percent (minimum range) of light output, flicker free. Ballast must start lamp at any preset light output setting without first having to go to full light output. Provide ballasts designed for the wattage of the light sources used in the indicated application. Provide ballasts designed to operate on the voltage system to which they are connected.
- b. Provide power factor of 0.95 (minimum) at full light output, and 0.90 (minimum) over the entire dimming range.
- c. Provide ballasts designed to operate at a frequency of 20,000 Hertz (minimum). Ballast must be compatible with and not cause interference with the operation of occupancy sensors or other infrared control systems. When available, provide higher operating frequency of 40,000 hertz or above.
- d. Ballast factor at full light output must be between 0.85 (minimum) and 1.00 (maximum). Current crest factor must be a maximum of 1.7.
- e. Provide ballast with Class P UL listing and with a sound rating of "A".
- f. Provide ballast with circuit diagrams displayed on the ballast exterior.
- g. Provide programmed-start ballast. Ballast may operate light sources in a series circuit configuration. Provide series/parallel wiring for programmed-start ballasts where available.
- h. Ballast shall be capable of starting and maintaining operation at a minimum of **0 degrees F** unless otherwise indicated.
- i. Provide ballast with total harmonic distortion (THD) of 20 percent (maximum) over the entire dimming range.
- j. Ballasts for T-5 and smaller light sources must have end-of-life protection circuits as required by **NEMA ANSLG C78.81** and **ANSI C78.901** as applicable.

2.3.2.4.1 T-8 Lamp Ballast

Input wattage:

- a. 35 watts (maximum) when operating one F32T8 light source.
- b. 70 watts (maximum) when operating two F32T8 light sources.
- c. 104 watts (maximum) when operating three F32T8 light sources.

2.4 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type and wattage as indicated in luminaire schedule on project plans.

2.4.1 LED Light Sources

- a. Corrected Color Temperature (CCT) of 3500 degrees K.
- b. Minimum Color Rendering Index (CRI) R9 value of 80.
- c. High power, white light output utilizing phosphor conversion (PC) process.
- d. RoHS compliant.
- e. Provide light source color consistency by utilizing a binning tolerance within a 4 step McAdam ellipse.

2.4.2 Fluorescent Light Sources

NEMA C78.376. Fluorescent light sources must be low-mercury, energy-savings type and be compliant with the most current TCLP test procedure per **ANSI/NEMA C78.LL 1256** at the time of manufacture.

2.4.2.1 Linear Fluorescent Light Sources

NEMA ANSLG C78.81. Provide linear fluorescent light sources with minimum CRI of 85 and CCT of 3500 degrees K.

2.4.2.1.1 T8 Linear Fluorescent Light Sources

Provide T8 light sources with medium bi-pin base, rated **as indicated on fixture schedule**, and with an average rated life of 30,000 hours using a average three hour burn time and programmed-start ballast.

2.4.2.1.2 T5HO (High-Output) Linear Fluorescent Light Sources

Provide T5HO light sources with miniature bi-pin base, rated **as indicated on fixture schedule**, and with an average rated life of 30,000 hours using a average three hour burn time and programmed start ballast.

2.4.2.2 Compact Fluorescent (CFL) Light Sources

ANSI C78.901. Provide compact fluorescent (CFL) light sources with minimum CRI of 82 and CCT of 3500 degrees K.

2.4.2.2.1 T4 Triple Tube CFL Light Source

Provide T4 Triple Tube CFL light sources with four pin, GX24q base, rated **as indicated on fixture schedule**, and with an average rated life of 17,000 hours.

2.4.2.2.2 T4 Quad Tube CFL Light Source

Provide T4 Quad Tube CFL light sources with four pin, GX24q base, rated **as indicated on fixture schedule**, and with an average rated life of 17,000 hours.

2.5 LIGHTING CONTROLS

ASHRAE 90.1 - IP, ASHRAE 189.1. Provide network certification for all networked lighting control systems and devices per requirements of DOD 8500.01 and DOD 8510.01.

2.5.1 Toggle Switches

Provide line-voltage toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.5.2 Dimming Switches

UL 1472, UL 20, IEEE C62.41, NEMA SSL 7A. 120 V, 277 V, 16 A, 10 A dimming switches must provide full range, flicker-free, continuously variable light output. Provide radio frequency interference suppression integral to device. Provide device with a vertical slider, paddle, rotary button, or toggle (with adjacent vertical slider) type control, with finish to match switches and outlets in same area. Provide back box in wall with sufficient depth to accommodate body of switch and wiring. Devices must be capable of operating at their full rated capacity regardless of being single or ganged-mounted, and be compatible with three-way and four-way switching scenarios. Dimming switch must be capable of controlling two-wire, three-wire, or 0-10 volt ballasts or LED drivers. Ensure compatibility of dimming switch with separate power packs when utilized for lighting control. Dimming switches, and the ballasts or drivers they control, must be provided from the same manufacturer, or tested and certified as compatible for use together.

2.5.3 Sensors for Lighting Control

IEEE C62.41, NEMA WD 1, UL 94, UL 916, UL 508, ASTM D4674.

2.5.3.1 Occupancy Sensors and Vacancy Sensors

Provide passive infrared (PIR) and dual technology occupancy and vacancy sensors as indicated on project plans. Sensor area of coverage must be approximately 300 square feet with 180 degree field of view for wall mounted for desktop level of motion. Sensor area of coverage must be approximately 500 square feet with 360 degree field of view for ceiling mounted. Sensor must be provided with an adaptive learning function that automatically sets sensor in optimum calibration in a set period of time after installation and a non-volatile memory that saves settings after a power outage. Provide sensor designed for ceiling or wall or wall box installation as indicated. Operating voltage must be 24V in conjunction with a separate power pack which interacts with luminare being controlled. Housing must be high-impact, injection-molded thermoplastic with a multi-segmented lens for PIR and dual technology sensors.

2.5.3.1.1 Passive Infrared (PIR) Sensors

- a. Temperature compensated, dual element sensor and a multi-element fresnel lens (Poly IR4 material).
- b. Technology to optimize automatic time delay to fit occupant usage patterns by DIP switch.
- c. No minimum load requirement for line voltage sensors and be capable of switching from zero to 800 W at 120 VAC, 50/60 Hz and from zero to 1200

W at 277 VAC, 50/60 Hz. Control voltage sensors must not exceed a maximum load requirement of 20 mA at 24VDC.

- d. Automatic-on or manual operation adjustable with DIP switch.
- e. Time delay of five to 30 minutes in increments of five minutes with a walk through and test mode set by DIP switch.
- f. LED indicator that remains active during occupancy.
- g. Built-in light level sensor that is operational from eight to 180 foot-candles.
- h. Coverage pattern tested to NEMA WD 7 standards.
- i. Standard five year warranty and be UL listed
- j. No leakage current to load when in the off mode.

2.5.3.1.2 Ultrasonic Sensors

Provide ceiling-mounted ultrasonic sensors meeting the following requirements:

- a. 120 volt AC, 277 volt AC, or 24 volt DC input, operating at an ultrasonic frequency of 40 kHz or 25 kHz. Refer to drawings for more information.
- b. 360 degree coverage area covering approximately 1000 square feet. Linear coverage pattern for hallway applications of approximately 90 by 10 feet. Provide LED on exterior of device to indicate detection. Coverage shall match design parameters indicated on drawings.
- c. Adjustable time delay period of 5 minutes.
- d. UL listed with minimum five year warranty.
- e. Provide with isolated relay for integrating HVAC or other automated systems.

2.5.3.1.3 Dual Technology Sensors

Provide dual technology sensors that meet the requirements for Passive Infrared Sensors and the following requirements for Ultrasonic Sensors. If either the passive infrared or ultrasonic registers occupancy, the luminaires must remain on.

- a. Ultrasonic sensing, volumetric in coverage with a frequency of 40kHz.
- b. Contain signal processing to compensate for constantly changing levels of activity and air flow throughout the space.
- c. No minimum load requirement for line voltage sensors and be capable of switching zero to 800W at 120VAC, 50/60 Hz and zero to 1200W at 277VAC, 50/60 Hz. Control voltage sensors must not exceed a maximum load requirement of 20mA at 24VDC.
- d. Automatic on or manual operation adjustable with DIP switch.

- e. Time delay of five to 30 minutes in increments of five minutes with a walk through and test mode set by DIP switch.
- f. LED indicator that remains active during occupancy.
- g. Built-in light level sensor that is operational from [eight to 180 foot-candles](#).
- h. Coverage pattern tested to [NEMA WD 7](#) standards.
- i. Standard five year warranty and UL listed
- j. No leakage current to load when in the off mode.

2.5.3.1.4 High/Low-Bay Sensors

Provide occupancy sensors specifically designed for high/low-bay mounting application using passive infrared (PIR) technology, with the following characteristics:

- a. Input voltage of 120-277 volts, at 50-60 hertz.
- b. High-impact, injection-molded thermoplastic housing with interchangeable lenses for [360 degree](#) open area coverage or narrow rectangular, warehouse aisle coverage.
- c. Utilize zero-crossing circuitry to prevent damage from high inrush current and to promote long life operation.
- d. Be designed to mount directly to or adjacent to high or low-bay luminaires.
- e. UL listed, [CEC Title 24](#) and [ASHRAE 90.1 - IP](#) compliant.

2.5.3.1.5 Power Packs for Sensors

[UL 2043](#), [CEC Title 24](#), [ASHRAE 90.1 - IP](#). Power packs used to provide power to one or more lighting control sensors must meet the following requirements:

- a. Input voltage - 120-277 VAC; output voltage - 24 VDC at 225 mA.
- b. Plenum-rated, high-impact thermoplastic enclosure.
- c. Utilizes zero-crossing circuitry to prevent damage from inrush current.
- d. Maximum load rating of 16 amps for electronic lighting loads.
- e. RoHS compliant.

2.5.4 [Lighting Control Panel](#)

Provide an electronic, programmable lighting control panel, capable of providing lighting control with input from internal programming, digital switches, time clocks, and other low-voltage control devices.

Enclose panel hardware in a surface-mounted, NEMA 1, painted, steel enclosure, with hinged, lockable access door and ventilation openings. Internal low-voltage compartment must be separated from line-voltage

compartment of enclosure with only low-voltage compartment accessible upon opening of door.

Input voltage - 120/277 V, 60 Hz, with internal 24 VDC power supply.

Provide relays as indicated on drawings. Provide provision for relays to close upon power failure that meets UL 924.

Relay control module must operate at 24 VDC and be rated to control relays as indicated on drawings.

2.6 EXIT AND EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 101, and NFPA 70 compliant.

2.6.1 Exit Signs

Provide exit signs consuming a maximum of five watts total.

2.6.1.1 LED Self-Powered Exit Signs

Provide in UV-stable, thermo-plastic housing with UL damp label, configured for ceiling mounting. Provide 6 inch high, 3/4 inch stroke red lettering on face of sign. Provide chevrons on either side of lettering to indicate direction. Provide single or double face. Equip with automatic power failure device, test switch, and pilot light, and fully automatic high/low trickle charger in a self-contained power pack. Battery must be sealed, maintenance free nickel-cadmium type, and must operate unattended for a period of not less than five years. Emergency run time must be a minimum of 1 1/2 hours. LEDs must have a minimum rated life of 10 years. Provide self-diagnostic circuitry integral to emergency LED driver.

2.6.2 Emergency Lighting Unit (EBU)

Provide in UV-stable, thermo-plastic housing with UL damp label as indicated. Emergency lighting units must be rated for 12 volts, except units having no remote-mounted lamps and having no more than two unit-mounted light sources may be rated six volts. Equip units with brown-out sensitive circuit to activate battery when input voltage falls to 75 percent of normal. Equip with two LED, MR-16 type light sources, automatic power failure device, test switch, and pilot light, and fully automatic high/low trickle charger in a self-contained power pack. Battery must be sealed, maintenance free nickel-cadmium type, and must operate unattended for a period of not less than five years. Emergency run time must be a minimum of 1 1/2 hours. LEDs must have a minimum rated life of 10 years. Provide self-diagnostic circuitry integral to emergency LED driver.

2.6.3 LED Emergency Drivers

Provide LED emergency driver with automatic power failure detection, test switch and LED indicator (or combination switch/indicator) located on luminaire exterior, and fully-automatic solid-state charger, battery and inverter integral to a self-contained housing. Provide self-diagnostic function integral to emergency driver. Integral nickel-cadmium battery is required to supply a minimum of 90 minutes of emergency power at 10 watts, 10-50 VDC compatible with LED forward voltage requirements, constant output. Driver must be RoHS compliant, rated for installation in plenum-rated spaces and damp locations, and be warranted for a minimum of

five years.

2.6.4 Self-Diagnostic Circuitry for LED and Fluorescent Emergency Drivers/Ballasts

Provide emergency lighting unit with fully-automatic, integral self-testing/diagnostic electronic circuitry. Circuitry must provide for a one minute diagnostic test every 28 days, and a 30 minute diagnostic test every six months, minimum. Any malfunction of the unit must be indicated by LED(s) visible from the exterior of the luminaire. A manual test switch must also be provided to perform a diagnostic test at any given time.

2.7 LUMINAIRE SUPPORT HARDWARE

2.7.1 Wire

ASTM A641/A641M; Galvanized, soft tempered steel, minimum 0.11 inches in diameter, or galvanized, braided steel, minimum 0.08 inches in diameter.

2.7.2 Wire for Humid Spaces

ASTM A580/A580M; Composition 302 or 304, annealed stainless steel, minimum 0.11 inches in diameter.

ASTM B164; UNS NO4400, annealed nickel-copper alloy, minimum 0.11 inches in diameter.

2.7.3 Threaded Rods

Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.7.4 Straps

Galvanized steel, one by 3/16 inch, conforming to **ASTM A653/A653M**, with a light commercial zinc coating or **ASTM A1008/A1008M** with an electrodeposited zinc coating conforming to **ASTM B633**, Type RS.

2.8 EQUIPMENT IDENTIFICATION

2.8.1 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.

2.8.2 Labels

Provide labeled luminaires in accordance with **UL 1598** requirements. All luminaires must be clearly marked for operation of specific light sources and ballasts or drivers. Note the following light source characteristics in the format "Use Only _____":

- a. Light source diameter code (T-4, T-5, T-8), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
- b. Start type (programmed start, instant start) for fluorescent and compact fluorescent luminaires.

- c. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. Ballasts, or drivers must have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.9 FACTORY APPLIED FINISH

Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum, meets requirements of [NEMA 250](#) corrosion-resistance test.

2.10 RECESS- AND FLUSH-MOUNTED LUMINAIRES

Provide access to lamp and ballast from bottom of luminaire. Provide trim and lenses for the exposed surface of flush-mounted luminaires as indicated on project drawings and specifications.

2.11 SUSPENDED LUMINAIRES

Provide hangers capable of supporting twice the combined weight of luminaires supported by hangers. Provide with swivel hangers to ensure a plumb installation. Provide cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers must allow fixtures to swing within an angle of [45 degrees](#). Brace pendants [4 feet](#) or longer to limit swinging. Single-unit suspended luminaires must have twin-stem hangers. Multiple-unit or continuous row luminaires must have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Provide rods in minimum [0.18 inch](#) diameter.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations must conform to [IEEE C2](#), [NFPA 70](#), and to the requirements specified herein. Install luminaires and lighting controls to meet the requirements of [ASHRAE 90.1 - IP](#) and [ASHRAE 189.1](#).

3.1.1 Light Sources

When light sources are not provided as an integral part of the luminaire, deliver light sources of the type, wattage, lumen output, color temperature, color rendering index, and voltage rating indicated to the project site and install just prior to project completion, if not already installed in the luminaires from the factory.

3.1.2 Luminaires

Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires and secure in accordance with manufacturers' directions and approved drawings. Installation must meet requirements of [NFPA 70](#). Mounting heights specified or indicated must be to the bottom of the luminaire for ceiling-mounted luminaires and to center of luminaire for wall-mounted luminaires. Obtain 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. Recessed and semi-recessed luminaires must be independently supported from the building structure by a minimum of four wires, straps or rods per luminaire and located near each corner of the luminaire. Ceiling grid clips are not allowed as an alternative to independently supported luminaires. Round luminaires or luminaires smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires, straps or rods per luminaire, spaced approximately equidistant around. Do not support luminaires by acoustical tile ceiling panels. Where luminaires of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support each independently and provide at least two 3/4 inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the luminaire. Provide wires, straps, or rods for luminaire support in this section.

3.1.3 Suspended Luminaires

Provide suspended luminaires with 45 degree swivel hangers so that they hang plumb and level. Locate so that there are no obstructions within the 45 degree range in all directions. The stem, canopy and luminaire must be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding luminaire must be braced to prevent swaying using three cables at 120 degree separation. Suspended luminaires in continuous rows must have internal wireway systems for end to end wiring and must be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Utilize aligning splines on extruded aluminum luminaires to assure minimal hairline joints. Support steel luminaires to prevent "oil-canning" effects. Luminaire finishes must be free of scratches, nicks, dents, and warps, and must match the color and gloss specified. Match supporting pendants with supported luminaire. Aircraft cable must be stainless steel. Canopies must be finished to match the ceiling and must be low profile unless otherwise shown. Maximum distance between suspension points must be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.4 Ballasts, and Power Supplies

Typically, provide ballasts, and power supplies (drivers) integral to luminaire as constructed by the manufacturer.

3.1.5 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the local switch, to the normal lighting circuit located in the same room or area.

3.1.5.1 Exit Signs

Connect exit signs as indicated on plans.

3.1.6 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.7 Occupancy/Vacancy Sensors

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage

must provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage.

3.1.8 Daylight or Ambient Light Level Sensor

Locate sensor as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for 30 footcandles or for the indicated light level measured at the work plane for that particular area.

3.2 FIELD APPLIED PAINTING

Paint lighting equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Provide painting as specified in Section 09 90 00 PAINTS AND COATINGS.

-- End of Section --

This page is intentionally left blank.

SECTION 26 56 00

EXTERIOR LIGHTING

05/13

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.

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

ASHRAE 90.1 - IP (2013) Energy Standard for Buildings
Except Low-Rise Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM B117 (2016) Standard Practice for Operating
Salt Spray (Fog) Apparatus

CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24 (2008; Effective Jan 2010) California's
Energy Efficiency Standards for
Residential and Nonresidential Buildings

ILLUMINATING ENGINEERING SOCIETY (IES)

IES HB-10 (2011; Errata 2015) IES Lighting Handbook

IES LM-79 (2008) Electrical and Photometric
Measurements of Solid-State Lighting
Products

IES LM-80 (2015) Measuring Lumen Maintenance of LED
Light Sources

IES RP-16 (2010; Addendum A 2008; Addenda B & C
2009) Nomenclature and Definitions for
Illuminating Engineering

IES RP-8 (2014) Roadway Lighting

IES TM-15 (2011) Luminaire Classification System for
Outdoor Luminaires

IES TM-21 (2011) Projecting Long Term Lumen
Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative
Dictionary of IEEE Standards Terms

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017)
National Electrical Safety Code

IEEE C62.41.2 (2002) Recommended Practice on
Characterization of Surges in Low-Voltage
(1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2014) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NEMA ANSLG C78.377 (2017) Electric Lamps— Specifications for
the Chromaticity of Solid State Lighting
Products

NEMA C136.31 (2010) American National for Roadway and
Area Lighting Equipment - Luminaire
Vibration

NEMA C82.77 (2002) Harmonic Emission Limits - Related
Power Quality Requirements for Lighting
Equipment

NEMA ICS 2 (2000; R 2005; Errata 2008) Industrial
Control and Systems Controllers,
Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2016) Industrial Control and
Systems: Enclosures

NEMA IEC 60529 (2004) Degrees of Protection Provided by
Enclosures (IP Code)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

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

47 CFR 15 Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 1310 (2011; Reprint Dec 2014) UL Standard for
Safety Class 2 Power Units

UL 1598 (2008; Reprint Oct 2012) Luminaires

UL 773 (1995; Reprint Mar 2002) Standard for
Plug-In, Locking Type Photocontrols for
Use with Area Lighting

UL 773A (2006; Reprint Nov 2013) Standard for
Nonindustrial Photoelectric Switches for
Lighting Control

UL 8750 (2009; Reprint May 2014) UL Standard for

Safety Light Emitting Diode (LED)
Equipment for Use in Lighting Products

UL 916

(2007; Reprint Aug 2014) Standard for
Energy Management Equipment

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires or lighting equipment are specified in Section(s) 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION . Luminaires and accessories installed in interior of buildings are specified in Section 26 51 00.00 22 INTERIOR LIGHTING .

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings shall be as defined in IEEE 100 and IES RP-16.
- c. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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 "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

LED Luminaire Warranty; G

SD-03 Product Data

LED Luminaires; G

Luminaire Light Sources; G

Luminaire Power Supply Units (Drivers); G

Lighting contactor; G

Time switch; G

Lighting Control Relay Panel; G

Photocell; G

SD-05 Design Data

Design Data for luminaires; G

SD-06 Test Reports

LED Luminaire - IES LM-79 Test Report; G

LED Light Source - IES LM-80 Test Report; G

Operating test

Submit operating test results as stated in paragraph entitled "Field Quality Control."

SD-07 Certificates

Luminaire Useful Life Certificate; G

Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life shall be directly correlated from the IES LM-80 test data using procedures outlined in IES TM-21. Thermal properties of the specific luminaire and local ambient operating temperature and conditions shall be taken into consideration.

SD-10 Operation and Maintenance Data

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

1.5 QUALITY ASSURANCE

1.5.1 Design Data for Luminaires

- a. Provide distribution data according to IES classification type as defined in IES HB-10.
- b. Shielding as defined by IES RP-8 or B.U.G. rating for the installed position as defined by IES TM-15.
- c. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification per NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).
- d. Provide long term lumen maintenance projections for each LED luminaire in accordance with IES TM-21. Data used for projections shall be obtained from testing in accordance with IES LM-80.
- e. Provide wind loading calculations for luminaires mounted on poles. Weight and effective projected area (EPA) of luminaires and mounting brackets shall not exceed maximum rating of pole as installed in particular wind zone area.

1.5.2 LED Luminaire - IES LM-79 Test Report

Submit test report on manufacturer's standard production model luminaire. Submittal shall include all photometric and electrical measurements, as well as all other pertinent data outlined under "14.0 Test Report" in IES LM-79.

1.5.3 LED Light Source - IES LM-80 Test Report

Submit report on manufacturer's standard production LED package, array, or module. Submittal shall include:

- a. Testing agency, report number, date, type of equipment, and LED light source being tested.
- b. All data required by IES LM-80.

1.5.3.1 Test Laboratories

Test laboratories for the IES LM-79 and IES LM-80 test reports shall be one of the following:

- a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.
- b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.
- c. A manufacturer's in-house lab that meets the following criteria:
 1. Manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires and the manufacturer's lab has been successfully certifying these fixtures for a minimum of 15 years.
 2. Annual equipment calibration including photometer calibration in accordance with National Institute of Standards and Technology.

1.5.4 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.

1.5.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 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. 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.

1.5.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if the manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires for a minimum of 15 years. Products shall have been in satisfactory commercial or industrial use for 15 years prior to bid opening. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 15-year period.

1.5.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

1.6.1 Aluminum Poles

Do not store poles on ground. Support poles so they are at least **one foot** above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.7 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.

1.7.1 LED Luminaire Warranty

Provide **Luminaire Useful Life Certificate**.

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.

- a. Provide a written five year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.
 1. Finish warranty shall include warranty against failure and against substantial deterioration such as blistering, cracking, peeling, chalking, or fading.
 2. Material warranty shall include:
 - (a) All power supply units (drivers).
 - (b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.
- b. Warranty period must begin on date of beneficial occupancy. Contractor shall provide the Contracting Officer signed warranty certificates prior to final payment.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be luminaires, equipment or accessories are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Luminaires and associated equipment and accessories for interior applications are specified in Section 26 51 00.00 22 INTERIOR LIGHTING.

2.2 LED LUMINAIRES

UL 1598, NEMA C82.77 and UL 8750. Provide luminaires as indicated in luminaire schedule and XL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. All luminaires of the same type shall be provided by the same manufacturer.

2.2.1 General Requirements

- a. LED luminaire housings shall be die cast or extruded aluminum.
- b. LED luminaires shall be rated for operation within an ambient temperature range of minus 22 degrees F to 104 degrees F.
- c. Luminaires shall be UL listed for wet locations per UL 1598. Optical compartment for LED luminaires shall be sealed and rated a minimum of IP65 per NEMA IEC 60529.
- d. LED luminaires shall produce a minimum efficacy as shown in the following table, tested per IES LM-79. Theoretical models of initial raw LED lumens per watt are not acceptable.

Application	Luminaire Efficacy in Lumens per Watt
Exterior Pole/Arm-Mounted Area and Roadway Luminaires	65
Exterior Pole/Arm-Mounted Decorative Luminaires	65
Exterior Wall-Mounted Area Luminaires	60
Bollards	35
Parking Garage Luminaires	70

- e. Luminaires shall have IES distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans per IES HB-10.
- f. Housing finish shall be baked-on enamel, anodized, or baked-on powder coat paint. Finish shall be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.
- g. Luminaires shall not exceed the following IES TM-15 Backlight, Uplight

and Glare (B.U.G.) ratings:

1. Maximum Backlight (B) rating shall be determined by lighting zone in which luminaire is placed.
 2. Maximum Uplight (U) rating shall be U0.
 3. Maximum Glare (G) rating shall be determined by lighting zone in which luminaire is placed.
- h. Luminaires shall be fully assembled and electrically tested prior to shipment from factory.
- i. The finish color shall be as indicated in the luminaire schedule or detail on the project plans.
- j. Luminaire lenses shall be constructed of clear tempered glass or UV-resistant acrylic. Provide polycarbonate vandal-resistant lenses as indicated.
- k. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, power supply units, ballasts, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.
- l. Luminaires shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- m. Luminaire must pass 3G vibration testing in accordance with NEMA C136.31.
- n. All factory electrical connections shall be made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

2.2.2 Luminaire Light Sources

2.2.2.1 LED Light Sources

- a. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377:

Nominal CCT: 4000 degrees K: 3985 plus or minus 275 degrees K

- b. Color Rendering Index (CRI) shall be:

Greater than or equal to 70 for 4000 degrees K light sources.

- c. Color Consistency:

Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.

2.2.3 Luminaire Power Supply Units (Drivers)

2.2.3.1 LED Power Supply Units (Drivers)

UL 1310. LED Power Supply Units (Drivers) shall meet the following requirements:

- a. Minimum efficiency shall be 85 percent.
- b. Drive current to each individual LED shall not exceed 600 mA, plus or minus 10 percent.
- c. Shall be rated to operate between ambient temperatures of minus 22 degrees F and 122 degrees F.
- d. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120 V to 480 V nominal.
- e. Operating frequency shall be: 60 Hz.
- f. Power Factor (PF) shall be greater than or equal to 0.90.
- g. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.
- h. Shall meet requirements of 47 CFR 15, Class B.
- i. Shall be RoHS-compliant.
- j. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed.
- k. Power supplies in luminaires mounted under a covered structure, such as a canopy, or where otherwise appropriate shall be UL listed with a sound rating of A.
- l. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.

2.2.4 LED Luminaire Surge Protection

Provide surge protection integral to luminaire to meet C Low waveforms as defined by IEEE C62.41.2, Scenario 1, Location Category C.

2.3 EXTERIOR LUMINAIRE CONTROLS

2.3.1 Photocell

UL 773 or UL 773A. Photocells shall be hermetically sealed, cadmium sulfide light sensor type, rated at minimal watts, 120 volts, 60 Hz with single-pole, single-throw contacts. Photocell shall be designed to fail to the ON position. Housing shall be constructed of polycarbonate, rated to operate within a temperature range of minus 40 to 158 degrees F. Photocell shall have a 1/2 in threaded base for mounting to a junction box or conduit. Provide swivel base type housing. Photocell shall turn on at 1-3 footcandles and turn off at 3 to 15 footcandles. A time delay shall

prevent accidental switching from transient light sources. Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.

2.3.2 Timeswitch

Timeswitch shall be electromechanical type with a astronomic dial that changes on/off settings according to seasonal variations of sunset and sunrise. Switch shall be powered by an enclosed synchronous motor with a maximum 3 watt operating rating. Timeswitch contacts shall be rated for 40 amps at 120-277 VAC resistive load in a DPST normally open (NO) configuration. Switch shall have an automatic spring mechanism to maintain accurate time for up to 16 hours during a power failure. Provide switch with function that allows automatic control to be skipped on certain selected days of the week. Provide switch with manual bypass or remote override control.

Timeswitch shall be housed in a surface-mounted, lockable NEMA 1 enclosure constructed of painted steel or plastic polymer conforming to NEMA ICS 6.

2.3.3 Lighting Contactor

NEMA ICS 2. Provide a mechanically-held lighting contactor housed in a NEMA 1 enclosure conforming to NEMA ICS 6. Contactor shall have 4 poles, configured as normally open (NO). Contacts shall be rated 600 volts, 30 amperes for a resistive load. Coil operating voltage shall be 120 volts. Contactor shall have silver cadmium oxide double-break contacts and coil clearing contacts for mechanically held contactors and shall require no arcing contacts. Provide contactor with hand-off-automatic on-off selector switch.

2.3.4 Lighting Control Relay Panel

Panel shall consist of a single NEMA 1 surface-mounted enclosure with two separate interior sections; one for Class 1 (branch circuit) and one for Class 2 (low voltage) wiring. Provide panel as specified on drawings. The Class 1 section shall contain the load side of all relays and the incoming branch circuit wiring. The Class 2 section shall contain the control power transformer (24 volt output), relays, relay control modules, and control wiring, and native BACnet field-programmable application controller for panels connected to the facility automated control system. Panel enclosure shall be constructed of 16 gauge cold-rolled steel with baked-on enamel finish. Panel shall meet requirements of UL 916, ASHRAE 90.1 - IP, CEC Title 24 and 47 CFR 15.

Relays shall be 1-pole, rated at 20 amperes 480 VAC with rated life of 120,000 mechanical operations minimum.

Relay control module shall be 24 volt, electronic type and control up to 16 separate relays (16 channel) or programmed groups of relays. Provide with inputs for signals from devices such as photocells, timeclocks, and motion sensors. Relay control module with integral timeclock function shall be 24 volt, electronic type with LCD display and control up to 8 separate relays (8 channel).

2.4 EQUIPMENT IDENTIFICATION

2.4.1 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.

2.4.2 Labels

Provide labeled luminaires in accordance with [UL 1598](#) requirements. Luminaires shall be clearly marked for operation of specific light sources and ballasts according to proper light source type. The following light source characteristics shall be noted in the format "Use Only _____":

- a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place.

2.5 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of [NEMA 250](#) corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to [IEEE C2](#), [NFPA 70](#), and to the requirements specified herein.

3.1.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section [09 90 00](#) PAINTS AND COATINGS.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an [operating test](#) after 100 hours of burn-in time to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

This page is intentionally left blank.

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

08/11

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 D709 (2016) Standard Specification for
Laminated Thermosetting Materials

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECIA EIA/ECA 310-E (2005) Cabinets, Racks, Panels, and
Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative
Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596 (2011) Indoor Optical Fiber Cables

ICEA S-90-661 (2012) Category 3, 5, & 5e Individually
Unshielded Twisted Pair Indoor Cables for
Use in General Purpose and LAN
Communications Wiring Systems Technical
Requirements

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/BICSI 568 (2006) Standard for Installing Building
Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66 (2013) Performance Standard for Category 6
and Category 7 100 Ohm Shielded and
Unshielded Twisted Pairs

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-1152 (2009) Requirements for Field Test
Instruments and Measurements for Balanced

Twisted-Pair Cabling

TIA-455-21	(1988a; R 2012) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices
TIA-526-7	(2015a) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA-568-C.0	(2009; Add 1 2010; Add 2 2012) Generic Telecommunications Cabling for Customer Premises
TIA-568-C.1	(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Add 1 2011) Optical Fiber Cabling Components Standard
TIA-569	(2015d) Commercial Building Standard for Telecommunications Pathways and Spaces
TIA-606	(2012b) Administration Standard for the Telecommunications Infrastructure
TIA-607	(2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA/EIA-604-3	(2004b; R 2014) Fiber Optic Connector Intermateability Standard (FOCIS), Type SC and SC-APC, FOCIS-3

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)
-------------	--------------------------------------------------------------------------

UNDERWRITERS LABORATORIES (UL)

UL 1286	(2008; Reprint Feb 2015) Office Furnishings
UL 1666	(2007; Reprint Jun 2012) Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
UL 1863	(2004; Reprint Nov 2012) Communication Circuit Accessories
UL 444	(2008; Reprint Apr 2015) Communications Cables

UL 467	(2007) Grounding and Bonding Equipment
UL 50	(2007; Reprint Apr 2012) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 514C	(2014; Reprint Dec 2014) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(1995; Reprint Sep 2014) Standard for Marking and Labeling Systems

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP), 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-C.1, TIA-568-C.2, TIA-568-C.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 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).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled 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.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with the campus distributor at the center or hub of the star. Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. The telecommunications contractor must coordinate with the NMCI/COSC/NGEN contractor concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort within the telecommunications spaces with the NMCI/COSC/NGEN contractor.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings; G

Telecommunications Space Drawings; G

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G

Patch panels; G

Telecommunications outlet/connector assemblies; G

Equipment support frame; G

Connector blocks; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Manufacturer Qualifications; G

Test plan; G

SD-09 Manufacturer's Field Reports

Factory reel tests; G

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G

SD-11 Closeout Submittals

Record Documentation; G

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings shall be a minimum of 11 by 17 inches in size using a minimum scale of 1/8 inch per foot, except as specified otherwise. 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 Drawings

Provide registered communications distribution designer (RCDD) approved, drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure in accordance with TIA-606. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's, BD's, and FD's to the telecommunications work area outlets. The following drawings shall be provided as a minimum:

- a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.
- b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.
- c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings in accordance with TIA-606 that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and , rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

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, and the supervisor (if different from the installer). 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

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 within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Key Personnel

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.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. They 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 systems 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 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-C.1, TIA-568-C.2 and TIA-568-C.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, 60 days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.4 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 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 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. 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.

1.6.5.1 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 furnished.

1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing.

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.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and Section 01 78 24.00 20 FACILITY ELECTRONIC OPERATION AND MAINTENANCE SUPPORT INFORMATION (eOMSI) 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 DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration.

1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided on electronic media using Windows based computer cable management software. Provide the following T5 drawing documentation as a minimum:

- a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include only the required data fields in accordance with TIA-606. Include manufacture date of cable with submittal.
- b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with TIA-606. Documentation shall include the required data fields as a

minimum in accordance with TIA-606.

PART 2 PRODUCTS

2.1 COMPONENTS

Components shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. 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. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide system furniture pathways in accordance with UL 1286.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and NFPA 70. Provide a labeling system for cabling as required by TIA-606 and UL 969. Ship cable on reels or in boxes bearing manufacture date for for unshielded twisted pair (UTP) in accordance with ICEA S-90-661 and optical fiber cables in accordance with ICEA S-83-596 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.3.1 Backbone Cabling

2.3.1.1 Backbone Copper

Copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, 100 -pair, Category 3, UTP, in accordance with ICEA S-90-661, TIA-568-C.1, TIA-568-C.2 and UL 444, formed into 25 pair binder groups covered with a gray thermoplastic jacket and overall metallic shield, where required. Shield requirements and sheath materials will be determined by location and circumstances of install. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular length marking intervals in accordance with ICEA S-90-661. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. Backbone copper cabling shall be terminated on a Krone-style, rack-mounted slider bar with a capacity for

200 pair.

2.3.1.2 Backbone Optical Fiber

Provide in accordance with ICEA S-83-596, TIA-568-C.3, UL 1666 and NFPA 70. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 40 inches.

Provide the number of strands indicated, (but not less than 12 strands between the main telecommunication room and each of the other telecommunication rooms), of single-mode(OS1), tight buffered fiber optic cable.

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be yellow unless location requires an outdoor rated cable.

2.3.2 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.1.

2.3.2.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with TIA-568-C.2, UL 444, ANSI/NEMA WC 66, ICEA S-90-661 . Provide four each individually twisted pair, minimum size 24 AWG conductors, Category 6, with a blue thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA 70.

2.3.3 Work Area Cabling

2.3.3.1 Work Area Copper

Provide work area copper cable in accordance with TIA-568-C.2, with a blue, thermoplastic jacket.

2.3.3.2 Work Area Optical Fiber

Provide optical work area cable in accordance with TIA-568-C.3.

2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility and telecommunication equipment room to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA-606.

2.4.1 Backboards

Provide void-free, interior grade A-C plywood 3/4 inch thick 4 by 8 feet as indicated. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible. Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces.

2.4.2 Equipment Support Frame

Provide in accordance with ECIA EIA/ECA 310-E and UL 50.

- b. Racks, floor mounted modular type, 16 gauge steel or 11 gauge aluminum construction, minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug. Rack shall be compatible with 19 inches panel mounting.

2.4.3 Connector Blocks

Provide rack-mounted, krone-style blocks on slider bars for Category 6 systems. Blocks shall have 200 pair capacity. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare.

2.4.4 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inches equipment racks and telecommunications backboards. Cable guides of ring or bracket type devices mounted on rack panels/backboard for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws, or nuts and lockwashers.

2.4.5 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized optical fiber and copper patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified. Provide fiber optic patch cables with crossover orientation in accordance with TIA-568-C.3. Patch cords shall meet minimum performance requirements specified in TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3 for cables, cable length and hardware specified.

2.4.5.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.1 and TIA-568-C.2. Panels shall be third party verified and shall comply with EIA/TIA Category 6 requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be rack mounted and compatible with an ECIA EIA/ECA 310-E 19 inches equipment rack. Panel shall provide 48 non-keyed, 8-pin modular ports, wired to T568A. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.4.5.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 16 gauge steel or 11 gauge aluminum minimum and shall be rack mounted and compatible with a [ECIA EIA/ECA 310-E 19 inches](#) equipment rack. Each panel shall provide [24](#) adapters as duplex SC in accordance with [TIA/EIA-604-3](#) with zirconia ceramic alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of [8 inches](#) deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

2.4.6 Optical Fiber Distribution Panel

Rack mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with [ECIA EIA/ECA 310-E](#) utilizing 16 gauge steel or 11 gauge aluminum minimum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides, splice tray and shall be lockable, user section shall have a cover for patch cord protection. Each panel shall provide [24](#) single-mode pigtails and adapters. Provide adapters as duplex SC with zirconia ceramic alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS.

2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with [FCC Part 68](#), [TIA-568-C.1](#), and [TIA-568-C.2](#). UTP outlet/connectors shall be [UL 1863](#) listed, non-keyed, 8-pin modular, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with [TIA-568-C.2](#) Category 6 requirements. Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired T568A. UTP outlet/connectors shall comply with [TIA-568-C.2](#) for 200 mating cycles. UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.

2.5.2 Optical Fiber Adapters(Couplers)

Provide optical fiber adapters suitable for duplex SC in Accordance with [TIA/EIA-604-3](#) with zirconia ceramic alignment sleeves, as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with [TIA-455-21](#) for 500 mating cycles.

2.5.3 Optical Fiber Connectors

Provide in accordance with [TIA-455-21](#). Optical fiber connectors shall be duplex SC in accordance with [TIA/EIA-604-3](#) with zirconia ceramic ferrule, epoxyless crimp style compatible with 8/125 single-mode fiber. The connectors shall provide a maximum attenuation of 0.3 dB at 1310 nm with less than a 0.2 dB change after 500 mating cycles.

2.5.4 Cover Plates

Telecommunications cover plates shall comply with [UL 514C](#), and [TIA-568-C.1](#),

TIA-568-C.2, TIA-568-C.3; flush design constructed of high impact thermoplastic material to match color of receptacle/switch cover plates specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM. Provide labeling in accordance with the paragraph LABELING in this section.

2.6 GROUNDING AND BONDING PRODUCTS

Provide in accordance with **UL 467, TIA-607, and NFPA 70**. Components shall be identified as required by **TIA-606**. Provide ground rods, bonding conductors, and grounding busbars as specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM. Provide **#2 AWG copper conductor from TMGB to MDP and building steel**.

2.7 FIRESTOPPING MATERIAL

Provide as specified in Section **07 84 00** FIRESTOPPING.

2.8 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.

2.9 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified 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 inches** 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 inches** high normal block style.

2.10 TESTS, INSPECTIONS, AND VERIFICATIONS

2.10.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with **TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-526-7** for single mode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with **NECA/BICSI 568, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, NFPA 70**, and UL standards as applicable. Provide cabling in a star topology network. Pathways and outlet boxes shall be installed as specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling. Cabling shall be run with horizontal and vertical cable guides in

telecommunications spaces with terminating hardware and interconnection equipment.

3.1.1.1 Cabling

Install UTP, and optical fiber telecommunications cabling system as detailed in [TIA-568-C.1](#), [TIA-568-C.2](#), [TIA-568-C.3](#). Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed [25 pounds](#) pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Install in accordance with [TIA-568-C.1](#), [TIA-568-C.2](#) and [TIA-568-C.3](#). Do not exceed cable pull tensions recommended by the manufacturer.

Plenum cable shall be used where open cables are routed through plenum areas. Cable routed exposed under raised floors shall be plenum rated. Plenum cables shall comply with flammability plenum requirements of [NFPA 70](#). Install cabling after the flooring system has been installed in raised floor areas.

3.1.1.1.2 Backbone Cable

- a. Copper Backbone Cable. Install intrabuilding backbone copper cable, in indicated pathways ([4" conduit](#)), between the campus distributor, located in the telecommunications entrance facility or room, the building distributors and the floor distributors located in telecommunications rooms and telecommunications equipment rooms as indicated on drawings.
- b. Optical fiber Backbone Cable. Install intrabuilding backbone optical fiber in indicated pathways ([4" conduit](#)). Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket [10 inches](#) leaving strength members exposed for approximately [10 inches](#). Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with manufacturer's recommendations.

3.1.1.1.3 Horizontal Cabling

Install horizontal cabling as indicated on drawings. Do not untwist Category 6 UTP cables more than [one half inch](#) from the point of termination to maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, [10 feet](#) in the telecommunications room, and [12 inches](#) in the work area outlet..

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70. Provide building pathway as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.3 Service Entrance Conduit, Underground

Provide service entrance underground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.4 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP and OFNP type cable shall be installed in a plenum.

3.1.5 Work Area Outlets

3.1.5.1 Terminations

Terminate UTP cable in accordance with TIA-568-C.1, TIA-568-C.2 and wiring configuration as specified. Terminate fiber optic cables in accordance with TIA-568-C.3

3.1.5.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.5.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.5.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

3.1.6 Telecommunications Space Termination

Install termination hardware required for Category 6 and optical fiber system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.6.1 Connector Blocks

Connector blocks shall be rack mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

3.1.6.2 Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 25 percent spares.

- a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel as recommended by the manufacturer to prevent movement of the cable.
- b. Fiber Optic Patch Panel. Fiber optic cable loop shall be provided as recommended by the manufacturer. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.6.3 Equipment Support Frames

Install in accordance with TIA-569:

- b. Racks, floor mounted modular type. Permanently anchor rack to the floor in accordance with manufacturer's recommendations.

3.1.7 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.8 Grounding and Bonding

Provide in accordance with TIA-607, NFPA 70 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using laser printer .

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers in accordance with TIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers in accordance with TIA-606.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

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 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, TIA-568-C.2, TIA-568-C.3.

Test equipment shall conform to TIA-1152. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.5.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, . Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

3.5.1.3 Performance Tests

Perform testing for each outlet and MUTOA as follows:

- a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELNEXT, PSENEXT, return loss, propagation delay, and delay skew.
- . Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with TIA-568-C.3.

3.5.1.4 Final Verification Tests

Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

- a. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test

number is available, make and receive a local, long distance, and DSN telephone call.

- b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

This page is intentionally left blank.

SECTION 28 31 63.00 20

ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM

10/07

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.

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges
Environment in Low-Voltage (1000 V and
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on
Characterization of Surges in Low-Voltage
(1000 V and Less) AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 (2013; Errata 2015) Standard for
Safeguarding Construction, Alteration, and
Demolition Operations

NFPA 72 (2016) National Fire Alarm and Signaling
Code

NFPA 90A (2015) Standard for the Installation of
Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1971 (2002; Reprint Oct 2008) Signaling Devices
for the Hearing Impaired

UL 464 (2016) Standard for Audible Signal
Appliances

UL Electrical Constructn (2012) Electrical Construction Equipment
Directory

UL Fire Prot Dir (2012) Fire Protection Equipment Directory

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.3 DESCRIPTION OF WORK

1.3.1 Scope

This work includes designing and modifying the existing analog/addressable fire alarm system as described herein and on the contract drawings for the **Building 4630**. The system shall include wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide system complete and ready for operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in strict accordance with the required and advisory provisions of **NFPA 72** except as modified herein. The system layout on the drawings show the intent of coverage and are shown in suggested locations. Final quantity, layout, and coordination is the responsibility of the Contractor.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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. Submit the following in accordance with Section **01 33 00** SUBMITTAL PROCEDURES:

Provide six complete sets of submittals. Partial submittals will not be acceptable and will be returned without review. **The** Naval Facilities Engineering Command, Fire Protection Engineer, will review and approve submittals.

SD-02 Shop Drawings

Provide point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems which are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

Provide plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors.

Provide a complete description of the system operation in matrix format on the drawings.

Provide a complete list of device addresses and corresponding messages.

Include annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components.

Provide complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment.

Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

Battery power calculations

Submit shop drawings not smaller than 24 by 36 inches. As a minimum, the shop drawing submittal shall include the items listed above.

SD-03 Product Data

Terminal cabinets/assemblies; G

Manual stations; G

Batteries; G

Smoke sensors; G

Wiring and cable; G

Notification appliances; G

Addressable interface devices; G

Waterflow detectors; G

Tamper switches; G

Smoke sensor testing procedures; G

Submit data on proposed equipment, including, but not limited to the items listed above. Include UL or FM listing cards for equipment provided.

SD-06 Test Reports

Furnish preliminary test results to the Contracting Officer. Include the control panel and initiating and indicating devices, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information.

SD-07 Certificates

Qualifications of installer

SD-10 Operation and Maintenance Data

INTERIOR FIRE ALARM SYSTEM, Data Package 5; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Record drawing software

SD-11 Closeout Submittals

Prepare and submit to the Contracting Officer six sets of detailed as-built drawings. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized mylar sheets not less than 30 by 42 inches with 8 by 4 inch title block similar to contract drawings. These drawings shall be submitted within 2 weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

Submit the installer's training history for the employees involved with this contract.

1.5 ADDITIONAL SUBMITTAL REQUIREMENTS

1.5.1 Battery Power Calculations

Verify that battery capacity exceeds supervisory and alarm power requirements.

- a. Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere hour requirements for each system component shall be submitted with the calculations.
- b. Provide data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.
- c. Provide data to indicate that the amplifiers have sufficient capacity to simultaneously drive fire alarm speakers at their 1/2 watt tap plus 50 percent spare capacity. Annotate data for each circuit on the drawings.
- d. Provide a detailed description of the final acceptance testing procedures (including equipment necessary for testing smoke detectors using real smoke).

1.5.2 Qualifications of Installer

Design shall be by a National Institute for Certification in Engineering Technologies (NICET) Level Level III Technician. Installer shall have an office, which has been in existence for at least 3 years. Installation shall be accomplished by an electrical contractor with a minimum of 5 years' experience in the installation of fire alarm systems. The Contracting Officer may reject any proposed installer who cannot show evidence of such qualifications. The services of a technician provided by the control equipment manufacturer shall be provided to supervise installation, adjustments, and tests of the system. The Contractor shall furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization which carries a stock of repair parts for the system to be furnished. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Contracting Officer and the receipt of as-built drawings and schematics of

all equipment. Prior to installation, submit data for approval by the Naval Facilities Engineering Command, Fire Protection Engineer, showing that the Contractor has successfully installed addressable, analog intelligent interior fire alarm systems of the same type as specified herein, or that the Contractor has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least three installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months. Submit names and phone numbers of points of contact at each site.

1.5.3 Record Drawing Software

Furnish one set of floppy diskettes containing CAD based drawings in DXF format of as-built drawings and schematics.

1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system.

1.6.1 Regulatory Requirements

Devices and equipment for fire alarm service shall be listed by **UL Fire Prot Dir** or approved by **FM APP GUIDE**.

1.6.1.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in **UL Fire Prot Dir** or approved by FM and listed in **FM APP GUIDE**. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in **UL Fire Prot Dir** or **FM APP GUIDE**. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.

1.6.1.2 Testing Services or Laboratories

Fire alarm and fire detection equipment shall be constructed in accordance with **UL Fire Prot Dir**, **UL Electrical Constructn**, or **FM APP GUIDE**.

1.6.2 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by **NFPA 72** or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials.

1.6.3 Modification of References

- a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Naval Facilities Engineering Command, Fire Protection Engineer.

- b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

1.8 SPARE PARTS AND TOOLS

1.8.1 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

1.8.2 Spare Parts

Furnish the following spare parts and accessories:

- a. 4 audiovisual devices of each type installed
- b. 4 fuses for each fused circuit
- c. 1 manual stations
- d. 2 smoke sensors and base of each type installed
- e. 3 test magnets/devices for each type of sensors installed

1.8.3 Parts List

Furnish a list, in duplicate, of all other parts and accessories which the manufacturer of the system recommends to be stocked for maintenance.

1.9 KEYS

Keys and locks for equipment shall be identical. Provide not less than six keys of each type required.

PART 2 PRODUCTS

2.1 EXISTING FIRE ALARM EQUIPMENT

Existing fire alarm equipment shall be maintained fully operational and the new equipment to be connected to the existing system shall be tested and accepted by the Contracting Officer. As new equipment is installed, it shall be labeled "NOT IN SERVICE" until the new equipment is accepted. Once the modified system is completed, tested, and accepted by the Government, it shall be placed in service and connected to the station fire alarm system. New equipment shall have tags removed and the existing equipment shall be tagged "NOT IN SERVICE" until removed from the building.

2.1.1 Equipment Removal

After acceptance of the new system by the Contracting Officer, any fire alarm equipment removed as part of the fire alarm modification shall be

disposed of by the Contractor. Unused exposed conduit shall be removed and disposed of and damaged surfaces shall be restored.

2.1.2 Other Divisions To Be Coordinated With

Refer to the following sections for related work and coordination:

Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

Section 21 13 16.00 20 DRY-PIPE FIRE SPRINKLER SYSTEMS

Section 07 84 00 FIRESTOPPING for additional work related to firestopping.

2.1.3 Manufacturer Qualifications

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

2.2 INTERIOR FIRE ALARM SYSTEM DESIGN

2.2.1 Definitions

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

- a. Analog/Addressable System: A system in which multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.
- b. Hard Wired System: A system in which alarm and supervisory initiating devices are directly connected, through individual dedicated conductors, to a central control panel without the use of analog/addressable circuits or devices.
- c. Interface Device: An addressable device which interconnects hard wired systems or devices to an analog/addressable system.
- d. Fire Alarm Control Unit: A control panel, remote from the fire alarm control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.
- e. Fire Alarm Control Panel (FACP): A master control panel having the features of a fire alarm control unit and to which fire alarm control units are interconnected. The panel has central processing, memory, and input and output terminals.
- f. Terminal Cabinet: A steel cabinet with locking, hinge-mounted door in which terminal strips are securely mounted.

2.2.2 System Operation

The system shall be a complete, supervised, noncoded, analog/addressable

fire alarm system conforming to NFPA 72. The system shall have an interconnected riser loop or network having Style 6 supervision that shall not be located in the same room or shaft. The return portion of the loop shall be remote from the supply portion of the loop. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. The system shall provide the following functions and operating features:

- a. The FACP and fire alarm control units, if used, shall provide power, annunciation, supervision, and control for the system.
- b. Match existing circuit wiring classification of initiating device circuits.
- c. Match existing circuit wiring classification of signaling line circuits.
- d. Match existing circuit wiring classification of notification appliance circuits. The visual alarm notification appliances shall have the flash rates synchronized.
- e. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.
- f. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault. The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature which shall silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.
- g. Provide a notification appliance silencing switch which, when activated, will silence the audible signal appliance, but will not affect the visual alarm indicator, the liquid crystal display, or the automatic notification of the fire department. This switch shall be overridden upon activation of a subsequent alarm.
- h. Provide alarm verification capability for smoke sensors. Alarm verification shall initially be set for 30 seconds.
- k. Alarm, supervisory, and/or trouble signals shall be automatically transmitted to the fire department.
- l. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
- m. The system shall be capable of being programmed from the panel's keyboard. Programmed information shall be stored in non-volatile memory.
- n. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

- o. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.
- p. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as an HVAC system , the addressable fire alarm relay shall be within 3 feet of the emergency control device.
- q. An alarm signal shall automatically initiate the following functions:
 - (1) Transmission of an alarm signal to the fire department.
 - (2) Visual indication of the device operated on the fire alarm control panel (FACP), .
 - (3) Continuous actuation of all alarm notification appliances, except those in stairs or in elevator cabs.
 - (4) Operation of a duct smoke sensor shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.
- r. A supervisory signal shall automatically initiate the following functions:
 - (1) Visual indication of the device operated on the FACP and sound the audible alarm at the respective panel.
 - (2) Transmission of a supervisory signal to the fire department .
- s. A trouble condition shall automatically initiate the following functions:
 - (1) Visual indication of the system trouble on the FACP , and sound the audible alarm at the respective panel.
 - (2) Transmission of a trouble signal to the fire department.
- t. The maximum permissible elapsed time between the actuation of an initiating device and its indication at the FACP shall be 15 seconds.
- u. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP shall not exceed 200 seconds.

2.2.3 System Monitoring

- a. Valves: Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Each tamper switch shall be provided with a separate address.

2.2.4 Overvoltage and Surge Protection

- a. Signaling Line Circuit Surge Protection: For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41.1 and IEEE C62.41.2. Cables and conductors, which serve as communications links, shall have surge protection circuits installed at each end that meet the following waveforms:

- (1) A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

2.2.5 Addressable Interface Devices

The addressable interface (AI) device shall provide an addressable input interface to the FACP for monitoring normally open or normally closed contact devices such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc.

2.2.6 Smoke Sensors

2.2.6.1 Duct Smoke Sensors

Duct smoke sensors shall be analog/addressable photoelectric type as described in paragraph entitled "Photoelectric Smoke Sensors," and shall be provided in ductwork in accordance with NFPA 90A and in accordance with manufacturer's recommendations.

2.2.6.2 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval.

2.2.7 Emergency Power Supply

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

2.2.7.1 Batteries

If required, provide sealed, maintenance-free, lead-calcium batteries as the source for emergency power to the FACP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.2.7.2 Capacity

Provide the batteries with sufficient capacity to operate the system under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal devices under alarm conditions for an additional 10 minutes.

2.2.8 System Field Wiring

2.2.8.1 Wiring Within Cabinets, Enclosures, Boxes, Junction Boxes, and Fittings

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors which are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, which are securely mounted. The use of wire nuts or similar devices shall be prohibited.

2.2.8.2 Terminal Cabinets

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size shall be appropriate for the size of the wiring to be connected. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the terminal cabinet. Minimum size is 8 inches high by 8 inches.

2.2.8.3 Alarm Wiring

Signaling line circuits and initiating device circuit field wiring shall be copper, No. 16 AWG size conductors at a minimum. Notification appliance circuit conductors, that contain audible alarm devices, other than speakers, shall be solid copper No. 14 AWG size conductors at a minimum. Wire may be solid or stranded. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be No. 12 AWG solid copper having similar insulation. Provide all wiring in rigid metal conduit or intermediate metal conduit. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP. Color coding is required for circuits and shall be maintained throughout the circuit.

2.2.8.4 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACP, and fire alarm control unit shall contain a laminated drawing which indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

2.2.9 Manual Stations

Provide metal or plastic, semi-flush mounted, double action, addressable manual stations, which are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations which require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station.

2.2.10 Notification Appliances

2.2.10.1 Visual Alarm Signals

Provide strobe light visual alarm signals which operate on a supervised 24 volt DC circuit. The strobe lens shall comply with UL 1971 and conform to the Americans With Disabilities Act. The light pattern shall be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. The strobe flash output shall be a minimum of 15 candela based on the UL 1971 test. The strobe shall have a xenon flash tube. Visible appliances may be part of an audio-visual assembly. Where more than two appliances are located in the same room or corridor, provide synchronized operation.

2.2.10.2 Fire Alarm Horns

Provide surface mounted electronic multi-tone horns that produce a minimum of four distinct sounds, suitable for use in an electrically supervised circuit. Horns shall have a rating of 90 dBA at 10 feet when tested in accordance with UL 464 while emitting a slow whoop tone. Output from the horn shall match existing fire alarm system output tone. Where horns and strobes are provided in the same location, they may be combined into a single unit.

2.2.10.3 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

2.2.11 Valve Monitor Switches (Tamper Switches)

Provide a tamper switch for each fire protection system control valve. Tamper switches shall be UL listed as "Extinguishing System Attachment" for the location and type of valve supervised. The device shall contain double pole, double throw contacts. Operation of the switch shall cause a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Tamper switches shall be equipped with screw terminals for each conductor.

2.2.12 Waterflow Detectors

- a. Provide vane type waterflow detectors for wet pipe sprinkler systems. The device shall contain double pole, double throw contacts. Equip the detector with a pneumatic time delay, field adjustable from 0 to 90 seconds. The time delay shall be set initially to 30 seconds. The

device shall be a UL listed extinguishing system attachment rated for the particular pressure and location at which it is installed. Flow switches shall be equipped with screw terminals for each conductor.

2.3 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE ALARM INITIATING AND INDICATING DEVICES

- a. Manual Stations: Locate manual stations where shown on the drawings. Mount stations so that their operating handles are 4 feet above the finished floor. Mount stations so they are located no farther than 5 feet from the exit door they serve, measured horizontally.
- b. Notification Appliance Devices: Locate notification appliance devices as required by NFPA 72 and where shown on the drawing. Mount assemblies on walls 80 inches above the finished floor or 6 inches below the ceiling whichever is lower.
- c. Water Flow Detectors and Tamper Switches: Locate water flow detectors and tamper switches where shown on the drawings and at each supervised sprinkler valve station.
- d. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.

3.2 DISCONNECTION AND REMOVAL OF EXISTING SYSTEM

- a. The existing fire alarm and smoke detection system shall remain in operation at all times during the installation and commissioning of the additional devices. Once the new devices are on-line and accepted by the Government, remove any fire alarm equipment that was demolished as part of the renovation.. As new equipment is installed, label it "NOT IN SERVICE." Upon acceptance, remove labels.
- b. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items that are no longer being used.

3.3 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Section 07 84 00 FIRESTOPPING.

3.4 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes, conduit, and surface metal raceways, red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

3.5 FIELD QUALITY CONTROL

3.5.1 Tests

- a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- b. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- c. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- d. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Officer.
- e. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are provided at the job site:
 - (1) The systems manufacturer's technical representative
 - (2) Marked-up red line drawings of the system as actually installed
 - (3) Megger test results
 - (4) Loop resistance test results
 - (5) Complete program printout including input/output addresses

The final tests shall be witnessed by the Naval Facilities Engineering Command, Fire Protection Engineer. At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance. In existing buildings, the transfer of devices from the existing system to the new system and the permission to begin demolition of the old fire alarm system will not be

permitted until the as-built drawings and O&M manuals are received.

3.5.2 Minimum System Tests

Test the system in accordance with the procedures outlined in **NFPA 72**. The required tests are as follows:

- a. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
- b. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- c. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Testing of duct smoke detectors shall comply with the requirements of **NFPA 72**.
- d. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- e. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
- f. Determine that the system is operable under trouble conditions as specified.
- g. Visually inspect wiring.
- h. Test the battery charger and batteries.
- i. Verify that software control and data files have been entered or programmed into the **existing** FACP. Hard copy records of the software shall be provided to the Contracting Officer.
- j. Verify that red-line drawings are accurate.
- k. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- l. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- m. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.
- n. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

3.6 INSTRUCTION OF GOVERNMENT EMPLOYEES

Equipment manufacturer shall provide 3 days on site **training**. Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. **Training** shall

occur within 6 months of system acceptance.

3.6.1 Instructor

Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection system.

3.6.2 Qualifications

Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

3.6.3 Required Instruction Time

Provide 16 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

-- End of Section --

SECTION 31 23 00.00 20

EXCAVATION AND FILL

02/11

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.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2010) Installation of Ductile-Iron Water Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M (2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C33/C33M (2016) Standard Specification for Concrete Aggregates

ASTM D1140 (2017) Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No. 200) Sieve in Soils by Washing

ASTM D1556/D1556M (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

ASTM D1557 (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³)

ASTM D2216 (2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D2321 (2014; E 2014) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D2487 (2011) Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D4318 (2010; E 2014) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM D6938 (2017) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D698

(2012; E 2014; E 2015) Laboratory
Compaction Characteristics of Soil Using
Standard Effort (12,400 ft-lbf/cu. ft.
(600 kN-m/cu. m.))

1.2 DEFINITIONS

1.2.1 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.2 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D698, for general soil types, abbreviated as percent laboratory maximum density.

1.2.3 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.4 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Borrow Site Testing; G

Fill and backfill test

Porous fill test for capillary water barrier

Density tests

Moisture Content Tests

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- c. Hard materials and rock will not be encountered.
- d. Borrow material in the quantities required is not available at the project site.
- e. Blasting will not be permitted. Remove material in an approved manner.
- f. Contaminated soil may be encountered at the site. Refer to construction drawings and this Section for disposal requirements. Comply with State and Region IV EPA requirements when encountering the water table. Submit a Health and Safety Plan to the Contracting Officer a minimum of two months prior to initiating excavation activities for continued distribution to the AHJ. Provide individual Health and Safety Plans for each construction area.

1.6 REQUIREMENTS FOR OFF SITE SOIL

Do not furnish or transport soils onto MCAS Cherry Point or outlying fields when such act would violate the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or the General Statutes of North Carolina.

The contractor shall provide documentation certifying that all soil furnished under the contract contains no petroleum or hazardous or toxic materials as stated in DoD Instruction 4715.6, which implements 10 U.S.C. 2692. This documentation shall include the Soil Authorization Form (SAF) showing the volume of soil needed, analytical test data to support the environmental condition of the soil, and a copy of the State-issued "mining permit" for the borrow pit source. The MCAS Cherry Point Environmental Affairs Department (EAD) will review these documents before off site soil is considered approved for use.

The following methods shall be used to determine if soil meets the requirements for off site soil (RFOSS).

If the total amount of soil to be brought onto MCAS Cherry Point for a single contract is less than 200 cubic yards, the contractor shall certify the soil meets the RFOSS by inspecting for "apparent contamination" as determined by visual or other indications of contamination including abnormal or unnatural color, chemical or petroleum odors, or saturation with a chemical or petroleum. If the soil shows no apparent contamination,

the contractor shall provide to EAD a signed SAF certifying the soil contains no apparent contamination. Soil showing apparent contamination shall not be utilized aboard MCAS Cherry Point or outlying fields.

If the total amount of soil to be brought aboard MCAS Cherry Point for a single contract is equal to or greater than 200 cubic yards, the soil shall be analyzed by a North Carolina certified laboratory. The laboratory must be certified by North Carolina in the specific tests to be performed. Sampling must be conducted by qualified personnel following proper field sampling methodology and proper chain-of-custody protocol must be followed. Otherwise, the sampling will be considered invalid. Consult with the selected laboratory about the specific sample handling procedures required by the analytical methods. Sample containers, sample volumes, and timeframes differ depending on the analytical method.

Sampling requirements are summarized below and are for a single soil source only.

- a. One representative sample for soil volumes of 200 cubic yards to 1,000 cubic yards needed.
- b. For soil volumes greater than 1,000 cubic yards, one additional representative sample is required for each additional 2,000 cubic yards or portion thereof.

A representative sample is achieved by collecting multiple samples in a defined area (e.g. soil stockpile or borrow pit) and directing the laboratory to combine them into a "composite sample" for analysis. The composite or representative sample is intended to represent the soil source as a whole.

Samples shall be collected by qualified personnel following proper field sampling methodology. For each representative sample, 3 "primary samples" from each of 2 soil borings (or excavation pits) shall be obtained for a total of 6 primary samples. The 3 primary samples collected from each boring/pit shall be obtained at even intervals throughout the soil column (i.e. upper, middle, lower) and placed into individual sampling containers. Samples shall not be combined in the field. The 6 primary samples shall be sent to the NC certified laboratory where they will be combined into one "composite sample" for analysis.

Soil sample(s) shall be analyzed for Gasoline Range Organics (GRO), Diesel Range Organics (DRO), Oil and Grease (O&G), and eight Metals (Arsenic; Barium; Cadmium; Chromium; Lead; Mercury; Selenium; and Silver). The laboratory method detection limits must be set below the State action levels or the testing will be considered invalid. All units are to be reported in milligrams per kilograms (mg/kg).

Soil samples should be analyzed for the following parameters:

- a. Gasoline Range Organics - use Standard Method 5030
- b. Diesel Range Organics - use Standard Method 5030
- c. Oil & Grease - use EPA Method 9071 with a silica gel wash
- d. Total Metals - use EPA 6010 (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, and Silver)

e. Total Metals - use EPA 7471 (Mercury only)

If test results are greater than the allowed detection limits for petroleum constituents (GRO, DRO, O&G) or the standards for the eight metals (as provided by the EPA), the soil from which the sample was taken shall not be approved for use.

1.7 CONTAMINATED SOILS

The project site is located near or within an area with a history of major POL or chemical spills. Pre-characterization or soil sampling is not required prior to excavation. This information is provided to give the contractor's Industrial Hygiene Department for incorporation into their Health and Safety Plan to ensure worker safety.

If any soil which exhibits an abnormal or unnatural color, a chemical or petroleum odor, or is saturated with a chemical or petroleum is encountered during excavation, Contractor shall immediately stop work in that area, and the Contractor shall advise the Environmental Affairs Department (EAD) of the situation so a course of action can be developed to address the contamination.

All excavated soil may be re-utilized as backfill at the same location from which it was removed unless petroleum contamination is discovered. If petroleum contamination is discovered, the soil shall be segregated by PID (≥ 10 ppm or exhibits staining), properly stockpiled, tested, and disposed. If soil is stockpiled, it shall be stockpiled on plastic, bermed, and covered in accordance with NC DEQ Groundwater Section Guidelines for the Investigation and Remediation of Soil and Groundwater, Vol. 1 dated July 2000 (Guidelines), or placed in a rolloff container and covered with plastic.

Any excess soil that cannot be re-utilized as backfill at the same location from which it was removed shall be disposed at a Subtitle D landfill (e.g.; Tuscarora) as a minimum with the understanding that the analytical testing results shall determine the final disposal facility. Contractor shall provide supporting laboratory analysis to the EAD for review. The EAD shall review and sign the waste manifests/bill of lading for the soil disposal prior to any of this soil leaving the Air Station. The manifest shall also contain the amount of soil (weight) and supporting laboratory results for EAD to review. One composite sample shall be taken and analyzed for each 200 cubic yards of the stockpile per DEQ Guidelines in order to determine the proper method for disposal.

Use of a North Carolina certified laboratory to perform the specific soil analyses is required. The laboratory shall be certified by North Carolina in the specific tests to be performed. Contractor shall consult with the selected laboratory about the specific sample handling procedures required by the analytical methods. Sample containers, volumes, procedures, and preservation vary among methods. Sampling shall be conducted by qualified personnel and proper chain-of-custody protocol shall be followed. The stockpile sample(s) shall be analyzed for the following:

Std Method 5030 sample prep with Modified 8015 (CA GC-FID Method) - Gasoline Range Organics,

Std Method 5030 and 3550 sample prep with Modified 8015 - Diesel Range Organics,

EPA Method 9071 - Oil & Grease, with silica gel wash

Full TCLP

All disturbed areas shall also be capped topping the excavated area with 12 inches of compacted, clean fill. Capping is required to prevent an increased exposure risk from both surficial exposure and contaminant leaching. Therefore, backfilled soils shall be compacted to minimize infiltration of surface water through the soil column.

In contaminated areas, if dewatering is required during excavation, all water shall be containerized. The groundwater shall not be discharged to the ground surface, storm sewer etc. prior to sampling and analysis due to the potential contamination from migrating plumes. FACENG/ROICC shall make arrangements with the IWTP for disposal of contaminated groundwater. If groundwater is accepted for disposal by the IWTP, then sampling may not be required (water disposed of at the IWTP, historically has not required testing). A chit shall be obtained from EAD (Timothy Lawrence 466-2754) prior to sending contaminated water to the IWTP.

1.8 QUALITY ASSURANCE

1.8.1 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Excavation made with power-driven equipment is not permitted within **two feet** of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

2.1.1 Satisfactory Materials

Any materials classified by **ASTM D2487** as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SP-SM, free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than **3 inches**. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in [ASTM D2487](#) as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

2.1.4 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.1.5 Backfill and Fill Material

[ASTM D2487](#), classification GW, GP, GM, GC, SW, SP, SM, SC with a maximum [ASTM D4318](#) liquid limit of 35, maximum [ASTM D4318](#) plasticity index of 12, and a maximum of 25 percent by weight passing [ASTM D1140](#), No. 200 sieve.

2.2 POROUS FILL FOR CAPILLARY WATER BARRIER

[ASTM C33/C33M](#) fine aggregate grading with a maximum of 3 percent by weight passing [ASTM D1140](#), No. 200 sieve, or coarse aggregate Size 57 and conforming to the general soil material requirements specified in paragraph entitled "Satisfactory Materials."

2.3 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with [AWWA C600](#), Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of [ASTM D698](#) maximum density. Plastic piping shall have bedding to spring line of pipe. Provide [ASTM D2321](#) materials as follows:

- a. Class I: Angular, [0.25 to 1.5 inches](#), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- b. Class II: Coarse sands and gravels with maximum particle size of [1.5 inches](#), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in [ASTM D2487](#).

2.3.1 Sand

Clean, coarse-grained sand classified as SW or SP by [ASTM D2487](#) for bedding.

2.4 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property, [at Contractor's cost](#).

2.5 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and

alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes	
Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Potable Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air
Purple:	Non Potable, Reclaimed Water, Irrigation and Slurry lines

2.5.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.5.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.6 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water

encountered during construction.

3.1.1.1 Drainage

See Paragraph 1.7 for Contaminated Soils.

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils, prevent erosion and undermining of foundations. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.1.1.2 Dewatering

See Paragraph 1.7 for Contaminated Soils.

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously.

3.1.2 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall contact the Public Works Department for assistance in locating existing utilities. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

3.1.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 SURFACE PREPARATION

3.2.1 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with backfill and fill material and compact to 95 percent of maximum density. Unless specified otherwise, refill excavations cut below indicated depth with backfill and fill material and satisfactory material and compact to 95 percent of **ASTM D1557** maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.3.1 Structures With Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

3.3.2 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

3.3.3 Stockpile

Any soil that is excavated during construction that shows contamination by visible sight, smell or pid detection shall be segregated and stockpiled for testing prior to removal from the project site. See construction drawings for detail as to construction of typical containment stockpile. Temporary stockpile shall be constructed and maintained in accordance with EOA, EPA, and NCDENR standards and specification.

3.3.4 Soil and Water Testing

The Contractor shall test all soil and water for contaminants indicated prior to removal from site. The Contractor shall be responsible for all labor, materials, equipment necessary to test and control soil and water on-site. Soil and water testing shall be performed by a certified laboratory and written reports provided to the Contracting Officer.

- a. Std. Method 5030 Sample Prep with modified 8015 - gasoline range organics
- b. Std Method 5030 and 3550 Sample Prep with modified 8015 - diesel range organics
- c. EPA Method 9071 - oil & grease with silica gel wash
- d. Full TCLP

All contaminated soil and water removed from site shall be treated and/or disposed of at a NCDENR permitted site.

Water determined by testing to be free of contamination shall be released from the site in accordance with NCDENR sediment and erosion control regulations and permits.

3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified herein.

3.4.1 Proof Rolling

Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade of the building addition with six passes of a dump truck loaded with 15 ton, pneumatic-tired roller. Operate the truck in a systematic manner to ensure the number of passes over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. When proof rolling under buildings, the building subgrade shall be considered to extend 5 feet beyond the building lines, and one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut as directed by the Contracting Officer.

3.5 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

3.5.1 Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs and foundations. Place in 6 inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.5.2 Porous Fill Placement

Provide under floor and area-way slabs on a compacted subgrade. Place in 4 inch lifts with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.5.3 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6 inch lifts to top of trench and in 6 inch lifts to one foot over pipe outside structures and paved areas.

3.6 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained from off-base sources at Contractor's expense.

3.7 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.8 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.9 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required.

3.9.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area or structure to 90 percent of ASTM D1557.

3.9.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact

fill and backfill material to 95 percent of ASTM D1557.

3.9.3 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact fill and backfill materials to 95 percent of ASTM D1557.

3.10 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

3.11 FIELD QUALITY CONTROL

3.11.1 Sampling

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

3.11.2 Testing

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

3.11.2.1 Fill and Backfill Material Testing

Test fill and backfill 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 D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.11.2.2 Porous Fill Testing

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

3.11.2.3 Density Tests

Test density in accordance with ASTM D1556/D1556M, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556/D1556M density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556/D1556M density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations every 2000 square feet of existing grade in fills for structures and concrete slabs, and every 2500 square feet for other fill areas and every 2000 square feet of subgrade in cut. Include density test results in daily report.

3.11.2.4 Moisture Content Tests

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D2216. Include moisture content test results in daily report.

-- End of Section --

F-35B Lift System Repair Facility
MCAS CHERRY POINT, NC

17P766
EPROJECT W.O. NO. 1564839

SECTION 31 66 13

HELICAL PILES AND HELICAL ANCHORS
08/15

PART 1 GENERAL

1.1 DEFINITIONS

- A. Helical Pile: Manufactured steel foundation with one or more helical bearing plates that is rotated into the ground to support structures.
- B. Engineer: Individual or firm retained by General Contractor to verify Helical Pile and Helical Anchor quality assurance with the Contract, the Drawings, and this specification.
- C. Allowable Bearing Capacity: Ultimate bearing capacity of the bearing stratum divided by a factor of safety.
- D. Lead Section: The first section of a Helical Pile or Helical Anchor to enter the ground. Lead Sections consist of a central shaft with a tapered end and one or more helical bearing plates affixed to the shaft.
- E. Extension Section: Helical Pile or Helical Anchor sections that follow the Lead Section into the ground and extend the Helical Lead to the appropriate depth. Extension Sections consist of a central shaft and may have helical bearing plates affixed to the shaft.
- F. Brackets: Cap plate, angle, thread bar, or other termination device that is bolted or welded to the end of a Helical Pile or Helical Anchor after completion of installation to facilitate attachment to structures or embedment in cast-in-place concrete.
- G. Augering: Rotation of the shaft with little or no advancement. It can occur when the helical bearing plates pass from a relatively soft material into a comparatively hard material. Augering can also result from insufficient crowd or downward pressure during installation. In some cases, augering may be (temporarily) necessary in order to grind through an obstruction.
- H. Pile Design Professional: Individual or firm responsible for the design of Helical Piles, Helical Anchors, and Brackets.

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.

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|---------------------------------------------------------------------------------------------------|
| ASTM D1143/D1143M | (2007; R 2013) Piles Under Static Axial Compressive Load |
| ASTM D3689 | (2007; E 2013; R 2013) Standard Test Methods for Deep Foundations Under Static Axial Tensile Load |

ASTM D3966/D3966M

(2007) Standard Test Methods for Deep
Foundations Under Lateral Load

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Helical Piles; G
Design Calculations

SHOP DRAWINGS: HELICAL PILES

A Contractor shall prepare and submit to the Government for review and approval, Shop Drawings and specifications for the Helical Piles and Helical Anchors intended for use on the project prior to start of installation. The Shop Drawings shall include the following:

1. Helical Pile and Helical Anchor product identification number(s) and designation(s)
2. Maximum allowable mechanical compression and tensile strength of the Helical Piles and Helical Anchors
3. Number of Helical Piles and Helical Anchors and respective design allowable capacities from the Drawings
4. Planned installation depth and the number of lead and extension sections
5. Preliminary helical configuration (number and diameter of helical bearing plates)
6. Manufacturer's recommended capacity to installation torque ratio
7. Product identification numbers and designations for all Bracket Assemblies and number and size of connection bolts or concrete reinforcing steel detail
8. Corrosion protection coating on Helical Piles, Helical Anchors, and Bracket Assemblies

B. Contractor's Pile Design Professional shall submit to the Government design calculations for the Helical Piles, Helical Anchors, and Brackets intended for use on the project. The Shop Drawings shall include the following:

1. Reduction in shaft dimension and strength by the sacrificial thickness anticipated based on corrosion loss over the design life for project soil conditions.
2. Minimum installation depth to reach bearing stratum and to achieve pullout capacity (if required).
3. Soil bearing and pullout capacity.

4. Lateral resistance of the shaft (if required).
5. Estimated pile head movement at design loads.

C. Work shall not begin until all the submittals have been received and approved by the **Government**. The Contractor shall allow the **Government** a reasonable number of days to review, comment, and return the submittal package after a complete set has been received. All costs associated with incomplete or unacceptable submittals shall be the responsibility of the Contractor.

1.4 QUALIFICATIONS

A. The Helical Pile Contractor shall be experienced in performing design and construction of Helical Piles and shall furnish all materials, labor, and supervision to perform the work. The Contractor shall be trained and certified in the proper methods of design and installation of Helical Piles. The Contractor shall provide names of on-site personnel materially involved with the work, including those who carry documented certification. At a minimum, these personnel shall include foreman, machine operator, and project engineer/manager.

B. Due to the special requirements for design of Helical Piles, Helical Anchors, and Brackets, all Helical Piles, Helical Anchors, and Brackets shall be designed by a licensed design professional specialized in the engineering and design of Helical Piles and Helical Anchors.

1.5 DELIVERY, STORAGE, AND HANDLING

All Helical Pile, Helical Anchor, and Bracket Assemblies shall be free of structural defects and protected from damage. Store Helical Piles, Helical Anchors, and Bracket Assemblies on wood pallets or supports to keep from contacting the ground. Damage to materials shall be cause for rejection.

PART 2 PRODUCTS

2.1 HELICAL PILES

A. Unless noted otherwise, it is the Contractor's Pile Design Professional's responsibility to select the appropriate size and type of Helical Piles and Brackets to support the design loads shown on the Drawings. These specifications and the Drawings provide minimum requirements to aid the Contractor in making appropriate materials selections. The size and number of helical bearing plates must be such that the Helical Piles and Helical Anchors achieve the appropriate capacity in the soils at the site within the minimum and maximum length requirements. Failure to achieve proper capacity shall result in Contractor replacing Helical Piles and Helical Anchors as appropriate to support the required loads. All material replacements shall be acceptable to **the Government**.

B. The design strength of the helical bearing plates, shaft connections, Brackets, and the pile shaft itself shall be sufficient to support the design loads specified on the Drawings times appropriate service load factors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor shall take reasonable effort to locate all utilities and structures above and underground in the area of the Work. Contractor shall pot hole to determine the exact location of underground utilities and buried structures within a distance from a Helical Pile or Helical Anchor equal to three times the maximum helix diameter. Contractor is responsible for protection of utilities and structures shown on the Drawings.

B. Contractor shall review Drawings and soil borings in the Contract Documents to determine subsurface conditions for sizing and installation of Helical Piles and Helical Anchors. In addition, Contractor shall make a site visit to observe conditions prior to the start of Work.

C. Contractor shall notify **Government** of any condition that would affect proper installation of Helical Piles and Helical Anchors immediately after the condition is revealed. Contractor shall halt installation work until the matter can be resolved upon mutual satisfaction of Contractor, **Contracting Officer**, and **Government**.

3.2 TERMINATION CRITERIA

A. Helical Piles and Helical Anchors shall be advanced until all of the following criteria are satisfied.

1. Axial capacity is verified by achieving the final installation **requirements** as provided by the Pile Design Professional.

2. Minimum depth is obtained. The minimum depth shall be as shown on the Drawings which corresponds to the planned bearing stratum.

3.3 ALLOWABLE TOLERANCES

A. Helical Piles and Helical Anchors shall be installed as close to the specified installation and orientation angles as possible. Tolerance for departure from installation and orientation angles shall be +/- 5 degrees.

B. Helical Piles, Helical Anchors, and Bracket Assemblies shall be installed at the locations and to the elevations shown on the Plans. Tolerances for Bracket Assembly placement shall be +/- 1 inch in both directions perpendicular to the shaft and +/- 1/4 inch in a direction parallel with the shaft unless otherwise specified.

3.4 QUALITY ASSURANCE

A. The Contractor shall provide the **Government** and Contracting Officer copies of installation records after each installation is completed. These installation records shall include, but are not limited to, the following information:

1. Name of project and Contractor

2. Name of Contractor's supervisor during installation

3. Date and time of installation

4. Name and model of installation equipment
5. Type of torque indicator used
6. Location of Helical Pile or Helical Anchor by grid location, diagram, or assigned identification number
7. Type and configuration of Lead Section with length of shaft and number and size of helical bearing plates
8. Type and configuration of Extension Sections with length and number and size of helical bearing plates, if any
9. Installation duration and observations
10. Total length installed
11. Final elevation of top of shaft and cut-off length, if any
12. Final plumbness or inclination of shaft
13. Installation torque at minimum three-foot depth intervals
14. Final installation torque
15. Comments pertaining to interruptions, obstructions, or other relevant information
16. Verified axial load capacity

B. Unless specified otherwise on the Drawings or by local codes, the **Government**, the Pile Design Professional, or an inspection agency accepted by the **Government** shall observe and document at least 10 percent of Helical Pile and Helical Anchor installations.

3.5 LOAD TESTING

A. Helical Pile Compression Tests

1. Compression tests shall be performed following the "quick test" procedure described in **ASTM D1143/D1143M** specifications
2. Load tests shall be observed and documented by the **Government**
3. Unless otherwise shown on the Drawings, the maximum test load shall be 200% of the allowable load shown on the Drawings
4. The locations of Helical Piles to be tested shall be determined by the Contractor, unless noted on the Drawings
5. Installation methods, procedures, equipment, products, and final installation torque shall be identical to the production Helical Piles to the extent practical except where otherwise approved by the **Government**
6. A load test shall be deemed acceptable provided the maximum test load is applied without Helical Pile failure and the deflection of the pile head at the design load is less than 1-inch unless noted otherwise

on the Drawings. Failure is defined when continuous jacking is required to maintain the load.

B. If a load test fails the forgoing acceptance criteria, the Contractor shall modify the Helical Pile or Helical Anchor design and/or installation methods and retest the modified pile or anchor, as directed by the **Government**. These modifications include, but are not limited to, de-rating the load capacity, modifying the installation methods and equipment, changing the helical configuration, or changing the product (i.e., duty). Modifications that require changes to the structure shall have prior review and acceptance of the **Contracting Officer**. Any modifications of design or construction procedures, and any retesting required shall be at the Contractor's expense.

C. The Contractor shall provide the **Contracting Officer** and **Government** copies of load test reports confirming configuration and construction details within 1 week after completion of the load tests. This written documentation will either confirm the load capacity as required on the working drawings or propose changes based upon the results of the tests. At a minimum, the documentation shall include:

1. Name of project and Contractor
2. Date, time, and duration of test
3. Location of test Helical Pile or Helical Anchor by grid location, diagram, or assigned identification number
4. Test procedure (**ASTM D1143/D1143M**, **ASTM D3689**, or **ASTM D3966/D3966M**)
5. List of any deviations from procedure
6. Description of calibrated testing equipment and test set-up
7. Type and configuration of Helical Pile or Helical Anchor including lead section, number and type of extension sections, and manufacturer's product identification numbers
8. Load steps and duration of each load increment
9. Cumulative pile-head movement at each load step
10. Comments pertaining to test procedure, equipment adjustments, or other relevant information

-- End of Section --

SECTION 32 11 23

AGGREGATE BASE COURSES
08/17

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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

- | | |
|--------------|----------------------------------------------------------------------------------------------------------------------------------|
| AASHTO T 180 | (2015) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop |
| AASHTO T 224 | (2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test |
| AASHTO T 88 | (2013) Standard Method of Test for Particle Size Analysis of Soils |

ASTM INTERNATIONAL (ASTM)

- | | |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM C117 | (2013) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing |
| ASTM C131/C131M | (2014) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C136/C136M | (2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates |
| ASTM C29/C29M | (2016) Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate |
| ASTM D1556/D1556M | (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method |
| ASTM D1557 | (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³) |
| ASTM D2167 | (2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method |

ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4318	(2010; E 2014) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM E11	(2016) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve will be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

ABC Stone

SD-06 Test Reports

Sampling and Testing; G
Field Density Tests; G

1.4 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00.00 20 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

Perform the following tests in conformance with the applicable standards listed:

1.4.2.1 Sieve Analysis

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. Perform particle-size analysis of the soils in conformance with AASHTO T 88.

1.4.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.4.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.4.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, ASTM D2167 or ASTM D6938. For the method presented in ASTM D1556/D1556M use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.4.2.5 Wear Test

Perform wear tests on ABC course material in conformance with

ASTM C131/C131M.

1.4.2.6 Weight of Slag

Determine weight per cubic foot of slag in accordance with ASTM C29/C29M on the ABC course material.

1.5 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide ABC conforming to NCDOT, Section 1005.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

- a. Sieve Analysis.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.
- e. Weight per cubic foot of Slag.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.2.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws or authorities. Clearing, stripping, and excavating are the responsibility of the Contractor.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the base course(s). Do not construct base course(s) on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in [ASTM D2487](#), stabilize the surface prior to placement of the base course(s). Stabilize by mixing ABC into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the base course is placed.

3.5 GRADE CONTROL

Provide a finished and completed base course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.6 MIXING AND PLACING MATERIALS

Mix the coarse and fine aggregates in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification. Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. Place the layers so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, clean the previously constructed layers of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Make adjustments in placing procedures or equipment as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

3.7 LAYER THICKNESS

Compact the completed base course to the thickness indicated. No individual layer may be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. Compact the base course(s) to a total thickness that is within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 1/4 inch of the thickness indicated. Measure the total thickness of the base course at intervals of one measurement for each 500 square yards of base course. Measure total thickness using 3 inch diameter test holes penetrating the base course.

3.8 COMPACTION

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Remove any materials found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.9 PROOF ROLLING

In addition to the compaction specified, proof roll areas designated on the drawings by application of two coverages of a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 30,000 pounds and inflated to a minimum of 125 psi. A coverage is defined as the application of one tire print over the designated area. In the areas designated, apply proof rolling to the top of the underlying material on which the base course is laid and to the top of each layer of base course. Maintain water content of the underlying material and each layer of the base course as specified in Paragraph COMPACTION from start of compaction to completion of proof rolling of that layer. Remove any base course materials or any underlying materials that produce unsatisfactory results by proof rolling and replace with satisfactory materials. Then recompact and proof roll to meet these specifications.

3.10 EDGES OF BASE COURSE

Place the base course(s) so that the completed section will be a minimum of one-half foot feet wider, on all sides, than the next layer that will be placed above it. Place approved material along the outer edges of the base course in sufficient quantity to compact to the thickness of the course

being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each layer of the base course, as directed.

3.11 FINISHING

Finish the surface of the top layer of base course after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin layers of material to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, scarify the top layer to a depth of at least 3 inches and blend new material in and compacted and proof rolled to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

3.12 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at 50 foot intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.13 FIELD QUALITY CONTROL

3.13.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compacted ABC. Take samples and test at the rates indicated.

- a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.
- b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 500 square yards, or portion thereof, of material placed.
- c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.
- d. Measure the thickness of the base course at intervals providing at least one measurement for each 500 square yards of base course or part thereof. Measure the thickness using test holes, at least 3 inch in diameter through the base course.

3.13.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.14 TRAFFIC

Do not allow traffic on the completed base course.

3.15 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

3.16 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 11 26.16

BITUMINOUS CONCRETE BASE COURSE

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 C131/C131M	(2014) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C183/C183M	(2015) Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM D1188	(2007; E 2010) Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens
ASTM D1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D2172/D2172M	(2017) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2726/D2726M	(2014) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3625/D3625M	(2012) Standard Practice for Effect of Water on Bituminous-Coated Aggregate Using Boiling Water
ASTM D546	(2017) Standard Test Method for Sieve Analysis of Mineral Filler for Asphalt Paving Mixtures
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D995	(1995b; R 2002) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT)

NCDOT (2012) Standard Specifications for Roads
and Structures

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-P-1952 (2015; Rev F) Paint, Traffic and Airfield
Markings, Waterborne

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. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05 Design Data

Bituminous material job-mix formula

Submit a job-mix formula prior to preparing and placing bituminous mixture. Formula shall indicate definite percentage of each sieve fraction, percentage of bitumen, percentage of each aggregate, temperature of mixture leaving mixer, number of blows of compaction per side of molded specimen, stability, flow, percent of voids total mix, percent of voids in mineral aggregate, and temperature/viscosity relationship of asphalt cement.

SD-06 Test Reports

Bituminous mix test reports

Density test reports

Thickness test reports

Smoothness test reports

1.3 QUALITY ASSURANCE

1.3.1 Safety Requirements

Provide adequate and safe stairways with handrails to mixer platform and safe and protected ladders or other means for accessibility to plant operations. Guard equipment and exposed steam or other high temperature lines which endanger personnel or create a fire hazard or cover with a suitable type of insulation. Provide hearing protection to Contractor employees and roller and spreader operators in vicinity of equipment which may emit hazardous noise levels.

1.4 DELIVERY AND STORAGE

Inspect materials delivered to the site for damage and store to prevent segregation.

1.5 ENVIRONMENTAL CONDITIONS

Construct bituminous courses when underlaying course is dry and do not construct when atmospheric temperature is below 40 degrees F.

1.6 CONSTRUCTION EQUIPMENT

Calibrated equipment, such as asphalt distributors, scales, batching equipment, spreaders and similar equipment, shall have been recalibrated by an approved calibration laboratory within 6 months of commencing work.

1.6.1 Mixing Plant

Design, coordinate, and operate mixing plant to produce a mixture within job-mix formula tolerances. The mixing plant shall meet requirements of ASTM D995, except as specified otherwise herein. The plant shall be a batch type, continuous mixing type, or drum dryer-mixer type with a minimum capacity of 100 tons per hour. Mixing plant and equipment shall remain accessible at all times for checking its adequacy, inspecting its operation, verifying weights, proportions, character of materials, and checking mixture temperatures.

1.6.1.1 Plant Screens for Batch and Continuous Mix Plants

Use screens to obtain accurate gradation. Allow no bin to contain more than 10 percent oversize or undersize. Inspect screens each day prior to commencing work for plugged, worn or broken screens. Clean plugged screens and replace worn or broken screens with new screens prior to beginning operations.

1.6.1.2 Bins

Divide bins into at least three compartments arranged to insure separate and adequate storage of appropriate fractions of aggregate.

1.6.1.3 Dust Control

Equip plant with a dust collector designed to waste or return in a constant flow all or part of the material collected. Recover quantity as necessary to provide and maintain composition specified. Plant shall have a mixer cover and such additional housing to insure proper control of dust.

1.6.2 Paving Equipment

1.6.2.1 Spreading Equipment

Self-propelled electronically controlled type, unless other equipment is authorized by the Contracting Officer. Equip spreading equipment of the self-propelled electronically controlled type with hoppers, tamping or vibrating devices, distributing screws, electronically adjustable screeds, and equalizing devices. Capable of spreading hot bituminous mixtures without tearing, shoving, or gouging and to produce a finished surface of specified grade and smoothness. Operate spreaders, when laying mixture, at variable speeds between 5 and 45 feet per minute. Design spreader with a quick and efficient steering device; a forward and reverse traveling speed; and automatic devices to adjust to grade and confine the edges of the mixture to true lines. The use of a spreader that leaves indented areas or other objectionable irregularities in the fresh laid mix during operations will not be permitted.

1.6.2.2 Rolling Equipment

Self-propelled pneumatic-tired rollers supplemented by three-wheel and tandem type steel wheel rollers. The number, type and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material. All rollers shall be suitable for rolling hot-mix bituminous pavements and capable of reversing without backlash. Pneumatic-tired rollers shall be capable of being operated both forward and backward without turning on the mat, and without loosening the surface being rolled. Equip rollers with suitable devices and apparatus to keep the rolling surfaces wet and prevent adherence of bituminous mixture.

Vibratory Rollers: At the Contractor's option, vibratory rollers especially designed for bituminous concrete compaction may be used provided rollers do not impair stability of pavement structure and any underlying layers. Repair depressions in pavement surfaces resulting from use of vibratory rollers at no cost to the Government. Rollers shall be self-propelled, single or dual vibrating drums, and steel drive wheels, as applicable; equipped with variable amplitude and separate controls for energy and propulsion.

1.6.2.3 Hand Tampers

Hand tampers shall weigh not less than 25 pounds and have a tamping face of not more than 50 square inches.

1.6.2.4 Mechanical Hand Tampers

Commercial type, operated by pneumatic pressure or by internal combustion.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE

Provide asphalt concrete in accordance with the applicable requirements of the NCDOT RS, Section 610, except where specified otherwise. Recycled asphalt pavement material may be used as permitted by NCDOT.

2.2 BINDER COURSE

NCDOT, materials for the construction of the binder course shall be Type I-19.0 B.

2.3 SURFACE COURSE

NCDOT, materials for construction of the surface course shall be Type S-9.5 B.

2.4 STRIPING

Paint shall conform to FS TT-P-1952, Types I, or II.

2.5 COMPOSITION OF MIXTURE REQUIREMENTS

2.5.1 Mixture Properties

Gradation of mineral aggregate shall be as specified. Percentage of

bituminous material provided in the bituminous mixtures shall be within the limits specified. Mixtures shall have the following physical properties:

<u>Test Property</u>	<u>Values</u>
Stability (50 Blows)	Not less than 1000 pounds
Flow (0.01 inch)	Not more than 20 nor less than 8
Percent Air Voids	Not less than 3 nor more than 8 for binder course; not less than 3 nor more than 5 for wearing course
Percent Voids in Mineral Aggregates	See Table I

TABLE I		
MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE (VMA)		
<u>U.S.A. Standard Sieve Designation</u>	<u>Nominal Maximum Particle Size, Inch</u>	<u>Minimum VMA Percent</u>
No. 4	0.187	18
3/8 inch	0.375	16
1/2 inch	0.500	15
3/4 inch	0.750	14
1 inch	1.000	13

PART 3 EXECUTION

3.1 MIXING

Produce bituminous mixture in a plant as specified herein. Stockpile fine and coarse aggregates separately and feed to drier by separate mechanical feeders in a manner to produce an asphaltic concrete mixture within tolerances specified for job-mix formula. Heat and dry aggregates thoroughly. Make temperature of aggregate, mineral filler, and asphalt in mixer such that viscosity of asphalt in mixture shall be in the range of 150 to 300 centistokes kinematic or 75-150 seconds, Saybolt-Furol. Provide adequate dry storage for mineral filler at mixing plant. After aggregates have been prepared, accurately weigh or measure and convey them into mixer in proportionate amounts of each aggregate size required. Weigh or feed mineral filler by some accurate and uniform measurement, and add separately, and in a dry condition, as near as possible to center of mixer. Introduce required amount of asphalt for each batch, or calibrated amount for continuous mixing, into mixer. In batch mixing, charge aggregates into mixer, add asphalt, and continue mixing for at least 25 seconds or longer to obtain a homogeneous mixture. When a continuous mixer

is used, mixing time shall be not less than 30 seconds to obtain a homogeneous mixture. Temperature of asphalt at time of mixing shall not exceed 350 degrees F. When prepared in a twin pugmill mixer, depth of mixture shall be not greater than the tips of mixer blades when blades are in a vertical position. Reject overheated and carbonized mixtures, and mixtures that foam, segregate, or strip. When excessive moisture causes foaming, segregation, or stripping, remove all aggregates in hot bins and place in their respective stockpiles; for drum-drier plant mixes, waste the mix, except as otherwise approved by the Contracting Officer.

3.2 TRANSPORTATION OF BITUMINOUS MIXTURES

Transport bituminous mixture from paving plant to the site in trucks having tight, clean, smooth beds which have been painted or sprayed with a limewater, soap, or detergent solution at least once a day to prevent adhesion of the mixture to truck bodies. Cover each load with canvas or other suitable material of ample size to protect it from the weather and to prevent loss of heat. Make deliveries so that spreading and rolling of all mixture prepared for a day's run can be completed during daylight, unless satisfactory artificial light is provided. Deliver mixture to the area to be paved in such a manner that temperature at the time of dumping the spreader shall be not less than 225 degrees F or that required to obtain the specified compaction. Reject any load that has become wet prior to placing.

3.3 PLACING

Provide line and grade stakes as necessary for control. Place grade stakes in lanes parallel to centerline of area to be paved, and suitably space for string lines. Place and compact bituminous courses in such thicknesses to achieve density and smoothness requirements. Maximum lift of bituminous base course shall not exceed 6 inches. Prior to laying the base course, clean underlying course of foreign and objectionable matter with power blowers, power brooms, or hand brooms in places inaccessible to power equipment, and inspect for compaction and smoothness requirements. The range of temperatures of the mixtures at the time of spreading shall be between 225 degrees F and 300 degrees F. Reject bituminous mixture having a temperature outside these limits when dumped into the hopper of the spreader. Adjust mechanical spreader and regulate speed so that the surface of the course is smooth, and when compacted conforms to depth, cross sections, grades, and contours indicated. When irregularities of surface or deficiency in depth is more than specified tolerances, remove defective work and replace with new material. Whenever possible, place the mixture in strips not less than 10 feet wide. Overlap rolling to previously placed strip and extend to overlap first strip. Place mixture as continuously as possible. Shovelers and rakers shall follow spreading equipment, adding hot mixture and raking as required to produce a course that, when completed, shall conform to requirements specified. In areas where the use of machine spreading is impractical, mixture may be spread by hand. Distribute mixture into place from dump boards by means of hot shovels and spread with hot rakes in a uniformly loose layer of such thickness that, when completed, it conforms to required grade and thickness. Do not dump loads any faster than they can be handled by shovelers and rakers. Paint contact surfaces of previously constructed curbs, manholes, and similar structures with a thin coat of emulsion or other approved bituminous material prior to placing the bituminous mixture.

3.4 JOINTS

All joints shall present the same texture, density, and smoothness as other portions of the course. Carefully make joints between old and new pavements or within new pavements in a manner as to ensure a thorough and continuous bond between old and new sections of the course. Paint all vertical contact surfaces of previously constructed sections with a thin uniform coat of emulsion or other approved bituminous material just before the fresh mixture is placed.

3.4.1 Transverse

The roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is to be discontinued. Except when an approved bulkhead is used, cut back the edge of the previously laid course to expose an even, vertical surface for the full thickness of the course. When required, rake fresh mixture against the joints, thoroughly tamp with hot tampers, smooth with hot smoothers, and roll. In all cases, transverse joints in adjacent lanes shall be offset a minimum of **2 feet**.

3.4.2 Longitudinal

Place longitudinal joints so that they shall not coincide with that of underlying course and shall be separated by at least **one foot**. When edges of longitudinal joints are irregular, honeycombed, or poorly compacted, cut back unsatisfactory sections of joint to expose an even, vertical surface for the full thickness of the course. Prior to placing adjacent asphalt concrete, roll joint first, then proceed to opposite side and roll, moving each time toward the joint.

3.5 COMPACTION OF MIXTURE

Affect compaction by rolling. Begin rolling as soon after placing as the mixture will bear the roller without undue displacement. Delays in rolling freshly spread mixture will not be tolerated. Start rolling longitudinally at extreme sides of lanes and proceed toward center of pavement, overlapping on successive strips by at least one-half the width of rear wheel of roller. Alternate trips of roller shall be slightly different lengths. Affect initial longitudinal rolling by the use of steel roller. Make tests for conformity with specified crown, grade, and smoothness immediately after initial compression. Before continuing rolling, correct any variations by removing or adding materials, then roll course using pneumatic-tired rollers or tandem rollers, while mixture is hot and in condition suitable for proper compaction. Speed of rollers shall not exceed **3 miles per hour** and at all times be slow enough to avoid displacement of hot mixture. Correct any displacement of mixture at once by use of rakes and apply fresh mixture or remove mixture as required. Continue rolling until all roller marks are eliminated and course has a density of at least 97 percent of that attained in a laboratory specimen of the same mixture prepared in accordance with **ASTM D1559**. During rolling, moisten rollers to prevent adhesion of mixture to rolling surfaces, but do not permit an excess of water. Provide sufficient rollers for each spreading machine in operation on the job and to handle plant output. In places not accessible to rollers, compact mixture with hot pneumatic or manual hand tampers. Skin patching of an area that has been rolled is not permitted. Remove any mixture that becomes mixed with foreign material or is defective, replace with fresh mixture, and compact to density of surrounding area. Roller shall pass over unprotected edge of course only when laying of course is to be discontinued for a length of time to permit mixture to become cold.

Contractor shall provide workmen who are capable of performing work incidental to correction of pavement irregularities. After final rolling, permit no traffic of any kind on the pavement until the surface temperature has cooled to at least 120 degrees F. Measure surface temperature with surface thermometers or other satisfactory methods.

3.6 FIELD SAMPLING AND TESTING

Approve materials and material sources not less than 21 days prior to use of such materials in work.

3.6.1 Sampling

3.6.1.1 Aggregates at Source

Prior to production and delivery of aggregates, take at least one initial sample in accordance with ASTM D75/D75M at the source from each stockpile. Collect each sample by taking three incremental samples at random from source material to make a composite sample of not less than 50 pounds. Make repetition of the above sampling when source of material is changed or when unacceptable deficiencies or variations from specified grading of materials are found in testing.

3.6.1.2 Cold Feed Aggregate Sampling

Take two samples daily from belt conveying materials from cold feed. Collect materials in three increments at random to make a representative composite sample of not less than 50 pounds. Take samples in accordance with ASTM D75/D75M.

3.6.1.3 Coarse and Fine Aggregates

Take 50 pounds sample from cold feed at least once daily for sieve analyses and specific gravity tests. Additional samples may be required to perform more frequent tests on mineral fillers, or will be required when analyses show deficiencies, or unacceptable variances or deviations. Method of sampling is as described herein for aggregates.

3.6.1.4 Mineral Filler

ASTM C183/C183M. Take samples large enough to provide ample material for testing.

3.6.1.5 Pavement and Mixture

Take samples for the determination of mix properties, thickness and density of the completed pavements. Furnish all tools, labor and material for samples and for satisfactory replacement of pavement. Take samples and test at not less than frequency specified hereinafter and at the beginning of plant operations; for each day's work as a minimum; each change in the mix or equipment; and as often as directed. Accomplish sampling in accordance with ASTM D979/D979M.

3.6.1.6 Sample Identification

Furnish each sample in a clean container, securely fastened to prevent loss of material. Tag each sample for identification. Tag shall contain the following information:

Contract No. _____
Sample No. _____ Quantity _____
Date of Sample _____
Sample _____
Source _____
Intended use _____
For testing _____

3.6.2 Testing

3.6.2.1 Aggregate

- a. Gradation: **ASTM C136/C136M** for fine and coarse aggregate. **ASTM D546** for mineral filler.
- b. Abrasion: **ASTM C131/C131M** for wear (Los Angeles test). Perform one test initially prior to incorporation into work and whenever source is changed.
- c. Stripping Test: **ASTM D3625/D3625M**. Perform a stripping test initially on all aggregate prior to incorporation into work and whenever source is changed.

3.6.2.2 Bituminous Mix

ASTM D2172/D2172M. Test one sample for each **500 tons**, or fraction thereof, of the uncompacted mix for extraction. Sieve analysis per **ASTM C136/C136M**. Test one sample for each **500 tons**, or fraction thereof, for stability and flow in accordance with **ASTM D1559**.

3.6.2.3 Pavement Course

- a. **Density**: For each **1000 tons** of bituminous course placed, determine the representative laboratory density by averaging the density of 4 laboratory specimens prepared in accordance with **ASTM D1559**; samples for these specimens shall be taken from trucks delivering mixture to the site; the Contractor shall record in an approved manner the project areas represented by the laboratory densities. From each representative area so recorded, determine field density of the pavement by averaging the densities of **4 inch** diameter cores obtained from the base course; take one core for each **2000 square yards** or fraction thereof of course placed. Determine density of the laboratory prepared specimens and the cored samples in accordance with **ASTM D1188** or **ASTM D2726/D2726M**, as applicable. The maximum allowable deficiency at any point shall not be more than 2 percent less than the specified density. The average density shall be not less than the specified density. When the deficiency is more than the specified tolerances, the Contractor shall correct each such representative area or areas by removing the pavement in question and replacing with new pavement.
- b. **Thickness**: Determine thickness of the course from samples taken for the field density test. The maximum allowable deficiency at any point shall not be more than **1/4 inch** less than the indicated thickness for the course. The average thickness of the course shall be not less than the indicated thickness. Where the deficiency is more than the specified tolerances, the contractor shall correct each such representative area or areas by removing the pavement in question and replacing with new pavement.

- c. **Smoothness:** Straightedge test the compacted surface of the course as the work progresses. Apply straightedge parallel with and at right angles to the centerline after final rolling. Unevenness of the course shall not vary more than plus or minus $1/4$ inch in 10 feet. Correct any portion of the pavement showing irregularities greater than that specified.

-- End of Section --

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING
05/16

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 WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2013) Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVC0) Pressure Pipe and Fittings
AWWA C651	(2014) Standard for Disinfecting Water Mains

ASME INTERNATIONAL (ASME)

ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
------------	-----------------------------------------------------------------------------

ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM B61	(2015) Standard Specification for Steam or Valve Bronze Castings

ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM D1785	(2012) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2012) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2855	(2015) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM F402	(2005; R 2012) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves
-----------	------------------------------------------------------

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
---------	--------------------------------------------------------------------------------------------------

NSF INTERNATIONAL (NSF)

NSF 372	(2011) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2017b) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2016) Drinking Water System Components - Health Effects

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. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipe, Fittings, Joints and Couplings

Valves

Valve Boxes; G

Pipe Anchorage; G

SD-06 Test Reports

Backflow Preventer Tests

Bacteriological Samples; G

SD-07 Certificates

Pipe, Fittings, Joints and Couplings

Valves

Disinfection Procedures

SD-08 Manufacturer's Instructions

Manufacturer's Instructions

1.3 QUALITY CONTROL

1.3.1 Regulatory Requirements

Comply with NSF/ANSI 61 and NSF 372 for materials for potable water piping, components and specialties for domestic water; comply with lead content requirements for "lead-free" plumbing as defined by the U.S. Safe Drinking Water Act effective January 2014.

Comply with NSF/ANSI 14 for plastic potable water piping and components. Provide plastic pipe and fittings, bearing the seal of the National Sanitation Foundation (NSF) for potable water service from the same manufacturer.

Comply with NFPA 24 for materials, installation, and testing of fire main piping and components.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with

minimum handling and in accordance with manufacturer's instructions. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, [hydrants](#), and other accessories free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, [hydrants](#), and other accessories in accordance with manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace material found to be defective before or after laying with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

Handle PVC and PVC0 pipe, fittings, and accessories in accordance with [AWWA C605](#).

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Water Service Lines

Provide water service lines indicated as less than 4 inch diameter pipe sizes from water distribution main to building service at the point indicated. Provide water service lines of PVC pipe. Provide water service line appurtenances as specified and where indicated.

2.2 PIPE, FITTINGS, JOINTS AND COUPLINGS

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on and rubber-gasketed bell-and-spigot joints. Include information concerning gaskets with submittal for joints and couplings.

2.2.1 Ductile-Iron Piping

2.2.1.1 Pipe and Fittings

- a. Pipe, [AWWA C151/A21.51](#), Pressure Class 350. Flanged pipe, [AWWA C115/A21.15](#). Provide fittings with pressure ratings equivalent to that of the pipe. Pipe ends and fittings are to be compatible for the specified joints. Provide cement-mortar lining, [AWWA C104/A21.4](#), standard thickness on pipe and fittings.

2.2.1.2 Joints and Jointing Material

Provide push-on joints or mechanical joints for pipe and fittings unless otherwise indicated. Provide mechanical joints where indicated. Provide

flanged joints where indicated. Provide mechanically coupled type joints using a sleeve-type mechanical coupling. Sleeve-type mechanical couplings in lieu of push-on joints are acceptable, subject to the limitations specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS.

- a. Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly as recommended in AWWA C111/A21.11.
- b. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets as recommended in AWWA C111/A21.11.
- c. Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115/A21.15. Provide ductile iron setscrewed flanges, ASTM A536, Grade 70-50-05 or 60-42-10, and conform to ASME B16.1, Class 125. Provide setscrews for setscrewed flanges with a tensile strength of 190,000 psi, heat treated and zinc-coated steel. Gasket and lubricants for setscrewed flanges, in accordance with mechanical-joint gaskets specified in AWWA C111/A21.11. During the design of setscrewed gasket provide for confinement and compression of gasket when joint to adjoining flange is made.
- d. Sleeve-Type Mechanical Coupled Joints: As specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS.

2.2.2 Plastic Piping

2.2.2.1 PVC Piping for Service Lines

2.2.2.1.1 Pipe and Fittings

ASTM D1785, Schedule 40; or ASTM D2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D2466 or ASTM D2467. Provide pipe and fittings of the same PVC plastic material and of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 1120/PVC I; PVC 1220/PVC 12.

2.2.2.1.1.1 Joints and Jointing Materials

Provide solvent cement joints. Solvent cement for jointing, ASTM D2564. Test pipe couplings, when used as required by ASTM D2464.

2.2.3 Pipe Anchorage

Provide pipe anchorage designed for a minimum working pressure of 350 psi and in accordance with AWWA C600. Provide concrete thrust blocks (reaction backing).

2.3 VALVES

2.3.1 Water Service Valves

2.3.1.1 Gate Valves Smaller than 3 Inch in Size on Buried Piping

Gate valves smaller than 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem, with flanged or threaded end connections, a union on one side of the valve, and a handwheel operator.

2.3.2 Valve Boxes

Provide a valve box for each gate valve on buried piping. Construct adjustable valve boxes manufactured from cast iron of a size compatible for the valve on which it is used. Provide cast iron valve boxes with a minimum cover and wall thickness of 3/16 inch and conforming to ASTM A48/A48M, Class 35B. Coat the cast-iron box with a heavy coat of bituminous paint. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box is 5 1/4 inches.

2.4 ACCESSORIES

2.4.1 Dielectric Fittings

Install dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains to prevent metal-to-metal contact of dissimilar metallic piping elements and compatible with the indicated working pressure.

2.4.2 Tracer Wire for Nonmetallic Piping

Provide bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe.

2.4.3 Water Service Line Appurtenances

2.4.3.1 Curb or Service Stops

Ground key, round way, inverted key type; made of lead-free bronze, ASTM B61 or ASTM B62; and compatible with the working pressure of the system. Provide compatible ends for connection to the service piping. Cast an arrow into body of the curb or service stop indicating direction of flow.

2.4.3.2 Service Clamps

Provide service clamps used for repairing damaged cast-iron, steel or PVC pipe with a pressure rating not less than that of the pipe to be connected and either the single or double flattened strap type. Provide clamps with a galvanized malleable-iron body with cadmium plated straps and nuts and a rubber gasket cemented to the body.

2.5 DISINFECTION

Chlorinating materials are to conform to: Chlorine, Liquid: AWWA B301; Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 PRECAUTIONS

3.1.1 Connections to Existing System

Perform all connections to the existing water system in the presence of the Contracting Officer.

3.1.2 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water

system unless expressly directed to do so by the Contracting Officer.

3.2 INSTALLATION OF PIPELINES

3.2.1 General Requirements for Installation of Pipelines

Submit [manufacturer's instructions](#) for pipeline installations. These manufacturer's instructions apply to all pipeline installation except as noted herein.

3.2.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately [5 feet](#) from the building , unless otherwise indicated.

Do not lay water lines in the same trench with gas lines, fuel lines, electric wiring, or any other utility.

Where water piping is required to be installed within [3 feet](#) of existing structures, sleeve the water pipe. Provide ductile-iron or Schedule 40 steel sleeves. Fill annular space between pipe and sleeves with mastic. Install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

All water piping shall be laid with a minimum cover of 36 inches.

3.2.1.1.1 Water Piping Installation Parallel With Sewer Piping

3.2.1.1.1.1 Normal Conditions

Lay water piping at least [10 feet](#) horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.

Unusual Conditions: When local conditions or barriers prevent a 10-foot lateral separation, then:

- (1) The water main shall be laid in a separate trench and the bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping. The water main can be laid in the same trench; however, the water main shall be laid on the opposite side of the trench on an undisturbed bench constructed 18-inches above the top of the sewer pipe.
- (2) Where the horizontal separation cannot be obtained, the sewer and water piping shall be constructed of AWWA-ferrous pipe. All pipe shall be pressure tested in place without leakage prior to backfilling.
- (3) The sewer manhole shall be of watertight construction and tested in place.

3.2.1.1.2 Installation of Water Piping Crossing Sewer Piping

- (1) Normal Conditions: Water piping shall be laid to cross above sewer piping with a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.
- (2) Unusual Conditions: When local conditions prevent a vertical separation as described above, use the following construction:

(a) Water piping passing over sewer piping without a vertical separation of at least 18 inches between the top of the sewer piping and the bottom of the water piping; the provide adequate structural support for the water piping to prevent excessive deflection of the joints and the settling on and breaking of the sewer piping; and both the water piping and sewer piping shall be constructed of AWWA ferrous materials with joints equivalent to water main standards for a minimum distance of 10 feet on each side of the point of crossing. For water and sewer mains, a 20 foot minimum section of AWWA ferrous piping shall be centered at the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.

(b) Water piping passing under sewer piping shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping; providing adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping; and both the water piping and sewer piping shall be constructed of AWWA ferrous materials with joints equivalent to water main standards for a minimum distance of 10 feet on each side of the point of crossing. For water and sewer mains, a 20 foot minimum section of AWWA ferrous piping shall be centered at the point of crossing that joints shall be equidistant and as far as possible from the sewer piping.

(3) Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

3.2.1.1.3 Sewer Piping or Sewer Manholes

No water piping is to pass through or come in contact with any part of a sewer manhole.

3.2.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material. Blocking or wedging between bells and spigots is not permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Make provision for expansion and contraction of pipelines.

Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Provide a minimum of 3 feet depth of cover over top of pipe.

3.2.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.2.1.5 Connections to Existing Water Lines

Make connections to existing water lines after coordination with the facility and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.

3.2.2 Special Requirements for Installation of Water Lines

3.2.2.1 Installation of Plastic Piping

Install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES and with the applicable requirements of ASTM D2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.

3.2.2.1.1 Jointing

Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.2.1.2 Plastic Pipe Connections to Appurtenances

Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.2.3 Installation of Water Service Piping

3.2.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; close such water service lines with plugs or caps.

3.2.3.2 Service Line Connections to Water Mains

Connect service lines to the main as indicated.

3.2.4 Disinfection

Prior to disinfection, provide disinfection procedures, proposed neutralization and disposal methods of waste water from disinfection procedures as part of the disinfection submittal. Disinfect new water piping and existing water piping affected by Contractor's operations in

accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive bacteriological samples from new water piping. Analyze samples by a certified laboratory, and submit the results of the bacteriological samples. Obtain approval by the Contracting Officer prior to the new water piping being placed into service.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Tests and Inspections

Notify the Contracting Officer a minimum of five days in advance of hydrostatic testing. Coordinate the proposed method for disposal of waste water from hydrostatic testing. Perform field tests, and provide labor, equipment, and incidentals required for testing. Provide documentation that all items of work have been constructed in accordance with the Contract documents. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least five days after placing of the concrete.

3.3.2 Testing Procedure

3.3.3 Hydrostatic Testing

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains and water service lines in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method.

The maximum allowable leakage shall be as determined by the following formula:

$$L = (S \times D \times (P)^{\frac{1}{2}}) / 148,000$$

Where L = allowable leakage over the two hour test period in gallons per hour, S = length of the tested section in feet, D = diameter of the pipe in inches, and P = test pressure in psi.

3.3.4 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. 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.

3.3.5 Leakage Testing

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.

3.3.6 Special Testing Requirements for Fire Service

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.

3.3.7 Tracer Wire Continuity

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.

3.4 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove all debris and surplus materials resulting from the work.

-- End of Section --

This page is intentionally left blank.

SECTION 33 30 00

SANITARY SEWERS
04/08

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Sanitary Sewer Gravity Pipeline

Provide laterals of polyvinyl chloride (PVC) plastic pipe. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein.

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.

ASTM INTERNATIONAL (ASTM)

ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM C969	(2017) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM D2321	(2014; E 2014) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2680	(2001; R 2014) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D2751	(2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D3034	(2016) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASTM F949

(2015) Poly(Vinyl Chloride) (PVC)
Corrugated Sewer Pipe with a Smooth
Interior and Fittings

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6

(1998) Recommended Practice for
Low-Pressure Air Testing of Installed
Sewer Pipe

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation 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. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions

SD-03 Product Data

Pipeline Materials

SD-06 Test Reports

Reports

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.

1.4.2 Drawings

- a. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.
- b. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.
- c. Sign and seal As-Built Drawings by a Professional Surveyor and Mapper. Include the following statement: "All potable water lines crossed by sanitary hazard mains are in accordance with the permitted utility separation requirements."

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

1.5.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.5.1.2 Metal Items

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.5.1.3 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.5.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Carry, do not drag, pipe to trench.

1.6 PROJECT/SITE CONDITIONS

Submit drawings of [existing conditions](#), after a thorough inspection of the area in the presence of the Contracting Officer. Details shall include the environmental conditions of the site and adjacent areas. Submit copies of the records for verification before starting work.

PART 2 PRODUCTS

2.1 [PIPELINE MATERIALS](#)

Pipe shall conform to the respective specifications and other requirements specified below. Submit manufacturer's standard drawings or catalog cuts.

2.1.1 PVC Plastic Gravity Sewer Piping

2.1.1.1 PVC Plastic Gravity Pipe and Fittings

[ASTM D3034](#), SDR 35, or [ASTM F949](#) with ends suitable for elastomeric gasket joints.

2.1.1.2 PVC Plastic Gravity Joints and Jointing Material

Joints shall conform to [ASTM D3212](#). Gaskets shall conform to [ASTM F477](#).

2.2 CONCRETE MATERIALS

2.2.1 Portland Cement Concrete

Portland cement concrete shall conform to [ASTM C94/C94M](#), compressive

strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.3 REPORTS

Compaction and density test shall be in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL. Submit Test Reports. Submit Inspection Reports for daily activities during the installation of the sanitary system. Information in the report shall be detailed enough to describe location of work and amount of pipe laid in place, measured in linear feet.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

3.1.1 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

Submit request for field support from the Installation's Utilities Field Support two weeks prior to making connection. Submit request for pre-connection inspection to be conducted after trenching and layout is completed, but before the proposed service has been connected.

3.1.2 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.1.2.1 Location

The work covered by this section shall terminate the service connection at the temporary facility. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.

3.1.2.1.1 Sanitary Piping Installation Parallel with Water Line

3.1.2.1.1.1 Normal Conditions

Sanitary piping or manholes shall be laid at least 10 feet horizontally from a water line whenever possible. The distance shall be measured edge-to-edge.

3.1.2.1.1.2 Unusual Conditions

When local conditions prevent a horizontal separation of 10 feet, the sanitary piping or manhole may be laid closer to a water line provided that:

- a. The top (crown) of the sanitary piping shall be at least 18 inches below the bottom (invert) of the water main.
- b. Where this vertical separation cannot be obtained, the sanitary piping shall be constructed of AWWA-approved ductile iron water pipe pressure tested in place without leakage prior to backfilling.
- c. The sewer manhole shall be of watertight construction and tested in place.

3.1.2.1.2 Installation of Sanitary Piping Crossing a Water Line

3.1.2.1.2.1 Normal Conditions

Lay sanitary sewer piping by crossing under water lines to provide a separation of at least 18 inches between the top of the sanitary piping and the bottom of the water line whenever possible.

3.1.2.1.2.2 Unusual Conditions

When local conditions prevent a vertical separation described above, use the following construction:

- a. Sanitary piping passing over or under water lines shall be constructed of AWWA-approved ductile iron water pipe, pressure tested in place without leakage prior to backfilling.
- b. Sanitary piping passing over water lines shall, in addition, be protected by providing:
 - (1) A vertical separation of at least 18 inches between the bottom of the sanitary piping and the top of the water line.
 - (2) Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.
 - (3) That the length, minimum 20 feet, of the sanitary piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the water line.

3.1.2.1.3 Sanitary Sewer Manholes

No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.1.2.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.1.2.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots

will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D2680; saddles for ABS pipe shall comply with Table 3 of ASTM D2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D3034.

3.1.3 Special Requirements

3.1.3.1 Installation of PVC Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.1.4 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.1.5 Miscellaneous Construction and Installation

3.1.5.1 Connecting to Existing Manholes

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.1.5.2 Metal Work

3.1.5.2.1 Workmanship and Finish

Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

3.1.5.2.2 Field Painting

After installation, clean cast-iron frames, covers, gratings, and steps not

buried in concrete to bare metal of mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.1.6 Installations of Wye Branches

Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.2.2 Post-Construction Inspection

Submit post-construction inspection request for field support from the Installation's Utilities Field Support two weeks prior to post-connection inspection.

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. Dye must be a nontoxic non-staining sewer tracing dye. Test results are to be noted in the daily Construction Quality Control (CQC) Report.

- a. Continue testing until it can be visually confirmed by way of the dye that the sewer connection is appropriate or until deficiencies are discovered.
- b. During the test, monitor the storm drainage system downstream from the project, either manholes or outfalls, for any sign of cross-connection.

Perform a smoke test on the relevant portion of the sewer system. Test results are to be noted in the daily Construction Quality Control (CQC) Report.

- a. Continue testing until it can be visually confirmed that the projects sanitary sewer point of connection has not been cross-connected to the storm drainage system.
- b. During the test, monitor the storm drainage system, either manholes or outfalls, for any sign of cross-connection.

3.2.3 Tests for Nonpressure Lines

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line. When pressure piping is used in a nonpressure line for nonpressure use, test this piping as specified for nonpressure pipe.

3.2.3.1 Leakage Tests

Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

3.2.3.1.1 Infiltration Tests and Exfiltration Tests

Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with [ASTM C969](#). Make calculations in accordance with the Appendix to [ASTM C969](#).

3.2.3.1.2 Low-Pressure Air Tests

Perform tests as follows:

3.2.3.1.2.1 PVC Plastic Pipelines

Test in accordance with [UBPPA UNI-B-6](#). Allowable pressure drop shall be as given in [UBPPA UNI-B-6](#). Make calculations in accordance with the Appendix to [UBPPA UNI-B-6](#).

3.2.4 Field Tests for Concrete

Field testing requirements are covered in Section [03 30 00](#) CAST-IN-PLACE CONCRETE.

-- End of Section --

SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION

02/15

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.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS8 (2013) Specification for Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B3 (2013) Standard Specification for Soft or Annealed Copper Wire

ASTM B496 (2014) Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors

ASTM B8 (2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM F512 (2012) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386 (2006; INT 1 2011) Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V

IEEE 400.2 (2013) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)

IEEE 404 (2012) Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V

IEEE 48 (2009) Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV

through 765 kV or Extruded Insulation
Rated 2.5 kV through 500 kV

- IEEE 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
- IEEE Stds Dictionary (2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

- NETA ATS (2013) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C119.1 (2011) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
- ANSI/NEMA WC 71/ICEA S-96-659 (1999) Standard for Nonshielded Cables Rated 2001-5000 Volts for use in the Distribution of Electric Energy
- NEMA RN 1 (2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- NEMA TC 2 (2013) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
- NEMA TC 6 & 8 (2013) Standard for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations
- NEMA TC 9 (2004) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
- NEMA WC 70 (2009) Power Cable Rated 2000 V or Less for the Distribution of Electrical Energy--S95-658
- NEMA WC 74/ICEA S-93-639 (2012) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758 (2012b) Customer-Owned Outside Plant
Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644 (2002) Underground Plant Construction

UNDERWRITERS LABORATORIES (UL)

UL 1072 (2006; Reprint Jun 2013) Medium-Voltage
Power Cables

UL 467 (2007) Grounding and Bonding Equipment

UL 486A-486B (2013; Reprint Feb 2014) Wire Connectors

UL 510 (2005; Reprint Jul 2013) Polyvinyl
Chloride, Polyethylene and Rubber
Insulating Tape

UL 514B (2012; Reprint Nov 2014) Conduit, Tubing
and Cable Fittings

UL 6 (2007; Reprint Nov 2014) Electrical Rigid
Metal Conduit-Steel

UL 651 (2011; Reprint May 2014) Standard for
Schedule 40 and 80 Rigid PVC Conduit and
Fittings

UL 83 (2014) Thermoplastic-Insulated Wires and
Cables

UL 854 (2004; Reprint Nov 2014) Standard for
Service-Entrance Cables

UL 94 (2013; Reprint Mar 2016) UL Standard for
Safety Tests for Flammability of Plastic
Materials for Parts in Devices and
Appliances

1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.
- b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.
- c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation;

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

SD-02 Shop Drawings

SD-03 Product Data

Medium voltage cable; G

Medium voltage cable joints; G

Medium voltage cable terminations; G

SD-06 Test Reports

Medium voltage cable qualification and production tests; G

Field Acceptance Checks and Tests; G

Arc-proofing test for cable fireproofing tape; G

SD-07 Certificates

Cable splicer/terminator; G

Cable Installer Qualifications; G

1.4 QUALITY ASSURANCE

1.4.1 Certificate of Competency for Cable Splicer/Terminator

The cable splicer/terminator must have a certification from the National Cable Splicing Certification Board (NCSCB) in the field of splicing and terminating shielded medium voltage (5 kV to 35 kV) power cable using pre-manufactured kits (pre-molded, heat-shrink, cold shrink). Submit "Proof of Certification" for approval, for the individuals that will be performing cable splicer and termination work, 30 days before splices or terminations are to be made.

1.4.2 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" 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 must be in accordance with the mandatory and advisory provisions of [IEEE C2](#) and [NFPA 70](#) unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must 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.

1.4.4.1 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 furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

[UL 6](#).

2.1.1.1 Rigid Metallic Conduit, PVC Coated

[NEMA RN 1](#), Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum [400 volts per mil](#) at 60 Hz, and tensile strength must be minimum [3500 psi](#).

2.1.2 Plastic Conduit for Direct Burial and Riser Applications

[UL 651](#) and [NEMA TC 2](#), EPC-80.

2.1.3 Plastic Duct for Concrete Encasement

Provide Type EB-35 per [UL 651](#), [ASTM F512](#), and [NEMA TC 6 & 8](#).

2.1.4 Duct Sealant

[UL 94](#), Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be

capable of curing in temperature ranges of 35 degrees F to 95 degrees F. Cured sealant must withstand temperature ranges of -20 degrees F to 200 degrees F without loss of function.

2.1.5 Fittings

2.1.5.1 Metal Fittings

UL 514B.

2.1.5.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.5.3 PVC Duct Fittings

NEMA TC 9.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements, or in accordance with NEMA WC 70. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller must be solid. Conductors No. 8 AWG and larger must be stranded. All conductors must be copper.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type THWN/THHN conforming to UL 83. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 Jackets

Multiconductor cables must have an overall PVC outer jacket.

2.2.4 In Duct

2.2.5 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors must be color coded. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves, or colored electrical tape. Control circuit terminations must be properly identified. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals must be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems must be as follows:

- a. 208/120 volt, three-phase
 - (1) Phase A - black
 - (2) Phase B - red
 - (3) Phase C - blue
- b. 480/277 volt, three-phase
 - (1) Phase A - brown
 - (2) Phase B - orange
 - (3) Phase C - yellow
- c. 120/240 volt, single phase: Black and red

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Must provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

- a. For use with copper conductors: [UL 486A-486B](#).

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with [ANSI C119.1](#).

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide Type MV cable, conforming to NEMA WC 74/ICEA S-93-639 and UL 1072. Provide cables manufactured for use in duct applications as indicated. Cable must be rated 15 kV with 133 percent insulation level.

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B compact round conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding or ASTM B496 for compact stranding.

2.5.3 Insulation

Provide ethylene-propylene-rubber (EPR) insulation conforming to the requirements of ANSI/NEMA WC 71/ICEA S-96-659 and AEIC CS8.

2.5.4 Shielding

Cables rated for 2 kV and above must have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper wire shield for each phase.

2.5.5 Neutrals

Neutral conductors must be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable. For high impedance grounded neutral systems, the neutral conductors from the neutral point of the transformer or generator to the connection point at the impedance must utilize copper conductors, employing the same insulation level and construction as the phase conductors.

2.5.6 Jackets

Provide cables with a PVC jacket. Provide PVC jackets with a separator that prevents contact with underlying semiconducting insulating shield.

2.6 MEDIUM VOLTAGE CABLE TERMINATIONS

IEEE 48 Class 1; of the molded elastomer, prestretched elastomer, or heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations, where required, must be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Terminations must be provided in a kit,

including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations must be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator must be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination must not require heat or flame for installation. Termination kit must contain all necessary materials (except for the lugs). Termination must be designed for installation in low or highly contaminated indoor and outdoor locations and must resist ultraviolet rays and oxidative decomposition.

2.6.2 Heat Shrinkable Type

Terminator must consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. Provide heat shrinkable sheds or skirts of the same material. Termination must be designed for installation in low or highly contaminated indoor or outdoor locations.

2.6.3 Separable Insulated Connector Type

IEEE 386. Provide connector with steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material. Provide connectors of the loadbreak or deadbreak type as indicated, of suitable construction for the application and the type of cable connected, and that include cable shield adaptors. Provide external clamping points and test points. Separable connectors must not be used in manholes/handholes.

- a. 200 Ampere loadbreak connector ratings: Voltage: 15 kV, 95 kV BIL. Short time rating: 10,000 rms symmetrical amperes.
- c. Provide one set of three grounding elbows and one set of three feed-thru inserts. Deliver grounding elbows and feed-thru inserts to the Contracting Officer.

2.7 MEDIUM VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with **IEEE 404** suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints must be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with **IEEE 404**. Connectors for joint must be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Heat-Shrinkable Joint

Consists of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding.

Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating.

2.7.2 Cold-Shrink Rubber-Type Joint

Joint must be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket must be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice must be packaged three splices per kit, including complete installation instructions.

2.8 TAPE

2.8.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.8.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with project requirements .

2.8.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than .030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.9 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.10.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.11 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with project requirements. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.12 SOURCE QUALITY CONTROL

2.12.1 Arc-Proofing Test for Cable Fireproofing Tape

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. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. The arc must be directed toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly must be tested at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

2.12.2 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS8 qualification and production tests as applicable for each type of medium voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors must be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide PVC, Type EPC-40 conduit from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

Encase the underground portion of the conduit in a concrete envelope and

bury as specified for underground duct with concrete encasement.

3.4 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.4.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 4/0 AWG bare copper grounding conductor below medium-voltage distribution duct banks. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grounding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of **3 inches per 100 feet**. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Provide ducts with end bells whenever duct lines terminate in structures.

Perform changes in ductbank direction as follows:

- a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.
- b. The minimum manufactured bend radius must be **18 inches** for ducts of less than **3 inch** diameter, and **36 inches** for ducts **3 inches** or greater in diameter.
- c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of **25 feet** for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections: 30 degrees.

3.4.2 Treatment

Ducts must be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers must be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer must be used whenever an existing duct is connected to a duct of different material or shape. Ducts must be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts must be thoroughly cleaned before being laid. Plastic ducts must be stored on a flat surface and protected from the direct rays of the sun.

3.4.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes **3 inches** and larger, draw a flexible testing mandrel approximately **12 inches** long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than **3 inches**, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.4.4 Multiple Conduits

Separate multiple conduits by a minimum distance of 3 inches, except that light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.4.5 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty must be provided with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.4.6 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 24 inches below finished grade. Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified.

3.4.6.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement must extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 24 inches below finished grade.

3.4.7 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less than 18 inches below finished grade, except under roads and pavement, concrete envelope must be not less than 24 inches below finished grade. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and must provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring must be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly.

3.4.7.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.4.7.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.4.7.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.4.7.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks. Remove existing cables which constitute interference with the work.

3.4.7.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately one foot apart. Restrain reinforcing assembly from moving during concrete pouring.

3.4.8 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.5 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use

flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with wire shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.5.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.6 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, 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 on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.6.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.7 CONDUCTORS INSTALLED IN PARALLEL

Conductors must be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.8 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.

3.9 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.10 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions

of the joint kit manufacturer.

3.10.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

3.11 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must 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.

3.12 GROUNDING SYSTEMS

NFPA 70 and **IEEE C2**, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.12.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.

If the specified ground resistance is not met, an additional ground rod must be provided in accordance with the requirements of **NFPA 70** (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

3.12.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.12.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts

and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.13 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and project requirements.

3.13.1 Reconditioning of Surfaces

3.13.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct . Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.13.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists

3.14 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with project requirements.

3.14.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab must be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.14.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.15 FIELD QUALITY CONTROL

3.15.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.15.1.1 Medium Voltage Cables

Perform tests after installation of cable, splices, and terminators and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

- (1) Inspect exposed cable sections for physical damage.
- (2) Verify that cable is supplied and connected in accordance with contract plans and specifications.
- (3) Inspect for proper shield grounding, cable support, and cable termination.
- (4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.
- (5) Inspect for proper fireproofing.
- (6) Visually inspect jacket and insulation condition.
- (7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

- (1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.
- (2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests must be very low frequency (VLF) alternating voltage withstand tests in accordance with [IEEE 400.2](#). VLF test frequency must be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages must be as follows:

CABLE RATING AC TEST VOLTAGE for ACCEPTANCE TESTING	
5 kV	10kV rms (peak)
8 kV	13kV rms (peak)
15 kV	20kV rms (peak)
25 kV	31kV rms (peak)
35 kV	44kV rms (peak)

CABLE RATING AC TEST VOLTAGE for MAINTENANCE TESTING	
5 kV	7kV rms (peak)
8 kV	10kV rms (peak)
15 kV	16kV rms (peak)
25 kV	23kV rms (peak)
35 kV	33kV rms (peak)

3.15.1.2 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

- (1) Inspect exposed cable sections for physical damage.
- (2) Verify that cable is supplied and connected in accordance with contract plans and specifications.
- (3) Verify tightness of accessible bolted electrical connections.
- (4) Inspect compression-applied connectors for correct cable match and indentation.
- (5) Visually inspect jacket and insulation condition.
- (6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

- (1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.
- (2) Perform continuity tests to insure correct cable connection.

3.15.1.3 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with [IEEE 81](#). On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to

test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.15.2 Follow-Up Verification

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. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- 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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire
- ASTM B8 (2011) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM D1557 (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³)
- ASTM D709 (2016) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
- IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

- ICEA S-87-640 (2011) 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
- ICEA S-99-689 (2012) Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C62.61 (1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;
TIA 17-3) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-107 (1999a) FOTP-107 Determination of
Component Reflectance or Link/System
Return Loss using a Loss Test Set

TIA-455-78-B (2002) FOTP-78 Optical Fibres - Part
1-40: Measurement Methods and Test
Procedures - Attenuation

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-526-14 (2015c) OFSTP-14A Optical Power Loss
Measurements of Installed Multimode Fiber
Cable Plant

TIA-526-7 (2015a) OFSTP-7 Measurement of Optical
Power Loss of Installed Single-Mode Fiber
Cable Plant

TIA-568-C.1 (2009; Add 2 2011; Add 1 2012) Commercial
Building Telecommunications Cabling
Standard

TIA-568-C.2 (2009; Errata 2010) Balanced Twisted-Pair
Telecommunications Cabling and Components
Standards

TIA-568-C.3 (2008; Add 1 2011) Optical Fiber Cabling
Components Standard

TIA-569 (2015d) Commercial Building Standard for
Telecommunications Pathways and Spaces

TIA-590 (1997a) Standard for Physical Location and
Protection of Below Ground Fiber Optic
Cable Plant

TIA-606 (2012b) Administration Standard for the
Telecommunications Infrastructure

TIA-607 (2011b) 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) Optical Fiber Cable Color Coding

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction

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)

RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)

RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

UNDERWRITERS LABORATORIES (UL)

UL 497 (2001; Reprint Jul 2013) Protectors for Paired Conductor Communication Circuits

UL 510 (2005; Reprint Jul 2013) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

UL 83 (2014) Thermoplastic-Insulated Wires and Cables

1.2 RELATED REQUIREMENTS

Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM, 1.3
DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.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 the NMCI contractor 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 the NMCI contractor.

1.5 SUBMITTALS

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

SD-02 Shop Drawings

Telecommunications Outside Plant; G

Telecommunications Entrance Facility Drawings; G

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

Cable splices, and connectors; G

Building protector assemblies; G

Protector modules; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required for certificates in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Pre-installation tests; G

Acceptance tests; G

Outside Plant Test Plan; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Minimum Manufacturer's Qualifications; G

SD-08 Manufacturer's Instructions

Building protector assembly installation; G

Cable tensions; G

Fiber Optic Splices; G

Submit instructions prior to installation.

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; G

SD-10 Operation and Maintenance Data

Telecommunications outside plant (OSP), Data Package 5; G

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

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 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. Update existing telecommunication Outside Plant T0 drawings to include information modified, deleted or added as a result of this installation in accordance with TIA-606. 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-C.1](#), [TIA-568-C.2](#) and [TIA-568-C.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-99-689](#).

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-C.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 in 500 feet length 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.

Provide record documentation as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

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 **pairs indicated on plans**. 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** three-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with **RUS Bull 345-83** and shall be heavy duty, A>10kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with **ANSI C62.61**. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with **UL 497**. 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 CABLE SPLICES, AND CONNECTORS

2.3.1 Copper Cable Splices

Provide multipair, foldback **or** in-line **and** single pair, in-line, butt, **or** box tap splices of a moisture resistant, two**or** three-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.

2.3.2 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**.

2.3.3 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion methods at locations shown on the construction drawings. 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.

2.3.4 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.

2.3.5 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](#).

2.4 CONDUIT

Provide conduit as specified in Section [33 71 02](#) UNDERGROUND ELECTRICAL DISTRIBUTION.

2.5 PLASTIC INSULATING TAPE

[UL 510](#).

2.6 WIRE AND CABLE

2.6.1 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; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductor shall conform to the following:

2.6.1.1 Underground

Provide filled cable meeting the requirements of [ICEA S-99-689](#) and [RUS 1755.390](#).

2.6.2 Fiber Optic Cable

Provide single-mode, 8/125-um, 0.10 aperture 1310 nm 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 12 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

2.6.2.1 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.

2.6.2.2 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

2.6.3 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.

2.7 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.

2.7.1 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.

2.8 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with TIA-590. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 23 00.00 20, EXCAVATION AND FILL.

2.9 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.

2.10 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.

2.11 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.

2.12 TESTS, INSPECTIONS, AND VERIFICATIONS

2.12.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with [TIA-568-C.1](#) and [TIA-568-C.3](#). Use [TIA-526-7](#) for single mode fiber and [TIA-526-14](#) Method B for multi 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-99-689](#). 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](#), 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 Underground Duct

Provide underground duct and connections to existing manholes, as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.4 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.5 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.

3.1.6 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.

3.1.6.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.6.2 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.

3.1.6.3 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.

3.1.7 Cable Splicing

3.1.7.1 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.

3.1.7.2 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.

3.1.8 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.

3.1.9 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.

3.1.9.1 Telecommunications Master Ground Bar (TMGB)

The TMGB 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 TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.9.2 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 TMGB.

3.1.10 Cut-Over

All necessary transfers and cut-overs, shall be accomplished by the telecommunications contractor.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using laser printer.

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 only new wire and cable provided by this contract. The labeling of telecommunications cable tag identifiers shall be in accordance with TIA-606. 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.

3.3 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.

3.4 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.

3.4.1 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.

3.4.1.1 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.

3.4.1.2 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.

3.4.1.3 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.

3.4.2 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.

3.4.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with **TIA-758**:

- 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

3.4.2.2 Fiber Optic Cable

Test fiber optic cable in accordance with **TIA/EIA-455** and as further specified in this section. 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 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. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.
- 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.

3.4.3 Soil Density Tests

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

-- End of Section --