17-0016, Interior and Exterior Repairs, Building 523

AT THE

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

JACKSONVILLE, NORTH CAROLINA

DESIGN BY:

The Walker Group Architecture, Inc.
New Bern, North Carolina

A/E Contract: N40085-08-D-8416

SPECIFICATION PREPARED BY:

The Walker Group Architecture, Inc.

Date: July 28, 2017

SPECIFICATION APPROVED BY:

T.H. Burton, P.E., Director
Design Branch, Public Works Division

J. M. Roche, Commander, CEC, U.S. Navy for
Commander, Naval Facilities Engineering

05-17-0016
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1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work includes a complete interior and exterior renovation to Building 527. The work includes demolition of HVAC systems, electrical systems, plumbing systems, windows, doors, partition walls, and plaster walls and ceilings. New work includes new HVAC systems, electrical system including lighting, plumbing system, new windows, doors, metal and gypsum board wall partitions, and new finishes. Also included are new fire suppression system and fire alarm system. New site work includes a new accessible entrance.

1.1.2 Location

The work shall be located at the Marine Corps Base Camp Lejeune, North Carolina, Building 523, approximately as shown. The exact location will be indicated by the Contracting Officer.

1.2 PHASED CONSTRUCTION SCHEDULE

The work shall be completed in a single phase.

1.3 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 shall be in a condition equal to or better than that which existed before new work started.
1.4 LOCATION OF UNDERGROUND FACILITIES

The Contractor will be responsible for obtaining the services of a professional utility locator to scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated or specified to be removed but indicated or discovered during scanning in locations to be traversed by piping, ducts, and other work to be installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.4.1 Notification Prior to Excavation

Notify the Contracting Officer 48 hours prior to starting excavation work in order to permit making arrangements with public works personnel to scan the area for unmarked utilities. Obtain station digging permits prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --
PART 1   GENERAL

1.1   CONTRACTOR ACCESS AND USE OF PREMISES

1.1.1   Station Regulations

Ensure that Contractor personnel employed on the Station become familiar
with and obey Station regulations. Keep within the limits of the work and
avenues of ingress and egress as directed. Do not enter restricted areas
unless required to do so and until cleared for such entry. Wear hard hats
in designated areas. Do not enter any restricted areas unless required to
do so and until cleared for such entry. The Contractor's equipment shall
be conspicuously marked for identification.

1.1.2   Working Hours

Regular working hours shall consist of an eight and one-half hour period
established by the Contracting Officer, Monday through Friday, excluding
Government holidays.

1.1.3   Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval.
Provide written request at least 15 calendar days prior to such work to
allow arrangements to be made by the Government for inspecting the work in
progress. During periods of darkness, the different parts of the work
shall be lighted in a manner approved by the Contracting Officer.

1.1.4   Occupied and Existing Buildings

The Contractor shall be working in an existing building which is not
occupied.

1.1.5   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 in the 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,
and compressed air shall be considered utility cutovers pursuant
to the paragraph entitled "Work Outside Regular Hours." This time
limit includes time for deactivation and reactivation.
d. Operation of Station Utilities: The Contractor shall 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 shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --
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.

U.S. ARMY CORPS OF ENGINEERS (USACE)


1.2   SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Schedule of prices

1.3   SCHEDULE OF PRICES

1.3.1   Data Required

Within 15 calendar days of notice of award, prepare and deliver to Contracting Officer a schedule of prices (construction contract) on the forms furnished by the Government. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices therefor. Schedule of prices shall be separated by individual building numbers with subtotals for each building.

1.3.2   Schedule Instructions

Payments will not be made until the schedule of prices has been submitted to and approved by the Contracting Officer. Identify the cost for site work, and include incidental work to the 5 foot line. Identify costs for the building(s), and include work out to the 5 foot line. Workout to the 5 foot line shall include construction encompassed within a theoretical line 5 feet from the face of exterior walls and shall include attendant construction, such as cooling towers, placed beyond the 5 foot line.

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
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1.5 CONTRACTOR'S PAYMENT REQUEST

1.5.1 Proper Payment Request

A proper request for payment/invoice shall comply with all requirements specified in this Section and the contract payment clauses. If any invoice does not comply with these requirements, it shall be returned with a statement of the reasons why it was not a proper invoice. A proper payment request/invoice includes the following information, completed forms, and number of copies indicated. Upon request, the Contracting Officer will furnish copies of Government forms.

a. Contractor's Invoice on NAVFAC Form 7300/30, which shall show the basis for arriving at the amount of the invoice. Submit one original and two copies.

b. Contractor's Monthly Estimate for Voucher (LANTNAVFACENGCOM Form 4-4330/110. Submit original and two copies.

c. Payment Certification. Furnish as specified in "FAR Clause 52.232-5 (c) Payments under Fixed-Price Construction Contracts." Submit one original.

d. QC Invoice Certification. Furnish as specified in Section 01 45 10, "Quality Control." Submit one original.

1.5.1.1 Progress Payments

In addition to the requirements stated in Paragraph 1.5.1, "Proper Payment Request" above, the Contractor's request for progress payments shall include the following:

a. Updated Progress Schedule: Furnish an updated progress schedule as specified in contract clause FAR 52.236-15 "Schedules for Construction Contracts" and Section 01 32 16, "Construction Progress Documentation." Submit one copy.

1.5.1.2 Final Payments

The request for final payment is submitted after completion and acceptance of all work and all other requirements of the contract. Before submitting the final invoice the Contractor shall meet with the appropriate Government representatives to determine the final invoice amount, including the assessment of liquidated damages, if any, and to make sure the final release is complete and accurate. In addition to the requirements in Paragraph 1.5.1, "Proper Payment Request" above, the Contractor's request for final payment shall include the following:

a. A final release executed on the standard form provided by the Contracting Officer. Submit two originals with final payment request.

b. NC Tax certified statement and report for the prime and each subcontractor (FAR 52.229-7). Submit two copies.

c. As-built drawings (if applicable).
d. Warranties (if applicable).

e. O&M manuals (if applicable).

f. Final payrolls (FAR 52.222-6).

g. A release for an assignment of claims (if applicable). Submit three originals.

1.5.2 Procedures for Submitting Payment Request

a. The Contractor may submit only one invoice for payment each month as the work progresses.

b. The invoice shall be delivered to the ROICC Office, Administrative Branch, between five calendar days before and five calendar days after the contract award date. Invoices received outside this schedule shall be returned to the Contractor unprocessed. The Contractor will have to wait until the following month to submit their next invoice.

c. Invoices shall be delivered during normal work hours from 7:30 AM up to 4:00 PM (EST), Monday through Friday, excluding holidays.

1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of a proper payment request/invoice by 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 the following:

a. Reasonable retention and/or deductions due to defects in material or workmanship; potential liquidated damages; and/or failure to comply with any other requirements of the contract.

b. Claims which the Government may have against the Contractor under or in connection with this contract; and

c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor.

d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings"; NC State tax certified statement and report in accordance with FAR 52.229-2; labor payrolls in accordance with FAR 52.222-6; as-built drawings in accordance with Section 01 45 10, "Quality Control"; warranties and O&M manuals; and any other requirements in the contract.

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 considerations 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 no 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 considerations 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 --
SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

03/12

PART 1   GENERAL

1.1  SUBMITTALS

Submit the following in accordance with the Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals
   List of contact personnel

1.2  MINIMUM INSURANCE REQUIREMENTS

Procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

   a.  Comprehensive general liability:  $500,000 per occurrence

   b.  Automobile liability:  $200,000 per person, $500,000 per occurrence, $20,000 per occurrence for property damage

   c.  Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws,

   d.  Employer's liability coverage of $100,000, except in States where workers compensation may not be written by private carriers,

   e.  Others as required by State law.

1.3  ELECTRONIC MAIL (EMAIL)

   a.  The Contractor is required to establish and maintain electronic mail (email) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats.

   b.  Within 10 days after contract award; the Contractor shall provide the Contracting Officer a single (only one) email address for the ROICC office to send communications related to this contract correspondence. The ROICC office may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc.

   c.  Multiple email addresses are not authorized.

   d.  It is the Contractor's responsibility to make timely distribution of all ROICC email within its own organization, including field office(s).

   e.  The Contractor shall promptly notify the Contracting Officer, in
1.4 CONTRACTOR PERSONNEL REQUIREMENTS

1.4.1 Subcontractors and Personnel

Furnish 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.

1.4.2 Identification Badges

Identification badges will be furnished without charge. Application for and use of badges will be as directed below. Immediately report instances of lost or stolen badges to the Contracting Officer. Employees are required to resubmit a complete 50 state criminal records check in order to renew their contractor badge.

1.4.3 Business Access Security Requirements

1.4.3.1 Business Access Definition

Contractor/subcontractor employees requiring installation access to MCB, Camp Lejeune or MCAS New River, N.C. must obtain a Business Access Identification Badge for that particular installation. Regularly scheduled delivery personnel, to include FEDEX, UPS, Pick-up and deliveries, should, also, follow the Business Access guidelines described below. Personnel requiring Business Access Identification Badges shall submit all documentation listed below. Badges are not required if the contracted position requires the employee to obtain a Common Access Card (CAC) which will be identified separately within the Government contract.

1.4.3.2 Installation Security Access Requirements

Contractor shall accomplish the security requirements below within 10 days after award or prior to performance under the contract.

1.4.3.3 Business Access Identification Badge Requirement

In order to obtain a Business Access Identification Badge for access to MCB, Camp Lejeune, and satellite activities, or MCAS New River, NC, all personnel providing services under this contract shall be required to present the documentation below to the following offices, as applicable:

MCB, Camp Lejeune, NC and its satellite activities. Report as follows:

1. Identification Card Center, 60 Molly Pitcher Road for badge (910-450-8444).

MCAS New River, NC. Report as follows:


1.4.3.4 Proof of Employee Citizenship or Legal Alien Status

Employers may participate in the E-verify program (1-888-464-4218, www.DHS.gov/e-verify) allowing U.S. employers to verify name, DOB, and SSN...
along with immigration information for non-citizens, against federal databases in order to verify the employment eligibility of both citizens and non-citizen new hires.

1.4.3.5 Proof of Criminal Records Check

Commercial and contract employees must provide proof a complete 50 state criminal records check on an annual basis. The record check may be obtained from any of the following Internet investigative services: Kroll (former Infolink Screening Services) at www.kroll.com, Castle Branch at www.castlebranch.com, or any other investigative services company that provides records checks for all 50 states. These services also validate social security card numbers. All criminal history checks must be completed no more than 30 days prior to start date of contract. (Note: These Internet screening services are listed as possible sources for obtaining a criminal background check. The United States government and the United States Marine Corps do not endorse nor are they affiliated with any of these services).

1.4.3.6 Letter Provided By Contracting Officer Indicating Contract

Letter provided by Contracting Officer indicating contract, contract period and prime contractor. Proof of employment on a valid Government contract (e.g., a letter on company letterhead from the prime contractor including contract number and term).

1.4.3.7 Photo ID

Valid state or federal issued picture identification card. Acceptable documents include state drivers license, DMV issued photo identification, or alien registration card.

1.4.3.8 National Crime Investigation Center (NCIC) Check

Provost Marshals are authorized to conduct a national crime information center (NCIC) check of all persons entering the installation, if/where applicable, the NCIC check may include drivers’s license query, wants and warrants, and criminal history.

1.4.4 Denial of Access

Installation access shall be denied if it is determined that an employee:

a. Is on the National Terrorist Watch List

b. Is illegally present in the United States.

c. Is subject to an outstanding warrant.

d. Has knowingly submitted an employment questionnaire with false or fraudulent information.

e. Has been issued a debarment order and is currently banned from military installations.

f. Is a Registered Sexual Offender.

g. Has been convicted of a felony or a drug crime within the past five years.
Individuals who have received a DUI/DWI in the last year may be allowed access to the installation, but will not be permitted to drive on the installation.

Any reason the Installation Commander deems reasonable for the good order and discipline.

1.4.5 Appeal Process

All appeals should be directed to the Base Inspector's Office for any individual that has been denied access to the Base.

1.4.6 Display of Badges

Contractors/subcontractors shall prominently display their badges on their person at all times. Upon completion/termination of this contract or an individual's employment, the Contractor shall collect and turn in to the Pass & ID Office all badges. If the Contractor fails to obtain the employee's badge, the Pass & ID Office will be notified within 24 hours. Immediately report instances of lost or stolen badges to the Contracting Officer.

1.4.7 Contractor and Subcontractor Vehicle Requirements

Each vehicle to be used in contract performance shall show the Contractor's or subcontractor's name so that it is clearly visible and shall always display a valid state license plate and safety inspection sticker. To obtain a vehicle decal, which will be valid for one year or contract period, whichever is shorter, Contractor or subcontractor vehicle operators shall provide to the Vehicle Registration Office, 60 Molly Pitcher Road (910-451-1158) or to MCAS, Building AS-187 (910-449-5513) for vehicle decal:

a. An installation sponsor request forwarded to provost Marshall office

b. A valid form of Federal or state government I.D.

c. If driving a motor vehicle, a valid driver's license, vehicle registration and proof of insurance

Upon completion/termination of this contract or an individual's employment, the Contractor shall collect and turn in to Vehicle Registration all Government vehicle decals. If any are not collected, the Contractor shall notify the Vehicle Registration Office within 24 hours.

1.4.8 Security Checks

Contractor personnel and vehicles shall only be present in locations relevant to contract performance. All Contractor personnel entering the base shall conform to all Government regulations and are subject to such checks as may be deemed necessary to ensure that violations do not occur. Employees shall not be permitted on base when such a check reveals that their presence would be detrimental to the security of the base. Subject to security regulations, the Government will allow access to an area for servicing equipment and/or performing required services. Upon request, the Contractor shall submit to the Contracting Officer questionnaires and other forms as may be required for security purposes.
1.4.9 Subcontractor Special Requirements

1.4.9.1 Space Temperature Control, HVAC TAB, and Apparatus Inspection

All contract requirements shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4.9.2 Telecommunication and High Voltage Work

When telecommunications and high voltage work is required, all work associated with telecommunications and high voltage shall be accomplished by a first tier subcontractor. The contractor must possess a valid North Carolina Public Utility - Electrical, contractor's license and be insured to do such work in the State of North Carolina.

1.5 DISCLOSURE OF INFORMATION

Contractor shall comply as follows:

(a) The Contractor shall not release to anyone outside the Contractor's organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless -

   (1) The Contracting Officer has given prior written approval; or

   (2) The information is otherwise in the public domain before the date of release.

(b) Requests for approval shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 45 days before the proposed date for release.

(c) The Contractor agrees to include a similar requirement in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

1.6 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working hours. In addition, if a Quality Control (CQ) representative is required on the contract, then that individual shall also have fluent English communication skills.

NOTE: If training and experience requirements of Section 01 45 10, "Quality Control" and 01 35 29, "Safety and Occupational Health Requirements" have been met the supervisor may also serve as QC Manager.
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1.7 PRECONSTRUCTION CONFERENCE

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, shop drawings, and other submittals, scheduling programming, and prosecution of the work. Major subcontractors who will engage in the work shall also attend.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --
17-0016, Interior and Exterior Repairs, Bldg. 523

SECTION 01 31 50
TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY
01/07

PART 1   GENERAL

1.1   SUBMITTALS
The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

   SD-11 Closeout Submittals

   Interim DD-1354, Transfer & Acceptance of Military Real Property

1.2   Interim DD-1354, Transfer & Acceptance of Military Real Property
Submit Interim DD-1354 thirty (30) days prior to beneficial occupancy date (draft copy attached).

PART 2   PRODUCTS
Not Used.

PART 3   EXECUTION
Not Used.

-- End of Section --
PART 1   GENERAL

1.1  SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Construction schedule

Equipment delivery schedule

1.2  CONSTRUCTION SCHEDULE

Within 21 days after receipt of the Notice of Award, prepare and submit to the Contracting Officer for approval a Critical Path Method (CPM), Network Schedule in accordance with the terms in Contract Clause "FAR 52.236-15, Schedules for Construction Contracts," except as modified in this contract. Primavera P6 will be utilized to produce and update all progress schedules.

1.3  EQUIPMENT DELIVERY SCHEDULE

1.3.1  Initial Schedule

Within 30 calendar days after approval of the proposed construction schedule, submit for Contracting Officer approval a schedule showing procurement plans for materials, plant, and equipment. Submit in the format and content as prescribed by the Contracting Officer, and include as a minimum the following information:

a. Description.

b. Date of the purchase order.

c. Promised shipping date.

d. Name of the manufacturer or supplier.

e. Date delivery is expected.

f. Date the material or equipment is required, according to the current construction schedule.

1.4  NETWORK ANALYSIS SYSTEM (NAS)

The Contractor shall use the critical path method (CPM) to schedule and control construction activities. The Network shall have a minimum of 25
activities and a maximum of 75 activities. The schedule shall identify as a minimum:

a. Construction time for all major systems and components;

b. Major submittals and submittal processing time; and

c. Major equipment lead time.

1.4.1 CPM Submittals and Procedures

The Contractor shall use the critical path method (CPM) to schedule and control project activities. Project schedules shall be prepared and maintained using Primavera P6, Primavera SureTrak 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. The network analysis system shall be kept current, with changes made to reflect the actual progress and status of the construction.

1.5 UPDATED SCHEDULES

Update the construction schedule and equipment delivery schedule at monthly intervals or when schedule has been revised. Reflect any changes occurring since the last update. Submit copies of the purchase orders and confirmation of the delivery dates as directed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --
17-0016, Interior and Exterior Repairs, Bldg. 523

SECTION 01 33 00

SUBMITTAL PROCEDURES

05/13

PART 1   GENERAL

1.1 SUMMARY

1.1.1 Government-Furnished Information

Submittal register will be delivered to the contractor in hard copy format. Register will have the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required. Column (d): Lists each submittal description (SD No. and type, e.g. SD-04 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. The Contracting Officer is approving authority for all submittals.

1.2 DEFINITIONS

1.2.1 Submittal

Shop drawings, product data, samples, and administrative submittals presented for review and approval. Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.2.2 Types of Submittals

All submittals are classified as indicated in paragraph "Submittal Descriptions (SD)". Submittals also are grouped as follows:

a. Shop drawings: As used in this section, drawings, schedules, diagrams, and other data prepared specifically for this contract, by contractor or through contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower tier contractor, to illustrate portion of work.

b. Product data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other
data to illustrate portion of work, but not prepared exclusively for this contract.

c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portion of work, illustrating portion of work or establishing standards for evaluating appearance of finished work or both.

d. Administrative submittals: Data presented for reviews and approval to ensure that administrative requirements of project are adequately met but not to ensure directly that work is in accordance with design concept and in compliance with contract documents.

1.2.3 Submittal Descriptions (SD)

SD-01 Preconstruction Submittals

Certificates of insurance
Surety bonds
List of proposed subcontractors
List of proposed products
Construction Progress Schedule
Submittal schedule
Schedule of values
Health and safety plan
Work plan
Quality control 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 or equipment for some portion of the work.

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

SD-04 Samples

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
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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

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 checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements 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 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.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
Factory test reports.

SD-10 Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

SD-11 Closeout Submittals

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

As-built drawings

Special warranties

Posted operating instructions

Training plan

1.2.4 Approving Authority

Person authorized to approve submittal.

1.2.5 Work

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

1.3 SUBMITTALS

Submit the following in accordance with the requirements of this section.

SD-11 Closeout Submittals

Submittal register

Complete Submittal Package 2 CD/DVD's

1.4 USE OF SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Use the hard copy submittal register furnished by the Government or other approved format. 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.

1.4.1 Submittal Register

Submit submittal register as a hard copy. Submit with quality control plan and project schedule required. Do not change data in columns (c), (d), (e), and (f) as delivered by the government. Verify that all submittals required for project are listed and add missing submittals. Complete the following on the register:

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.

The Commissioning Authority will review the submittal register and identify submittals which will need to be reviewed by the Commissioning Authority related to the equipment and systems to be Commissioned. Any review comments by the Commissioning Authority will be provided to the COR for consideration.

1.4.2 Contractor Use of Submittal Register

Update the following fields in the government-furnished submittal register.

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.

1.4.3 Approving Authority Use of Submittal Register

Update the following fields in the government-furnished submittal register.

Column (b).

Column (l) List date of submittal receipt.

Column (m) through (p).

Column (q) List date returned to contractor.

1.4.4 Contractor Action Code and Action Code

Entries used will be as follows (others may be prescribed by Transmittal Form):

NR - Not Received
AN - Approved as noted
A - Approved
RR - Disapproved, Revise, and Resubmit

1.4.5 Copies Delivered to the Government

Deliver one copy of submitted register updated by contractor to government with each invoice request.
1.4.5.1 Submittals reserved for Marine Corps North Carolina IPT approval

a. 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.

b. Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP): 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.

1.5 PROCEDURES FOR SUBMITTALS

1.5.1 Reviewing, Certifying, Approving Authority

QC organization shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. The Contracting Officer is the approving authority for all submittals.

1.5.2 Constraints

a. Submittals listed or specified in this contract shall conform to provisions of this section, unless explicitly stated otherwise.

b. Submittals shall be complete for each definable feature of work; components of definable feature interrelated as a system shall be submitted at same time.

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.

1.5.3 Scheduling

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 requirements to resubmit.

b. 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. Period of review for each resubmittal is the same as for initial submittal.

c. For submittals requiring review by fire protection engineer, allow review period, beginning when government receives submittal from QC organization, of 45 working days for return of submittal to the contractor. Period of review for each resubmittal is the same as for initial submittal.
1.5.4 Variations

Variations from contract requirements require Government approval pursuant to contract Clause entitled "FAR 52.236-21, Specifications and Drawings for Construction" and will be considered where advantageous to government.

1.5.4.1 Considering Variations

Discussion with contracting officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

1.5.4.2 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. If lower cost is a benefit, also include an estimate of the cost saving. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.5.4.3 Warranting That Variations Are Compatible

When delivering a variation for approval, contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.5.4.4 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.

1.5.5 Contractor's Responsibilities

a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.

b. Transmit submittals to QC organization in accordance with schedule on approved Submittal Register, and to prevent delays in the work, delays to government, or delays to separate contractors.

c. Advise contracting officer of variation, as required by paragraph entitled "Variations."

d. Correct and resubmit submittal as directed by approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.
e. Furnish additional copies of submittal when requested by contracting officer, to a limit of 20 copies per submittal.

f. Complete work which must be accomplished as basis of a submittal in time to allow submittal to occur as scheduled.

g. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted," except to the extent that a portion of work must be accomplished as basis of submittal.

1.5.6 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, "Actions Possible."

   (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 N40085-15-B-011, 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)
g. Sign certifying statement or approval statement. The person signing certifying statements shall be QC organization member designated in the approved QC plan. The signatures shall be in original ink. 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.

1.5.7 Government's Responsibilities

When approving authority is contracting Officer, the Government will:

a. Note date on which submittal was received from QC manager, on each submittal for which the contracting officer is approving authority.

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 "Actions Possible" and with markings appropriate for action indicated.

1.5.8 Actions Possible

Submittals will be returned with one of the following notations:

a. 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.

b. Submittals marked "approved" "approved as submitted" authorize contractor to proceed with work covered.

c. Submittals marked "approved as noted" authorize contractor to proceed with work as noted provided contractor takes no exception to the notations.

d. Submittals marked "revise and resubmit" or "disapproved" indicate submittal is incomplete or does not comply with design concept or requirements of the contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until resubmittal is approved.

1.6 FORMAT OF SUBMITTALS

1.6.1 Complete Submittal Package

Contractor shall make electronic copies of all submittals, including the approved transmittal sheets, and provide two (2) CD/DVD's containing all submittals for the project.
The CD/DVD's shall be marked "Complete Submittal Package - Contract # 17-0016, Interior and Exterior Repairs, Building 523."

1.6.2 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. The transmittal form shall identify contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.6.3 Identifying Submittals

Identify submittals, except sample panel and sample installation, 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. Section number of the specification section by which submittal is required.

d. Submittal description (SD) number of each component of submittal.

e. When a resubmission, alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.

f. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier contractor associated with submittal.

g. Product identification and location in project.

1.6.4 Format for Product Data

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.

1.6.5 Format for Shop Drawings

a. Shop drawings shall not be less than 8 1/2 by 11 inches nor more than 30 by 42 inches.
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. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings. Identify materials and products for work shown.

1.6.6 Format of 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.

   (7) Sample Panel: 4 by 4 feet.

   (8) Sample Installation: 100 square feet.

b. Samples Showing Range of Variation: Where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.

c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples shall 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.
1.6.7 Format of Administrative Submittals

a. 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.

b. Operation and Maintenance Manual Data: Submit in accordance with Section 01 78 23, "Operation and Maintenance Data." Include components required in that section and the various technical sections.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of Product Data

a. Submit five copies of submittals of product data requiring review and approval only by the Contracting Officer. Submit three copies of submittals of product data for operation and maintenance manuals.

1.7.2 Number of Copies of Shop Drawings

Submit shop drawings in compliance with quantity requirements specified for product data.

1.7.3 Number of 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. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.7.4 Number of Copies of Administrative Submittals

a. Unless otherwise specified, submit administrative submittals compliance with quantity requirements specified for product data.

b. Submit administrative submittals required under "SD-19 Operation and Maintenance Manuals" to conform to Section 01 78 23, "Operation and Maintenance Data."

1.8 FORWARDING SUBMITTALS

1.8.1 Samples and Submittals

Except as otherwise noted, submit samples and submittals to:

The Walker Group Architecture, Inc.
409 Broad Street
New Bern, NC 28560
1.8.1.1 Administrative Submittals

Submit administrative submittals for asbestos/lead removal and environmental protection plan to the Resident Officer in Charge of Construction (ROICC/OICC).

1.8.1.2 Fire Protection and Fire Alarm System Submittals

Submit fire protection and fire alarm system submittals to ROICC/OICC.

1.8.1.3 TAB Submittals

Submit to ROICC/OICC for all projects.

1.8.2 Shop Drawings, Product Data, and O&M Data

As soon as practicable after award of the contract, and before procurement or fabrication, submit shop drawings, product data and O&M Data required in the technical sections of this specification.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --
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 Z359.1  (1992; R 1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

ASME INTERNATIONAL (ASME)

ASME B30.8  (2000) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10  (2013) Standard for Portable Fire Extinguishers
NFPA 51B  (2003) Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70  (2017) National Electrical Code

U. S. ARMY CORPS OF ENGINEERS (USACE)

17-0016, Interior and Exterior Repairs, Bldg. 523

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

29 CFR 1910.146 Permit-required Confined Spaces
29 CFR 1910.94 Ventilation
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 1926.500 Fall Protection

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3 DEFINITIONS

a. Associate Safety Professional (ASP). An individual who is currently certified by the Board of Certified Safety Professionals.

b. Certified Construction Health & Safety Technician (CHST). An individual who is currently certified as a CHST by the Board of Certified Safety Professionals.

c. Certified Industrial Hygienist (CIH). An individual who is currently certified as a CIH by the American Board of Industrial Hygiene.

d. Certified Safety Professional (CSP). An individual who is currently certified as a CSP by the Board of Certified Safety Professionals.

e. Certified Safety Trained Supervisor (STS). An individual who is currently certified as an STS by the Board of Certified Safety Professionals.

f. 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.

g. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

h. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

i. 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 through provided by a physician or registered personnel.

j. Multi-Employer Work Site (MEWS). A multi-employer work site, as
defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.

k. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

l. Qualified Person for Fall Protection. A person with a recognized degree or professional certificate, extensive knowledge, training and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

m. 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;
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.

n. Site Safety and Health Officer (SSHO). The superintendent or other qualified or competent person who is responsible for the on-site safety and health required for the project.

o. Steep roof. A roof having a slope greater than 4 in 12 (vertical to horizontal).

p. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

q. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six 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; and collision, including unplanned contact between the load, crane, and/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.).
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. The checklist will be completed monthly by the Contractor and submitted 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, will result in a retention of up to 10 percent of the voucher.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and the following 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 shall apply.

1.6 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

1.7 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.7.1 Personnel Qualifications

Work performed under this contract shall meet Level 2.

1.7.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO shall meet the following requirements:

Level 1:
- Worked on similar projects.
- 10-hour OSHA construction safety class or equivalent within last 3 years.
- Competent person training as needed.

Level 2:
- A minimum of 3 years safety work on similar project.
- 30-hour OSHA construction safety class or equivalent within last 3 years.
- Competent person training as needed.

Level 3:
- A minimum of 5 years safety work on similar projects.
- 30-hour OSHA construction safety class or equivalent within the
last 5 years.
An average of at least 24 hours of formal safety training each year for the past 5 years.
Competent person training as needed.

Level 4:
A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.
30-hour OSHA construction safety class or equivalent within the last 5 years.
An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: 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.

Level 5:
An Associate Safety Professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health & Safety Technician (CHST).
A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.
30-hour OSHA construction safety class or equivalent within the last 5 years.
An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: 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.

Level 6: A
Certified Safety Professional (CSP) and/or Certified Industrial Hygienist (CIH).
A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.
30-hour OSHA construction safety class or equivalent within the last 5 years.
An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: 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.

1.7.1.2 Certified Safety Professional (CSP) and/or Certified Industrial hygienist (CIH)
Provide a Certified Safety Professional (CSP) and/or Certified Industrial Hygienist (CIH) at the work site to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The CSP and/or CIH shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The CSP and/or CIH shall have no other duties than safety and occupational health management, inspections, and/or industrial hygiene.
1.7.1.3  Associate Safety professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health and Safety Technician (CHST).

Provide an Associate Professional (ASP); Certified Safety Trained Supervisor (STS); and/or Construction Health & Safety Technician (CHST) at the work site to perform safety management, surveillance, inspections, and safety enforcement for the Contractor to meet the designated safety level in paragraph 1.6.1. The ASP, STS, and/or CHST shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The ASP, STS, and/or CHST shall be at the work site at all times whenever work or testing is being performed and shall conduct and document daily safety inspections. The ASP, STS, and/or CHST shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

1.7.1.4  Competent Person for Confined Space Entry

Provide a competent person meeting the requirements of EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;

b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;

c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;

d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;

e. Determine ventilation requirements for confined space entries and operations;

f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,

g. Maintain records required.

When the work involves marine operations that handle combustible or hazardous materials, this qualified person shall be a NFPA certified marine chemist.

1.7.1.5  Competent Person for the Health Hazard Control and Respiratory Protection Program

Provide a competent person meeting the requirements of EM 385-1-1 who is:

a. Capable by education, specialized training and/or experience of anticipating, recognizing, and evaluating employee exposure to hazardous chemical, physical and biological agents in accordance with USACE EM 385-1-1, Section 6.
b. Capable of specifying necessary controls and protective actions
to ensure worker health.

1.7.2 Personnel Duties

1.7.2.1 Site Safety and Health Officer (SSHO)/Superintendent

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. Safety inspection logs shall be attached
to the Contractors' daily 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. A list of
unresolved safety and health deficiencies shall be posted on the safety
bulletin board.

g. Ensure sub-contractor compliance with safety and health
requirements.

h. Ensure an approved "Special Permission Energized Electrical Work
Permit" prior to starting any activity on energized electrical systems.

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

1.7.2.2 Certified Safety Professional (CSP), Certified Industrial Hygienist
(CIH), Associate Safety Professional (ASP), Certified Safety Trained
Supervisor (STS), and/or Certified Construction Health & Safety Technician
(CHST)

a. Perform safety and occupational health management, surveillance,
inspections, and safety enforcement for the project.

b. Perform as the safety and occupational health "competent person"
as defined by USACE EM 385-1-1.

c. Be on site whenever work or testing is being performed.

d. Conduct and document safety inspections.

e. Shall have no other duties other than safety and occupational
health management, inspections, and enforcement on this contract.

If the CSP, CIH, ASP, STS, CHST is appointed as the SSHO all duties of that
position shall also be performed.
1.7.3 Meetings

1.7.3.1 Preconstruction Conference

a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's Accident Prevention Plan (APP) before the initiation of work.

b. 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).

c. The Contractor shall 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, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

d. 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. Work shall not begin until there is an accepted APP.

e. The functions of a Preconstruction conference may take place at the Post-Awar Kickoff meeting for Design Build Contracts.

1.7.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily report.

1.7.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

1.8 TRAINING

1.8.1 New Employee Induction

New employees (prime and sub-contractor) will be informed of specific site
hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.8.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

1.8.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.9 DISPLAY OF SAFETY INFORMATION

Within 1 calendar days after commencement of work, erect a safety bulletin board at the job site. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

a. Map denoting the route to the nearest emergency care facility.
b. Emergency phone numbers.
c. Copy of the most up-to-date APP.
d. Current AHA(s).
e. OSHA 300A Form.
f. OSHA Safety and Health Protection-On-The-Job Poster.
g. Hot work permit.
h. A sign indicating the number of hours worked since last lost workday accident.
i. Safety and Health Warning Posters.

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 HOT WORK

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will 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.

a. Oil painting materials (paint, brushes, empty paint cans, etc.), and all flammable liquids shall be removed from the facility at quitting time. All painting materials and flammable liquids shall be stored outside in a suitable metal locker or box and will require re-submittal with non-hazardous materials.

b. Accumulation of trays, paper, shavings, sawdust, boxes and other packing materials shall be removed from the facility at the close of each workday and such material disposed of in the proper containers located away from the facility.

c. The storage of combustible supplies shall be a safe distance from structures.

d. Area outside the facility undergoing work shall be cleaned of trash, paper, or other discarded combustibles at the close of each workday.

e. All portable electric devices (saws, sanders, compressors, extension chord, lights, etc.) shall be disconnected at the close of each workday. When possible, the main electric switch in the facility shall be deactivated.

f. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency phone number 911. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED IMMEDIATELY.

g. Obtain services from th FIRE DIVISION for "HOT WORK" within or around flammable materials (such as fuel systems, welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, vaults, etc.) that have the potential for flammable or explosive atmospheres.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for all required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm (one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m (5 feet).

2.2 FALL PROTECTION ANCHORAGE

Fall protection anchorage, conforming to ANSI Z359.1, installed under the supervision of a qualified person in fall protection, shall be left in place for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).
PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard shall prevail.

3.1.1 Hazardous Material Use

Each hazardous material must receive approval 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. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

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-isocynates, 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.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. 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

Contractors are required to 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, the Contractor shall 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.

3.3 FALL HAZARD PROTECTION AND PREVENTION

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall 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 escape procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

3.3.2 Fall Protection Equipment

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 1.8 m (6 feet) or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 1.8m (6 feet) of any leading edge. In addition to the required fall protection systems, safety skiff, personal flotation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.I. and 05.J. 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 may be 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 and USACE EM 385-1-1.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest 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 1.8 m (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.
3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

(1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

(2) For work greater than 1.8 m (6 feet) from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

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

3.3.4 Safety Nets

If safety nets are used as the selected fall protection system on the project, they shall be provided at unguarded workplaces, leading edge work or when working over water, machinery, dangerous operations and or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, fall arrest systems or restraint/positioning systems are impractical. Safety nets shall be tested immediately after installation with a drop test of 181.4 kg (400 pounds) dropped from the same elevation a person might fall, and every six months thereafter.

3.3.5 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Exiting horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

3.3.6 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.3.7 Guardrail Systems

Guardrails shall consist of top and mid-rails, post and toe boards. The top edge height of standard railing must be 42 inches plus or minus 3 inches above the walking/working level. When mid-rails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. Posts shall be placed no more than 8 feet apart (29 CFR 1926.500 and USACE EM 385-1-1).
3.3.8 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. A Rescue and Evacuation Plan shall be prepared by the contractor 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. The Rescue and Evaluation Plan shall be included in 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).

3.4 PERSONAL PROTECTIVE EQUIPMENT

All personnel who enter a construction site area shall wear Personal Protective Equipment (PPE) at all times as outlined in the EM 385 1-1. In addition to the requirements of the EM 385 1-1, Safety Glasses (ANSI Z87.1) and High-Visibility Apparel (ANSI 107-2004 Performance Class II, Shirt or Vest) will be worn at all times on construction sites. Hearing protection is required in noise hazard areas or when performing noise hazard tasks. Mandatory PPE on all construction sites includes:

a. Hard Hats
b. Safety Glasses
c. High-Visibility Shirt or Vest
d. Safety-Toed Shoes or Boots

3.5 SCAFFOLDING

Employees shall be provided 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 to scaffold platforms greater than 6 m (20 feet) in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 m (20 feet) in height. The use of an adequate gate is required. Contractor shall 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. Special care shall be given 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. Work platforms shall be placed 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.
3.5.1 Stilts

The use of stilts for gaining additional height in construction, renovation, repair or maintenance work is prohibited.

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.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.6.2 Weight Handling Equipment

a. Cranes must be equipped with:

   (1) Load indicating devices (LIDs) and a boom angle or radius indicator,

   (2) or load moment indicating devices (LMIs).

   (3) Anti-two block prevention devices.

   (4) Boom hoist hydraulic relief valve, disconnect, or shutoff (stops hoist when boom reaches a predetermined high angle).

   (5) Boom length indicator (for telescoping booms).

   (6) Device to prevent uncontrolled lowering of a telescoping hydraulic boom.

   (7) Device to prevent uncontrolled retraction of a telescoping hydraulic boom.

b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.

c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall 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. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

f. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.

g. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

h. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

i. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

j. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

k. All employees shall be kept clear of loads about to be lifted and of suspended loads.

l. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.

m. The Contractor shall use cribbing when performing lifts on outriggers.

n. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

o. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

p. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.

q. 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.

r. 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.
3.6.3 Equipment and Mechanized Equipment

a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.

b. Manufacture 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. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.

d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

3.7 EXCAVATIONS

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly. The competent person shall perform soil classification in accordance with 29 CFR 1926.

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

The Contractor must 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. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet when parallel within 5 feet of the excavation.

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

Utilities located within concrete slabs or pier decks, 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 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.7.5 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.8 ELECTRICAL

3.8.1 Conduct of Electrical Work

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. Positive cable identification must be made prior to submitting any outage request for electrical systems. 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. 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 with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor's AHA.
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.

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 Special Permission Energized Electrical Work Permit

All work on energized electrical systems, including high voltage, must have an approved "Special Permission Energized Electrical Work Permit." The results of a Arc Flash Risk/Hazard Analysis, per NFPA 70E, shall be included in the "Special Permission Energized Electrical 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

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

3.9 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. 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 06.I.05 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. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.

d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.

f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

3.10 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and USACE EM 385-1-1, Appendix C. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.11 HOUSEKEEPING

3.11.1 Clean-Up

All debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location, however garbage accumulation must be removed each day.

3.11.2 Falling Object Protection

All areas must be barricaded to safeguard employees. When working overhead, barricade the area below to prevent entry by unauthorized employees. Construction warning tape and signs shall be posted so they are clearly visible from all possible access points. When employees are working overhead all tools and equipment shall be secured so that they will not fall. When using guardrail as falling object protection, all openings shall be small enough to prevent passage of potential falling objects.

-- End of Section --
PART 1    GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g. ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

ACOUSTICAL SOCIETY OF AMERICA (ASA)
1305 Walt Whitman Road, Suite 300
Melville, NY 11747-4300
Ph:   516-576-2360
Fax:  631-923-2875
E-mail: asa@aip.org
Internet: http://asa.aip.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL  60004-1893
Ph:   847-394-0150
Fax:  847-253-0088
E-mail: amca@amca.org
Internet: http://www.amca.org

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
2111 Wilson Blvd, Suite 500
Arlington, VA  22201
Ph:   703-524-8800
Fax:  703-562-1942
Internet: http://www.ahrinet.org

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA  22209
Ph:   703-358-2960
E-Mail: info@aluminum.org
Internet: http://www.aluminum.org

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AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square, Suite 550
Schaumburg, IL  60173-4268
Ph:   847-303-5664
Fax: 847-303-5774
E-mail: customerservice@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC  20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
1 Davis Drive
P.O. Box 12215
Research Triangle Park, NC  27709-2215
Ph: 919-549-8141
Fax: 919-549-8933
Internet: http://www.aatcc.org

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI  48331-3439
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH  45240
Ph: 513-742-2020 or 513-742-6163
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: http://www.acgih.org

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
3141 Fairview Park Dr, Suite 777
Falls Church, VA  22042
Tel: 703-849-8888
Fax: 703-207-3561
E-mail: infonet@aiha.org
Internet: http://www.aiha.org

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700
Chicago, IL  60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Bookstore: 800-644-2400
E-mail: aisc@ware-pak.com
Internet: http://www.aisc.org
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Herndon, VA 20170
Ph: 571-323-0294
Fax: 571-323-0245
E-mail: emikoski@ecaus.org
Internet: http://www.ecianow.org/

FM GLOBAL (FM)
270 Central Avenue
P.O. Box 7500
Johnston, RI 02919-4923
Ph: 877-364-6726
Fax: 401-275-3029
E-mail: servicedesk.myrisk@fmglobal.com
Internet: http://www.fmglobal.com

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)
University of South California
Research Annex 219
3716 South Hope Street
Los Angeles, CA 90089-7700
Ph: 213-740-2032 or 866-545-6340
Fax: 213-740-8399
E-mail: fccchr@usc.edu
Internet: http://www.usc.edu/dept/fccchr

GYPSUM ASSOCIATION (GA)
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782
Ph: 301-277-8686
Fax: 301-277-8747
E-mail: info@gypsum.org
Internet: http://www.gypsum.org

ILLUMINATING ENGINEERING SOCIETY (IES)
120 Wall Street, 17th Floor
New York, NY 10005-4001
Ph: 212-248-5000
Fax: 212-248-5018
E-mail: IES@IES.org
Internet: http://www.IES.org

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane
Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-9667
E-mail: onlinesupport@ieee.org
Internet: http://www.ieee.org

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 1568
Carrollton, GA 30112
E-mail: http://www.icea.net/Public_Pages/Contact/Email_Contact.html
Internet: http://www.icea.net
INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)
4755 E. Philadelphia St.
Ontario, CA 91761
Ph:   909-472-4100
Fax:  909-472-4150
E-mail: iapmo@iapmo.org
Internet:  http://www.iapmo.org

INTERNATIONAL CODE COUNCIL (ICC)
500 New Jersey Avenue, NW
6th Floor, Washington, DC 20001
Ph:   800-786-4452 or 888-422-7233
E-mail: order@iccsafe.org
Internet:  www.iccsafe.org

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 102
Portage, MI 49024
Ph:  269-488-6382
Internet:  http://www.netaworld.org

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe
P.O. Box 131
CH-1211 Geneva 20, Switzerland
Ph:   41-22-919-02-11
Fax:  41-22-919-03-00
Internet:  http://www.iec.ch

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
1, ch. de la Voie-Creuse
Case Postale 56
CP 56 - CH-1211 Geneva 20
Switzerland
Ph:   41-22-749-01-11
Fax:  41-22-733-34-30
E-mail: central@iso.ch
Internet:  http://www.iso.org

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)
1901 North Moore Street
Arlington, VA  22209-1762
Ph:   703-525-1695
Fax:  703-528-2148
Internet:  http://www.safetyequipment.org/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA  22180-4602
Ph:   703-281-6613
E-mail: info@mss-hq.com
Internet:  http://mss-hq.org/Store/index.cfm

MARBLE INSTITUTE OF AMERICA (MIA)
380 E. Lorain Street
Oberlin, OH 44074
Ph:   440-250-9222
Fax: 847-299-1183  
E-mail: info@nrca.net  
Internet: http://www.nrca.net

NATIONAL SECURITY TELECOMMUNICATIONS AND INFORMATION SYSTEMS SECURITY (NSTISS)  
CNSS Secretariat  
National Security Agency  
9800 Savage Road, Ste 6716  
Fort George G. Meade, MD 20755-6716  
Ph: 410-854-6805  
Fax: 410-854-6814  
E-mail: cnss@radium.ncsc.mil  

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)  
272 Tuttle Road  
Cumberland, ME 04021  
Ph: 207-829-6901  
Fax: 207-829-4293  
E-mail: info@nelma.org  
Internet: http://www.nelma.org

NSF INTERNATIONAL (NSF)  
789 North Dixboro Road  
P.O. Box 130140  
Ann Arbor, MI 48105  
Ph: 734-769-8010 or 800-NSF-MARK  
Fax: 734-769-0109  
E-mail: info@nsf.org  
Internet: http://www.nsf.org

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)  
800 Roosevelt Road  
Building C, Suite 312  
Glen Ellyn, IL 60137  
Ph: 630-858-6540  
Fax: 630-790-3095  
Internet: http://www.ppfahome.org

PLUMBING AND DRAINAGE INSTITUTE (PDI)  
800 Turnpike Street, Suite 300  
North Andover, MA 01845  
Ph: 978-557-0720 or 800-589-8956  
E-Mail: pdi@PDIconline.org  
Internet: http://www.pdionline.org

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)  
818 Grayson Road, Suite 201  
Pleasant Hill, CA 94523  
Ph: 925-935-1499  
Fax: 925-935-1496  
E-Mail: ris@calredwood.org  
Internet: http://www.redwoodinspection.com/

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)  
2000 Powell Street, Suite 600
Emeryville, CA 94608
Ph: 800-326-3228
E-mail: info@SCSGlobalServices.com
Internet: http://www.scmGlobalServices.com/

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
4201 Lafayette Center Drive
Chantilly, VA 20151-1219
Ph: 703-803-2980
Fax: 703-803-3732
Internet: http://www.smacna.org

SOCIETY FOR PROTECTIVE COATINGS (SSPC)
40 24th Street, 6th Floor
Pittsburgh, PA 15222
Ph: 412-281-2331
Fax: 412-281-9992
E-mail: info@sspc.org
Internet: http://www.sspc.org

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
400 Commonwealth Drive
Warrendale, PA 15096
Ph: 724-776-4970
Fax: 877-606-7323
E-mail: customerservice@sae.org
Internet: http://www.sae.org

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)
665 Rodi Road, Suite 305
Pittsburgh, PA 15235
Ph: 412-244-0440
Fax: 412-244-9090
E-Mail: member-services@cypressinfo.org
Internet: http://www.cypressinfo.org

SOUTHERN PINE INSPECTION BUREAU (SPIB)
P.O. Box 10915
Pensacola, FL 32504-0915
Ph: 850-434-2611
Fax: 850-433-5594
Internet: http://www.spib.org

STEEL DOOR INSTITUTE (SDI/DOOR)
30200 Detroit Road
Westlake, OH 44145
Ph: 440-899-0010
Fax: 440-892-1404
E-mail: info@steeldoor.org
Internet: http://www.steeldoor.org

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
1320 N. Courthouse Rd., Suite 200
Arlington, VA 22201
Ph: 703-907-7700
Fax: 703-907-7727
Internet: http://www.tiaonline.org
17-0016, Interior and Exterior Repairs, Bldg. 523

TILE COUNCIL OF NORTH AMERICA (TCNA)
100 Clemson Research Boulevard
Anderson, SC 29625
Ph: 864-646-8453
Fax: 864-646-2821
E-mail: info@tileusa.com
Internet: http://www.tcnatile.com/

U.S. ARMY CORPS OF ENGINEERS (USACE)
CRD-C DOCUMENTS available on Internet:
http://www.wbdg.org/ccb/browse_cat.php?c=68
Order Other Documents from:
USACE Publications Depot
Attn: CEHEC-IM-PD
2803 52nd Avenue
Hyattsville, MD 20781-1102
Ph: 301-394-0081
Fax: 301-394-0084
E-mail: pubs-army@usace.army.mil
Internet: http://www.publications.usace.army.mil/
or
http://www.hnc.usace.army.mil/Missions/Engineering/TECHINFO.aspx

U.S. DEPARTMENT OF DEFENSE (DOD)
Order DOD Documents from:
Room 3A750-The Pentagon
1400 Defense Pentagon
Washington, DC 20301-1400
Ph: 703-571-3343
FAX: 215-697-1462
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Internet: http://www.ntis.gov
Obtain Military Specifications, Standards and Related Publications from:
Acquisition Streamlining and Standardization Information System
(ASSIST)
Department of Defense Single Stock Point (DODSSP)
Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: http://assist.daps.dla.mil/online/start/; account registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, CD 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet: http://www.wbdg.org/references/docs_refs.php

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-272-0167
Internet: http://www2.epa.gov/libraries
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-888-584-8332
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: http://www.ntis.gov

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)
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Washington, DC 20554
Ph: 888-225-5322
TTY: 888-836-3332
Fax: 866-418-0232
Internet: http://www.fcc.gov
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Internet: http://www.gpoaccess.gov/

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General Services Administration
1275 First St. NE
Washington, DC 20417
Ph: 202-501-1231
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Obtain documents from:
Acquisition Streamlining and Standardization Information System
(ASSIST)
Internet: https://assist.dla.mil/online/start/; account registration required

U.S. GREEN BUILDING COUNCIL (USGBC)
2101 L St NW, Suite 500
Washington, D.C. 20037
Ph: 800-795-1747
Internet: http://www.usgbc.org

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Fax: 301-837-0483
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Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

SECTION 01 42 00 Page 12
PART 2   PRODUCTS

Not used

PART 3   EXECUTION

Not used

-- End of Section --
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 D 3740 (1999c) Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction


1.2   SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-11 Closeout Submittals

Quality Control Plan (QC PLAN)

Submit a QC plan within 15 calendar days after receipt of Notice of Award.
1.3 INFORMATION FOR THE CONTRACTING OFFICER

Deliver the following to the Contracting Officer:

a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet): Original and 1 copy, by 10:00 AM the next working day after each day that work is performed;

b. QC Specialist Reports and Test Results: Originals and 1 copy, by 10:00 AM the next working day after each day that work is performed;

c. Testing Plan and Log, 1 copy, at the end of each month;

d. QC Meeting Minutes: 1 copy, within 2 calendar days of the meeting;

e. Rework Items List: 1 copy, by the last working day of the month and;

f. 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. The QC program consists of a QC Organization, a QC Plan, attending a QC Plan meeting, attending a Coordination and Mutual Understanding Meeting, conducting QC meetings, performing three phases of control, performing submittal review, ensuring testing is performed, and preparing 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 shall cover construction operations on-site and off-site and shall be keyed to the proposed construction sequence.

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to manage and implement the QC program. The QC Manager is required to attend the QC Plan meeting, attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review, ensure testing is performed and prepare QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC specialists. In addition to managing and implementing the QC program, the QC Manager may perform the duties of project superintendent.

1.5.1.2 Qualifications

An individual with a minimum of five years experience as a foreman, superintendent, inspector, QC Manager, project manager, or construction manager on similar size construction contracts which included the major trades that are part of this Contract.

Provide a separate QC Specialist at the work site for each of the areas of responsibilities for the following:
Electrical and Telecommunication Systems QC Specialists.

Provide ICC IBC Special Inspection Certification from the following specialist:

 Telecommunication Systems Installation Specialist, (10) years minimum experience in Telecommunication Systems Installation.

Area of responsibility:

 Telecommunication Systems, all Division 27, Division 28, and Division 33 Outside Plant work.

Frequency of specialists is full time during systems installation and testing. 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.

1.5.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management for Contractors." This course is periodically offered by the Navy and the Corps of Engineers. However, it is sponsored by both the AGC and the ABC of Charlotte, North Carolina. Call one of the following to sign up for the next available class:

The Army Corps of Engineers, Baltimore District;
(Offered in Baltimore, MD)
Contact: Corps of Engineers, Baltimore District
10 South Howard Street
Baltimore, MD 21201
Phone: 410-962-2323

The Associated General Contractors (AGC), Virginia Chapter in Cooperation with the Army Corps of Engineers, Norfolk District, and the Naval Facilities Engineering Command, Atlantic Division.
(Offered at rotating locations in Norfolk, Williamsburg, and Richmond)
Contact: AGC of Virginia
8631 Maylan Drive, Parham Park
Richmond, VA 23294
Phone: 804-346-3383

Carolinas Associated General Contractors (CACG)
Contact: CACG
1100 Euclid Avenue
Charlotte, NC 28203
Phone: 704-372-1450 (ext. 5248)

Associated Builders and Contractors (ABC), Carolinas Chapter
Contact: ABC, Carolinas Chapter
3705 Latrobe Drive
Charlotte, NC 28211
Phone: 704-367-1331
or: 877-470-4819
1.5.2 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 shall be three years of experience in one of the specified positions.

1.6 QC PLAN

1.6.1 Requirements

Provide for approval by the Contracting Officer, a QC plan submitted in a 3-ring binder with pages numbered sequentially that covers, both on-site and off-site work and includes, the following:

a. A table of contents listing the major sections identified with tabs in the following order:

   I. QC ORGANIZATION
   II. NAMES AND QUALIFICATIONS
   III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL
   IV. OUTSIDE ORGANIZATIONS
   V. APPOINTMENT LETTERS
   VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER
   VII. TESTING LABORATORY INFORMATION
   VIII. TESTING PLAN AND LOG
   IX. PROCEDURES TO COMPLETE REWORK ITEMS
   X. DOCUMENTATION PROCEDURES
   XI. LIST OF DEFINABLE FEATURES
   XII. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL
   XIII. PERSONNEL MATRIX
   XIV. PROCEDURES FOR COMPLETION INSPECTION

b. A chart showing the QC organizational structure and its relationship to the production side of the organization.

c. Names and qualifications, in resume format, for each person in the QC organization.

d. Duties, responsibilities and authorities of each person in the QC organization.

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

f. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.

g. Procedures for reviewing, approving and managing submittals. Provide the names of the persons in the QC organization authorized to review and certify submittals prior to approval.

h. Testing laboratory information required by the paragraphs entitled
"Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.

i. 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.

j. Procedures to identify, record, track and complete rework items.

k. Documentation procedures, including proposed report formats.

l. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements. As a minimum, if approved by the Contracting Officer, consider each Section of the Specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each Section of the Specifications.

m. A personnel matrix showing, for each section of the specification, who will perform and document the three phases of control, and who will perform and document the testing.

o. Procedures for Identifying and Documenting the Completion Inspection process. Include in these procedures the responsible party for punch out inspection, prefinal inspection, and final acceptance inspection.

1.6.2 Preliminary Work Authorized Prior to Approval

The only work that is authorized to proceed prior to the approval of the QC plan is mobilization of storage and office trailers and surveying.

1.6.3 Approval

Approval 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 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 his/her submitted qualifications.

1.6.4 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. Proposed changes must be approved by the Contracting Officer.

1.7 QC PLAN MEETING

Prior to submission of the QC plan, 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.

1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, but prior to the start of construction,
meet with the Contracting Officer to discuss the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used for documentation, administration for on-site and off-site work, and the coordination of the Contractor’s management, production and QC personnel with the Contracting Officer. As a minimum, the Contractor’s personnel required to attend shall include the project manager, project superintendent, and QC Manager. Minutes of the meeting shall be prepared by the QC Manager and signed by both the Contractor and the Contracting Officer.

1.9 QC MEETINGS

After the start of construction, the QC Manager shall conduct weekly QC meetings at the work site with the project superintendent and QC specialists. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work:
   - Work or testing accomplished since last meeting
   - Rework items identified since last meeting
   - Rework items completed since last meeting;

c. Review the status of submittals:
   - Submittals reviewed and approved since last meeting
   - Submittals required in the near future;

d. Review the work to be accomplished in the next 2 weeks and documentation required. Schedule the three phases of control and testing:
   - Establish completion dates for rework items
   - Preparatory phases required
   - Initial phases required
   - Follow-up phases required
   - Testing required
   - Status of off-site work or testing
   - Documentation required;

e. Resolve QC and production problems; and

f. Address items that may require revising the QC plan:
   - Changes in QC organization personnel
   - Changes in procedures.

1.9.1 THREE PHASES OF CONTROL

The QC Manager shall perform the three phases of control to ensure that work complies with Contract requirements. The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following for each definable feature of work: A definable feature of work
is a task which is separate and distinct from other tasks and requires separate control requirements.

1.9.2 Preparatory Phase

Notify the Contracting Officer at least 48 hours in advance of each preparatory phase. Conduct the preparatory phase with the superintendent, and the foreman responsible for the definable feature. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report. Perform the following prior to beginning work on each definable feature of work:

a. Review each paragraph of the applicable specification sections;

b. Review the Contract drawings;

c. 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;

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

e. Examine the work area to ensure that the required preliminary work has been completed;

f. 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;

g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

h. Discuss construction methods

1.9.3 Initial Phase

Notify the Contracting Officer at least 48 hours in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the QC Specialists, the superintendent, and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. 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 definable feature of work:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and

d. Ensure that testing is performed by an approved laboratory.
1.9.4 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work and document in the daily Contractor Quality Control 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 an approved laboratory; and
d. Ensure that rework items are being corrected.

1.9.5 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.

1.10 SUBMITTAL REVIEW

Procedures for submittals are as described in Section entitled "Submittal Procedures."

1.11 TESTING

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

1.11.1 Testing Laboratory Requirements

Provide an independent testing laboratory or establish a laboratory qualified to perform sampling and tests required by this Contract. When the proposed testing laboratory is not accredited by an acceptable accreditation program as described by the paragraph entitled "Accredited Laboratories", submit to the Contracting Officer for approval, certified statements signed by an official of the testing laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

a. Sampling and testing shall be under the technical direction of a Registered Professional Engineer (P.E) with at least 5 years of experience in construction material testing.
b. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077.
c. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666.
d. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.
e. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A 880. Laboratories shall meet the requirements of ASTM E 329.
f. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.
g. Laboratories engaged in hazardous materials testing shall meet the requirements of OSHA and EPA.

1.11.2 Accredited Laboratories

Acceptable accreditation programs are the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program and the American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer, a copy of the Certificate of Accreditation, Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

1.11.3 Inspection of Testing Laboratories

Prior to approval of non-accredited laboratories, the proposed testing laboratory facilities and records shall be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

1.11.4 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.

1.11.5 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. 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 shall 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. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.12 QC CERTIFICATIONS

1.12.1 Contractor Quality Control Report Certification

Each Contractor Quality Control Report shall contain the following statement: "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."
1.12.2 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 and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.12.3 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".

1.13 DOCUMENTATION

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

1.13.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed and dated by the project superintendent and shall contain the following information:

a. Date of report, report number, name of contractor, contract number, title and location of Contract and superintendent present.

b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.

c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed and hours worked.

e. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:

   (1) Was a job safety meeting held this date? (If YES, attach a copy of the meeting minutes.)

   (2) Were there any lost time accidents this date? (If YES, attach a copy of the completed OSHA report.)

   (3) Was crane/manlift/trenching/scaffold/hv electrical/high work/hazmat work done? (If YES, attach a statement or checklist showing inspection performed.)

   (4) Was hazardous material/waste released into the environment? (If YES, attach a description of incident and proposed action.)

f. A list of safety actions taken today and safety inspections conducted.

g. A list of equipment/material received each day that is
incorporated into the job.

h. A list of construction and plant equipment on the work site including the number of hours used, idle and down for repair.

i. Include a "remarks" section in this report which will contain 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.

1.13.2 Contractor Quality Control Report

Reports are required for each day that work is performed and for every seven consecutive calendar days of no-work and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed and dated by the QC Manager and shall contain the following information:

a. Identify the control phase and the definable feature of work.

b. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.

c. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed and include a list of who performed the tests.

d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed and include a list of who performed the tests.

e. Results of the three phases of control for off-site work, if applicable, including actions taken.

f. List the rework items identified, but not corrected by close of business.

g. List the rework items corrected from the rework items list along with the corrective action taken.
h. Include a "remarks" section in this report which will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that as-built drawings have been updated, corrective direction given by the QC Organization and corrective action taken by the Contractor.

i. Contractor Quality Control Report certification.

1.13.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks and acknowledgement that an accredited or Contracting Officer approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

1.13.4 Rework Items List

The QC Manager shall 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, 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 "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Contracting Officer.

1.13.5 As-Built Drawings

The QC Manager is required to review the as-built drawings required by Section 01 11 00, "Summary of Work", to ensure that as-built drawings are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.13.6 Report Forms

The following forms, which are attached at the end of this section, are acceptable for providing the information required by the paragraph entitled "Documentation". While use of these specific formats are not required, any other format used shall contain the same information:

a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet

b. Testing Plan and Log

c. Rework Items List

PART 2 PRODUCTS

Not used.
PART 3   EXECUTION

Not used.
PART 1   GENERAL

1.1   TEMPORARY UTILITIES

1.1.1 Availability of Utility Services

a. The Contract clause related to utilities applies. Reasonable amounts of water and electricity from the nearest outlet will be provided free of charge for pursuance of work within a facility under this contract. If the nearest available outlet cannot be utilized by the Contractor because of improper voltage, insufficient current, improper pressure, incompatible connectors, etc., it shall be the responsibility of the Contractor to provide temporary utilities as required.

b. Reasonable amounts of utilities for contractor trailers and storage buildings will be made available to the Contractor, when available. The Contractor shall be responsible for providing transformers, electrical service poles and drops for electrical services, and backflow preventer devices on connections to domestic water lines. Final taps and tie-ins to the Government utility grid will be made by the Contractor after approval by the Contracting Officer. Tap-in cost, if any, shall be the responsibility of the Contractor. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

1.1.2 Trailers

Electrical service will be supplied by the Government, when available, except at Tarawa Terrace where Carolina Power and Light Company will be the supplier.

1.1.3 Energy and Utilities Conservation

The Contractor shall carefully conserve utilities furnished without charge. The Contractor, at his own expense and in a manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines and remove the same prior to final acceptance of the construction.

1.1.4 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 indicted in
locations to be traversed by new piping, ducts, and other excavations the elevations of the existing utilities and obstructions shall be determined before the new work is completed.

a. In addition, the Contractor will be responsible for obtaining the services of a professional utility locator prior to digging. Contractor will provide documentation that the site has been surveyed and checked for underground utilities. All utilities must be located, including but not limited to power, water, sewer, storm drains, fiber optics, T.V. cable, telephone, and intrusion detection wiring. A set of known utility drawings will be available in the ROICC office for review to assist the locator.

b. It is mandatory that the Contractor also contact the Base Telephone Office (451-2531) prior to accomplishing any digging at Camp Lejeune. A telephone office representative will assist in locating telephone lines.

c. It is mandatory that the Contractor also contact Charter Communications, cable TV service prior to accomplishing any digging at Camp Lejeune, to ensure that all buried cable lines are identified. Contact Mr. Olin Criswell at 353-8677 for assistance.

d. 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 requests may also be submitted online at www.nc811.org.

1.1.4.1 The Locations of Underground Utilities

The locations of underground utilities shown at 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.

1.1.4.2 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. For any additional work required by reason of conflict between the new and existing work, an adjustment in contract price will be made in accordance with Contract clause entitled "Differing Site Conditions", if appropriate.

1.2 WEATHER PROTECTION

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.
1.2.1 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 shall 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.

1.2.1.1 Hurricane Conditions of Readiness

Unless directed otherwise, comply with:

a. Condition FIVE: Normal weather conditions are expected for the foreseeable future. No action is required.

b. Condition FOUR (Sustained winds of 74 mph or greater expected within 72 hours): Contractors shall continue normal daily clean up and good house keeping 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. Stack lumber in neat piles less than 4 feet high. Prepare to remove or secure all debris, trash, or stored materials that could become missile hazards during high wind conditions. Meetings should be held on-site with all subcontractors to review the measures that are going to need to be taken should the base go to a higher readiness condition. Contact the ROICC for any additional updates and upon completion of all required actions.

c. Condition THREE (Sustained winds of 74 mph or greater expected within 48 hours): Once Condition 3 is set, contractors shall shift their focus from their normal activities to taking the actions that are required to prepare the job site for the potential of destructive weather. All debris and rubbish shall be removed form the site at the end of the workday. All stored materials shall either be removed from the job site or secured (metal straps or heavy lines/ropes). All tools, equipment and gear shall be secured at the end of the workday. Begin preparations to adequately secure the facility (windows boarded up, etc.). Meetings should be held on-site with all subcontractors to review the measures that are going to be taken should base go to a higher readiness condition. Contract the ROICC for any additional updates and upon completion of all required actions.

d. Condition TWO (Sustained winds of 74 mph or greater expected within 24 hours): Cease all normal activities until the job-site is completely prepared for the onslaught of destructive weather. The job site should be completely free of debris, rubbish and scrap materials. The facility being worked on should be made weather-tight. All scaffolding planking shall be removed. All formwork and free standing structural steel shall be braced. All machinery, tools, equipment and materials shall be properly secured or removed from the job-site. Expend every effort to clear all missiles hazards and loose equipment from the job site. When the contractor secures for the day the job site should be left in a condition that is ready for the storm and the contractor
should assume that they will not be allowed to return to their job site until after the storm passes and the base is reopened. Contact ROICC for additional updates and upon completion of required actions.

e. Condition ONE (Sustained winds of 74 mph or greater expected within 12 hours): If still on the job site, the contractor will be required to immediately leave the base until the storm passes and the base is reopened.

1.3 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required and approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance. Dispose of sewage through connection to a municipal, district, or station sanitary sewage system. Where such systems are not available, use chemical toilets or comparably effective units, and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Include provisions for pest control and elimination of odors.

1.4 TEMPORARY BUILDINGS

Locate these where indicated.

1.4.1 Maintenance of Temporary Facilities

Suitably paint and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

1.4.2 Trailers or Storage Buildings

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Contracting Officer. The trailers or buildings shall be in good condition, free from visible damage rust and deterioration, and meet all applicable safety requirements. Trailers shall be roadworthy and comply with all appropriate state and local vehicle requirements. Failure to maintain storage trailers or buildings to these standards shall result in the removal of non-complying units at the Contractor's expense. A sign not smaller than 24 by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state of local standards for anchoring mobile trailers.

PART 2 PRODUCTS

PART 3 EXECUTION

Not used.

-- End of Section --
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.

**U.S. DEPARTMENT OF DEFENSE (DOD)**

MIL-S-16165 (Rev E) Shielding Harnesses, Shielding Items and Shielding Enclosures for Use in the Reduction of Interference from Engine Electrical Systems

MIL-STD-461 (Rev E) Control of Electromagnetic Interference Emissions and Susceptibility

MIL-STD-462 (Rev D; Notice 4) Electromagnetic Interference Characteristics

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

29 CFR 1910 Occupational Safety and Health Standards

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Generators of Hazardous Waste

40 CFR 263 Transporters of Hazardous Waste

40 CFR 264 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 265 Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan

49 CFR 171 General Information, Regulations, and Definitions

49 CFR 172 Hazardous Materials Tables and Hazardous Materials Communications Regulations
1.2 Contractor Liabilities for Environmental Protection

Contractors shall complete and provide environmental training documentation for training required by Federal, State, and local regulations.

1.3 DEFINITIONS

1.3.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.3.2 Solid Waste

Rubbish, debris, garbage, and other discarded solid materials, except recyclables and hazardous waste as defined in paragraph entitled "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.

1.3.3 Sanitary Wastes

Wastes characterized as domestic sanitary sewage.

1.3.4 Rubbish

Combustible and noncombustible wastes such as non-recyclable paper and cardboard, crockery, and bones.

Recyclables includes: clean paper, cardboard, glass, plastics (No. 1 & 2), metal, and cans.

Non-recyclable paper and cardboard are defined as material that has become wet or contaminated with food or other residue that render it un-acceptable for recycling.

Treated wood/lumber is defined as wood that has been stained or treated to prevent rot, or composite wood products such as OSB, pressboard furniture, etc.

Untreated wood is defined as lumber, trees, stumps, limbs, tops, and shrubs.

1.3.5 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, (excluding organic matter) leaves, pine straw, grass and shrub clippings.

1.3.6 Chemical Wastes

This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.3.7 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
1.3.8 Hazardous Waste

Hazardous substances as defined in 40 CFR 261 or as defined by applicable State and local regulations.

1.3.9 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

1.3.10 Landscape Features

Trees, plants, shrubs, and ground cover.

1.3.11 Lead Acid Battery Electrolyte

The electrolyte substance (liquid medium) within a battery cell.

1.3.12 Oily Waste

Petroleum products and bituminous materials.

1.3.13 Class I Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Sections 602 (a and b) of The Clean Air Act.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-06 Test Reports
   Abrasive blasting

SD-11 Closeout Submittals
   Solid waste disposal permit
   Disposal permit for hazardous waste
   Environmental training documentation
   Permit to transport hazardous waste
   Hazardous waste certification

1.4.1 Solid Waste Disposal Permit

Submit one copy of a State permit or license for the solid waste disposal facility. If the contract permits the use of the Base Landfill, request a letter from the Contracting Officer authorizing permission to dump on base; submit the letter to the Base Landfill Office. In lieu of the letter a copy of the contract must be delivered to the Landfill Office for review.

1.4.2 Disposal Permit for Hazardous Waste

Submit a copy of the applicable EPA and State permits, manifests, or licenses for transportation, treatment, storage, and disposal of hazardous waste.
waste by permitted facilities.

1.4.3 Permit to Transport Hazardous Waste

Submit one copy of the EPA or State permit license, or regulation for the transporter who will ship the hazardous waste to the permitted Treatment, Storage, and Disposal (TSD) facility.

1.4.4 Hazardous Waste Certification

Submit written certification that hazardous waste turned in for disposal was generated on Government property and is identified, packaged, and labeled in accordance with 40 CFR 261, 40 CFR 262, and 40 CFR 263.

1.5 ENVIRONMENTAL PROTECTION REGULATORY REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in this Section. 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 but not limited to water, air, solid waste, and noise pollution.

1.6 ADMINISTRATIVE REQUIREMENTS

1.6.1 Licenses and Permits

Obtain licenses and permits pursuant to "FAR 52.236-7, Permits and Responsibilities" except for those permits which will be obtained by the Contracting Officer.

For permits obtained by the Contracting Officer, whether or not required by the permit, perform inspections of the work in progress, and submit certifications to the applicable regulatory agency, via the Contracting Officer, that the work conforms to the contract and permit requirements. The inspections and certifications shall be provided through the services of a Professional Engineer, 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 subitem containing the name, P.E. registration number, address, and telephone number of the professional engineer(s) who will be performing the inspections and certifications for each permit listed above.

1.7 GENERAL ENVIRONMENTAL MANAGEMENT SYSTEM AND ENVIRONMENTAL AWARENESS

The Contractor shall familiarize himself with requirements of the attached "Marine Corps Base (MCB), Camp Lejeune, Contractor Environmental Guide."

1.8 CAMP LEJEUNE SANITARY LANDFILL INFORMATION SHEET

See attached "Camp Lejeune Sanitary Landfill Information Sheet" for hours of operation and other important information pertaining Landfill.
PART 2   PRODUCTS

PART 3   EXECUTION

3.1 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. 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.

3.2 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 designated times.

3.3 RESTRICTIONS ON EQUIPMENT

3.3.1 Electromagnetic Interference Suppression

a. Electric motors must comply with MIL-STD-461 relative to radiated and conducted electromagnetic interference. A test for electromagnetic interference will not be required for motors that are identical physically and electrically to those that have previously met the requirements of MIL-STD-461. An electromagnetic interference suppression test will not be required for electric motors without commutation or sliprings having no more than one starting contact and operated at 3,600 revolutions per minute or less.

b. Equipment used by the Contractor shall comply with MIL-S-16165 for internal combustion engines and MIL-STD-461 for other devices capable of producing radiated or conducted interference.

c. Conduct tests for electromagnetic interference on electric motors and Contractor’s construction equipment in accordance with MIL-STD-461 and MIL-STD-462. Test location shall be reasonably free from radiated and conducted interference. Furnish testing equipment, instruments, and personnel for making the tests; a test location; and other necessary facilities.

3.3.2 Radio Transmitter Restrictions

Conform to the restrictions and procedures for the use of radio transmitting equipment, as directed. Do not use transmitters without prior approval.

3.4 CONTROL AND DISPOSAL OF SOLID WASTES

Pick up and separate 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.
3.4.1 Disposal of Metal Paint Cans

All metal paint cans shall be taken to Building 962 for recycling. The cans shall be empty and completely dry. The cans shall be triple rinsed and stenciled "Triple Rinsed" prior to turn in. The Contractor shall give the Government 72 hours advance notice prior to turn-in. Contractor is responsible for rinsing, stenciling, crushing, and depositing in Government owned receptable, located at Building 962.

3.4.2 Disposal of Rubbish and Debris

Rubbish and debris shall be taken off-base for disposal, unless specifically directed otherwise below:

Metals shall be taken to the DRMO disposal area at Lot 203, as specified.
### INFORMATION FOR DEPOSIT IN THE LANDFILL

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recyclable Cardboard</td>
<td>Breakdown corrugated cardboard boxes and deliver to the Base Recycling Center located at Building 982. If base personnel rejects the cardboard, take cardboard for off-base disposal.</td>
</tr>
<tr>
<td>Recyclable Wood Pallets</td>
<td>Deliver usable pallets to the Base Recycling Center located at Building 982. If base personnel rejects the pellets, take pallets for off-base disposal.</td>
</tr>
<tr>
<td>Organic Matter</td>
<td>Organic matter will not be accepted at the landfill.</td>
</tr>
<tr>
<td>Metals</td>
<td>Metals will not be accepted at the landfill. Remove metals from each and every category before delivery to landfill. (Example: Remove hardware from doors and windows.) Dispose of metal construction debris at Defense Reutilization Maintenance Office (DRMO). Aluminum, brass, copper, lead, other metal, electrical wiring, cable (cut in 3 foot or less sections)</td>
</tr>
<tr>
<td>Treated &amp; Untreated Wood/Lumber</td>
<td>Treated &amp; untreated wood/lumber will not be accepted at the landfill.</td>
</tr>
<tr>
<td>Concrete</td>
<td>Concrete will not be accepted at the landfill.</td>
</tr>
<tr>
<td>Construction Material</td>
<td>Construction material should be managed and placed in a designated area. Area shall be kept clean of debris and all material removed at the end of the project.</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>Separate each category of solid waste to enhance recycling.</td>
</tr>
<tr>
<td>Hazardous Material</td>
<td>This project involves demolition, renovation/repair and/or construction activities; therefore, hazardous material (such as paints, solvents, thinners, adhesives, etc) may be used during the execution of this project. The contractor</td>
</tr>
</tbody>
</table>
CONSTRUCTION DEBRIS DISPOSAL - BASE
SANITARY LANDFILL EXAMPLE/GENERAL

CATEGORY

INFORMATION FOR DEPOSIT IN THE LANDFILL

will be required to appropriately manage the hazardous material and provide secondary containment.

Solid Waste Report
All solid waste generated and recycled will be weighed. Contractor will report the amount of solid waste disposed and recycled at the end of the project to EMD's Solid Waste Manager or the Pollution Prevention Manager via the OICC.

Tonnage information for all materials delivered to the Base Landfill is available at the Landfill Office. Submit a written request to the Landfill Manager, specifying the desired information.

Recycling of Construction Debris
Recyclable material (ex. Scrap metal/aluminum/brass/copper/lead, and other metal) may be recycled through Defense Utilization Maintenance Office) DRMO using a 1348-1a with the following information (Proceeds for the sale of recyclable material are to go to the Qualified Recycling financial account - 17F3875 27RM 00767001 0 000027 3c 000000 06700198004). For additional information contact the Base Recycling Coordinator 910-451-4214.

Electrical Equipment
Before demolition or removal of electrical equipment from the Base - Contractor shall contact Base High Voltage Shop Supervisor at (910) 451-2790, to allow for first right of refusal of electrical equipment such as: ATS, transformers, and generators. Electrical equipment will not be accepted at landfill.
3.4.3 Disposal Off-Base

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 shall require the Contractor at his own expense to remove, transport and relocate the debris to a State approved site. The Contractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris.

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.5.1 Hazardous Waste Generation

Handle generated hazardous waste in accordance with 40 CFR 262.

3.5.2 Hazardous Waste Storage

Store hazardous waste in containers in accordance with 49 CFR 178. Identify hazardous waste in accordance with 40 CFR 261 and 40 CFR 262. Identify hazardous waste generated within the confines of the station by the station's EPA generator identification number.

3.5.3 Spills of Oil and Hazardous Materials

Take precautions to prevent spills of oil and hazardous material. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable State regulations.

3.5.4 Lead-Acid Batteries

Dispose of lead-acid batteries that are not damaged or leaking at a State-approved battery recycle or at a permitted or interim status hazardous waste TSD facility. For lead-acid batteries that are leaking or have cracked casings, dispose of the electrolyte solution using one of the following alternatives:

a. An industrial waste water treatment plant, if available and approved by the Contracting Officer for disposing of lead-acid battery electrolyte.

b. Dispose of the lead-acid battery electrolyte at a permitted or interim status hazardous waste TSD facility.

The management and disposal of waste lead-acid batteries and electrolyte shall comply with requirements for management and disposal of hazardous wastes.
3.5.5 Mercury Control

Prior to starting work, remove thermostats, switches, and other components that contain mercury. Upon removal, place items containing mercury in doubled polyethylene bags, label, and turn over to the Contracting Officer for disposal.

3.5.6 Petroleum Products

Protect against spills and evaporation during fueling and lubrication of equipment and motor vehicles. Dispose of lubricants to be discarded and excess oil.

3.6 DUST CONTROL

Keep dust down at all times, including 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 shake bags of cement, concrete mortar, or plaster unnecessarily.

3.6.1 Abrasive Blasting

3.6.1.1 Blasting Operations

The use of silica sand is prohibited in abrasive blasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris in accordance with the requirements specified. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.6.1.2 Disposal Requirements

Collect dust, abrasive, paint, and other debris resulting from abrasive blasting operations and store in 55 gallon drums with watertight lids. Take a representative sample of this material, and test for EP toxicity with respect to lead, chromium, and cadmium content. The sampling and testing shall be performed in accordance with 40 CFR 261. Handle debris resulting from the abrasive blasting operations as a hazardous material, and dispose of in accordance with 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Transport hazardous material by a transporter licensed and permitted for transportation of hazardous materials. Dispose of hazardous material in an EPA-approved and permitted facility specifically designated for hazardous waste disposal.

3.7 QUARANTINE FOR IMPORTED FIRE ANT (4/82)

Onslow, Jones, and Carteret Counties and portions of Duplin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Publication 301.81 of 31 December 1992, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station
17-0016, Interior and Exterior Repairs, Bldg. 523

(Helicopter), New River and the Marine Corps Air Station, Cherry Point, which are to be transported outside Onslow County or adjacent suppression areas, include the following:

a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program (PPQ) of the U.S. Department of Agriculture.

(1) Bulk soil

(2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil).

(3) Other products, articles, or means of conveyances, if it is determined by an inspector that they present a hazard of transporting spread of the imported fire ant and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Box 28, Goldsboro, North Carolina, 27533-0028, Attn: Mr. William Scroggins or Mr. Frank Best, telephone (919) 735-1941. If Mr. Scroggins or Mr. Best are not available, contact Mr. Jim Kelley at (910) 815-4667, the supervisor's office in Wilmington. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.
Contractor shall submit data annually (By 1 December) for the following products used during the previous fiscal year (1 October - 30 September) as required by 6002 of the Solid Waste Disposal Act as ammended by Resource Conservation and Recovery Act (RCRA):

<table>
<thead>
<tr>
<th>Contract Number:</th>
<th>Fiscal Year:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>UNIT</th>
<th>QUANTITY (CRM)</th>
<th>TOTAL QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Insulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Loose fill</td>
<td>Ft3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Blanket or batt</td>
<td>Ft2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Board</td>
<td>Ft2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Spray-in-place</td>
<td>m3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Cement and Concrete</td>
<td>yd3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Paper and Paper Products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Copy Paper</td>
<td>Box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Printing/Writing Paper</td>
<td>Box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Corrugated and fiberboard boxes</td>
<td>Box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Folding boxboard and cartons</td>
<td>Box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Stationary, office papers, envelopes, and computer paper</td>
<td>$Amt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Toilet tissue, paper towels, facial tissue, paper napkins, doilies and industrial wipes</td>
<td>$Amt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Brown papers and coarse papers</td>
<td>Box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX A
<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quantity (CRM)</td>
<td>Quantity used containing recovered materials.</td>
</tr>
<tr>
<td>2. Total Quantity</td>
<td>Quantity used containing recovered materials plus quantity used not containing recovered materials.</td>
</tr>
<tr>
<td>3. Unit</td>
<td>Ft³ (cubic feet), Ft² (square feet), m³ (cubic meters), yd³ (cubic yards), box (number of boxes used), $ Amt (dollar value of material used)</td>
</tr>
<tr>
<td>4. Loose-Fill Insulation</td>
<td>Includes, but is not limited to... &quot;cellulose fiber, mineral fibers (fiberglass and rock wool), vermiculite, and perlite.&quot;</td>
</tr>
<tr>
<td>5. Blanket or Batt Insulation</td>
<td>Includes, but is not limited to... &quot;mineral fibers (fiberglass and rock wool).&quot;</td>
</tr>
<tr>
<td>6. Board Insulation</td>
<td>This category refers to sheathing, roof decking, and wood panel insulation. It includes, but is not limited to... &quot;cellulose fiber fiberboard, perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites.&quot;</td>
</tr>
<tr>
<td>7. Spray-in-place Insulation</td>
<td>Includes, but is not limited to... &quot;foam-in-place polyurethane and polyisocyanurate, and spray-on cellulose.&quot;</td>
</tr>
<tr>
<td>8. Cement or Concrete Containing Recovered Materials, Cement, or Concrete Containing Fly Ash</td>
<td></td>
</tr>
<tr>
<td>9. Copy Paper</td>
<td>This item refers to... &quot;any grade of paper suitable for copying by the xerographic method.&quot;</td>
</tr>
<tr>
<td>10. Printing &amp; Writing Paper</td>
<td>This item refers to... &quot;paper designed for printing, other than newsprint, such as offset or book paper,&quot; and... &quot;paper suitable for pen and ink, pencil, typewriter or printing.&quot;</td>
</tr>
<tr>
<td>MATERIAL</td>
<td>DEFINITION</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11. Corrugated &amp; Fiberboard</td>
<td>Corrugated boxes refer to... &quot;boxes made of corrugated paperboard, which, in turn, is made from a fluted corrugating medium pasted to two flat sheets of paperboard (linerboard).&quot;  Fiber or fiberboard boxes refer to... &quot;boxes made from containerboard, either solid fiber or corrugated paperboard (general term); or boxes made from solid paperboard of the same material throughout.&quot;</td>
</tr>
<tr>
<td>Boxes</td>
<td></td>
</tr>
<tr>
<td>12. Folding Boxes and Cartons</td>
<td>This item refers to... &quot;a paperboard suitable for the manufacture of folding cartons.&quot;</td>
</tr>
<tr>
<td>13. Stationery, Office Papers,</td>
<td>This item is considered self-explanatory, however, if questions arise refer to 40 CFR 250.4 for definitions of any of these items.</td>
</tr>
<tr>
<td>Envelopes, and Manifold Business</td>
<td></td>
</tr>
<tr>
<td>Forms</td>
<td></td>
</tr>
<tr>
<td>14. Toilet Tissue, Paper Towels,</td>
<td>This item is considered self-explanatory, however, if questions arise refer to 40 CFR 250.4 for definitions of any of these items.</td>
</tr>
<tr>
<td>Facial Tissue, Paper Napkins,</td>
<td></td>
</tr>
<tr>
<td>Doilies, and Industrial Wipes</td>
<td></td>
</tr>
<tr>
<td>15. Brown Papers, and Coarse</td>
<td>Brown papers refer to... &quot;papers usually made from unbleached kraft pulp and used for bags, sacks, wrapping paper, and so forth.&quot; Coarse papers refer to... &quot;papers used for industrial purposes, as distinguished from those used for cultural or sanitary purposes.&quot;</td>
</tr>
<tr>
<td>Papers</td>
<td></td>
</tr>
<tr>
<td>16. Other</td>
<td>Any other type of paper not included in any of the above categories.</td>
</tr>
</tbody>
</table>
PART 1   GENERAL

1.1   SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-10, Operation and Maintenance Data

   Equipment/product warranty list

   Submit Data Package 1 in accordance with Section 01 78 23, "Operation and Maintenance Data."

SD-11 Closeout Submittals

   As-built drawings

   Record of materials

   Maximo requirements

   Complete Submittal Package 2 CD/DVD's

   Equipment/product warranty tag

1.2   PROJECT RECORD DOCUMENTS

As-Built Drawings will be submitted as specified in 1.2.1 along with GIS Deliverables which will be created and submitted as specified in Section 01 78 30, DIGITAL DATA DELIVERABLES (GIS).

1.2.1   As-Built Drawings

   "FAC 5252.236-9310, Record Drawings."  As-built drawings will be submitted in redline mark-up format.

1.2.2   As-Built Record of Materials

Furnish a record of materials.

Where several manufacturers' brands, types, or classes of the item listed have been used in the project, designate specific areas where each item was used.  Designations shall be keyed to the areas and spaces depicted on the contract drawing.  Furnish the record of materials used in the following format:
1.3 **MAXIMO REQUIREMENTS**

Submit maximo requirements as specified in Section 26 00 00.00 20.

1.4 **EQUIPMENT/PRODUCT WARRANTIES**

1.4.1 **Equipment/Product Warranty List**

Furnish to the Contracting Officer a bound and indexed notebook containing written warranties for equipment/products that have extended warranties (warranty periods exceeding the standard one-year warranty) furnished under the contract, and prepare a complete listing of such equipment/products. The equipment/products list shall state the specification section applicable to the equipment/product, duration of the warranty therefor, start date of the warranty, ending date of the warranty, and the point of contact for fulfillment of the warranty. The warranty period shall begin on the same date as project acceptance and shall continue for the full product warranty period. Execute the full list and deliver to the Contracting Officer prior to final acceptance of the facility.

1.4.2 **Equipment Warranty Tags and Guarantor's Local Representative**

Furnish with each warranty the name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and appliances are installed. The guarantor's representative, upon request of the station representative, shall honor the warranty during the warranty period, and shall provide the services prescribed by the terms of the warranty. At the time of installation, tag each item of warranted equipment with a durable, oil- and water-resistant tag approved by the Contracting Officer. Attach tag with copper wire and spray with a clear silicone waterproof coating. Leave the date of acceptance and QC's signature blank until project is accepted for beneficial occupancy. Tag shall show the following information:

**EQUIPMENT/PRODUCT WARRANTY TAG**

Type of Equipment/Product ____________________
Warranty Period __________ From ______ To ________
Contract No. ____________________
Inspector's Signature ____________________ Date Accepted ______________

Construction Contractor:
Name: ____________________
Address: ______________________
Telephone: ____________________

Warranty Contact: ____________________
Name: ____________________
Address: ______________________
Telephone: ____________________

STATION PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE
1.5 **MECHANICAL TESTING AND BALANCING**

All contract requirements shall be fully completed, including all testing, prior to contract completion date. In addition, all contract requirements shall be fully completed, including testing and inspection, prior to contract completion date, except as noted otherwise.

1.6 **COMPLETE SUBMITTAL PACKAGE**

Contractor shall make electronic copies of all submittals, including the approved transmittal sheets, and provide two (2) CD/DVD's containing all submittals for the project.

The CD/DVD's shall be marked "Complete Submittal Package - Contract # 17-0016, Interior and Exterior Repairs, Building 523."

1.7 **CLEANUP**

Leave premises "broom clean." 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. Clean filters of operating equipment. 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.

PART 2  **PRODUCTS**

Not used.

PART 3  **EXECUTION**

Not used.

-- End of Section --
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)


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 shall compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor shall 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 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. Commissioned items without a specified data package requirement in the individual technical sections shall use Data Package 3.

1.2.3   Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.
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 E 1971.

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 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).

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:
17-0016, Interior and Exterior Repairs, Bldg. 523

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
17-0016, Interior and Exterior Repairs, Bldg. 523

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 ---
PART 1   GENERAL

1.1   OBJECTIVE

The primary objective of this section is to provide detailed specifications for the collection and creation of Geographic Information System (GIS) data to ensure that all GIS data delivered is compatible and will add value to MCB Camp Lejeune's Installation Geospatial Information and Services (IGI&S) repository MCAS Cherry Point's Installation Geospatial Information and Services (IGI&S) repository.

1.1.1   Point of Contact for MCB Camp Lejeune

The Point of Contact (POC) for assistance in preparation of GIS deliverables is:

NAVFAC MIDLANT
Officer In Charge Of Construction
(Construction Manager)
1005 Michael Drive
Camp Lejeune, NC   28547-2521
(910) 451-2581

1.1.2   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

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

SD-11 Closeout Submittals

GIS Data Deliverables
1.3 COLLECTION AND CREATION OF GEOSPATIAL DATA

Prior to data collection and creation the contractor shall provide the Government Project Manager a Technical Approach Plan for approval which describes the contractor's plan to collect and create GIS Data as specified in this section.

1.3.1 Technical Approach Plan

The Technical Approach Plan will contain the following:

a. How features will be collected utilizing Global Positioning System (GPS) technology

b. Which features, as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES", will be located, GPS and created

c. Source of attribute data

d. Steps taken to create personal Geodatabase e. What GIS data will be delivered

1.3.2 Geospatial Data Collection

All questions regarding the Specification For Digital Data - GIS Deliverables shall be directed to MCB Camp Lejeune I&E, PWD GIS Section MCAS Cherry Point I&E, PWD GIS Section, via the Government Project Manager. Specific Tasks are as follows:

a. Contractor is responsible for the collection and creation of geospatial data for newly constructed or replaced utilities and infrastructure features that fall within the realm of this specification.

b. Utilize GPS technology to locate and create GIS data and deliver only features that are relevant to this contract as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES".

c. Follow instructions in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" which defines the following:

1. GIS feature requirements.

2. The manner in which the data will be collected in GPS.

3. The manner in which GIS data will be created.

4. Required Attribute data.

5. Other instructions pertaining to GIS data.

1.3.3 Data Collection requirements

Survey Grade and Sub-Foot GPS Geospatial Data Collection requirements:

a. GPS data shall be completed in accordance with the "Statewide
Global Positioning System (GPS) Data Collection and Documentation Standards, Version 3" (or higher version if available at the time of this project) as prepared by the Statewide Mapping Advisory Committee and adopted by the North Carolina Geographic Coordinating Council in May 2006. Copies of these standards can be found on the Internet at: www.ncgicc.org.

b. Only bench marks included in the North Carolina Geodetic Survey Base Station Network shall be used for mapping grade GPS data collection.

c. Mission planning is essential and contractor should utilize lowest possible PDOP values.

d. Geographic data shall be collected and created into the Universal Transverse Mercator (UTM) coordinate system.
   1. North American Datum (NAD) 1983 / UTM Zone 18N.

e. Spatial accuracy requirements for Survey and Sub-Foot grade data collection are as follows:

   Sub-Foot requirements
   1. All points shall be within + 12 inches
   2. 95% accuracy rate for all points.

   Survey Grade requirements
   1. All points shall be within + 1 centimeter
   2. 98% accuracy rate for all points

f. Every effort shall be made to capture feature locations without using offsets.

   1. Offsets will be noted in final report and user_flag field for which each feature it applies, unless otherwise specified.

1.3.4 Geospatial Data Standards

The IGI&S repository model is based on the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) with modifications.

a. Copies of the SDSFIE may be obtained from the Solutions and Technology for the Advancement and Refinement of SDSFIE (STARS) Team Internet homepage at http://www.sdsfieonline.org/.

b. Due to on-going government modifications to MCB Camp Lejeune's MCAS Cherry Point's IGI&S repository the contractor shall ensure the schema of the final product is in compliance and all data will be created and delivered utilizing MCB Camp Lejeune's MCAS Cherry Point's most current IGI&S repository schema.

   1. The contractor shall request an additional template prior to
delivery to be used for the final delivery of data.

2. Final report will include date of last data request for IGI&S schema and geospatial data.

1.3.5 Government Provided Geospatial Data

MCB Camp Lejeune's MCAS Cherry Point's IGI&S repository's schema and geospatial data shall be obtained via the Government Project Manager before any data is collected or created. The Project Manager, upon request, shall furnish the contractor with a Geospatial data request package. The contractor shall:

a. Request only GIS data that is pertinent to the contract.
   b. Request shall include the following information:
      1. Contract Number and Title.
      2. Contractor's Name, Address, Phone Number, Email and Point of Contact.
      3. Summary of Project.
      5. Expected Delivery date and features.

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 will consult with the Government Project Manager for direction and final approval.

b. All new feature data class shall be created in compliance with SDSFIE noted on the final report.

1.3.7 Collection of Geospatial data

a. 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.

b. Prior to GPS efforts, buried underground utilities shall be located in order to GPS accurate location.

c. Other infrastructure data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be collected utilizing Sub-Foot GPS data collection methods.

d. GPS data and collection data files shall be included with every phase of delivery.

1.3.8 Creation of Geospatial Data

Data will be created in a Personal Geodatabase using ArcGIS 9.3 or higher if a higher version is being used by the government at the time of this
Contractor shall verify the ArcGIS version, via the Government Project Manager, at the commencement of this contract.

Geodatabase Spatial Reference Properties shall include the following:


1.3.9 Data Format and Structure

To ensure that all Geospatial data created can be loaded and add value to MCB Camp Lejeune's MCAS Cherry Point's IGI&S repository; data will be created in such a way that the delivered file personal geodatabase mirrors the IGI&S repository. This includes, but is not limited to the following:

a. Geospatial database table structure. b. Domain(s) configuration.

1. SDSFIE domains have been modified by MCB Camp Lejeune MCAS Cherry Point for operational purposes, it is the contractor's responsibility to request and utilize associated domain structure to ensure deliverable will load into the geodatabase.

c. Required attribute data as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be obtained via contract specifications, plans and on as-built drawings.

1. Actual field data always supersedes drawings.

c. The contractor may have to research and verifying existing as-built data in the Technical Records Section located at the Public Works Building, MCB Camp Lejeune MCAS Cherry Point.

d. The GIS Data Deliverable does not replace the requirements for as-built drawings and or files for this contract.

1.3.10 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:


b. Polygons must not have slivers.

c. All utility or infrastructure system data, which is, but not limited to, transportation system and electrical, water, steam distribution, and wastewater collection etc., will be created using GIS spatially connectivity rules which specifies that vertex, edge and endpoints be snapped to features within the system.

1. Features will be snapped to the appropriate item.

2. Data will be created to represent the real world, for example, direction of flow, i.e., water, sewer and
transportations systems will be drawn and created in the direction of flow.

3. Utility systems will be created from source to sink, etc.

4. Abandoned In Place (AIP) utility lines will be located and updated in the current utility line feature data set and identified as AIP in the attribute table.

5. Polylines will be connected by nodes, i.e., fittings, valves, street connections and other natural occurring items within the data.

6. Demolished Lines are to be delivered in a feature data set, which appropriately reflects the utility.

1.3.11 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 'Mandatory' and 'Mandatory-if-Applicable' fields shall be completed for each geographic data set.

Metadata generation tools included in the ArcGIS suite of software shall be used in the production of the required metadata in XML format. If neither of these tools is used, the Contractor must insure that the metadata is delivered in a format that can be easily translated to the XML format. Copies of the FGDC metadata standard can be obtained on the Internet at http://www.fgdc.gov.

The documentation shall include, but not be limited to, the following:

a. The name and description of the data set/data layer.

b. The source of the data and any related data quality information such as positional accuracy and time period of content.

c. Descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into final geographic data delivery format.

d. Type of data layer (point, line, polygon, etc.)

e. Field names of all attribute data and a description of each field name.

f. Definition of all codes used in the data fields.

g. Ranges of numeric fields and the meaning of these numeric ranges.

h. The creation date of the data layer and the name of the person or company who created it.

i. A point of contact shall be provided to answer technical questions.
1.3.12 Final Report

Final report will also be required with the following supplement information:

a. Specific procedures and list of equipment, software and versions that was utilized for the GPS data collection and creation of geospatial data.

b. Any offsets.

c. Modifications to the geodatabase to include any new feature data class.

d. Source that was utilized for all required attributes.

e. Miscellaneous information that the contractor deems significant.

f. A Technical Point of Contact.

g. GPS data controller files.

1.3.13 GIS Submittals GIS Data Deliverables

Submit GIS data deliverables for review and approval by the MCB Camp Lejeune, MCAS Cherry Point Public Works GIS section.

a. Reports will be submitted in the following formats and or versions. Contractor shall verify required version(s) of software, via the Government Project Manager, at the commencement of this contract.

   1. Microsoft Office 2003 or higher upon verification.


b. All GIS data will be provided in a ArcGIS file personal geodatabase as specified.

c. Media for Geospatial Data Deliverables: Geographic data shall be delivered on a compact disk read-only memory (CD-ROM) -or- digital versatile disk read-only memory (DVD-ROM).

d. Map submittals shall accompany each geospatial deliverable.

   1. Include ANSI C map for each project / area.

   2. Data should be labeled and attributed per specification.

1.3.14 Ownership

All digital files, final hard-copy products, GPS raw data, source data acquired for this project, and related materials, including that furnished by the Government, shall become the property of MCB Camp Lejeune MCAS Cherry Point and will not be issued, distributed, or published by the Contractor.
1.3.15 Geographic Data Review

a. The digital geographic maps, GPS collection files and related
data, all working text and documents and file personal geodatabase
shall be included for review in the draft and final contract
submittals.

b. The contract shall submit a preliminary review of data between 15-
25 percent to ensure specifications are being met.

c. The data will be analyzed for discrepancies in subject content,
correct format in accordance with these specifications, and
compatibility with MCB Camp Lejeune's MCAS Cherry Point's IGI&S
repository schema.

d. Failure for non-compliance of the specifications outlined in this
document will result in non-acceptance of data deliverables.

1.4 ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES

1.4.1 Infrastructure

GPS and collect attribute data as specified in the Collection and Creation
of Geospatial data section for each feature listed with Sub-foot GPS
accuracy and enter attribute data in compliance with the IGI&S database.

1.4.1.1 Structures: CLJN.structure_existing_area
CPT.structure_existing_area

GPS Structure and collect the following attributes:

a. Subtype ID
b. Building ID (building number)
c. Structure Status
d. Number of Levels
e. Structure Use 2: Populate "Residential" if structure is a
   residential unit
f. Building No (building number)
g. Facility No (building number)
h. Material
i. Drawing Number
j. Contract Number
k. Date Acquired
l. Data Source

1.4.1.2 Floor Outline: CLJN.building.floor_outline (Polyline)
CPT.building.floor_outline (Polyline)

All new and renovated buildings will be required to have a "clean floor
plan" for each floor level that will be delivered in GIS format. Each
level will represent one feature and provide the following: walls, doors,
windows, closet, crawlspace, head facility, stairwells, etc.

Create feature and update the following attributes:

a. Building ID: (building number)
b. Floor Name
c. Drawing Number
d. Contract Number:
1.4.1.3 Slabs: CLJN.slab_area CPT.slab_area

GPS and collect the following attributes:

a. Structure ID: (Facility Number, if applicable)
b. Feature Description
c. Structure Material
d. Structure Condition
e. Built Date
f. Drawing Number
g. Contract Number
h. Data Source

1.4.2 Transportation

Attribute data requirements for Transportation: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Sub-Peet accuracy.

1.4.2.1 Road Centerline: CLJN.road_centerline CPT.road_centerline

GPS and collect the following attributes:

a. Category
b. Road Name
c. Paved: Paved/Unpaved
d. Date Acquired
e. Surface Type
f. Drawing Number
g. Contract Number
h. Data Source
i. Use

1.4.2.2 Road Area: CLJN.road_area CPT.road_area

GPS and collect the following attributes:

a. Road Segment
b. Paved
c. Divided: Yes/No
d. Number of Lanes
e. Date Acquired
f. Surface Type
g. Drawing Number
h. Contract Number
i. Data Source
j. Road Name

1.4.2.3 Curb line: CLJN.curb_line CPT.curb_line

GPS and collect the following attributes:

a. Curb Material
b. Description
c. Drawing Number
d. Contract Number
e. Data Source
1.4.2.4 Driveways: CLJN.vehicle_driveway_area CPT.vehicle_driveway_area

GPS and collect the following attributes:

a. Paved or Unpaved
b. Surface Material
c. Date Acquired
d. Drawing Number
e. Contract Number
f. Data Source

1.4.2.5 Parking Lots: CLJN.vehicle_parking_area CPT.vehicle_parking_area

GPS and collect the following attributes:

a. Parking ID: Building that is associated with this feature
b. Paved Description
c. Total Spaces
d. Lighting
e. Drawing Number
f. Contract Number
g. Data Source
h. Surface Type
i. Park Use
j. Feature Name
k. Striping

1.4.2.6 Bridge: CLJN.road_bridge_area CPT.road_bridge_area

GPS and collect the following attributes:

a. Bridge ID: Facility Number
b. Number of Lanes
c. Bridge Material Type
d. Bridge Type
e. Capacity
f. Drawing Number
g. Contract Number
h. Data Source

1.4.2.7 Pedestrian Sidewalks: CLJN.pedestrian_sidewalk_area CPT.pedestrian_sidewalk_area

GPS and collect the following attributes:

a. Material
b. Use
c. Status
d. Drawing Number
e. Contract Number
f. Data Source
g. Date Acquired

1.4.3 Improvement General

Attribute data requirements for Improvement General: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Sub-Foot accuracy.
1.4.3.1 Fence: CLJN.fence_line CPT.fence_line

GPS and collect the following attributes:

a. Material: Chain Link, Wood, etc.
b. Drawing Number
c. Contract Number
d. Data Source
e. RECLIN ID: Facility Number
f. Date Acquired

1.4.3.2 Gates: CLJN.gate_line CPT.gate_line

GPS and collect the following attributes:

a. Material
b. Feature Height
c. Drawing Number
d. Contract Number
e. Data Source
f. Gate ID: Facility ID
g. Date Acquired

1.4.3.3 Walls: CLJN.wall_line CPT.wall_line

GPS and collect the following attributes:

a. Material
b. Feature Height
c. Drawing Number
d. Contract Number
e. Data Source
f. Facility ID:
g. Date Acquired

1.4.3.4 Recreation Trails: CLJN.recreation_trail_centerline
CPT.recreation_trail_centerline

GPS and collect the following attributes:

a. Subtype
b. Trail Description
c. Paved
d. Date Acquired
e. Drawing Number
f. Contract Number
g. Data Source
h. Trail ID
i. Trail Name

1.4.3.5 Miscellaneous Recreation Area
Playground: CLJN.playground_area CPT.playground_area

GPS and collect the following attributes:

a. Playground ID: Facility Number
b. Feature Description:
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c. Drawing Number
d. Contract Number
e. Data Source

1.4.3.6 Swimming Pool: CLJN.swimming_pool_area CPT.swimming_pool_area

GPS and collect the following attributes:

a. Swimming Pool ID
b. Feature Description
c. Drawing Number
d. Contract Number
e. Data Source

1.4.3.7 Athletic Court: CLJN.athletic_court_area CPT.athletic_court_area

GPS and collect the following attributes:

a. Court ID
b. Court Type
c. Court Name
d. Date Acquired
e. Drawing Number
f. Contract Number
g. Data Source
h. Court Desc

1.4.3.8 Athletic Field: CLJN.athletic_field_area CPT.athletic_field_area

GPS Structures and collect the following attributes:

a. Field ID: Facility Number
b. Field Description
c. Date Acquired
d. Field Type
e. Contract Number
f. Drawing Number
g. Data Source
h. Field Name

1.4.4 Environmental Storage Tanks

Attribute data requirements for Environmental Storage Tanks: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Survey Grade accuracy.

1.4.4.1 Underground Storage Tanks: CLJN.underground_storage_tank_point CPT.underground_storage_tank_point

GPS and collect the following attributes:

a. ENVUST ID for Under Ground Storage Tank
b. Hazsite ID
c. EH Tank: Fuel Type
d. Facility Number
e. X Coordinates
f. Y Coordinates
g. Installation Date
1.4.4.2 Aboveground Storage Tanks:   CLJN.aboveground_storage_tank_site
CPT.aboveground_storage_tank_site

GPS and collect the following attributes:

a. ENVAST ID for Above Ground Storage Tank
b. Hazsite ID
c. EH Tank
d. Facility Number
e. X Coordinates
f. Y Coordinates
g. Installation Date
h. Drawing Number
i. Contract Number
j. Data Source
k. Product D
l. Narrative
m. Serial Number
n. Tank Sys D
o. Status
p. Regulated
q. Volume
r. Volume U D

1.4.5 Other Features

Other Infrastructure Features:

All newly constructed features require GIS deliverables. If a particular utility is being installed and has been omitted from this specification, the feature shall be deliverable under these guidelines. At a minimum the following will be required;

a. Subtype ID
b. Facility ID
c. Installation Date
d. Type/Description
e. Material
f. Drawing Number
g. Contract Number
h. Data Source
i. Date Acquired

1.4.6 Utilities

Locate underground utilities, GPS and collect attribute data as specified in the Collection and Creation of Geospatial data section for each feature.
listed with survey grade accuracy and enter attribute data in compliance with the IGI&S database.

Please note: All utility lines that can be currently located in MCB Camp Lejeune's MCAS Cherry Point's GIS geodatabase that are to be demolished/removed within the specifications of this contract will be used to update the demolished line feature data set for that class. The existing spatial and non-spatial data will be copied into the demolished feature class. This information does not include Abandoned in Place (AIP) lines. Abandoned lines shall remain in the existing data feature class and be attributed AIP.

1.4.7 Electrical Distribution

Please Note: MCB, Camp Lejeune's Complete Circuit ID list is available. Please contract Government Project Manager for list which is provided by our Electrical Distribution shop in Public Works, MCB Camp Lejeune.

The following attributes shall be collected for each utility data class:
Collect GPS data for all features listed with survey grade accuracy.

1.4.7.1 Demolished Electrical Lines: CLJN.demolished_cable_line CPT.demolished_cable_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

a. Date
b. Drawing Number
c. Contract Number
d. Data Source

1.4.7.2 Electrical Lines: CLJN.electrical_cable_line CPT.electrical_cable_line

Locate all Electrical Line data and collect the following attributes:

a. Subtype Identifier
b. Disposition
c. Subtype
d. Date Acquired
e. Conduit Size
f. Number of Phases
g. Insulation Material
h. Voltage
i. Size of Units
j. Substation ID
k. Circuit ID
l. Contract Number
m. Drawing Number
n. Data Source

1.4.7.3 Electrical Meter: CLJN.electrical_meter_point CPT.electrical_meter_point

Locate, GPS and collect the following attributes:

a. Meter ID
b. Voltage
  c. KW Rate
  d. Number of Phases
  e. Model Number
  f. Date Acquired
  g. Facility ID
  h. Substation ID
  i. Circuit ID
  j. X Coordinates
  k. Y Coordinates
  l. Contract Number
  m. Drawing Number
  n. Data Source

1.4.7.4 Electrical Transformer: CLJN.elect_transformr_bank_point
CPT.elect_transformr_bank_point

Locate, GPS and collect the following attributes:

  a. Subtype
  b. Date Installed
  c. Primary Voltage
  d. Secondary Voltage
  e. Number of Transformers
  f. Total KVA
  g. Substation ID
  h. Circuit ID
  i. KVA Information
  j. X Coordinates
  k. Y Coordinates
  l. Contract Number
  m. Drawing Number
  n. Data Source

1.4.7.5 Electrical Poles: CLJN.utility_pole_tower_point
CPT.utility_pole_tower_point

Locate, GPS and collect the following attributes:

  a. Pole No
  b. Date Acquired
  c. Condition
  d. Type
  e. Material
  f. Pole Height
  g. Units of Measure
  h. Circuit ID
  i. X Coordinates
  j. Y Coordinates
  k. Contract Number
  l. Drawing Number
  m. Data Source

1.4.7.6 Exterior Lighting: CLJN.exterior_lighting_point
CPT.exterior_lighting_point

Locate, GPS and collect the following attributes:

  a. Light Type
b. X Coordinates
c. Y Coordinates
d. Sensor
e. Watts
f. Voltage
g. Circuit ID
h. Contract Number
i. Drawing Number
j. Date Acquired
k. Data Source

1.4.7.7 Electrical Switch:   CLJN.electrical_switch_point
CPT.electrical_switch_point

Locate, GPS and collect the following attributes:
a. Subtype ID
b. Switch ID
c. Disposition
d. Installation Type
e. Switch Status
f. Voltage
g. Circuit ID
h. X Coordinates
i. Y Coordinates
j. Contract Number
k. Drawing Number
l. Data Source

1.4.7.8 Electrical Regulator:   CLJN.electrical_regulator_point
CPT.electrical_regulator_point

Locate, GPS and collect the following attributes:
a. Electrical Regulator ID
b. Disposition
c. Regulator Type
d. Regulator Use
e. Primary Volts
f. Secondary Volts
g. Number of Taps
h. KV Rate
i. Fuse Type
j. Manufacturer
k. Model Number
l. Circuit ID
m. X Coordinates
n. Y Coordinates
o. Contract Number
p. Drawing Number
q. Data Source

1.4.7.9 Electrical Manholes:   CLJN.electrical_junction_point
CPT.electrical_junction_point

Locate, GPS and collect the following attributes:
a. Subtype ID
b. Type
c. Number of Cables
d. Rim Elevation
e. Units of Elevation
f. Diameter
g. Diameter Units
h. X Coordinates
i. Y Coordinates
j. Substation ID
k. Contract Number
l. Drawing Number
m. Data Source

1.4.7.10 Electrical Generators:  CLJN.electrical_generator_point  
CPT.electrical_generator_point

Locate, GPS and collect the following attributes:

a. Generator ID
b. Disposition
c. KVA
d. KW Rate
e. Voltage
f. Fuel Type
g. Manufacturer
h. Model
i. Serial Number
j. Circuit ID
k. X Coordinates
l. Y Coordinates
m. Facility ID
n. Contract Number
o. Drawing Number
p. Data Source

1.4.7.11 Substation:  CLJN.electrical_substation_point  
CPT.electrical_substation_point

Locate, GPS and collect the following attributes:

a. Disposition
b. Capacity Rate
c. Capacity Measure
d. Voltage In
e. Voltage Out
f. Voltage
g. Number of transformer
h. Number of Spares
i. Number of Circuits
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source
o. Date Acquired

1.4.8 Heating and Cooling Systems

The following attributes shall be collected for each utility data class:
Collect GPS data for all features listed with survey grade accuracy.
1.4.8.1 Boiler: CLJN.heat_cool_boiler_site CPT.heat_cool_boiler_site - If Required

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Type
d. Capacity Heat
e. Capacity Units
f. Building ID: Facility Number where Boiler Resides
g. X Coordinates
h. Y Coordinates
i. Contract Number
j. Drawing Number
k. Data Source

1.4.8.2 Fitting: CLJN.heat_cool_fitting_point CPT.heat_cool_fitting_point

Georeference fitting data and collect the following attributes:

a. Subtype ID
b. Date Acquired
c. Material
d. Size
e. Units
f. Line Diameter
g. Diameter in Units
h. X Coordinates
i. Y Coordinates
j. Contract Number
k. Drawing Number
l. Data Source

1.4.8.3 Valves: CLJN.heat_cool_valve_point CPT.heat_cool_valve_point

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Size
c. Size Units
d. Elevation
e. Elevation Units
f. Project ID
g. X Coordinates
h. Y Coordinates
i. Contract Number
j. Drawing Number
k. Data Source

1.4.8.4 Manholes: CLJN.heat_cool_junction_point CPT.heat_cool_junction_point

Locate, GPS and collect the following attributes:

a. Subtype ID
b. Number of Valves
c. Number of Pipes
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d. Width
e. Length
f. Diameter
g. Units for Measurements
h. Rim Elevations
i. Ground Elevation
j. Contract Number
k. Drawing Number
l. X Coordinates
m. Y Coordinates
n. Data Source

1.4.8.5 Chiller and Steam Line: CLJN.heat_cool_line CPT.heat_cool_line

Locate, GPS and collect the following attributes:

  a. Subtype ID: Condensate, Steam, Chiller
  b. Date Acquired
  c. Disposition
d. Use: Underground, Overhead, Abandoned
e. Material
f. Size
g. Length
h. Size Units
i. Ground Elevation
j. Invert Elevation
k. Units for Elevation
l. Taped: Yes/No
m. Building ID: If service line indicate Building
n. Insulation Material
o. Size of Insulation
p. Size Units
q. Contract Number
r. Drawing Number
s. Data Source

1.4.8.6 Demolished Steam Line: CLJN.demolished_heat_cool_line CPT.demolished_heat_cool_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

  a. Date
  b. Drawing Number
c. Contract Number
d. Data Source

1.4.9 Storm Sewer

1.4.9.1 Storm Sewer Lines: CLJN.storm_sewer_line CPT.storm_sewer_line

Locate, GPS and collect the following attributes:

  a. Date Acquired
  b. Use
c. Type
d. Material
e. Size
f. Diameter Units
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g. Elevation
h. Elevation Units
i. Contract Number
j. Drawing Number
k. Data Source

1.4.9.2 Storm Sewer Drainage Line: CLJN.storm_sewer_open_drainage_line
CPT.storm_sewer_open_drainage_line
Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Contract Number
d. Drawing Number
e. Data Source

1.4.9.3 Manhole: CLJN.storm_sewer_junction_point
CPT.storm_sewer_junction_point
Locate, GPS and collect the following attributes:

a. Subtype
b. X Coordinates
c. Y Coordinates
d. Contract Number
e. Drawing Number
f. Data Source

1.4.9.4 Inlet: CLJN.storm_sewer_inlet_point CPT.storm_sewer_inlet_point
Locate, GPS and collect the following attributes: Contract shall verify SWPPP GPS inlet and add to this feature.

a. Subtype
b. Date Acquired
c. X Coordinates
d. Y Coordinates
e. Contract Number
f. Drawing Number
g. Data Source

1.4.9.5 Outfall: CLJN.storm_sewer_outfall_point
CPT.storm_sewer_outfall_point
Locate, GPS and collect the following attributes:

a. Subtype Domain
b. Date Acquired
c. Basin ID: Contractor shall utilize existing data and coordinate Basin_ID with data manager.
d. User Flag
e. X Coordinates
f. Y Coordinates
g. Contract Number
h. Drawing Number
i. Data Source
1.4.9.6 Ponds, Basins, & Treatment Measures:
CLJN.storm_sewer_reservoir_areas CPT.storm_sewer_reservoir_areas

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Project ID
c. Permit ID: SW8 XXXXXX
d. Size
e. Facility ID
f. Installation ID
g. Drawing Number
h. Data Source

1.4.10 Wastewater Collection

The following attributes shall be collected for each utility data class:
Collect GPS data for all features listed with survey grade accuracy.

1.4.10.1 Wastewater Lines: CLJN.wastewater_line CPT.wastewater_line

Locate, GPS and collect the following attributes:

a. Pipe ID: By Manhole Number
b. Date Acquired
c. Use
d. Material
e. Size of Diameter
f. Units
g. Invert Elevation 1
h. Invert Elevation 2
i. Elevation Units
j. Slope
k. Slope Units
l. Building ID: If building/facility service line indicate
   Building number that the line services
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.10.2 Demolished Lines: CLJN.demolished_wastewater_line
CPT.demolished_wastewater_line

Existing attribute information will be copied into the demolished feature
class: Please add the following attribute data once updated.

a. Date
b. Drawing Number
c. Contract Number
d. Data Source

1.4.10.3 Fitting: CLJN.wastewater_fitting_point
CPT.wastewater_fitting_point

Georeference Fitting data and collect the following attributes:

a. Subtype ID
b. Date Acquired
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c. Type
d. Material
e. Size of Diameter
f. Units
g. User Flag: Named Area
h. Contract Number
i. Drawing Number
j. X Coordinates
k. Y Coordinates
l. Data Source

1.4.10.4 Valves:   CLJN.wastewater_valve_point CPT.wastewater_valve_point

Locate, GPS and collect the following attributes:

a. Valves ID: Manhole Number associated with valve
b. Date Acquired
c. Valve Style/Group
d. Valve Use
e. Size in Diameter
f. Valve Elevation
g. Units of Elevation
h. X Coordinates
i. Y Coordinates
j. Manhole ID
k. Contract Number
l. Drawing Number
m. Data Source

1.4.10.5 Manholes:   CLJN.wastewater_junction_point
                     CPT.wastewater_junction_point

Locate, GPS and collect the following attributes:

a. Subtype ID: Manhole
b. Manhole ID: Each section of the base has a unique numbering system for manholes; please see Public Work, GIS office for details.
c. Use
d. Type
e. Material
f. Number of Pipes in manhole
g. Rim Elevation
h. Invert Elevation
i. Elevation Units
j. Manhole Diameter
k. Diameter Units
l. X Coordinates
m. Y Coordinates
n. Date Acquired
o. Contract Number
p. Drawing Number
q. Data Source

1.4.10.6 Vent:   CLJN.wastewater_vent_point CPT.wastewater_vent_point

Locate, GPS and collect the following attributes:

a. Date Acquired

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b. Valve Style/Type
c. Use
d. Size in Diameter
e. Units in Diameters
f. X Coordinates
g. Y Coordinates
h. Subtype ID
i. Containment Type
j. Contract Number
k. Drawing Number
l. Data Source

1.4.10.7 Pump Stations: CLJN.wastewater_pump_point
CPT.wastewater_pump_point
Locate, GPS and collect the following attributes:

a. Pump Station ID: Facility Number
b. Date Acquired
c. Use
d. Type
e. Cooling Method
f. Rated Outflow Volume
g. Flow Unit Measure Code
h. X Coordinates
i. Y Coordinates
j. Number of Pumps
k. Contract Number
l. Drawing Number
m. Data Source

1.4.10.8 Oil Water Separators: CLJN.wstewat_oil_wat_separatr_point
CPT.wstewat_oil_wat_separatr_point
Locate, GPS and collect the following attributes:

a. Oil Water Separator ID: Facility Number
b. Date Acquired
c. Type
d. Separator Process
e. Separator Volume
f. Volume Units of Measure
g. Grit Chamber
h. Flow Capacity
i. Flow Units
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source

1.4.10.9 Grease Trap: CLJN.wastewater_grease_trap_point
CPT.wastewater_grease_trap_point
Locate, GPS and collect the following attributes:

a. Trap Identification: Nearest Facility use Number
b. Type of Trap
c. Material
d. Capacity  
e. Capacity Units  
f. Manhole  
g. Total Number of Laterals  
h. Flow Rate  
i. Flow Units  
j. Building ID: Facility Number On Associated Building  
k. X Coordinates  
l. Y Coordinates  
m. Contract Number  
n. Drawing Number  
o. Data Source

1.4.10.10 Septic Tank:  CLJN.wastewater_septic_tank_point  
CPT.wastewater_septic_tank_point

Locate, GPS and collect the following attributes:

a. Date Acquired  
b. Disposition  
c. Tank capacity  
d. Contract Number  
e. Drawing Number  
f. Data Source

1.4.11 Water Distribution

The following attributes shall be collected for each utility data class: Collect GPS data for all features listed with survey grade accuracy.

1.4.11.1 Water Lines:  CLJN.water_line CPT.water_line

Locate, GPS and collect the following attributes:

a. Date Acquired  
b. Use of Line  
c. Disposition  
d. Material  
e. Size  
f. Size Units  
g. Pipe Length  
h. Unit for Length Dimension  
i. Taped  
j. Source  
k. All Invert Elevation information  
l. Units of Measures  
m. Contract Number  
n. Drawing Number  
o. Data Source  
p. Subtype

1.4.11.2 Demolished Line:  CLJN.demolished_water_line  
CPT.demolished_water_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

a. Date  
b. Drawing Number
1.4.11.3 Water Meter: CLJN.water_meter_point CPT.water_meter_point

Locate, GPS and collect the following attributes:

a. Meter ID
b. Date Acquired
c. Type
d. Installation Type
e. Building ID: Facility Number - If attached to Building
f. X Coordinates
g. Y Coordinates
h. Contract Number
i. Drawing Number
j. Data Source

1.4.11.4 Water Tank: CLJN.water_tank_point CPT.water_tank_point

Locate, GPS and collect the following attributes:

a. Tank ID: Facility Number
b. Date Acquired
c. Disposition
d. Tank Use
e. Tank Status
f. Tank Width
g. Tank Length
h. Tank Diameter
i. Ground Elevation
j. Tank Volume
k. Unit of measure in Gallons
l. Top Elevation
m. Overflow Elevation
n. Pressure High
o. Pressure Low
p. X Coordinates
q. Y Coordinates
r. Contract Number
s. Drawing Number
t. Data Source

1.4.11.5 Water Valve: CLJN.water_valve_point CPT.water_valve_point

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Use: Valve
d. Valve Status
e. Size
f. Size Units
g. Valve Elevation
h. Ground Elevation
i. Size Unit
j. Manhole ID
k. X Coordinates
l. Y Coordinates
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m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.11.6 Water Fitting:  CLJN.water_fitting_point CPT.water_fitting_point

Georeference and collect the following attributes:

a. Date Acquired
b. Disposition
c. Type
d. Material
e. Size
f. Size Units
g. Contract Number
h. Drawing Number
i. Data Source

1.4.11.7 Water Well:  CLJN.potable_water_well_point CPT.potable_water_well_point

Locate, GPS and collect the following attributes:

a. Well ID: Facility Number
b. Use: Potable, Non-Potable
c. Well Status
d. Station ID: Building Number
e. Date Acquired
f. X Coordinates
g. Y Coordinates
h. Tank ID: Water Tank Facility Number for which well feeds
i. Contract Number
j. Drawing Number
k. Data Source

1.4.11.8 Water Manhole:  CLJN.water_junction_point CPT.water_junction_point

Locate, GPS and collect the following attributes:

a. Subtype
b. Use
c. Type
d. Material
e. Number Valves
f. Number Pipes
g. Installation Date
h. Size Diameter
i. Unit Diameter
j. X Coordinates
k. Y Coordinates
l. Contract Number
m. Drawing Number
n. Data Source

1.4.11.9 Fire Hydrant:  CLJN.water_fire_connection_point CPT.water_fire_connection_point

Locate, GPS and collect the following attributes:
a. Hydrant ID: TBD by Fire Department
b. Date Acquired
c. Disposition
d. Valve Connector Type
e. Valve Size
f. Inlet Diameter
g. Units of measure
h. X Coordinates
i. Y Coordinates
j. Contract Number
k. Drawing Number
l. Data Source

1.4.11.10 NON Potable Water Well: CLJN.non-potable_water_well_point
CPT.non-potable_water_well_point

   Locate, GPS and collect the following attributes:
   a. Well ID: Facility Number
   b. Use
c. Well Status
d. Station ID: Building Number
e. Date Acquired
f. X Coordinates
g. Y Coordinates
h. Tank ID: Water Tank Facility Number
i. Contract Number
j. Drawing Number
k. Data Source

1.4.11.11 Other Utility Features

   Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

   Geospatial data delivery does not replace as-built requirements. All newly constructed features require GIS deliverables.

   a. Facility ID
   b. Installation Date
c. Type/Description
d. Material
e. Size
f. Drawing Number
g. Contract Number
h. Data Source

1.4.12 Alternative Energy

1.4.12.1 Geothermal Wells CLJN.geothermal_wells CPT.geothermal_wells

   Locate, GPS and collect the following attributes:

   a. Bldg_ID
   b. X Coordinates
c. Y Coordinates
d. Well ID
e. Depth
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f. Units
g. Status
h. Bentonite
i. Casing
j. Construction
k. Installation Contract #
l. Contract Number
m. Drawing Number
n. Data Source

1.4.12.2 Water Wells associated with Geothermal Pumping System  CLJN.water wells associated with geothermal pumping system CPT.water wells associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Well ID:  Facility Number
b. Use:
c. Well Status
d. Station ID:  Building Number
e. Date Acquired:

1.4.12.3 Water Lines associated with Geothermal Pumping System (Hybrid Geothermal Loop)  CLJN.water lines associated with geothermal pumping system CPT.water lines associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Use of Line
c. Disposition
d. Material
e. Size
f. Size Units
g. Pipe Length
h. Unit for Length Dimension
i. Taped
j. Source
k. All Invert Elevation Information
l. Units of Measures
m. Contract Number
n. Drawing Number

1.4.12.4 Water Valve associated with Geothermal Pumping System  CLJN.water valve associated with geothermal pumping system CPT.water valve associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Date Acquired:
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b. Disposition
c. Use: Valve
d. Valve Status
e. Size
f. Size Units
g. Valve Elevation
h. Ground Elevation
i. Size Unit
j. Manhole ID
k. X Coordinates
l. Y Coordinates
m. Contract Number
n. Drawing Number
o. Data Source
p. Subtype

1.4.12.5 Water Fitting associated with Geothermal Pumping System CLJN.water
fitting associated with geothermal pumping system CPT.water fitting
associated with geothermal pumping system

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Type
d. Material
e. Size
f. Size Units
g. Contract Number
h. Drawing Number
i. Data Source

1.4.13 Natural Gas Line

Locate, GPS and collect the following attributes:

a. Date Acquired
b. Disposition
c. Material
d. Size
e. Size Units
f. Pipe Length
g. Taped
h. Source
i. All Invert Elevation Information
j. Units of Measures
k. Contract Number
l. Drawing Number
m. Data Source
n. Subtype

1.4.13.1 Natural Gas Valve

Locate, GPS and collect the following attributes:

a. Date Acquired:
b. Use:
c. Size
d. Size Units
1.4.12 Non-Compliance

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Geospatial data delivery does not replace as-built requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --
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 Guideline 0 (2005) The Commissioning Process

ASSOCIATED AIR BALANCE COUNCIL (AABC)


NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)


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


U.S. GREEN BUILDING COUNCIL (USGBC)


1.2 SUMMARY

Commissioning consists of systematically documenting that specified components and systems have been installed and started up properly and then functionally tested to verify and document proper operation through all sequences of operation and conditions. In addition, if enhanced commissioning is implemented, training of the Government's Operations Personnel will be verified and final project O&M Documents will be reviewed for completeness.

1.2.1 Systems for Commissioning

The following systems are scheduled to be commissioned as applicable to project design:

a. Mechanical Systems:
(1) Air distribution systems (All equipment of the heating, ventilating and air conditioning system)

(a) Air Handling Units
(b) VRV systems
(c) Exhaust Fans
(d) Energy recovery systems
(e) Air cooled chillers
(f) Pumps
(g) Boilers

(2) Building Automation Systems (BAS), including linkages to remote monitoring and control sites (excluding any security-related control interlocks)

b. Plumbing Systems

(1) Domestic Hot Water Heater
(2) Domestic Hot Water Recirculation Pump and associated control

1.2.2 Related Documents


1.3 DEFINITIONS

Basis of Design Document: A document that records the concepts, calculations, decisions, and product selections used to meet the Government's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Commissioning Authority: An entity identified by the Government who plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

Commissioning Plan: Prepared and updated by the Commissioning Authority, the Commissioning Plan outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

Commissioning Process: A quality-focused process for enhancing the delivery of a project. The Process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Government's Project Requirements. Commissioning is typically abbreviated by "Cx". Commissioning and Cx have the exact same meaning and will be used interchangeably throughout the Contract documents.

Commissioning Team: The individuals who through coordinated actions are responsible for implementing the Commissioning Process.

Construction Checklist: Documents prepared by the Cx Authority and issued to the Contractor early in the Construction Phase. The purpose of the Checklist is to verify that appropriate components are on site, correctly installed and functional and ready for Functional Performance Testing.

Corrective Issue Report: A report generated by the Cx Authority during
Functional Performance Testing documenting deficiencies found during the testing procedures.

Functional Performance Testing: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Government's Project Requirements.

Government's Project Requirements: A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

1.4 COMMISSIONING TEAM

The Commissioning Team shall consist of a minimum of one (1) Representative for each of the following:

a. Government.

b. Architect.

c. Engineer.

d. Contractor.

e. Sub-contractors.

f. Commissioning Authority.

Each Commissioning Team Representative shall have appropriate experience in construction administration along with a thorough understanding of construction project administrative procedures.

Each Cx Team Representative shall be familiar with ASHRAE Guideline 0 - The Commissioning Process.

1.5 SUBMITTALS

Submittals related to equipment and systems to be commissioned shall be provided to the Commissioning Authority for reference. The Commissioning Authority will coordinate required submittals with the contractor. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Completed Pre-Functional Performance Test Checklists

SD-11 Closeout Submittals

Training Attendance Roster

Training Plan

Training Questionaire
The following submittals shall be provided electronically to the commissioning authority if not included in specific Division 01 or 23 specifications:

- Equipment Start up Plan
- DALT Plan
- TAB Deficiency Report
- TAB Plan
- Pre-PVT Checklists

1.6 QUALITY ASSURANCE

1.6.1 Qualifications

1.6.1.1 Commissioning Firm

Government will provide a Commissioning Firm that is either a member of ACG 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. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Firm for approval. Any firm that has been the subject of disciplinary action by the ACG, 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 Commissioning. All work specified in this Section and in other related Sections to be performed by the Commissioning Firm shall be considered invalid if the Commissioning Firm loses its certification prior to Contract completion and must be performed by an approved successor. These Commissioning services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The Commissioning Firm shall be independent of the work of design and construction. The Commissioning Firm shall not be employed by, or contracted through, a Contractor or construction manager holding construction contracts. The Commissioning Firm shall be a consultant of the Government. The Commissioning Firm shall report results and recommendations directly to the Government.

1.6.1.2 Commissioning Authority

The Commissioning Authority shall be an ACG Certified Commissioning Agent, a NEBB Qualified Commissioning Administrator, or a TABB Certified Commissioning Supervisor and shall be an employee of the approved Commissioning Firm. The Commissioning Authority shall have documented commissioning authority experience in at least 2 building projects. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Commissioning Authority loses subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Authority for approval. Any individual that has been the subject of disciplinary action by the ACG, 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 Commissioning. All work specified in this Section and in other related Sections performed by the Commissioning Authority shall be considered invalid if the Commissioning Authority loses his certification.
prior to Contract completion and must be performed by the approved successor.

Duties of the Commissioning Authority include the following:

a. Assist In Responding To Bidder RFI's

   (1) During the Pre-Bid phase, the Commissioning Authority shall review all commissioning related Requests for Information (RFI) in effort to clearly define the unique requirements of the Commissioning Process to the prospective bidders. The Commissioning Authority shall provide responses to any RFI's that specifically address commissioning process issues.

b. Development of Commissioning Plan

c. Commissioning Specific Requirements

   (1) The Commissioning Authority will perform the enhanced commissioning requirements as listed in LEED.

   (2) A minimum of one commissioning review of the Government's project requirements, basis of design, and design documents will be performed prior to the mid construction documents phase. The subsequent submitted documents will be back-checked against the comments.

   (3) A review of the Contractor submittals for the applicable systems being commissioned will be performed. The review will verify compliance with the Government's project requirements and basis of design.

   (4) Coordinate commissioning related meetings with the contractor and owner. Verify required commissioning related activities are included in the master construction schedule.

   (5) Perform Construction Phase Commissioning site observations, maintain a commissioning issues log, and verify completion of Pre-Functional Construction Checklists.

   (6) Witness select equipment start-ups, QC testing (DALT) and verify TAB results.

   (7) Witness and Document Functional Performance Testing on systems to be commissioned.

   (8) A System Manual shall be development in conjunction with the Contractor. The Commissioning Plan will set the format to be followed and shall comply with ASHRAE Guideline 0.

   (9) Verification of the required training for the building's operating staff and occupants will be provided. The Commissioning Plan shall provide a listing of equipment and systems that will require training, along with the training requirements.

   (10) The Commissioning Authority will be involved in the review of building operations 10 months after substantial completion. The review will be performed in conjunction with the Operations and Maintenance staff and occupants. Any outstanding
commissioning-related issues shall be resolved during this period, which may include additional seasonal testing to be performed with the assistance of the contractor.

1.6.1.3 Contractor Commissioning Responsibilities

Perform and assist as required for all Commissioning work specified herein and in related sections under the direct guidance of the Commissioning Authority. In addition, the Contractor's commissioning representative shall fulfill the roles and responsibilities as specified in The Commissioning Plan. The Commissioning Authority shall prepare the Commissioning Plan. After approval of the Commissioning Plan, revise the Contract schedule to reflect the schedule requirements in the Commissioning Plan.

1.6.2 Regulatory Requirements

Commissioning shall be accomplished according to one or a combination of the following:

a. ASHRAE Guideline 0
b. NEBB Commissioning Standard
c. SMACNA 1429
d. ACG Commissioning Guideline
e. LEED

1.7 SEQUENCING AND SCHEDULING

Work described in this Section shall be coordinated, sequenced and scheduled with all work required in related Sections and the construction schedule.

PART 2 PRODUCTS

2.1 VERIFICATION TESTING EQUIPMENT AND INSTRUMENTS

Contractor shall provide all tools, instruments, laptop computers, PDA's, software programs and services required to perform system Verification Testing procedures. This includes providing the connection to systems to be tested, operation of the test equipment and instrumentation and generating test results as required.

PART 3 EXECUTION

3.1 PROJECT SCHEDULE

The Commissioning Authority will provide to the Contractor, within four (4) weeks after notification of award, a Schedule in CPM format identifying the Cx Activities and durations for the Project. The Contractor shall then incorporate these Cx Activities into the Master Construction Schedule. Some activities include but are not limited to:

a. Establishment of Permanent Power
c. TAB air and water.

d. TAB review meeting.

e. Pre-PVTs are performed.


g. Two-day Trending is performed.

h. Trend Review meeting is held.

i. Phase I control training is held with PW.

j. PVTs are performed.

k. Phase 2 control training and other building system training is performed.

The Cx Authority will review and update Cx Activities to coordinate with the Contractor's Master Schedule Update.

3.2 PREPARATION

Upon Contracting Officer's acceptance of the Submittal Schedule as required, the Cx Authority will indicate which submittals are "Commissioning Related".

Contractor shall submit one (1) copy of each Commissioning Related submittal to the Cx Authority at the time of submission to the Contracting Officer.

Commissioning Authority will review Product Submittals and Shop Drawings within the same review period as the Contracting Officer. The Cx Authority will review the Submittals and Shop Drawings for Cx Process related information and issue review comments directly to the Contracting Officer.

Contracting Officer will incorporate the Commissioning comments along with their comments on the "stamped" copy returned to the Contractor.

3.3 REQUEST FOR INFORMATION (INTERPRETATION)

Contractor shall submit one (1) copy of each RFI related to the equipment and systems to be commissioned to the Commissioning Authority at the time of submission to the Contracting Officer.

Commissioning Authority will review each RFI for Commissioning related information and issue comments directly to the Contracting Officer.

3.4 COMMISSIONING PROGRESS MEETINGS

The Commissioning Authority will conduct periodic Cx Progress Meetings throughout the construction phase of the project. Commissioning Team Members are required to attend these meetings. When feasible the commissioning meeting will coincide with other review and construction meetings. A scoping meeting will be held to identify responsibilities of the commissioning team members. Commissioning Progress Meetings will be held as needed. Additional meetings may become necessary if Commissioning
requirements are not being completed on schedule.

In addition to Commissioning Progress meetings, the contractor shall arrange for the following commissioning related meetings as coordinated with the commissioning authority and PWD:

1. Commissioning Kick-off meeting with subcontractors
2. Pre-DALT/TAB Scheduling and Coordination Meeting
3. Controls Integration Meeting

3.5 QUALITY ASSURANCE TESTING

3.5.1 Contractor Field Testing

Contractor shall issue one (1) copy of ALL Test Reports to the Commissioning Authority for recording into the Commissioning Systems Manual.

3.5.2 Independent Testing

Contractor shall issue one (1) copy of ALL Independent Testing Reports to the Commissioning Authority for recording into the Commissioning Systems Manual.

3.5.3 Witnessing of Testing by Cx Authority

Contractor shall notify the Commissioning Authority in advance of ALL Field or Independent Testing being performed. The Cx Authority will witness a random sampling of Field and Independent Testing.

3.6 SUBSTANTIATING SYSTEM STATUS

The Commissioning Authority will prepare and issue to the Contractor a Pre-Functional Construction Checklist Form for each system or major piece of equipment to be Commissioned. Reference sample Pre-Functional Construction Checklist at the end of this Section. The contractor shall be responsible for completion and submission of the forms.

The Commissioning Authority will monitor and track the completion of the Construction Checklist Forms during period construction site observation visits.

The Contractor shall complete the Pre-Functional Construction Checklist Forms, provided by the Cx Authority, as follows:

a. Complete Section 01 "Equipment Delivery" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after equipment delivery to the site.

b. Complete Section 02 "Equipment Installation" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment installation is completed.

c. Complete Section 03 "Equipment Start-up" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment has been successfully started.

d. Complete Section 04 "DDC/EMCS Control & Integration" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment is fully operational and ready for
3.7 OPERATION AND MAINTENANCE DATA

The Enhanced Commissioning Process has special requirements on compiling and submitting Operation and Maintenance Data.

Upon receipt of the "stamped" submittal from the Contracting Officer, the Contractor shall submit one (1) electronic copy of the respective Operations and Maintenance Data to the Commissioning Authority.

The Cx Authority will compile this information into the Project "Systems Manual" which will be used during Training Sessions, and finally turned over to the Physical Plant Personnel.

3.8 FUNCTIONAL PERFORMANCE TESTING

The Commissioning Authority will develop the Functional Performance Test Procedures to be used on the systems being Commissioned. The Test Procedures will be submitted to the Contractor in advance of scheduled Functional Performance Testing to give the Contractor and Subcontractor's time to review the Procedures and make comments or suggest revisions. Reference sample Functional Performance Test Procedure Form at the end of this Section.

The Commissioning Authority will oversee and document results of all Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.9 CORRECTIVE ISSUE REPORT

The Commissioning Authority will document deficiencies discovered during the construction phase and Functional Performance Testing of systems on a Corrective Issue Report. The Cx Authority will then forward this form to the Contractor for action in correcting the deficiency.

When the deficiency has been corrected, the Contractor shall note action taken and return the Corrective Issue Report to the Commissioning Authority. Reference sample Corrective Issue Report at the end of this Section.

Corrective Issue Reports must be completed as a pre-requisite for Substantial Completion.
3.10 TRAINING GOVERNMENT EMPLOYEES

All training sessions shall be coordinated with the Commissioning Authority. The Cx Authority will prepare a template Training Form to be used for each Training Session required by the Contract Documents and issue to the Contractor. The Training Plan and completed Training Forms shall be used to schedule, perform and document the required training sessions. The contractor shall submit the Training Plan and Forms for review prior to scheduling training. Reference sample form at the end of this Section.

Training Instructors shall be a Manufacturer's Representative or Applications Engineer fully qualified in the operation, troubleshooting and maintenance procedures for the equipment or systems being covered. Sales Representatives or others possessing only general knowledge of the equipment or systems will not be acceptable.

The following format shall be used to schedule, perform, document and evaluate the required training sessions:

a. Contractor shall submit a separate Training Form for each training session required by the Contract Documents to the Commissioning Authority. This form shall be submitted a minimum of fourteen (14) calendar days in advance of the proposed training session.

b. Contractor shall complete the first section of the form including the proposed training session date, name of instructor(s), and proposed length (time) of the session(s). Also, attach an Agenda indicating the format of the training session and listing any handouts that will be provided.

c. Commissioning Authority will then review the proposed training information with the Government. If the submitted information is complete and the proposed dates meet the Government's Operations Personnel schedule, the Government will respond to the Contractor to proceed with scheduling the subject training session.

d. During the training session, the Contractor shall have all in attendance sign in the third section of the Training Form. Attach additional pages if necessary. The Contractor shall then forward the Training Form to the Commissioning Authority.

Upon receipt of the Training Form, the Commissioning Authority will have each of the attendees complete the Evaluation Form to gain feedback on the value of the session. Reference sample form at the end of this Section.

a. If the session meets the objectives and intent of the Contract Documents, the Commissioning Authority will approve the training form and return to the Contractor for Project Records.

b. If negative feedback is received, the Evaluation Forms will be reviewed with the Commissioning Team and if necessary, re-scheduling of the training may be required.

Operations & Maintenance Manuals and accurate As-built Drawings shall be submitted and approved by the Contracting Officer BEFORE training sessions will be held. The As-built Drawings and O&M information will be reviewed and used as reference during training instructions.
3.11 SECOND SEASON TAB VERIFICATION

Second Season TAB Verification as required by Division 23 of this specification shall be performed during the occupancy phase. The contractor shall notify the commissioning Authority 14 days prior to performing second season (opposite season) TAB verification.

3.12 DEFERRED FUNCTIONAL TESTING

Deferred Testing shall be performed prior to the end of warranty no later than 10 months after building acceptance (BOD). Deferred testing will be required on equipment and systems that could not be completed or that failed due to defective parts or unacceptable installation. Deferred testing will only applicable to equipment and systems not required for occupancy at the time of BOD, subject to Governmental approval.

The Commissioning Authority will oversee and document results of all Deferred Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.13 SEASONAL TESTING

Seasonal Testing shall be performed prior to the end of warranty no later than 10 months after building acceptance (BOD). Seasonal testing will be required on equipment and systems that could not be tested due to seasonal ambient conditions.

The Commissioning Authority will oversee and document results of all Seasonal Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.14 OCCUPANCY PHASE REVIEW

The commissioning authority will assist in scheduling warranty review meeting with the facilities O/M staff, Users and PWD. Warranty review will consist of reviewing outstanding warranty items, outstanding commissioning issues and walk down of the commissioned systems to identify any additional warranty related items. Any outstanding or new items will be submitted to the contractor for resolution prior to the contractors warranty expiring.

The controls contactor shall provide trend data within 10 days of notification to the Commissioning Authority. Trend data shall consist of the identified points determined by the Commissioning Authority illustrating system operation for 5 consecutive days in each operational season.

3.15 COMMISSIONING FORMS

The following forms are provided for the commissioning process:
a. Commissioning Progress Meeting Agenda.

b. Construction Checklist.

c. Functional Performance Test Procedure.


e. Operation Training Form.

f. Training Evaluation Form.

g. Commissioning Schedule.

-- End of Section --
Training Evaluation Form

**PROJECT:** [name]

**PROJECT NUMBER:**

Training Session: ____________________________

Session Date: ____________________________

Name (optional): ____________________________

This form is to be completed by each person that attended this Training Session.

<table>
<thead>
<tr>
<th>General</th>
<th>5 = Strongly Agree</th>
<th>1 = Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Training provided was a good use of your time</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>2. The Training provided met your expectations</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>3. The Training provided was useful and relevant to perform your job</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>4. The Training provided increased knowledge of the subject matter</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>5. The Training utilized appropriate amount of hands on instruction</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instruction</th>
<th>5 = Strongly Agree</th>
<th>1 = Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Instructor(s) were clear and understandable</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>2. The Instructor(s) had strong knowledge of the material being presented</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>3. The topics and objectives of the training were well defined</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>4. Interaction and discussion of the subject matter was encouraged</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>5. The instructor(s) provided reasonable responses to questions</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content</th>
<th>5 = Strongly Agree</th>
<th>1 = Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Training material was appropriate and complete for the subject matter</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>2. The Training provided appropriate level of understanding of the subject matter</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>3. The Training allowed adequate time for questions and discussion</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>4. The Training material provided adequate detail of the subject matter</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
<tr>
<td>5. The material provided was organized and relevant to the subject matter covered</td>
<td>5 4 3 2 1</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Provide any additional comments:
OPERATIONS AND MAINTENANCE TRAINING
Contractor Training Requirements and Form

<table>
<thead>
<tr>
<th>Training Plan</th>
<th>[Equipment Type]</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>[M-01]</td>
<td></td>
<td>[XXXXXX]</td>
</tr>
</tbody>
</table>

Contractor Training Requirements:
Contractors are required to provide training on equipment and systems as identified in the contract documents. The contractor is to provide to the Owner and the Commissioning Authority (CxA) the following documentation:

- Instructor Qualifications / Resume
- Training Agenda / Outline
- Copies of all handouts / documents that will be provided during the instruction

The Contractor is to complete the Contractor Training Plan Submittal Form, as a checklist to ensure the above items are provided, to the Commissioning Authority for review and comment by both the Owners Representative and the Commissioning Authority.

The Contractor’s Instructor is responsible, during the delivery of the training, to ensure that all attendees sign into the training on the Class Attendance Roster. Once completed, the sign in sheet will be forwarded to the Cx Authority (CxA) and owner for their records.

Contractor Training Plan Submittal Form:

<table>
<thead>
<tr>
<th>Training Plan (Contractor Provides) Includes:</th>
<th>Training Conducted by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Instructor Qualifications/Resume</td>
<td>Instructor Name:</td>
</tr>
<tr>
<td>☐ Agenda / Training Outline</td>
<td>Title:</td>
</tr>
<tr>
<td>☐ Handouts / Documents</td>
<td>Phone:</td>
</tr>
<tr>
<td></td>
<td>FAX:</td>
</tr>
<tr>
<td></td>
<td>Email:</td>
</tr>
</tbody>
</table>

Equipment Included in Training:

[List each piece of equipment (AHU-1, AHU-2…..)]
Agenda Topics:
The following syllabi points shall be included as a minimum:

**EDIT THE FOLLOWING USING EXAMPLES GIVEN:**

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>LOCATION</th>
<th>TIME</th>
<th>PRESENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Overall Design Intent</td>
<td>Classroom</td>
<td>8 am – 10:30 am</td>
<td>Karpinski Engineers</td>
</tr>
<tr>
<td>Air Handling Systems</td>
<td></td>
<td>11 am - Noon</td>
<td></td>
</tr>
<tr>
<td>II Break</td>
<td>Classroom</td>
<td>10:30 – 11:00</td>
<td>Custom Air Handling Provider (Factory Trainer) BAS Provider</td>
</tr>
<tr>
<td>III Custom Air Handling Units (AHU-3 – AHU-8)</td>
<td>Classroom</td>
<td>Lunch</td>
<td>1:00pm – 4:30</td>
</tr>
</tbody>
</table>

A. Review General Unit Operation / Components / Performance including fans, motors, coils, filters, dampers, airflow stations, VFC’s, humidifiers, and other components operation with load and methods of control

B. Describe supply and return fans and required monitoring, maintenance and service including replacement of belts and sheaves, motors, and regular monthly maintenance

C. Review all coil installations and ongoing cleaning and maintenance

D. Review all Electrical Components including wiring diagrams, all safety interlocks, VFC’S wiring, performance and regular monitoring and maintenance

E. Describe unit Operator Interface and Controls, Control Points, Interface with main Operator Work Station. Describe use of the Operator Interface Panel. Describe use of VFC operator interface panels

F. Review procedures for filter replacement

G. Review all Alarms and Troubleshooting of alarms
   a. Types of Alarms and Meaning of alarm and actions required by maintenance depending upon the alarm
   b. Responses to different types of alarms

H. Review operation and maintenance of AHU humidifiers

I. Review operation and maintenance of damper actuators and control valve actuators and dampers and control valves

J. Review Daily, Monthly, and Annual Maintenance
## Contractor Training Class Attendance Roster &
Owner / Commissioning Authority Training Evaluation Form:

<table>
<thead>
<tr>
<th>Instructor Name:</th>
<th>Date &amp; Time of Training:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each Attendee to print name and title:

<table>
<thead>
<tr>
<th>Printed Name:</th>
<th>Job Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:

---

Training Plan
[M-01] | [Equipment Type] | Specifications [XXXXXX]

---

[Project Name] [Equipment Type]

JCI Project No.: [XXXXX] | Page 3 of 3 |
Training Form
[Project Name] [Equipment Type]
**Functional Performance Test**

**FACILITY SUSTAINMENT, RESTORATION AND MODERNIZATION (FSRM)**

**PROJECTS AT CAMP LEJEUNE, NORTH CAROLINA**

**Jacobs Project # F9W98914**

**Test ID:** FPT-M01-01  
**Related Systems:** Air Handling Unit  
**System Description:** Exhaust fan serving ventilation system to provide exhaust to specified rooms. Fan is either constant volume or variable volume controlled by the BAS.

**Test Purpose:** Verify system provides required functional operation according to the sequence of operation; operates to the intended set points (minimum and maximum); all stated safeties and alarms function and the operation meets the Owners Project Requirements.

### General Test Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Initial Test</th>
<th>Retest</th>
<th>Retest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Test Participants

<table>
<thead>
<tr>
<th>Name - Organization</th>
<th>Name - Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Document/Test Control

<table>
<thead>
<tr>
<th>Issue</th>
<th>Issue Date</th>
<th>Description</th>
<th>Issued By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev001</td>
<td></td>
<td></td>
<td>Jacobs</td>
</tr>
</tbody>
</table>

---

G526  
Jacobs Project # F9W98914  
AHU-1
TOOLS AND SUPPLIES

<table>
<thead>
<tr>
<th>Description</th>
<th>Calibration Status</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SYSTEM OPERATION

PREREQUISITES

<table>
<thead>
<tr>
<th>Description</th>
<th>Pass Y/N</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-functional Testing has been completed and Pre-Functional Test Forms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>have been provided as verification system is ready for Functional Testing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Commissioning Authority has Reviewed completed Pre-Functional Test and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issues Log.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Commissioning Authority has reviewed supportive documentation of equipment/system identified in Pre-Functional Test.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Pre-Test meeting has been held with NAVFAC, CM and required Contractors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to review the testing parameters and pass/fail criteria.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Any deviations from design have been identified, discussed and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>accommodated for Functional Testing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Functional Testing has been coordinated with other On-Site Activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Appropriate Base personnel have been contacted and scheduled to attend</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>testing as required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Base Emergency Response (Police and Fire) have been notified of Testing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>as required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Participant Sign-In Sheet has been completed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Required tools and supplies have been identified and provided.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Functional Test Procedures:

#### VERIFICATION OF FAN CONTROL

Override set points, sensor values or modes of operation to facilitate testing. After verification of the safety operation, reset safety, re-energize unit and allow unit to return to a stable operation. Return all set points, sensor values and modes to initial parameters.

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Set the Keypad-remote Switch to the “remote” position.</td>
<td>a. Supply Fan is now controlled by the DDC Controller.</td>
</tr>
<tr>
<td>2. Command the Supply Fan on with the DDC controller.</td>
<td>a. Supply Fan starts running.</td>
</tr>
<tr>
<td>3. Command the Supply Fan off with the DDC Controller</td>
<td>a. Supply Fan stops running.</td>
</tr>
<tr>
<td>4. Set the Keypad-remote Switch to the “Keypad” position.</td>
<td>a. Supply Fan is now controlled by the manual speed adjustment.</td>
</tr>
<tr>
<td>5. Command the Supply Fan on through the manual speed adjustment.</td>
<td>a. Supply Fan starts running.</td>
</tr>
<tr>
<td>7. Return Switch to original position.</td>
<td>a. Supply Fan resumes normal operation.</td>
</tr>
</tbody>
</table>

Notes and Issues shall be logged in the Commissioning Issues Report and assigned a CIR number.
## VERIFICATION OF UNOCCUPIED/OCCUPIED MODES

Override set points, sensor values or modes of operation to facilitate testing. After verification of the safety operation, reset safety, re-energize unit and allow unit to return to a stable operation. Return all set points, sensor values and modes to initial parameters.

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Override BAS Schedule to switch to unoccupied mode. Command the Supply Fan off.</td>
<td>a. Supply Fan turns off.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Outside Air Damper closes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Fan will cycle on and off to maintain thermostatic setpoint.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Observed Thermostatic Setpoint ______ °F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Outside Air Damper Remains closed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Override BAS Schedule to switch to occupied mode Command the Supply Fan On.</td>
<td>a. VFD engages the Supply Fan.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Supply Fan starts and runs continuously.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Outside Air Damper opens.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. AHUs are receiving specified minimum outside air quantity.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes and Issues shall be logged in the Commissioning Issues Report and assigned a CIR number.

## VERIFICATION OF SUPPLY DUCT STATIC PRESSURE CONTROL OPERATION

For the following, AHU shall be in a normal mode of operation. Override set points, sensor values or modes of operation to facilitate testing. At the end of the test, return all set points, sensor values and modes to initial parameters.

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clear all alarms and notifications in the BAS</td>
<td>a. BAS shows system in normal operation, with no alarms or notifications.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Observe the Supply Fan speed modulated to maintain the Static Pressure setpoint.</td>
<td>b. Supply Fan is modulating.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Record Static Pressure setpoint ______ ins.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Actual Static Pressure ______ ins.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Functional Performance Test

**Facility Sustainment, Restoration and Modernization (FSRM) Projects at Camp Lejeune, North Carolina**

**Jacobs Project # F9W98914**

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass Y/N</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
</table>
| **2.** Lower Static Pressure Setpoint to the minimum and observe the VAV box air flow. | a. Record minimum static Pressure setpoint __________ ins.  
 b. VAV box air flow is maintained. | | | |
| **3.** Return set point to initial values, allow unit to return to normal stable operation. | a. Unit returns to normal stable operation within a reasonable timeframe | | | |
| **4.** Lower the Static Pressure 25% over the setpoint. | a. Supply Fan speed decreases. 
 b. Static Pressure drops to the setpoint value and is maintained. | | | |
| **5.** Raise the Static Pressure 25% under the setpoint. | a. Supply fan speed increases. 
 b. Static Pressure rises to the setpoint value and is maintained. | | | |
| **6.** Return set point to initial values, allow unit to return to normal stable operation. | a. Unit returns to normal stable operation within a reasonable timeframe | | | |

Notes and Issues shall be logged in the Commissioning Issues Report and assigned a CIR number

---

**VERIFICATION OF ROOM TEMPERATURE CONTROL OPERATION**

For the following, AHU shall be in a normal mode of operation. Override set points, sensor values or modes of operation to facilitate testing. At the end of the test, return all set points, sensor values and modes to initial parameters.

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass Y/N</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.</strong> Clear all alarms and notifications in the BAS</td>
<td>a. BAS shows system in normal operation, with no alarms or notifications.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **3.** Energize Fan and allow unit to establish a minimum stable operation. | a. Unit starts and settles to a stable minimum operational point. 
 b. Outside air IAQ Damper opens. 
 c. Record Air Temperature setpoint ______ °F 
 d. Record the AHU Discharge Air Temperature __________ °F. | | | |
### Functional Performance Test

**FACILITY SUSTAINMENT, RESTORATION AND MODERNIZATION (FSRM)**

**PROJECTS AT CAMP LEJEUNE, NORTH CAROLINA**

**Jacobs Project # F9W98914**

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass Y/N</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
</table>
| 4. Change the temperature set point downward by 5°F of the normal set point value. | a. Chilled water coil control valve will open, pre-heat hot water coil control valve remains closed  
b. Record AHU Discharge Air temperature ________ °F. |          |       |        |
| 5. Change the temperature set point back to the original set point value. | a. Unit returns to normal stable operation within a reasonable time frame |          |       |        |
| 6. Change the temperature set point upward by 5°F of the normal set point value. | a. Pre-heat hot water coil control valve will open, chilled water coil control valve remains closed  
b. Record AHU Discharge Air temperature ________ °F. |          |       |        |
| 7. Return set point(s) to initial values, allow unit to return to normal stable operation. | a. Unit returns to normal stable operation within a reasonable timeframe |          |       |        |

**Notes and Issues shall be logged in the Commissioning Issues Report and assigned a CIR number**

### VERIFICATION OF ALARMS & SAFETIES

For the following, AHU shall be in a normal mode of operation. Override set points, sensor values or modes of operation to facilitate testing. At the end of the test, return all set points, sensor values and modes to initial parameters.

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass Y/N</th>
<th>CIR#</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clear all alarms and notifications in the BAS</td>
<td>a. BAS shows system in normal operation, with no alarms or notifications.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 2. **Supply Fan Failure Alarm** With the unit running, manually interrupt power to the supply fan. | a. The supply fan stops.  
b. An alarm is registered in the BAS. |          |       |        |
| 3. Release the test condition.                                         | a. The fan starts.  
b. Alarm is cleared from the BAS. |          |       |        |
| 4. **Smoke Detector Alarm** With the system ON, stimulated a smoke detector associated with the unit. | a. The supply fan is de-energized.  
b. An alarm is registered in the fire alarm panel. |          |       |        |
## Functional Performance Test

**FACILITY SUSTAINMENT, RESTORATION AND MODERNIZATION (FSRM)**

**PROJECTS AT CAMP LEJEUNE, NORTH CAROLINA**

**Jacobs Project # F9W98914**

5. **Release the test condition.**
   - a. The fan is energized.
   - b. Alarm is cleared from the BAS.

6. **Freezestat Alarm**
   - With the system ON, use an appropriate method to create a low temperature condition at the freezestat sensor to go below 40°F.
   - a. Supply fan stops.
   - b. OA Damper closes.
   - c. The hot water control valve opens.
   - d. An alarm is registered at the BAS

7. **Release the test condition.**
   - a. The alarm clears.
   - b. The system requires manual reset of the freezestat to start.

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**Notes and Issues shall be logged in the Commissioning Issues Report and assigned a CIR number**

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### RECORD OF OPERATION (TRENDING OR LOGGING REQUIREMENTS)

Return system to normal operation, check to make sure all overrides, alarms, etc… have been removed or cleared and allow the system to settle into a stable operation.

<table>
<thead>
<tr>
<th>Action</th>
<th>Expected Results</th>
<th>Pass Y/N</th>
<th>CIR#</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Create a trend logs for the following to record data on hourly intervals for 72 hours: a. Status b. Alarms</td>
<td>The trend log data shows the system to be functioning normally over the 72 hour period.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Record current set points and parameters for comparison to trend data</td>
<td><strong>Parameter:</strong></td>
<td><strong>Set-point</strong></td>
<td><strong>Value</strong></td>
</tr>
</tbody>
</table>

---

**Notes and Issues shall be logged in the Commissioning Issues Report and assigned a CIR number**
Notes and Issues Summary:

**Summary of Test Results:**
This test is accepted by the parties identified below. Any Corrective Issues noted above do not adversely impact the overall performance of the system.

**Acceptance of Test:**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commissioning Authority</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF TEST
This Pre-Functional Checklist is used during the Commissioning Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Performance Testing of related building systems. This Checklist does not take the place of the manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 5 Sections and is to be completed by the Contractor in 5 separate phases. As each Section is completed, the Contractor shall update the binder of Checklists that resides at the site. Upon completion of the Checklist, the Contractor shall forward the completed Checklist to the Government, in the same manner as that specified for other submittals. The Resident Office shall distribute to the Commissioning Authority and - if required - to other agencies/offices.

Unless otherwise directed by the Contracting Officer or Contracting Officer’s Representative, the Contractor shall provide electronic copies of the form per contract documents sections 01 30 00 ADMINISTRATIVE REQUIREMENTS paragraph 1.3 ELECTRONIC MAIL (E-MAIL), and 01 33 00 SUBMITTAL PROCEDURES.

When completing each Section, be sure to check and initial EACH line item as being completed. The Contractor shall complete and initial ALL of each Section’s items before sending the form to the Government. The Contractor should contact the Contracting Officer should there be any questions regarding completion of information on this form.
### DESIGN INFORMATION: Energy Recovery Ventilator

<table>
<thead>
<tr>
<th>PARAMETERS:</th>
<th>Design</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENERGY RECOVERY VENTILATOR UNIT (ERV-1, ERV-2)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Greenheck</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>ERCH-20-30L</td>
<td></td>
</tr>
<tr>
<td>Electrical volts/Φ/Hz</td>
<td>208/3/60</td>
<td></td>
</tr>
<tr>
<td><strong>Controls:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated</td>
<td>Factory installed manufacturer</td>
<td>Y / N</td>
</tr>
<tr>
<td>Communication</td>
<td>BACnet on MS/TP bus</td>
<td>Y / N</td>
</tr>
<tr>
<td>Air Flow Measuring Station</td>
<td>Furnished installed</td>
<td>Y / N</td>
</tr>
<tr>
<td><strong>Heat Recovery Wheel:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Total Enthalpy Desiccant</td>
<td></td>
</tr>
<tr>
<td>Dampers</td>
<td>Backdraft Dampers present</td>
<td>Y / N</td>
</tr>
</tbody>
</table>

| | Supply | Exhaust |
| Fan | - | - |
| CFM / E.S.P."W.C." | 2160 / 0.75 | |
| Type | Centrifugal Direct Drive | |
| Motor | Inverter Duty | |
| Speed control | VFD | |
| Supply Fan Size H.P. | 2.0 | --- |
| Exhaust Fan Size H.P. | 3.0 | --- |
| **Filters** | | |
| Size | 1-Inch | |
| Filter classification | Pleated throw-away | |

### COMMENTS:
SECTION 1 – EQUIPMENT DELIVERY:
The Contractor shall complete Section 1 when the equipment is delivered to the site. The purpose is to record the actual design parameters listed, along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be indicated as incomplete, the Contractor shall provide explanation, and immediately notify the Resident Office.

SECTION 2 – EQUIPMENT INSTALLATION:
The Contractor shall complete Section 2 when the installation of the equipment is being performed. The purpose of this Section is to ensure the equipment is installed to the Project Design and the Manufacturer’s recommendations. Provide explanation, and notify the Resident Office should any item be indicated as incomplete.

SECTION 3 – EQUIPMENT START-UP:
The Contractor shall complete Section 3 during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

SECTION 4 – DDC/EMCS CONTROL & INTEGRATION:
The Contractor shall complete Section 4 during the DDC/EMCS configuration and integration process for the system. The purpose of this Section is to document the full control and monitoring capabilities of the DDC/EMCS system including alarms, trends and full range of the sequence of operations.

SECTION 5 – COMPLETION & NOTIFICATION FOR TESTING:
The Contractor shall complete Section 5 to confirm that the equipment is properly installed, has been properly started up, is operational, and ready for functional performance testing to be witnessed by the Government.
### CHECKLIST ITEMS: Energy Recovery Ventilator

<table>
<thead>
<tr>
<th>Sect.</th>
<th>ID</th>
<th>Initial</th>
<th>Complete</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.1</td>
<td>Y / N</td>
<td></td>
<td>All related submittals approved by A/E.</td>
</tr>
<tr>
<td></td>
<td>1.2</td>
<td>Y / N</td>
<td></td>
<td>Equipment received is per project specifications and approved submittal.</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>Y / N</td>
<td></td>
<td>Equipment thoroughly inspected for physical damage.</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>Y / N</td>
<td></td>
<td>Equipment and control devices have been protected from moisture, dirt and other contaminates prior to installation.</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>Y / N</td>
<td></td>
<td>Installation / Maintenance Manuals received and submitted for review.</td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>Y / N</td>
<td></td>
<td>Factory QA/QC Test Reports received and submitted for review.</td>
</tr>
<tr>
<td></td>
<td>2.1</td>
<td>Y / N</td>
<td></td>
<td>Equipment installed at location specified in approved project documentation and drawings.</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>Y / N</td>
<td></td>
<td>Equipment is accessible for future maintenance &amp; repair.</td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>Y / N</td>
<td></td>
<td>All shipping materials and supports removed.</td>
</tr>
<tr>
<td></td>
<td>2.4</td>
<td>Y / N</td>
<td></td>
<td>Equipment is clean and free construction debris.</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>Y / N</td>
<td></td>
<td>Verify the ERV is secure on mountings and supporting devices.</td>
</tr>
<tr>
<td></td>
<td>2.6</td>
<td>Y / N</td>
<td></td>
<td>Ductwork and piping including drain lines are properly installed.</td>
</tr>
<tr>
<td></td>
<td>2.7</td>
<td>Y / N</td>
<td></td>
<td>All piping and duct insulation installed.</td>
</tr>
<tr>
<td></td>
<td>2.8</td>
<td>Y / N</td>
<td></td>
<td>Electrical power conduit, wiring and components are installed and labeled.</td>
</tr>
<tr>
<td></td>
<td>2.9</td>
<td>Y / N</td>
<td></td>
<td>Electrical power wiring including grounded is properly terminated. All connections have been torqued to proper specifications.</td>
</tr>
<tr>
<td></td>
<td>2.10</td>
<td>Y / N</td>
<td></td>
<td>Proper motor overload protection provided.</td>
</tr>
<tr>
<td></td>
<td>2.11</td>
<td>Y / N</td>
<td></td>
<td>All electrical safety devices and guards are installed.</td>
</tr>
<tr>
<td></td>
<td>2.12</td>
<td>Y / N</td>
<td></td>
<td>Equipment labels are permanently attached.</td>
</tr>
<tr>
<td></td>
<td>2.13</td>
<td>Y / N</td>
<td></td>
<td>Verify bearings are properly lubricated.</td>
</tr>
<tr>
<td></td>
<td>2.14</td>
<td>Y / N</td>
<td></td>
<td>Fan has free rotation.</td>
</tr>
<tr>
<td></td>
<td>2.15</td>
<td>Y / N</td>
<td></td>
<td>Verify that all setscrews and fasteners on the fan assemblies are still tight.</td>
</tr>
<tr>
<td></td>
<td>2.16</td>
<td>Y / N</td>
<td></td>
<td>Verify fan spring adjustment and that the fan assembly is level.</td>
</tr>
<tr>
<td></td>
<td>2.17</td>
<td>Y / N</td>
<td></td>
<td>Protective guards properly installed.</td>
</tr>
<tr>
<td></td>
<td>2.18</td>
<td>Y / N</td>
<td></td>
<td>Filters installed and clean.</td>
</tr>
<tr>
<td></td>
<td>2.19</td>
<td>Y / N</td>
<td></td>
<td>All Contractors’ installation documentation is completed and submitted to Government for review.</td>
</tr>
<tr>
<td></td>
<td>2.20</td>
<td>Y / N</td>
<td></td>
<td>Equipment is ready for Start-Up.</td>
</tr>
<tr>
<td>Sect.</td>
<td>ID</td>
<td>Initial</td>
<td>Complete</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>----</td>
<td>---------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Manufacturers Rep on site for start-up.</td>
</tr>
<tr>
<td></td>
<td>3.1</td>
<td></td>
<td></td>
<td>All dust and construction debris removed from all sections.</td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>All quality assurance testing completed and reports submitted.</td>
</tr>
<tr>
<td></td>
<td>3.3</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Dampers operate full stroke without binding.</td>
</tr>
<tr>
<td></td>
<td>3.4</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Power supply energized and properly identified for ERV.</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>All dust and construction debris removed from all sections.</td>
</tr>
<tr>
<td></td>
<td>3.6</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Motor voltages balanced and within normal limit.</td>
</tr>
<tr>
<td></td>
<td>3.7</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Motor amperages balanced and within normal limits.</td>
</tr>
<tr>
<td></td>
<td>3.8</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>For 3 phase motors, fan rotations are correct.</td>
</tr>
<tr>
<td></td>
<td>3.9</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>All Contractors’ start-up documentation is completed and submitted for review.</td>
</tr>
<tr>
<td></td>
<td>4.1</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Sequence of operations including all interlocks, safeties and alarms are functional per Basis of Design and Construction Documents.</td>
</tr>
<tr>
<td></td>
<td>4.2</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Point-to-point verifications have been completed.</td>
</tr>
<tr>
<td></td>
<td>4.3</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>DDC/EMCS monitoring points installed and functional.</td>
</tr>
<tr>
<td></td>
<td>4.4</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Graphics are completed and submitted to Government for approval.</td>
</tr>
<tr>
<td></td>
<td>4.5</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>All safety devices installed and checked.</td>
</tr>
<tr>
<td></td>
<td>4.6</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Trend data of control variables show stable operation.</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>All installation, testing, maintenance and warranty documentation has been submitted for review by CxA.</td>
</tr>
<tr>
<td></td>
<td>5.2</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>New filters have been installed.</td>
</tr>
<tr>
<td></td>
<td>5.3</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Test and balance activities are complete and reports submitted for review.</td>
</tr>
<tr>
<td></td>
<td>5.4</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>Specified extra materials turned over to Government.</td>
</tr>
<tr>
<td></td>
<td>5.5</td>
<td></td>
<td><strong>Y / N</strong></td>
<td>System is operational and ready for CxA Functional Testing.</td>
</tr>
</tbody>
</table>

**COMMENTS:**

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JEG Project No: F9W98914  
4 FSRM Projects, Camp Lejeune, NC  
Page 5 of 6  
Example PFC.doc
General Contractor / Subcontractor Completion:

The following contractors have verified all items associated with this system are complete and ready for functional performance testing to be witnessed by the Government and the Government’s Commissioning Authority.

Mechanical Contractor: ______________________  Date: _________

Electrical Contractor: ______________________  Date: _________

Test & Balance Contractor: ______________________  Date: _________

Controls Contractor: ______________________  Date: _________

Construction Manager: ______________________  Date: _________

COMMENTS:
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 A10.6  (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)


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

40 CFR 61  National Emission Standards for Hazardous Air Pollutants

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, 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. The work of this section is to be performed in a manner that maximizes the value derived from the salvage and recycling of materials. 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 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 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

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

SD-07 Certificates

Demolition Plan

Proposed demolition and removal procedures for approval before work is started.

SD-11 Closeout Submittals

Receipts

Receipts and bills of laden, as specified.

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify 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. 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 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure 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

Not used.

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. Remove meters and related equipment and deliver to a location on the station in accordance with instructions of the Contracting Officer.

3.1.2 Paving and Slabs

Sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat sawcuts at limits of pavement removal as indicated. Pavement and slabs not to be used in this project shall be removed from the Installation at Contractor's expense.

3.1.3 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. 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.

3.1.4 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 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 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.

3.3.2 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable combustible material in a properly permitted sanitary landfill area located off the site.

3.4 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.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.5.3 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.

3.6 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 --
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 INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z88.6 (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)


ASTM INTERNATIONAL (ASTM)


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

29 CFR 1926.103 Respiratory Protection
29 CFR 1926.1101 Asbestos
29 CFR 1926.59 Hazard Communication
40 CFR 61-SUBPART M National Emission Standard for Asbestos
40 CFR 763 Asbestos

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

ND OPNAVINST 5100.23 (2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Sep 2014) Standard for High-Efficiency Particulate, Air Filter Units
17-0016, Interior and Exterior Repairs, Bldg. 523

1.2 DEFINITIONS

1.2.1 ACM

Asbestos Containing Materials.

1.2.2 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 0.00042 psi.

1.2.3 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one percent.

1.2.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.7 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

1.2.8 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

1.2.9 Contractor

The Contractor is that individual, or entity under contract to the Navy to perform the herein listed work.

1.2.10 Competent Person

A person meeting the requirements for competent person as specified in
29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for project designer or supervisor, or its equivalent. The competent person shall have a current State of North Carolina asbestos contractors or supervisors license.

1.2.11 Encapsulation

The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.

1.2.12 Encapsulants

Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

a. Removal Encapsulant (can be used as a wetting agent)
b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)
c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)
d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

1.2.13 Friable Asbestos Material

One percent asbestos containing material that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

1.2.14 Glovebag Technique

Those asbestos removal and control techniques put forth in 29 CFR 1926.1101 Appendix G.

1.2.15 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

1.2.16 Navy Consultant (NC)

That qualified person employed directly by the Government to monitor, sample, inspect the work or in some other way advise the Contracting Officer. The NC is normally a private consultant, but can be an employee of the Government.
1.2.17 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.

1.2.18 Nonfriable Asbestos Material

Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

1.2.19 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

1.2.20 Private Qualified Person (PQP)

That qualified person hired by the Contractor to perform the herein listed tasks.

1.2.21 Qualified Person (QP)

A Registered Architect, Professional Engineer, Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan as described in 40 CFR 763 as a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer; and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The QP must be qualified to perform visual inspections as indicated in ASTM E1368. The QP shall be appropriately licensed in the State of North Carolina.

1.2.22 TEM

Refers to Transmission Electron Microscopy.

1.2.23 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

1.2.24 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 0.00042 psi.

1.3 REQUIREMENTS

1.3.1 Description of Work

The work covered by this section includes the handling and control of
asbestos containing materials and describes some of the resultant
procedures and equipment required to protect workers, the environment and
occupants of the building or area, or both, from contact with airborne
asbestos fibers. The work also includes the disposal of any asbestos
containing materials generated by the work. More specific operational
procedures shall be outlined in the Asbestos Hazard Abatement Plan called
for elsewhere in this specification. The asbestos work includes the
demolition and removal the nine inch tile as indicated on drawings. Under
normal conditions non-friable or chemically bound materials containing
asbestos would not be considered hazardous; however, this material may
release airborne asbestos fibers during demolition and removal and
therefore must be handled in accordance with the removal and disposal
procedures as specified herein. Provide techniques as outlined in this
specification. The Navy will evacuate the work area during the asbestos
abatement work. All asbestos removal work shall be supervised by a
competent person as specified herein.

1.3.2 Medical Requirements

Provide medical requirements including but not limited to medical
surveillance and medical record keeping as listed in 29 CFR 1926.1101.

1.3.2.1 Medical Examinations

Before exposure to airborne asbestos fibers, provide workers with a
comprehensive medical examination as required by 29 CFR 1926.1101 or other
pertinent State or local directives. This requirement must have been
satisfied within the 12 months prior to the start of work on this
contract. The same medical examination shall be given on an annual basis
to employees engaged in an occupation involving asbestos and within 30
calendar days before or after the termination of employment in such
occupation. Specifically identify x-ray films of asbestos workers to the
consulting radiologist and mark medical record jackets with the word
"ASBESTOS."

1.3.2.2 Medical Records

Maintain complete and accurate records of employees' medical examinations,
medical records, and exposure data for a period of 50 years after
termination of employment and make records of the required medical
examinations and exposure data available for inspection and copying to:
The Assistant Secretary of Labor for Occupational Safety and Health (OSHA),
or authorized representatives of them, and an employee's physician upon the
request of the employee or former employee.

1.3.3 Employee Training

Submit certificates, prior to the start of work but after the main
abatement submittal, signed by each employee indicating that the employee
has received training in the proper handling of materials and wastes that
contain asbestos in accordance with 40 CFR 763; understands the health
implications and risks involved, including the illnesses possible from
exposure to airborne asbestos fibers; understands the use and limits of the
respiratory equipment to be used; and understands the results of monitoring
of airborne quantities of asbestos as related to health and respiratory
equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis.
Certificates shall be organized by individual worker, not grouped by type
of certification. Train all personnel involved in the asbestos control
work in accordance with United States Environmental Protection Agency
(USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. The Contractor shall document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer. Furnish each employee with respirator training and fit testing administered by the PQP as required by 29 CFR 1926.1101. Fully cover engineering and other hazard control techniques and procedures. All asbestos workers shall have a current State of North Carolina asbestos worker's license.

1.3.4 Permits, Licenses, and Notifications

Obtain necessary permits and licenses in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by Federal, State, regional, and local authorities prior to the start of work. Notify the State's environmental protection agency and the Contracting Officer in writing 20 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M. Notify the Contracting Officer and other appropriate Government agencies in writing 20 working days prior to the start of asbestos work as indicated in applicable laws, ordinances, criteria, rules, and regulations. Submit copies of all Notifications to the Contracting Officer.

1.3.5 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61-SUBPART A, 40 CFR 61-SUBPART M, and ND OPNAVINST 5100.23. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government shall apply.

1.3.6 Respiratory Protection Program

Establish and implement a respirator program as required by AIHA Z88.6, 29 CFR 1926.1101, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

1.3.7 Asbestos Hazard Control Supervisor

The Contractor shall be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

1.3.8 Hazard Communication

Adhere to all parts of 29 CFR 1926.59 and provide the Contracting Officer with a copy of the Material Safety Data Sheets (MSDS) for all materials brought to the site.
1.3.9  Asbestos Hazard Abatement Plan

Submit a detailed plan of the safety precautions such as lockout, tagout, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal and demolition of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, shall be prepared, signed, and sealed by the PQP. Provide a Table of Contents for each abatement submittal, which shall follow the sequence of requirements in the contract. Such plan shall include but not be limited to the precise personal protective equipment to be used including, but not limited to, respiratory protection, type of whole-body protection and if reusable coveralls are to be employed decontamination methods (operations and quality control plan), the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan shall also include (both fire and medical emergency) response plans. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor, and PQP shall meet with the Contracting Officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

1.3.10  Landfill Approval

Submit written evidence that the landfill is for asbestos disposal by the U.S. Environmental Protection Agency, Region 3, Air Enforcement Section (38W12), and local regulatory agencies. Within 3 working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within 1 day of the shipment leaving the project site.

1.3.11  Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work but after the main abatement submittal.

1.4  SUBMITTALS

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

   SD-03 Product Data
Amended Water;

Material Safety Data Sheets (Msds) for all materials proposed for transport to the project site;

SD-06 Test Reports

Asbestos Disposal Quantity Report;

SD-07 Certificates

Asbestos Hazard Abatement Plan;

Private Qualified Person Documentation;
Contractor's License;
Competent Person documentation;
Worker's License;
Landfill Approval;
Employee Training;
Medical Certification requirements;
Waste Shipment Records and if applicable exemption report; G Respiratory Protection Program;
Delivery Tickets;
Notifications

Show compliance with ASSE Z9.2 by providing manufacturers' certifications.

SD-11 Closeout Submittals

Notifications;

Permits and Licenses;

1.5 QUALITY ASSURANCE

1.5.1 Private Qualified Person Documentation
Submit the name, address, and telephone number of the Private Qualified Person (PQP) selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as a Building Inspector, Contractor/Supervisor Abatement Worker, and Asbestos Project Designer as described by 40 CFR 763 and has successfully completed the National Institute of Occupational Safety and Health (NIOSH) 582 course "Sampling and Evaluating Airborne Asbestos Dust" or equivalent. The PQP shall be appropriately licensed in the State of North Carolina. The PQP and the asbestos contractor shall not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP shall be a first tier subcontractor.

1.5.2 Competent Person Documentation
Submit training certification and a current State of North Carolina Asbestos Contractor's and Supervisor's License.

1.5.3 Worker's License
Submit documentation that requires all workers have a current State of North Carolina Asbestos Workers License.

1.5.4 Contractor's License
Contractor shall have current North Carolina asbestos contractor's license. Submit a copy of the asbestos contractor's license issued by the State of North Carolina.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 WORK PROCEDURE

Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, and as specified herein. Use wet or if given prior
EPA approval, dry removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics shall not be permitted in the asbestos work or control areas. Personnel of other trades not engaged in the removal and demolition of asbestos containing material shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel. Seal all roof top penetrations, except plumbing vents, prior to asbestos roofing work. Shut down the building heating, ventilating, and air conditioning system, cap the openings to the system, prior to the commencement of asbestos work. Disconnect electrical service when wet removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any water. If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the Contracting Officer including clearance sampling, prior to resumption of work.

3.1.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the PQP work may proceed at the discretion of the Contracting Officer.

3.1.2 Removal Procedures

Wet asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation, wrap the pipes and insulation in plastic and remove the pipe by sections. Asbestos containing material shall be containerized while wet. At no time shall asbestos material be allowed to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

3.1.2.1 Sealing Contaminated Items Designated for Disposal

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lock-down encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lock-down encapsulant shall be tinted a contrasting
color. It shall be spray-applied by airless method. Thoroughness of sealing operation shall be visually gauged by the extent of colored coating on exposed surfaces. Lock-down encapsulants shall comply with the performance requirements specified herein.

3.1.3 Site Inspection

While performing asbestos engineering control work, the Contractor shall be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation shall be at the Contractor's expense.

3.2 CLEAN-UP AND DISPOSAL

3.2.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the enclosure removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor shall re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry will be permitted. The Government shall have the option to perform monitoring to determine if the areas are safe before entry is permitted.

3.2.2 Title to Materials

All waste materials, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable local, State, and Federal regulations and herein.

3.2.3 Disposal of Asbestos

3.2.3.1 Procedure for Disposal

Collect asbestos waste, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the
bags or use at least 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag. The name of the waste generator and the location at which the waste was generated shall be clearly indicated on the outside of each container. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Procedure for hauling and disposal shall comply with 40 CFR 61-SUBPART M, State, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

3.2.3.2 Asbestos Disposal Quantity Report

Direct the PQP to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as described initially in this specification and in cubic feet for the amount of asbestos containing material released for disposal.

-- End of Section --
PART 1   GENERAL

1.1   GENERAL REQUIREMENTS

The work covered by this section consists of preparing seedbeds; furnishing and placing limestone, fertilizer, and seed; compacting seedbeds; furnishing, placing, and securing mulch; mowing; and other operations necessary for the permanent establishment of grasses.

Seeding and mulching shall be performed on all earth areas disturbed by construction. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth.

The quantity of mowing to be performed will be affected by the actual conditions which occur during the construction of the project. The quantity of mowing may be increased, decreased, or eliminated entirely at the direction of the Contracting Officer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

PART 2   PRODUCTS

2.1   FERTILIZER

The quality of all fertilizer and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Fertilizer Law and with the rules and regulations, adopted by the North Carolina Board of Agriculture in accordance with the provisions of said law, in effect at the time of sampling. Fertilizer shall be 10-10-10. Dry fertilizer shall have been manufactured from cured stock. Liquid fertilizer shall be stored and cared for after manufacture in a manner that will prevent loss of plant food values.

2.2   LIMESTONE

The quality of all limestone and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Lime Law and with the rules and regulations adopted by the North Carolina Board of. Limestone shall be agricultural grade ground Dolomitic limestone. All limestone shall contain not less than 90 percent calcium carbonate equivalents. Dolomitic limestone shall contain not less than 10 percent of magnesium. Dolomitic limestone shall be so graded that at least 90 percent will pass through a U.S. Standard 20 mesh screen, and at least 35 percent will pass through a U.S. Standard 100 mesh screen.

2.3   SOD

Sod shall consist of a live, dense, well rooted growth of centipede grass free from an excessive amount of restricted noxious weeds as defined by the
North Carolina Board of Agriculture. The area from which sod is to be
obtained shall have been mowed to a height of not less than 2 inches. Sod
shall be cut into rectangular sections of sizes convenient for handling
without breaking or loss of soil. It shall be cut with a sod cutter or
other acceptable means to a depth that will retain in the sod practically
all of the dense root system of the grass. During wet weather the sod
shall be allowed to dry sufficiently before lifting to prevent tearing
during handling and placing, and during extremely dry weather it shall be
watered before lifting if such watering is necessary to insure its vitality
and to prevent loss of soil during handling.

2.4 MULCH FOR EROSION CONTROL

Mulch for erosion control shall consist of grain straw or other acceptable
material, and shall have been approved by the Contracting Officer before
being used. All mulch shall be reasonably free from mature seed bearing
stalks, roots, or bulblets. Material for holding mulch in place shall be
asphalt or other approved binding material.

2.5 SEED

The quality of all seed and all operations in connection with the
furnishing of this material shall comply with the requirements of the North
Carolina Seed Law and with the rules and regulations adopted by the North
Carolina Board of Agriculture. Seed shall have been approved by the North
Carolina Department of Agriculture before being sown. No seed will be
accepted with a date of test more than 8 months prior to the date of
sowing, excluding the month in which the test was completed. Seed mix by
weight shall be as specified on the plans.

2.6 MATTING FOR EROSION CONTROL

2.6.1 General

Matting for erosion control shall be or excelsior matting. Other
acceptable material manufactured especially for erosion control may be used
when approved by the Contracting Officer in writing before being used.
Matting for erosion control shall not be dyed, bleached, or otherwise
treated in a manner that will result in toxicity to vegetation.

2.6.2 Erosion Control Matting

Matting shall consist of a machine produced mat of curled wood excelsior a
minimum of 47 inches in width. The mat shall weigh 1.6 pounds per square
yard with a tolerance of plus or minus 10 percent. At least 80 percent of
the individual fibers shall be 6 inches or more in length. The fibers
shall be evenly distributed over the entire area of the blanket. One side
of the excelsior matting shall be covered with an extruded plastic mesh.
The mesh size for the plastic mesh shall be a maximum of 1 inch x 1 inch.

2.6.3 Wire Staples

Staples shall be machine made of No. 11 gage new steel wire formed into a
"U" shape. The size when formed shall be not less than 6 inches in length
with a throat of not less than 1 inch in width.

2.7 WATER

Water used in the planting or care of vegetation shall meet the requirements
17-0016, Interior and Exterior Repairs, Bldg. 523

of Class C fresh waters as defined in 15 NAC 2B.0200.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The work shall be performed immediately upon completion of earthwork areas. No exception will be made to this requirement unless otherwise permitted in writing by the Contracting Officer. Upon failure or neglect on the part of the Contractor to coordinate his grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, the Contracting Officer may suspend the Contractor's operations until such time as the work is coordinated in a manner acceptable to the Contracting Officer.

3.2 SEEDBED PREPARATION

The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. The soil shall then be scarified or otherwise loosened to a depth of not less than 3 inches except as otherwise provided below or otherwise directed by the Contracting Officer. Clods shall be broken and the top 2 to 3 inches of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by the Contracting Officer. All rock and debris 3 inches or larger shall be removed prior to the application of seed and fertilizer. On cut slopes that are \(2:1\) and steeper, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by the Contracting Officer, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge. On cut slopes that are either \(2:1\) or steeper, the Contracting Officer may permit the preparation of a partial or complete seedbed during the initial grading of the slope. If at the time of final sodding and mulching operations such initial preparation is still in a condition acceptable to the Contracting Officer, additional seedbed preparation may be reduced or eliminated. Seedbed preparation within 2 feet of the edge of any pavement shall be limited to a depth of 2 to 3 inches. The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when the Contracting Officer determines that it is an otherwise unfavorable working condition.

3.3 LIMESTONE AND FERTILIZER

Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed and then harrowed, raked, or otherwise thoroughly worked into the seedbed. Apply fertilizer at the rate as specified on the plans. Apply lime at the rate as specified on the plans. Application equipment for liquid fertilizer, other than a hydraulic seeder, shall be calibrated to ensure that the required rate of fertilizer is applied uniformly.

3.4 SODDING

Extreme care shall be exercised to prevent breaking the sod sections and to prevent the sod from drying out. Any sod that is torn, broken, or too dry will be rejected. Torn or broken sod, if kept moist, may be used for filling unavoidable small gaps in sod cover as permitted by the Contracting Officer. Sod shall be placed on the designated areas within 24 hours after
being cut. The area to be sodded shall be brought to a firm uniform surface. The limestone and fertilizer shall be distributed uniformly over the area. The area shall be roughened by means of picks, rakes, or other approved means to a depth of not less than 2 inches without distorting the uniformity of the surface. The finished surface shall be moistened with water prior to placing the sod. Within 24 hours after soil preparation has been completed, place the sod. Each piece of sod shall be packed tightly against the edge of adjacent pieces so that the fewest possible gaps will be left between the pieces. Unavoidable gaps shall be closed with small pieces of sod. Sod shall be placed beginning at either the top or the toe of the slope. Sod shall be placed with the long edge horizontal and with staggered vertical joints. The edge of the sod shall be turned slightly into the ground at the top of a slope and a layer of earth placed over it and tamped as to conduct the surface water over and onto the top of the sod. On all slopes 2:1 or steeper, in drainage channels, and on any areas that are in such condition that there is danger of sod slipping, sod shall be stapled in place by driving staples flush with the sod. Stapling shall be done concurrently with sod placement and prior to tamping. Use wire staples, per Section 2.6.3. The number of staples shall be sufficient to prevent slipping or displacement of the sod. Staples shall be driven perpendicular to the slope. Where backfill is necessary on cut slopes to obtain a uniform sodding area, staples shall be of sufficient length to reach a minimum of 3 inches into the solid earth underneath the backfill. Sod shall not be placed when the atmospheric temperature is below 32 degrees F. Frozen sod shall not be used. After sod has been placed and tamped, it shall be carefully and thoroughly watered as required to maintain the sod in a healthy condition. Watering shall be conducted until final acceptance. Application of water may be made by the use of hydraulic seeding equipment, farm type irrigation equipment, or by other acceptable means.

3.5 MULCHING

All seeded areas shall be mulched. Grain straw or excelsior mat may be used as mulch at any time of the year. Mulch shall be applied within 24 hours after completion of seeding unless otherwise permitted by the Contracting Officer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture. Mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of the Contracting Officer. Where the binding material is not applied directly with the mulch it shall be applied immediately following the mulch application. During the application of binding material, adequate precautions shall be taken to prevent damage to vehicles, structures, guardrails, and devices. Areas where seeding and mulching have been performed shall be maintained in a satisfactory condition until final acceptance of the project. Maintenance shall include mowing at the location and times directed by the Contracting Officer. Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by the Contracting Officer. Excelsior matting shall be installed on all seeded slopes greater than 3:1 (h:v). Install the matting per the manufacturer's printed instructions.
3.6 SEEDING

Seed shall be distributed uniformly over the seedbed at the rate as specified on the plans. Seed shall be harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be 1/4 inch. When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Contracting Officer. Immediately after seed has been properly covered the seedbed shall be compacted in the manner and degree approved by the Contracting Officer.

-- End of Section --
PART 1   GENERAL

1.1   REFERENCES

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

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

29 CFR 1926.57 Ventilation
29 CFR 1926.62 Lead Exposure in Construction
40 CFR 258 Disposal of Hazardous Materials

UNDERWRITERS LABORATORIES (UL)

UL 586 (2009; Reprint Sep 2014) Standard for High-Efficiency Particulate, Air Filter Units

1.2   DEFINITIONS

1.2.1   Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, "30 micrograms per cubic meter of air" refers to the action level.

1.2.2   Area Monitoring

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.

1.2.3   Physical Boundary

Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."

1.2.4   Certified Industrial Hygienist (CIH)

As used in this section, refers to an Industrial Hygienist employed by the Contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.
1.2.5 Change Rooms and Shower Facilities

Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.

1.2.6 Decontamination Room

Room for removal of contaminated personal protective equipment (PPE).

1.2.7 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.

1.2.8 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

1.2.9 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

1.2.10 Lead Control Area

An enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead-contaminated paint removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

1.2.11 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula:

\[
\text{PEL (micrograms/cubic meter of air)} = \frac{400}{\text{No. hrs worked per day}}
\]

1.2.12 Personal Monitoring

Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and the center at the nose or mouth of an employee.

1.2.13 Paint Stabilization

Utilizing amended water, contractor shall adequately wet the materials to be scraped. Using appropriate non-mechanical hand tools, contractor will scrape the surfaces of loose and peeling paint. The contractor shall collect all paint chips and plastic sheeting and place in 55-gallon drum. Contractor shall vacuum area, equipped with a HEPA filter, and place
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contents in said 55-gallon drum. Contractor shall dispose of drum at appropriate depository. All PWL waste shall be disposed in accordance with EPA and NC regulations. All methods of removal shall be approved by CP. Any components coated with PWL that will be replaced shall be removed intact as a component.

1.3 QUALITY ASSURANCE

1.3.1 Training

Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62.

1.3.2 Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

PART 2 PRODUCTS

2.1 PAINT PREPARATION PRODUCTS

Submit applicable Material Safety Data Sheets for Surface Preparation products used. Use the least toxic product.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Notification

Notify the Contracting Officer 20 days prior to the start of any surface preparation work.

3.1.2 RESERVED

3.1.3 Protection of Existing Work to Remain

Perform surface preparation work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.

3.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass
through the lead control areas. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.

3.1.5 Mechanical Ventilation System

   a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57.

3.2 WORK PROCEDURES

The work includes PAINT STABILIZATION of the noted lead containing painted members. These include painted metal door jamb protection, structural steel, & masonry and concrete, as indicated on drawings. The work includes repainting of existing painted materials. The Contractor shall use appropriate caution during preparation and repainting. If necessary, the work shall include removal of materials coated with lead containing paint. Remove dirt, dust, rust, caulkling, splinters, loose particles, grease, oil, disintegrated coatings, mildew, mold, and other substances deleterious to coating performance. Sand, spackle, and treat defects to render them smooth. Defects are defined as scratches, nicks, cracks, gouges, spills, alligatoring, previous runs, chalking, and irregularities due to partial peeling of previous coatings. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical. On interior surfaces, edges may be filled smooth with joint compound in lieu of sanding. The Contractor is advised of these conditions and shall be responsible for compliance with all EPA, Federal, State and Local Requirements.

3.3 CLEANUP AND DISPOSAL

3.3.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the surface preparation operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area.

3.3.2 Disposal

Dispose of removed materials and associated waste in compliance with Environmental Protection Agency (EPA), Federal, State, and Local requirements and the approved work plans for removal and disposal.

   a. Materials (except metals) coated with lead-contaminated paint which is well adhered shall be disposed of in the Base Sanitary Landfill, provided all Base and Landfill requirements are complied with. Comply with the land disposal restriction notification requirements of 40 CFR 258.

   b. All debris, paint chips, and dust will be considered a hazardous waste. Dispose of this material off Base in an approved hazardous waste facility.

-- End of Section --
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SECTION 03 30 53
MISCELLANEOUS CAST-IN-PLACE CONCRETE
05/14

PART 1   GENERAL

1.1  SUMMARY

Perform all work in accordance with ACI 318.

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 CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117  (2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary

ACI 301  (2016) Specifications for Structural Concrete


ACI 318  (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016) Building Code Requirements for Structural Concrete and Commentary

ACI 347  (2004; Errata 2008; Errata 2012) Guide to Formwork for Concrete


ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M  (2016b) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM A615/A615M  (2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement


ASTM C172/C172M (2014a) Standard Practice for Sampling Freshly Mixed Concrete


ASTM C231/C231M (2014) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method


ASTM C31/C31M (2015a; E 2016) Standard Practice for Making and Curing Concrete Test Specimens in the Field


ASTM C618 (2012a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C685/C685M (2014) Concrete Made by Volumetric Batching and Continuous Mixing

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Ready-Mixed Concrete


ASTM E1745 (2011) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs


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

40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.3 SUBMITTALS

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

SD-02 Shop Drawings
  Installation Drawings

SD-03 Product Data
  Air-Entraining Admixture
  Water-Reducing or Retarding Admixture
  Curing Materials
  Expansion Joint Filler Strips, Premolded
  Formwork
  Ready-Mix Concrete
  Curing Compound
  Air-Entraining Admixtures
  Fly Ash
  Accessories

SD-06 Test Reports
  Aggregates
  Concrete Mixture Proportions
  Compressive Strength Testing
  Slump

SD-07 Certificates
  Cementitious Materials
  Aggregates

SD-08 Manufacturer's Instructions
  Curing Compound

SECTION 03 30 53 Page 3
PART 2  PRODUCTS

2.1  SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each shift in which concrete is produced. Provide a minimum of five specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, two will be tested at 7 days for information and one held in reserve.

2.1.1  Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f’c, but not more than 20 percent, and no individual acceptance test result falls below f’c by more than 500 psi.

2.1.2  Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in ACI 117.

2.1.3  Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f’c is 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 3/4 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water-cementitious material ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

2.2  MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.
2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.2.1.1 Portland Cement

ASTM C150/C150M, Type I including false set requirements with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali content of 0.80 percent Na2Oe (sodium oxide) equivalent.

2.2.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F, including requirements of Tables 1A and 2A.

2.2.2 Aggregates

For fine and coarse aggregates meet the quality and grading requirements of ASTM C33/C33M and test and evaluate for alkali-aggregate reactivity in accordance with ASTM C1260. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. All results of the separate and combination testing must have a measured expansion less than 0.08 percent at 28 days after casting. If the test data indicates an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C1260 and ASTM C1567. Perform the additional testing using ASTM C1260 and ASTM C1567 using the low alkali portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. Use GGBF slag in the range of 40 to 50 percent of the total cementitious material by mass. Use Class F fly ash in the range of 25 to 40 percent of the total cementitious material by mass. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.2.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.
2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; potable, and free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66. Provide mechanical reinforcing bar connectors in accordance with ACI 301 and provide 125 percent minimum yield strength of the reinforcement bar.

2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to ASTM D1752, Type I.

2.2.7 Formwork

Design and engineer the formwork as well as its construction in accordance with ACI 301 Section 2 and 5 and ACI 347. Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

2.2.8 Form Coatings

Provide form coating in accordance with ACI 301.

2.2.9 Vapor Barrier

ASTM E1745 Class C polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.2.10 Curing Materials

Provide curing materials in accordance with ACI 301, Section 5.

2.3 READY-MIX CONCRETE

Provide ready-mix concrete with mix design data conforming to ACI 301 Part 2. Submit delivery tickets in accordance with ASTM C94/C94M for each ready-mix concrete delivery, include the following additional information:

a. Type and brand cement

b. Cement content in 94-pound bags per cubic yard of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixture
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e. Total water content expressed by water cementitious material ratio

2.4 ACCESSORIES

2.4.1 Curing Compound

Provide curing compound conforming to ASTM C309. Submit manufactures instructions for placing curing compound.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Provide all equipment needed to place, consolidate, protect, and cure the concrete at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges, unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.1.3.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to ASTM C685/C685M.

3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with ACI 301, Section 5.

3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with ACI 306R.
3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with ACI 305R

3.3 FINISHING

3.3.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.3.2 Finishing Formed Surfaces

Remove all fins and loose materials, and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Ream or chip surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete and fill with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete. Use a blend of portland cement and white cement in mortar or concrete for repairs to all surfaces permanently exposed to view shall be so that the final color when cured is the same as adjacent concrete.

3.3.3 Finishing Unformed Surfaces

Finish unformed surfaces in accordance with ACI 301, Section 5.

3.3.3.1 Expansion and Contraction Joints

Make expansion and contraction joints in accordance with the details shown or as otherwise specified. Provide 1/2 inch thick transverse expansion joints where new work abuts an existing concrete. Provide expansion joints at a maximum spacing of 30 feet on center in sidewalks and at a maximum spacing of 10 feet in slabs, unless otherwise indicated. Provide contraction joints at a maximum spacing of 5 linear feet in sidewalks and at a maximum spacing of 10 feet in slabs, unless otherwise indicated. Cut contraction joints at a minimum of 1 inch(esa) deep with a jointing tool after the surface has been finished.

3.4 CURING AND PROTECTION

Cure and protect in accordance with ACI 301, Section 5.

3.5 FORM WORK

Provide form work in accordance with ACI 301, Section 2 and Section 5.

3.5.1 Removal of Forms

Remove forms in accordance with ACI 301, Section 2.

3.6 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.
3.6.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI 318 and ACI SP-66. Provide shop details and bending in accordance with ACI 318 and ACI SP-66.

3.6.2 Splicing

Perform splices in accordance with ACI 318 and ACI SP-66.

3.6.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.7 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period. See Section 01 45 10 QUALITY CONTROL.

3.7.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.7.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

3.7.3 Sampling and Testing

a. Obtain samples and test concrete for quality control during placement. Sample fresh concrete for testing in accordance with ASTM C172/C172M. Make six test cylinders.

b. Test concrete for compressive strength at 7 and 28 days for each design mix and for every 100 cubic yards of concrete. Test two cylinders at 7 days; two cylinders at 28 days; and hold two cylinders in reserve. Conform test specimens to ASTM C31/C31M. Perform compressive strength testing conforming to ASTM C39/C39M.

c. Test slump at the site of discharge for each design mix in accordance with ASTM C143/C143M. Check slump once during each shift that concrete is produced for each strength of concrete required.

d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or extremely porous aggregates in accordance with ASTM C173/C173M. Check air content at least once during each shift that concrete is placed for each strength of concrete required.

e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M. Check concrete temperature at least once.
during each shift that concrete is placed for each strength of concrete required.

3.7.4 Action Required

3.7.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

3.7.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.7.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

-- End of Section --
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SECTION 05 51 00

METAL STAIRS

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)


AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)


AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 2015) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)


ASTM INTERNATIONAL (ASTM)


17-0016, Interior and Exterior Repairs, Bldg. 523


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 A924/A924M (2016a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process


1.2 SUBMITTALS

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

SD-02 Shop Drawings

Steel Shapes, Plates, Bars, and Strips

Metal Stair System

SD-03 Product Data

Structural-Steel Plates, Shapes, and Bars

Cold-Finished Steel Bars
17-0016, Interior and Exterior Repairs, Bldg. 523

Galvanized Carbon Steel Sheets
Masonry Anchorage Devices
Protective Coating
Steel Pan Stairs
Steel Stairs
SD-07 Certificates
Welder Qualification
SD-08 Manufacturer’s Instructions
Structural-Steel Plates, Shapes, and Bars
Cold-Finished Steel Bars
Galvanized Carbon Steel Sheets
Protective Coating
Masonry Anchorage Devices

1.3 QUALITY CONTROL

1.3.1 Qualifications for Welding Work

Certify 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, ensure that two test welds are retested immediately and that each test weld is made and passes. Failure in the immediate retest requires that the welder be retested after further practice or training and a complete set of test welds be made.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit complete and detailed fabrication drawings for all steel shapes, plates, bars, and strips used in accordance with the design specifications referenced in this section.

2.2 FABRICATION

Preassemble 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, before cleaning and treating surfaces and applying surface finishes, including zinc coatings.
2.2.1 General Fabrication

Prepare and submit metal stair system shop drawings with detailed plans and elevations at scales not less than 1 inch to 1 foot and with details of sections and connections at scales not less than 3 inches to 1 foot. Also detail the placement drawings, diagrams, and templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchorage devices.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce a finished product that is strong enough and durable enough for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven methods of fabrication and support. Use the 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 with straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Continuously weld corners and seams 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 wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flat-head (countersunk) screws or bolts.

Provide and coordinate anchorage of the type indicated for the supporting structure. Fabricate anchoring devices, and space them as indicated and as necessary 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 as fabricated from cold-finished or cold-rolled stock.

2.2.2 Steel Pan Stairs

2.2.2.1 General

Joining pieces by welding. Fabricate units so that bolts and other fastenings do not appear on finished surfaces. Make joints true and tight, and connections between parts lighttight. Grind continuous welds smooth where exposed.

Construct metal stair units to sizes and arrangements indicated to support a minimum live load of 100 pounds per square foot. Provide framing, hangers, columns, struts, clips, brackets, bearing plates, and other components as required for the support of stairs and platforms.

2.2.2.2 Stair Framing

Fabricate stringers of structural-steel channels, or plates, or a combination thereof as indicated. Provide closures for exposed ends of strings.
Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels, and bolt framing members to stringers and headers.

2.2.2.3 Riser, Subtread, and Subplatform Metal Pans

Form metal pans of 0.1084-inch (12-gage) galvanized structural steel sheets, conforming to ASTM A653/A653M, Grade A, with zinc coating conforming to ASTM A653/A653M and ASTM A924/A924M. Shape the pans to the configuration indicated.

Construct risers and subtread metal pans with steel angle supporting brackets, of the size indicated, welded to stringers. Secure metal pans to brackets with rivets or welds. Secure subplatform metal pans to platform frames with welds.

2.2.2.4 Steel Framing for Concrete Stairs

When necessary, modify fabricated units to fit actual dimensions of the supporting structure. Join steel components by welding. Provide 14-gage steel risers unless otherwise indicated. Arrange components to receive finish materials as indicated.

2.2.3 Protective Coating

Hot-dip galvanize steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.3 COMPONENTS

2.3.1 Steel Stairs

Provide steel stairs complete with stringers, metal-pan concrete-filled treads, landings, columns, handrails, and necessary bolts and other fastenings. Hot-dip-galvanize steel stairs and accessories.

2.3.1.1 Design Loads

Design stairs to sustain a live load of not less than 100 pounds per square foot, or a concentrated load of 300 applied where it is most critical. Except for a commercial product, design and fabricate steel stairs to conform to AISC 360.

2.3.1.2 Materials

Provide steel stairs of welded construction except that bolts may be used where welding is not practicable. Do not use screw or screw-type connections.

a. Structural Steel: ASTM A36/A36M.

b. Support metal pan for concrete fill on angle cleats welded to stringers or treads with integral cleats, welded or bolted to the stringer. Close exposed ends. For exterior stairs, form all exposed joints to exclude water.

c. Before fabrication, obtain necessary field measurements and verify drawing dimensions.
d. Clean metal surfaces free of mill scale, flake rust, and rust pitting before shop finishing. Weld permanent connections. Finish welds flush and smooth on surfaces that will be exposed after installation.

2.3.2 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

a. Lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded-nut type, multiple unit class, Group I, Type 1, Class 2.

b. Bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.

Use toggle bolts of the tumble-wing type, conforming to ASTM A325, ASTM A449, and ASTM C636/C636M, type, class, and style as required.

2.3.3 Fasteners

Select galvanized zinc-coated fasteners conforming to ASTM A153/A153M for exterior applications or where the fasteners are built into exterior walls or floor systems. Select the fasteners for the type, grade, and class required for the installation of steel stair items:

a. Standard/regular hexagon-head bolts and nuts, conforming to ASTM A307, Grade A.

b. Square-head lag bolts conforming to ASME B18.2.1.

c. Cadmium-plated steel machine screws, conforming to ASME B18.6.3.

d. Flat-head carbon steel wood screws, conforming to ASME B18.6.1.


f. Helical-spring, carbon steel lockwashers, conforming to ASME B18.2.1.

2.4 MATERIALS

2.4.1 Structural Steel Plates, Shapes and Bars

Structural-size shapes and plates, conforming to ASTM A36/A36M, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M, unless otherwise noted for steel bars and bar-size shapes.

2.4.2 Cold-Finished Steel Bars

Provide the following:

a. Cold-finished steel bars conforming to ASTM A108, grade as selected by the fabricator.
2.4.3 Galvanized Carbon Steel Sheets

Provide the following:

a. Galvanized carbon steel sheets conforming to ASTM A653/A653M, with galvanizing conforming to ASTM A653/A653M and ASTM A924/A924M.

2.4.4 Steel Pipe

Provide the following:

a. Steel pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

PART 3 EXECUTION

3.1 PREPARATION

Clean surfaces thoroughly before installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

Protect installed products until completion of project. Touch up, repair or replace, damaged products before substantial completion.

3.2 INSTALLATION

Install in accordance with the manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

Install items at locations indicated, according to the manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Ensure that exposed fastenings are compatible with generally match the color and finish of, and harmonize with the material to which they 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 is cause for rejection. Conceal fastenings where practicable. Select thickness of metal and details of assembly and supports that adequately strengthen and stiffen the construction. Form joints exposed to the weather to exclude water.

3.2.1 Field Preparation

Remove rust-preventive coating just before field erection, using a remover approved by the coating manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

3.2.2 Field Welding

Comply with AWS D1.1/D1.1M in executing manual shielded-metal arc welding, (for appearance and quality of new welds) and in correcting existing welding.
3.2.3 Safety Nosings

Completely embed nosing in concrete before the initial set of the concrete occurs and finish flush with the top of the concrete surface.

3.2.4 Touchup Painting

Immediately after installation, clean all field welds, bolted connections, and abraded areas of the shop-painted material, and repaint exposed areas with the same paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 2 mils.

-- End of Section --
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 2015) Structural Welding Code - Steel

**ASTM INTERNATIONAL (ASTM)**


**NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)**


1.2 SUBMITTALS

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

SD-02 Shop Drawings

Fabrication Drawings

Steel Shapes, Plates, Bars and Strips
17-0016, Interior and Exterior Repairs, Bldg. 523

SD-03 Product Data

Structural Steel Plates, Shapes, and Bars
Protective Coating
Steel Railings and Handrails
Anchorage and Fastening Systems

SD-07 Certificates

Welder Qualification

SD-08 Manufacturer's Instructions

Installation Instructions

1.3 QUALITY CONTROL

1.3.1 Welding Procedures

1.3.2 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 and handrails 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 wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

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 Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

a. Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.

b. 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.

c. Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

2.1.2 Protective Coating

Provide hot dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

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; hot dipped galvanized finish; 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.

2.2.4 Steel Railings And Handrails

Design handrails to resist a concentrated load of 250 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. Provide pipe collars of the same material and finish as the handrail and posts.

2.2.4.1 Steel Handrails

Provide steel handrails, steel pipe conforming to ASTM A53/A53M. Provide steel railings of 1-1/2inches nominal size, hot-dip galvanized.

Provide kickplates between railing posts where indicated, and consist of 1/8-inch steel flat bars not less than 6-inches high. Secure kickplates as indicated.

Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

PART 3 EXECUTION

3.1 PREPARATION

Adjust stair railings and handrails prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8-feet on center. 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. After posts have been inserted into sleeves, fill the annular space between post and sleeve with molten lead, sulfur, or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

b. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.
c. Anchor rail ends to steel with steel oval or round flanges welded to tail ends and bolted to the structural steel members.

Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

3.2 INSTALLATION

Submit manufacturer's installation instructions for the following products to be used in the fabrication of steel stair railing and handrail work:

a. Structural steel plates, shapes, and bars
b. Protective coating
c. Steel railings and handrails
d. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings 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 by means of base plates bolted to stringers or structural steel framework. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts.

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 --
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 LUMBER STANDARDS COMMITTEE (ALSC)


AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)


AMERICAN WOOD COUNCIL (AWC)


APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA L870 (2010) Voluntary Product Standard, PS 1-09, Structural Plywood

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)


ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square Neck Bolts


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 F547 (2006; R 2012) Nails for Use with Wood and Wood-Base Materials

INTERNATIONAL CODE COUNCIL (ICC)


NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (2011) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)


REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use (1998) Redwood Lumber Grades and Uses

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)


SOUTHERN PINE INSPECTION BUREAU (SPIB)


U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 2) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

CID A-A-1924 (Rev A; Notice 2) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)
1.2 SUBMITTALS

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

SD-02 Shop Drawings

Nailers and Nailing Strips

SD-03 Product Data

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces
of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

a. Framing lumber and board, 19 percent maximum

b. Timbers 5 inches and thicker, 25 percent maximum

c. Materials other than lumber; moisture content shall be in accordance with standard under which the product is produced

PART 2 PRODUCTS

2.1 MATERIALS

2.2 LUMBER

2.2.1 Structural Lumber

2.2.2 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed.
<table>
<thead>
<tr>
<th>Grading Rules</th>
<th>Species</th>
<th>Framing</th>
<th>Board Lumber</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WWPA G-5 standard grading</strong></td>
<td>Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole</td>
<td>All Species: Standard Light Framing</td>
<td>All Species: No. 3 Common</td>
</tr>
<tr>
<td><strong>WCLIB 17 standard grading</strong></td>
<td>Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock</td>
<td>All Species: Standard Light Framing</td>
<td>All Species: Standard</td>
</tr>
<tr>
<td><strong>rules</strong></td>
<td></td>
<td>or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)</td>
<td></td>
</tr>
<tr>
<td>Grading Rules</td>
<td>Species</td>
<td>Framing</td>
<td>Board Lumber</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>SPIB 1003 standard grading rules</td>
<td>Southern Pine</td>
<td>All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)</td>
<td>No. 2 Boards</td>
</tr>
<tr>
<td>SCMA Spec standard specifications</td>
<td>Cypress</td>
<td>No. 2 Common</td>
<td>No. 2 Common</td>
</tr>
<tr>
<td>NELMA Grading Rules standard grading rules</td>
<td>Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar</td>
<td>All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)</td>
<td>All Species: No. 3 Common except Standard for Eastern White and Northern Pine</td>
</tr>
<tr>
<td>RIS Grade Use standard specifications</td>
<td>Redwood</td>
<td>All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)</td>
<td>Construction Heart</td>
</tr>
<tr>
<td>Grading Rules</td>
<td>Species</td>
<td>Framing</td>
<td>Board Lumber</td>
</tr>
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<tr>
<td>NHLA Rules</td>
<td>Cypress</td>
<td>No. 2 Dimension</td>
<td>No. 2 Common</td>
</tr>
<tr>
<td>for the measurement and inspection of hardwood and cypress lumber</td>
<td></td>
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</tr>
</tbody>
</table>

2.3 OTHER MATERIALS

2.3.1 Roof Decking

Roof decking shall be commercial grade to match existing. Decking shall be 2 inches thick with single tongue and groove V-jointed, matched and dressed.

2.3.2 Miscellaneous Wood Members

2.3.2.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

<table>
<thead>
<tr>
<th>Member</th>
<th>Size inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridging</td>
<td>1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.</td>
</tr>
<tr>
<td>Corner bracing</td>
<td>1 x 4.</td>
</tr>
<tr>
<td>Furring</td>
<td>1 x 2</td>
</tr>
<tr>
<td>Grounds</td>
<td>Plaster thickness by 38.</td>
</tr>
<tr>
<td>Nailing strips</td>
<td>1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.</td>
</tr>
</tbody>
</table>

2.3.2.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

2.3.2.3 Sill Plates

Sill plates shall be standard or number 2 grade.
2.3.2.4 Blocking

Blocking shall be standard or number 2 grade.

2.3.2.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.4 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153/A153M.

2.4.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.4.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.4.3 Expansion Shields


2.4.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.4.5 Wood Screws

ASME B18.6.1.

2.4.6 Nails

ASTM F547, size and type best suited for purpose. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be hot-dipped galvanized in accordance with ASTM A153/A153M. Nailing shall be in accordance with the recommended nailing schedule contained in AWC WFCM. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AWC NDS. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.
2.4.7 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, G90. Steel shall be not lighter than 18 gage. Special nails supplied by the manufacturer shall be used for all nailing.

2.4.8 Panel Edge Clips

Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.5 AIR INFILTRATION BARRIER

Air infiltration barrier shall be building paper meeting the requirements of ASTM C1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of 125 g per square meter per 24 hours in accordance with ASTM E96/E96M, Desiccant Method at 23 degrees C or with a moisture vapor transmission rate of 670 g per square meter per 24 hours in accordance with ASTM E96/E96M, Water Method at 23 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to AWC WFCM unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Do not splice framing members between bearing points. Set joists, rafters, and purlins with their crown edge up. Frame members for the passage of pipes, conduits, and ducts. Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise shall be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts shall be drawn up tight. Use slate or steel shims when leveling joists, beams, and girders on masonry or concrete. Do not use shimming on wood or metal bearings.

3.1.1 Wall Framing

3.1.1.1 Studs

Select studs for straightness and set plumb, true, and in alignment. In walls and partitions more than eight feet tall, provide horizontal bridging at not more than 8 feet o.c. using nominal 2 inch material of the same width as the studs; install the bridging flat. Sizes and spacing of studs shall be as indicated. Double studs at jambs and heads of openings and triple at corners to form corner posts. Frame corner posts to receive sheathing, lath, and interior finish. Truss over openings exceeding 4 feet in width or use a header of sufficient depth. Toe-nail studs to sills or sole plates with four 8-penny nails or fasten with metal nailing clips or connectors. Anchor studs abutting concrete or masonry walls thereto near the top and bottom and at midheight of each story using expansion bolts or powder-actuated drive studs.
3.1.1.2 Plates

Use plates for walls and partitions of the same width as the studs to form continuous horizontal ties. Splice single plates; stagger the ends of double plates. Double top plates in walls and bearing partitions, built up of two nominal 2 inch thick members. Top plates for nonbearing partitions shall be single or double plates of the same size as the studs. Nail lower members of double top plates and single top plates to each stud and corner post with two 16-penny nails. Nail the upper members of double plates to the lower members with 10-penny nails, two near each end, and stagger 16 inches o.c. intermediately between. Nail sole plates on wood construction through the subfloor to each joist and header; stagger nails. Anchor sole plates on concrete with expansion bolts, one near each end and at not more than 6 feet o.c., or with powder-actuated fasteners, one near each end and at not more than 3 feet o.c. Provide plates cut for the passage of pipes or ducts with a steel angle as a tie for the plate and bearing for joist.

3.2 MISCELLANEOUS

3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.2 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

3.2.3 Wood Bumpers

Dress to the sizes indicated, and bevel edges. Bore, countersink, and bolt bumpers in place.

3.2.4 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

3.3 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: \(1/8\) in 8 feet from a true plane.

-- End of Section --
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)


ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds (8th Edition) AWI Quality Standards

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.2 (2009) 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)


1.2   SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework 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

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

SD-02 Shop Drawings
Shop Drawings
Installation
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 Qual Stds, Section 400G and Section 400B 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 Qual Stds requirements, in general, and the specific AWI Qual Stds 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 Lumber

a. All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 3/4 inch hardwood.
2.1.2 Panel Products

2.1.2.1 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 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. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 3 by 3 inches in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.2.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.048 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.2.2 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.

2.2.3 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be 0.042 inches (plus or minus 0.005 inches) in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

2.2.4 Vertical General Purpose Postformable (VGP) Grade

Vertical general purpose postformable 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 components where postforming is required for curved surfaces.

2.2.5 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.

2.3 ADHESIVES, CAULKS, AND SEALANTS

2.3.1 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.

2.3.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use urea-formaldehyde resin formula. Adhesives shall withstand a bond test as described in WDMA I.S. 1-A.

2.3.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be adhesive consistent with AWI and laminate manufacturer's recommendations. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

2.3.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.3.3 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.

2.4 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 Qual Stds, Section 400-G descriptions, shall be flush overlay.

2.4.1 Base and Wall Cabinet Case Body

2.4.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

drawings. **Laminate clad casework** assemblies shall be attached and anchored securely to walls with mechanical fasteners that are appropriate for the wall construction.

3.1.1 Anchoring Systems

3.1.1.1 Wall

   Cabinet 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 **as indicated on drawings**.

3.1.3 Doors and Removable Panels

   The fitting of doors and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with **AWI Qual Stds** custom grade requirements.

   -- End of Section --
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)


INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO Z124.3 (2005) Plastic Lavatories

IAPMO Z124.6 (2007) Plastic Sinks

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)


1.2   SYSTEM DESCRIPTION

a. Work under this section includes **countertops and window sills** 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

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

SD-02 Shop Drawings
   Detail Drawings
   Installation

SD-03 Product Data
   Solid polymer material
   Qualifications
   Fabrications

SD-04 Samples
   Material
   Counter and Vanity Tops

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 Mock-ups

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 IAPMO Z124.3 and IAPMO Z124.6 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 4 by 4 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:
<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>REQUIREMENT (min. or max.)</th>
<th>TEST PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>4000 psi (max.)</td>
<td>ASTM D638</td>
</tr>
<tr>
<td>Hardness</td>
<td>55-Barcol Impresor (min.)</td>
<td>ASTM D2583</td>
</tr>
<tr>
<td>Thermal Expansion</td>
<td>.000023 in/in/F (max.)</td>
<td>ASTM D 696</td>
</tr>
<tr>
<td>Boiling Water Surface Resistance</td>
<td>No Change</td>
<td>ANSI/NEMA LD 3-3.05</td>
</tr>
<tr>
<td>High Temperature Resistance</td>
<td>No Change</td>
<td>ANSI/NEMA LD 3-3.06</td>
</tr>
<tr>
<td>Impact Resistance (Ball drop)</td>
<td></td>
<td>ANSI/NEMA LD 3-303</td>
</tr>
<tr>
<td>1/4 inch sheet</td>
<td>36 inches, 1/2 lb ball, no failure</td>
<td></td>
</tr>
<tr>
<td>1/2 inch sheet</td>
<td>140 inches, 1/2 lb ball, no failure</td>
<td></td>
</tr>
<tr>
<td>3/4 inch sheet</td>
<td>200 inches, 1/2 lb ball, no failure</td>
<td></td>
</tr>
<tr>
<td>Mold &amp; Mildew Growth</td>
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<td>ASTM G21</td>
</tr>
<tr>
<td>Bacteria Growth</td>
<td>No growth</td>
<td>ASTM G21</td>
</tr>
<tr>
<td>Liquid Absorption (Weight in 24 hrs.)</td>
<td>0.1 percent max.</td>
<td>ASTM D570</td>
</tr>
<tr>
<td>Flammability</td>
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<td>ASTM E84</td>
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<tr>
<td>Flame Spread</td>
<td>25 max.</td>
<td></td>
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<tr>
<td>Smoke Developed</td>
<td>30 max.</td>
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</tr>
<tr>
<td>Sanitation</td>
<td>&quot;Food Contact&quot; approval</td>
<td>NSF/ANSI 51</td>
</tr>
</tbody>
</table>

2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be submitted for selection. 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 TCA 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 to be 4 inches high in conformance with dimensions and shapes as indicated on the drawings. Backsplashes and end splashes shall be provided for all counter tops and vanity tops at locations indicated on the drawings. Backsplashes shall be shop fabricated and be loose, to be field attached.

2.3.3.1 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 Window Stools

Fabricate window stools from 1/2 inch thick solid surfacing, solid polymer material. Dimensions, edge shape, and other details shall be as indicated on the drawings.

2.3.5 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. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam.

2.3.5.1 Counter Top With Sink

a. Vitreous China Sink. Countertops with sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for vitreous china rimless 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.

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 or vitreous china sinks and lavatory bowls 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.

3.1.2 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 three 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 --
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 E136  (2012) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C


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

29 CFR 1910.134  Respiratory Protection

1.2  SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket insulation

Accessories

SD-08 Manufacturer's Instructions

Insulation

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 Smoking

Do not smoke during installation of blanket thermal insulation.

1.4.3 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665, Type II, blankets with non-reflecting coverings; Class A, membrane-faced surface with a flame spread of 25 or less and a smoke developed rating of 150 or less when tested in accordance with ASTM E84.

2.1.1 Thermal Resistance Value (R-VALUE)

R-7, 2-3/4" in walls
R-45, 15"-16" in attic

2.1.2 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:

Rock Wool: 75 percent slag
Fiberglass: 20 to 25 percent glass cullet

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

2.2 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.
2.3 ACCESSORIES

2.3.1 Adhesive
As recommended by the insulation manufacturer.

2.3.2 Mechanical Fasteners
Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.3.3 Wire Mesh
Corrosion resistant and as recommended by the insulation manufacturer.

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, compressed insulation, or punctured vapor retarders. 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 INSTALLATION

3.2.1 Insulation
Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.2.1.1 Electrical wiring
Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.2.1.2 Continuity of Insulation
Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, 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.

3.2.1.3 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.

3.2.1.4 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.
3.2.1.5 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

3.2.1.6 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

-- End of Section --
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 D41/D41M** (2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

**UNDERWRITERS LABORATORIES (UL)**


1.2 DEFINITIONS

1.2.1 Top Lap

That portion of shingle overlapping shingle in course below.

1.2.2 Head Lap

The triple coverage portion of top lap which is the shortest distance from the butt edge of an overlapping shingle to the upper edge of a shingle in the second course below.

1.2.3 Exposure

That portion of a shingle exposed to the weather after installation.

1.3 SUBMITTALS

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

SD-03 Product Data
Shingles
Submit data including type, weight, class, UL labels, and special types of underlayment and eave flashing.

SD-04 Samples
Shingles
Full shingle sample and manufacturer's standard size samples of materials and products requiring color or finish selection.

Color Charts: Must be submitted to Camp Lejeune BEAP representative (Base Architect) and architect for approval.

SD-08 Manufacturer's Instructions
Application

SD-11 Closeout Submittals
Manufacturer's Warranty
Contractor's Warranty

1.4 DELIVERY AND STORAGE

Deliver materials in the manufacturer's unopened bundles and containers bearing the manufacturer's brand name. Keep materials dry, completely covered, and protected from the weather. Store according to manufacturer's written instructions. Store roll goods on end in an upright position or in accordance with manufacturer's recommendations. Immediately before laying, store roofing felt for 24 hours in an area maintained at a temperature not lower than 50 degrees F.

1.5 WARRANTIES

Warranties must begin on the date of Government acceptance of the work.

1.5.1 Manufacturer's Warranty

Furnish the asphalt shingle manufacturer's standard 25 year warranty for the asphalt shingles. The warranty must run directly to the Government.

1.5.2 Contractor's Warranty

Provide warranty for 5 years that the asphalt shingle roofing system, as installed, is free from defects in workmanship. When repairs due to defective workmanship are required during the Contractor's warranty period, the Contractor must make such repairs within 72 hours of notification. When repairs are not performed within the specified time, emergency repairs performed by others will not void the warranty.
PART 2   PRODUCTS

2.1   MATERIALS

2.1.1   Shingles

Mineral granule-surfaced asphalt shingles, self-sealing, square tab, strip, fungus-resistant. ASTM D3018/D3018M, Type I, and ASTM D3462/D3462M, architectural shingles weighing not less than 250 pounds per 100 square feet. Shingles must meet the fire resistance requirements of UL 790 for Class A and the wind resistance requirements of ASTM D7158/D7158M, Class H. Color must be as selected from the manufacturer's standard color charts. Shingle color must be submitted to in accordance with Camp Lejeune BEAP representative (Base Architect) and architect for approval.

2.1.2   Self-Adhering Membrane

Self-adhering rubberized asphaltic membrane, a minimum of 40 mils thick, and recommended by the shingle manufacturer for use over entire roof and flashing conditions. Products shall meet or exceed the performance criteria of ASTM D1970/D197M.

2.1.3   Nails for Applying Shingles

Aluminum or hot-dipped galvanized steel or equivalent corrosion resistant with sharp points and flat heads 3/8 to 7/16 inch in diameter. Shank diameter of nails must be a minimum of 0.105 inch and a maximum of 0.135 inch with garb or otherwise deformed for added pull-out resistance. Nails must be long enough to penetrate completely through or extend a minimum of 3/4 inch into roof deck, whichever is less, when driven through materials to be fastened.

2.1.4   Asphalt Roof Cement

ASTM D4586/D4586M, Type II.

2.1.5   Asphalt Primer

ASTM D41/D41M.

2.1.6   Ventilators

2.1.6.1   Nailable Plastic Shingle Over Type Ridge Vents

Ridge vents must be constructed of UV stabilized nailable rigid polypropylene material, approximately 1 foot wide and 1 inch thick, and must be in 4 foot long interlocking sections with self-aligning ends or corrugated polyethylene rigid roll or rigid strip ridge vent with aluminum wind deflectors on each side. Vents must be designed to prevent infiltration of insects, rain, and snow.

2.1.6.2   Nailable Mesh Shingle Over Type Ridge Vents

Ridge vents must be constructed of UV stabilized nailable polyester mesh material, approximately 1 foot wide. Vents must be designed to prevent infiltration of insects, rain, and snow. Fasten with 3" nails at each rafter, no exceptions.
2.1.6.3 Information Placard

Information placard must be 8.5 inch x 11 inch and contain the information contained in Table I. Information on the placard must be typed in Courier New 12 pitch. Manufacturer's Manufacture's and Contractor's information must include a phone number. Placard must be able to be mounted on the inside of a building. Placard can be aluminum or acrylic metal or a sheet of paper inside a standard compatible frame.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

Do not install building construction materials that show visual evidence of biological growth.

Ensure that roof deck is smooth, clean, dry, and without loose knots. Roof surfaces must be firm and free from loose boards, large cracks, and projecting ends that might damage the roofing. Vents and other projections through roofs must be properly flashed and secured in position, and projecting nails must be driven flush with the deck.

3.2 SURFACE PREPARATION

Cover knotholes and cracks with sheet metal nailed securely to sheathing. Flash and secure vents and other roof projections, and drive projecting nails firmly home.

3.3 APPLICATION

Apply roofing materials as specified herein unless specified or recommended otherwise by shingle manufacturer's written instructions.

3.3.1 Underlayment

Provide for roof slopes 4 inches per foot and greater. Apply one layer of shingle underlayment to roof deck. Lay underlayment parallel to roof eaves, starting at eaves. Provide minimum 2 inch head laps, 4 inch end laps, and 6 inch laps from both sides over hips and ridges. Nail sufficiently to hold until shingles are applied. Turn up vertical surfaces a minimum of 4 inches.

Provide for roof slopes between 2 inches per foot and 4 inches per foot. Apply two layers to roof deck. Provide a 19 inch wide strip as starter sheet to maintain specified number of layers throughout roof. Lay parallel to eaves, starting at eaves. Provide minimum 19 inch head laps, 6 inch laps from both sides over hips and ridges, and 12 inch end laps in the field of the roof. Nail sufficiently to hold until shingles are applied. Turn up vertical surfaces a minimum of 4 inches. When a self-adhering membrane is used for eave flashing, start underlayment from upper edge of eave flashing.

3.3.2 Drip Edges

Provide metal drip edges as specified in Section 07 60 00 FLASHING AND SHEET METAL applied directly on the wood deck at eaves and over the underlayment at rakes. Extend back from edge of deck a minimum of 3 inches, and secure with nails spaced a maximum of 4 inches o.c. along inner edge.
3.3.3 Starter Strip

Use a row of shingles with tabs removed and trimmed to ensure that joints are not exposed at shingle cutouts. Apply starter strip along eaves, overlaying and finishing even with lower edge of eave flashing strip overhanging the metal drip edge at eaves and rake edges 1/4 inch to 3/8 inch; fasten in a line parallel to and 3 to 4 inches above eave edge. Place nails so top of nail is not exposed in cutouts of first course of shingles. Seal tabs of first course of shingles, eaves, edges, and rakes with asphalt roof cement as specified below.

3.3.4 Shingle Courses

Start first course with full shingle, and apply succeeding courses with joints staggered at thirds or halves. Butt-end joints of shingles must not align vertically more often than every fourth course. Apply shingle courses as follows:

a. Fastening: Do not drive fasteners into or above the factory-applied adhesive unless adhesive is located 5/8 inch or closer to top of cutouts. Place fasteners so they are concealed by shingle top lap and penetrate the head lap.

b. Shingles applied with nails: Nominal 5 inch exposure. Apply each shingle with minimum of (6) six nails. Place one nail 1 inch from each end, and evenly space nails on a horizontal line a minimum of 5/8 inch above top of cutouts. Cement each tab with one spot of asphalt roof cement placed 1 to 2 inches from bottom edge of shingle.

c. Sealing: Seal each tab with continuous, 9 inch long, 1/4 inch diameter bead of asphalt roof cement, applied to the surface of course below. Place bead on horizontal line 5/8 inch above cutouts so bead will be 1 inch from bottom edge of tab to be sealed and so bead will not show through cutouts. After nailing each shingle, press tabs down to ensure spreading and bonding of asphalt roof cement.

3.3.5 Hips and Ridges

Form with 9 by 12 inch individual shingles or with 12 by 12 inch shingles cut from 12 by 36 inch strip shingles. Bend shingles lengthwise down center with equal exposure on each side of hip or ridge. Lap shingles to provide a maximum 5 inch exposure, and nail each side in unexposed area 5-1/2 inches from butt and 1 inch in from edge.

3.3.6 Valleys

Provide woven valleys.

3.3.6.1 Woven Valleys

Provide valley lining as specified for closed cut valley. Lay valley shingles over lining by either of the following methods:

a. Method I: Apply regular shingles on both roofs simultaneously. Weave each course in turn over the valley. Lay the first regular course of shingles along eaves of roof up to and over valley. Extend course along adjoining roof deck at least 12 inches. Carry first regular course of shingles of adjoining roof over valley on top of previously applied shingles. Lay succeeding courses alternately, weaving valley
shingles over each other for full length of valley.

b. Method II: Apply regular shingles on each roof surface separately to a line about 3 feet from center of valley, and weave valley shingles in place later, as specified for Method I.

In following either method, press shingles tightly into valley, and fasten in normal manner; except apply nails not closer than 6 inches to valley centerline, and apply additional nail in top corner of terminal shingle on both sides of valley.

3.3.7 Flashing

3.3.7.1 Eave Flashing

Provide for roof slopes between 2 inches per foot and 4 inches per foot and greater.

b. From the eaves to the roof peak apply one layer of self-adhering membrane. Follow membrane manufacturer's printed installation instructions.

3.3.7.2 Stepped Flashing

For sloping roofs which abut vertical surfaces, provide stepped metal flashing as specified in Section 07 60 00 FLASHING AND SHEET METAL.

3.3.7.3 Vent and Stack Flashing

Apply shingles up to point where vent or stack pipe projects through roof, and cut nearest shingle to fit around pipe. Before applying shingles beyond pipe, prepare flange of metal pipe vent flashing as specified in Section 07 60 00 FLASHING AND SHEET METAL, by applying a 1/8 inch thick coating of asphalt roof cement on bottom side of flashing flange. Slip flashing collar and flange over pipe, and set coated flange in 1/16 inch coating of asphalt roof cement. After applying flashing flange, continue shingling up roof. Lap lower part of flange over shingles. Overlap flange with side and upper shingles. Fit shingles around pipe, and embed in 1/16 inch thick coating of asphalt roof cement where shingles overlay flange.

Information Placard

Coordinate with Engineering Technician location of plaque inside the building.

TABLE I - ROOF INFORMATION PLACARD
DO NOT MAKE ALTERATIONS OR REPAIRS TO THIS ROOF WITHOUT APPROVAL FROM OWNER
Camp LeJeune, NC
Bldg: ______
Contract No: ________________ Task Order ____

Manufacturer's Warranty:
Expires: ____ _____
Warranty No: ______
Provided By: Company
Address
Phone
Contractor's Warranty:
Expires: ___ ___ ___
Warranty No: ______
Provided By: Company
     Address
     Phone

Description of Roof System:
    Deck:
    Ice and Water Membrane:
    Shingle:
    Ridge Vent:

-- End of Section --
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 INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z88.6  (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel

ASTM INTERNATIONAL (ASTM)


ASTM D2126  (2009) Response of Rigid Cellular Plastics to Thermal and Humid Aging


17-0016, Interior and Exterior Repairs, Bldg. 523

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

Personal Eye and Face Protection Devices

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-03 Product Data

Spray urethane foam

Submit literature including material description, physical
properties, recommended storage conditions, Material Safety Data
Sheets, and shelf life expiration date.

SD-07 Certificates

Qualification of Manufacturer

Qualification of Applicator

SD-08 Manufacturer's Instructions

SPRAY URETHANE FOAM

Polyurethane foam

Submit manufacturer's complete application instructions and
details, and to include storage, handling, and warnings or
precautions on flammability and toxicity. Include manufacturer's
written recommendations for primers and for surface preparation of
metals, concrete, roofing, and other materials and surface
substrates over which sprayed polyurethane foam and coating system
will be applied.

Surface preparation

Submit manufacturer's complete application instructions and
details, and to include storage, handling, and warnings or
precautions on flammability and toxicity. Include manufacturer's
written recommendations for primers and for surface preparation of
metals, concrete, roofing, and other materials and surface
substrates over which sprayed polyurethane foam and coating system
will be applied.

SD-11 Closeout Submittals

Warranty

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Manufacturer

Sprayed polyurethane foam and elastomeric coating products manufacturer
shall have a minimum of 10 years experience in the manufacture of
polyurethane foam and elastomeric coating products.
1.3.1.1 Manufacturer's Technical Representative

Manufacturer's technical representative shall have a minimum of 10 years experience with sprayed polyurethane roof systems products and installations and be thoroughly familiar with the products to be installed, installation requirements and practices, quality control of the installation, and with any special considerations in the geographical area and climate where construction will take place. The representative shall be available to perform field inspections and attend meetings as specified.

1.3.2 Qualification of Applicator

The roof system applicator shall have prior manufacturer training in the application of sprayed polyurethane foam and coating materials. Applicator shall be certified and approved by the foam and coating manufacturer to apply the specified materials and provide the specified manufacturer warranty. Applicator shall have a minimum of 5 years experience in application of the specified materials and minimum of 10 years experience in the application of sprayed polyurethane foam roof systems. Mechanics applying the foam and coating materials shall have minimum 3 years prior experience in handling and spraying the type of materials specified and spray equipment must be operated by or under the direct full-time supervision of manufacturer-trained personnel. The applicator shall supply the names, locations and client contact information of 5 projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Materials shall be delivered to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand name, description of contents, and shelf life of containerized materials.

1.4.2 Storage

Materials shall be stored in clean, dry areas, away from excessive heat, sparks, and open flame. Storage area shall be ventilated to prevent build-up of flammable gases. Maintain temperatures in the storage area below the materials' flash point and within limits recommended by the manufacturer's printed instructions.

1.4.3 Handling

Handle materials and containers during application work safely and in accordance with manufacturer recommendations. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials. Do not expose foam component containers to direct sunlight for periods of time sufficient to cause contents to exceed 80 degrees F. Mark and remove from job site materials which have been exposed to moisture or that exceed shelf life limits. Not more than half the shelf life shall have expired when materials are applied.
1.5 ENVIRONMENTAL CONDITIONS

Do not apply roof system materials during inclement weather or when ice, frost, surface moisture, or visible dampness is present on the surface to be covered, or when precipitation is imminent. Use moisture-measuring methods and equipment as required to verify that the moisture conditions of substrate surfaces are in accordance with roof system materials manufacturer requirements prior to application of foam and coating materials. Substrate temperatures shall be within limits recommended by the manufacturer's printed instructions, unless specified otherwise. Use wind screen protection for all spray applications when wind speeds exceed 10 miles per hour.

1.5.1 Primer

Follow manufacturer's printed application and curing instructions, except that no primer shall be applied when ambient temperature is below 40 degrees F or when ambient temperature is expected to fall below 35 degrees F during drying or curing period. Primer material and color shall be selected to promote proper substrate temperature for sprayed polyurethane foam application.

1.5.2 Sprayed Polyurethane Foam

Provide closed-cell spray Polyurethane foam insulation. Do not apply sprayed polyurethane foam if the surface temperature is less than 50 degrees F, higher than 130 degrees F, or is less than 5 degrees F above the dewpoint. Relative humidity shall be within limits recommended by the sprayed polyurethane foam manufacturer's printed instructions. Determine the dewpoint at the jobsite prior to and upon completion of each work day unless variable weather conditions require more frequent monitoring. The wet bulb and dry bulb temperatures during application of sprayed polyurethane foam shall be within the ranges recommended by the sprayed polyurethane foam manufacturer. Take wet bulb and dry bulb temperatures at the beginning of foaming, end of foaming, and at 2 hour intervals during foaming. Record each wet bulb and dry bulb temperature reading, substrate temperature, wind speed, humidity, time of reading, and date, and area foamed on a copy of the roof plan and submit with daily log to the Contracting Officer.

1.5.3 Elastomeric Coating

Prior to applying coating, check polyurethane foam with a moisture resistance meter to ensure that foam is dry. Apply coating between the temperature ranges of 50 and 110 degrees F, ambient.

1.6 CONTRACTOR'S FOAM SPRAY EQUIPMENT

1.6.1 Applicator

Use an airless foam spray gun of the mechanical, self-cleaning type, that does not require a flushing solvent during the spray operation.

1.6.2 Equipment Calibration

Fully calibrate the foam metering equipment to monitor each liquid component to within 2 percent of the foam material manufacturer's required metering ratio. Calibrate spray equipment each day at start of operations,
after each restart if spraying operations have been terminated for more than one hour, whenever there is a change in fan pattern or pressure, whenever slow curing areas are noticed, whenever a change is made in hose length or working height, and after changeover between materials. Calibration shall consist of demonstrating that the equipment is adjusted to deliver components in proper mix and proportion. Calibration test shall be done on cardboard or plywood on the roof adjacent to the area to be sprayed.

1.6.3 Metering Equipment Requirements

Use foam metering equipment capable of developing and maintaining the foam manufacturer's required liquid component pressures and temperatures. Foam metering equipment shall have gages for visual monitoring. Equipment shall provide temperature control of foam components to within the temperature ranges recommended by the foam manufacturer's printed instructions.

1.6.4 Moisture Protection

Protect the surfaces of component supply containers or tanks used to feed the foam metering equipment from moisture.

1.6.5 Compressed Air

Supply compressed air in contact with foam components during mixing or atomization through moisture traps that are continuously bled.

1.6.6 Dispense Excess Materials

Do not deposit materials used for cleaning of equipment or materials dispensed for calibration purposes and establishment of spray gun pattern on the roof surfaces to be sprayed. Dispense such materials into scrap containers or onto plastic film, or cardboard, and dispose of in compliance with safety requirements and jobsite regulations.

1.7 SPECIAL SAFETY PROVISIONS

During application, the following shall be required unless in conflict with the manufacturer's recommendations or requirements of a recognized legal authority, in which case, the manufacturer's recommendations or the legal authority's requirements take precedence:

1.7.1 Special Equipment

1.7.1.1 Air Masks

Wear fresh air supply masks when applying foam or when handling hazardous liquid materials. Respiratory protective devices shall be as recommended by AIHA Z88.6. Instruct personnel required to use respiratory protective devices in the use of the devices. Maintain such equipment and inspect regularly.

1.7.1.2 Eye and Face Masks

Use eye and face protection during materials application. Eye and face protective equipment shall meet the requirements of ANSI/ISEA Z87.1.
1.7.1.3  Clothing and Gloves

Wear protective clothing and gloves during materials application. Skin areas not covered by clothing shall be protected by protective creams.

1.7.2  Handling Precautions

1.7.2.1  Venting of Material Containers

Partially unscrew material container and drum caps to gradually vent the containers prior to opening. Do not inhale vapors. Decontaminate empty component containers by filling with water and allowing to stand for 48 hours with bung caps removed. Under no circumstances seal, stop, or close the containers which have been emptied of the foam component.

1.8  WARRANTY

Provide insulation system material and workmanship warranties meeting specified requirements. Revision or amendment to standard manufacturer warranty shall be provided as required to comply with the specified requirements.

PART 2  PRODUCTS

2.1  SPRAY URETHANE FOAM

Urethane foam shall be standard product of the manufacturer, and containers shall be factory marked with the manufacturer's name or trademark. The foam material shall be of a formulation suitable for the environmental and climatic conditions in which foam will be applied. Urethane foam shall meet the following requirements:

<table>
<thead>
<tr>
<th>Properties in Inch-Pound Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties</td>
</tr>
<tr>
<td>Density (Sprayed in Place)</td>
</tr>
<tr>
<td>K-Factor (aged)</td>
</tr>
<tr>
<td>Compressive Strength Parallel to Foam Rise</td>
</tr>
<tr>
<td>Shear Strength</td>
</tr>
<tr>
<td>Tensile Strength Parallel to Foam Rise</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Properties in Inch-Pound Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensional Stability (Humid Aging) 7 days volume change 160 degrees F, 100 relative humidity</td>
</tr>
<tr>
<td>Water Vapor Permeability</td>
</tr>
<tr>
<td>Closed Cell Content</td>
</tr>
<tr>
<td>Water Absorption</td>
</tr>
<tr>
<td>Flammability</td>
</tr>
</tbody>
</table>

PART 3 EXECUTION

3.1 PROTECTION OF PROPERTY

Protect the building structure, equipment, and other surfaces adjacent to the work from overspray from foam and coating materials. Protective coverings shall be secured and vented to prevent collection of moisture on covered surfaces. Use protective shields or barriers when spraying along open roof edges and walls to prevent uncontrolled overspray. Any surfaces damaged by roof system products shall be restored or replaced to the satisfaction of the Government at no additional expense to the Government.

3.1.1 Masking

Provide masking protection to protect surfaces immediately adjacent to foam and coating terminations at time of application. Adjust or provide new masking protection at roof perimeter to protect surfaces immediately adjacent to coating terminations and to provide for clean smooth coating termination lines.

3.1.2 Warning Signs

Post warning signs at ground level in the adjacent to the work area and a minimum of 150 feet from the application area stating the area is off limits to unauthorized persons and warning of potential overspray hazard. Place clearly visible and legible warning sign at entrance to primary road leading to the project facility warning of presence of flammable materials, irritating fumes, and potential of overspray damage.

3.2 SPECIAL PRECAUTIONS AND INSTRUCTIONS

3.2.1 Material Handling

Handle materials and containers during application work safely and in accordance with recommendations of the manufacturer. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials or products.
3.2.2  Fire and Explosion Hazards

Prohibit open flames, sparks, welding, and smoking in the application area. Provide and maintain a fire extinguisher of appropriate type and size in the application area.

3.3  SURFACE PREPARATION FOR FOAM APPLICATION

Surfaces that are to be primed or receive spray foam application shall be dry; completely cured; free of grease, oils, dirt and other foreign matter or contaminants which will interfere with total adhesion of primer and polyurethane foam. Prior to foam application, fill or otherwise seal openings where foam spray may damage or contaminate interior items or surfaces.

3.3.1  Wood Decks and Other Wood Surfaces

Prime untreated and unpainted surfaces. If painted, inspect surfaces for adhesion problems.

3.4  SPRAY FOAM APPLICATION

3.4.1  Spray Foam

Apply foam to provide a minimum finished thickness of 1 inch. Apply spray pass at right angle to the surface to the extent practicable. Check foam thickness during application by probing depth with probe wire. Adjust application procedures as necessary to develop required foam thickness.

3.4.2  Terminations

Unless otherwise indicated, conform with manufacturer's standard details, for foam thickness around penetrations and other terminations. Transitions between horizontal and vertical surfaces shall be smooth and sprayed at a nominal angle of 45 degrees.

3.4.3  Surface Uniformity

Do not exceed the minimum thickness of the foam by more than 1/2 inch, except as necessary at transitions and penetrations, or as otherwise approved by the Contracting Officer.

3.4.4  Foam Finish Correction

If the sprayed foam skin is removed to correct surface texture or to remove excess foam thickness, respray the cut surface with foam formation at least 1/2 inch thick to provide a protective foam skin prior to application of the protective coating.

3.4.5  Finish Removal

Remove foam that is not bonded, of poor cell structure, wet, or otherwise does not meet the material quality specifications.

3.4.6  Application Time Limits

Do not start foam application on an area larger than can be brought to the specified full foam thickness, cured, and coated with the base coat of the
coating system on the same day. No applied foam, except for leading edges, shall stand uncoated overnight. Inspect the leading edge of foam before resuming work the next day. Remove and replace damaged or wet foam material.

3.4.7 Curing Time

Cure the applied foam for a minimum of 2 hours and as otherwise recommended by the foam manufacturer prior to application of the protective coating.

3.4.8 Spray Foam Clean Up

Remove overspray masking materials and coverings upon completion of the spray foam application and prior to the application of the protective coating. Do not remove the masking over air intake vents until two hours after application of the foam. Remove foam overspray found on adjacent surfaces not scheduled to application of the protective coating.

3.5 SURFACE PREPARATION FOR PROTECTIVE COATING APPLICATION

Apply roof coating on surfaces free of water, grease, oils, dirt, debris, and other foreign materials, and cured completely. Foam surfaces to receive coating shall be as specified.

3.5.1 Masonry Surfaces

Wire brush masonry surfaces which are to receive coatings, and remove resulting dust.

3.5.2 Primer

Apply as recommended by the coating manufacturer.

3.6 CORRECTION OF DEFICIENCIES

Correction of deficiencies shall be as directed by the Contracting Officer at no additional cost to the Government.

3.7 CLEAN-UP AND DISPOSAL

All waste material, material containers, and debris shall be cleaned up daily and placed in appropriate trash containers. At completion of the work all waste material, debris, and containers shall be removed from the job site and disposed of as required by local regulations.

-- End of Section --
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


1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

1.3 SUBMITTALS

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

SD-02 Shop Drawings
  Exposed Sheet Metal Coverings
  Gutters
  Downspouts
  Expansion Joints
  Gravel Stops and Fasciae
  Reglets
  Drip Edges

1.4 MISCELLANEOUS REQUIREMENTS

1.4.1 Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot
be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

PART 2   PRODUCTS

2.1   MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA 1793 for a particular item, unless otherwise indicated. Provide materials, thicknesses, and configurations in accordance with SMACNA 1793 for each material. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items must be copper, and that contact between dissimilar metals must be avoided.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

2.1.1   Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fasciae; cap, valley, steeped, base, and eave flashings and related accessories.

2.1.2   Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.1.3   Copper, Sheet and Strip

Provide in accordance with ASTM B370, cold-rolled temper, H 00 (standard).

2.1.4   Lead-Coated Copper Sheet

Provide in accordance with ASTM B101.

2.1.5   Lead Sheet

Provide in a minimum weight of 4 pounds per square foot.

2.1.6   Steel Sheet, Zinc-Coated (Galvanized)

Provide in accordance with ASTM A653/A653M.

2.1.7   Zinc Sheet and Strip

Provide in accordance with ASTM B69, Type I, a minimum of 0.024 inch thick.
2.1.8 Stainless Steel

Provide in accordance with ASTM A480/A480M, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.1.9 Terne-Coated Steel

Provide in accordance with ASTM A308/A308M, a minimum of 14 by 20 inch with minimum of 40 pound coating per double base box. ASTM A308/A308M.

2.1.10 Aluminum Alloy Sheet and Plate

Provide in accordance with ASTM B209 color, as selected from manufacturer's standard colors, form alloy, and temper appropriate for use.

2.1.10.1 Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on one side unless otherwise indicated.

a. Gutters, downspouts, and hangers
b. Gravel stops and fasciae
c. Flashing

2.1.11 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

2.1.12 Solder

Provide in accordance with ASTM B32, 95-5 tin-antimony.

2.1.13 Reglets

2.1.13.1 Polyvinyl Chloride Reglets

Provide in accordance with ASTM D1784, Type II, Grade 1, Class 14333-D, 0.075 inch minimum thickness.

2.1.13.2 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1-1/4 inch, as approved.

2.1.13.2.1 Caulked Reglets

Provide with rounded edges, temporary reinforcing cores, and accessories as required for securing to adjacent construction. Provide built-up mitered corner pieces for inside and outside corners.

2.1.13.2.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snap-lock type receiver.
2.1.14 Bituminous Plastic Cement

Provide in accordance with ASTM D4586/D4586M, Type I.

2.1.15 Roofing Felt

Provide in accordance with ASTM D226/D226M Type II.

2.1.16 Asphalt Primer

Provide in accordance with ASTM D41/D41M.

2.1.17 Fasteners

Use the same metal as, or a metal compatible with the item fastened. Use stainless steel fasteners to fasten. Confirm compatibility of fasteners and items to be fastened to avoid galvanic corrosion due to dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Protection from Contact with Dissimilar Materials

3.1.2.1 Copper or Copper-bearing Alloys

Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal, or separate the surfaces by means of moistureproof building felts.

3.1.2.2 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.2.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials
with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.2.4 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.3 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fasciae by expansion and contraction joints spaced not more than 12 feet apart.

3.1.4 Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 1/4 inch and a minimum depth of 1-1/4 inch, when installed.

3.1.4.1 Caulked Reglets

Wedge flashing in reglets with lead wedges every 18 inches, caulked full and solid with an approved compound.

3.1.4.2 Friction Reglets

Install flashing snap lock receivers at 24 inches on center maximum. When flashing has been inserted the full depth of the slot, caulk the slot, lock with wedges, and fill with sealant.

3.1.5 Polyvinyl Chloride Reglets for Temporary Construction

Rigid polyvinyl chloride reglets may be provided in lieu of metal reglets for temporary construction.

3.1.6 Gravel Stops and Fasciae

Prefabricate in the shapes and sizes indicated and in lengths not less than 8 feet. Extend flange at least 4 inches onto roofing. Provide prefabricated, mitered corners internal and external corners. Install gravel stops and fasciae after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fasciae on both sides with an asphalt primer. After primer has dried, set flange on roofing membrane and strip-in. Nail flange securely to wood nailer with large-head, barbed-shank roofing nails 1.5 inch long spaced not more than 3 inches on center, in two staggered rows.

3.1.6.1 Edge Strip

Hook the lower edge of fasciae at least 3/4 inch over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inches maximum on center. Where fastening is made to concrete or masonry, use screws spaced 12 inches on center driven in expansion shields set in the concrete or masonry.
Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 1/16 inch thick compatible spacer or washers.

3.1.6.2 Joints

Leave open the section ends of gravel stops and fasciae 1/4 inch and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 4 inches set laps in plastic cement. Face nailing will not be permitted. Install prefabricated aluminum gravel stops and fasciae in accordance with the manufacturer's printed instructions and details.

3.1.7 Metal Drip Edges

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inches and secure with compatible nails spaced not more than 10 inches on center along upper edge.

3.1.8 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet. Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inches minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on adjustable hangers spaced not more than 30 inches on center. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

3.1.9 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.9.1 Terminations

Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.
3.1.10 **Expansion Joints**

Provide expansion joints for roofs, walls, and floors as indicated. Provide expansion joints in continuous sheet metal at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum. Provide evenly spaced joints. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.1.10.1 **Roof Expansion Joints**

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph COUNTERFLASHING, except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than one inch for flashing on one side of the expansion joint and be less than the width of the expansion joint plus one inch for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.1.11 **Single Pipe Vents**

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inches on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inches. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inches roof flange in bituminous plastic cement and nailed 3 inches on center. Extend sleeve a minimum of 8 inches above the roof deck and lapped a minimum of 3 inches by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.1.12 **Stepped Flashing**

Provide stepped flashing where sloping roofs surfaced with shingles abut vertical surfaces. Place separate pieces of base flashing in alternate shingle courses.

3.2 **PAINTING**

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products.

Field-paint sheet metal for separation of dissimilar materials.

3.2.1 **Aluminum Surfaces**

Clean with solvent and apply one coat of zinc-molybdate primer and one coat of aluminum paint.
3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

-- End of Section --
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 E2174 (2010a; E 2011) Standard Practice for On-Site Inspection of Installed Fire Stops


FM GLOBAL (FM)


FM AS 4991 (2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479 (2003; Reprint Oct 2012) Fire Tests of Through-Penetration Firestops
1.2 SYSTEM DESCRIPTION

Fire rated wall partitions are indicated on the drawings. If new or existing penetrations of an existing fire wall partition are encountered, follow guidelines in this section.

1.2.1 General

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.

1.2.2 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.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Firestopping Materials

SD-07 Certificates
Firestopping Materials.

Installer Qualifications

Inspection

1.4 QUALITY ASSURANCE

1.4.1 Installer

Engage an experienced Installer who is:

a. FM Research approved in accordance with FM AS 4991, operating as a UL Certified Firestop Contractor, or

b. Certified, licensed, or otherwise qualified 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. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. 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 written certification of training, and retain proof of certification for duration of firestop installation.

1.5 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. Remove damaged or deteriorated materials from the site.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic, water-based, noncombustible products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.1.1 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.

2.1.2 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. Firestop material must be free from Ethylene Glycol, PCB, MEK, or other types of hazardous chemicals.
2.1.3  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.

2.1.3.1  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:

a. Penetrations of Fire Resistance Rated Walls and Partitions:  F Rating = (1) hour or Rating of wall or partition being penetrated.

2.1.3.2  Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SYSTEM DESCRIPTION, and gaps such as those between floor slabs or roof decks 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 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.

2.1.4  Material Performance

All firestop materials are subject to these minimum standards of performance.

a. Firestop material shall be capable of installation at temperatures of 35 to 120 degrees F.

b. Material must be able to be frozen, thawed and still maintain manufacturer approval for installation.

c. Firestop material must convey a manufacturer's written warranty guaranteeing the performance of the material for the sustainable lifetime of the structure.

d. Material must maintain a shelf life of no less than two years from date of manufacturing.

e. Acceptable firestop cast-in-place devices are factory assembled intumescent lined round or oval plastic cylinders capable of protecting plastic, metallic, cable, and blank openings through the cast-in-place device equal to the fire-resistance rating of the floor.
PART 3   EXECUTION

3.1   PREPARATION

Areas to receive firestopping shall 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 shall 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 shall be capable of supporting the same load as the floor is designed to support or shall 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. 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. 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.

3.3 INSPECTION

3.3.1 General Requirements

For Navy projects, install one of each type of penetration and have it inspected and accepted by the Facilities Division, Naval Facilities Engineering Command, Fire Protection Engineer prior to the installation of the remainder of the penetrations. For all projects, the remainder of the firestopped areas shall not be covered or enclosed until inspection is complete and approved. The manufacturer's representative shall 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.

3.3.2 Inspection Standards

Inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results to be submitted to GC, Architect and Owner.

a. ASTM E2393

b. ASTM E2174

-- End of Section --
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 C734 (2015) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering

ASTM C834 (2014) Latex Sealants

ASTM C919 (2012) Use of Sealants in Acoustical Applications


1.2 SUBMITTALS

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

SD-03 Product Data
   Sealants
   Primers
   Bond Breakers
   Backstops

SD-06 Test Reports
   Field Adhesion
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 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.5 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.

1.6 QUALITY ASSURANCE

1.6.1 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.

1.6.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6.3 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 C834. Note, color "as selected" refers to manufacturer's full range of color options.
## 17-0016, Interior and Exterior Repairs, Bldg. 523

### 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. | Match adjacent
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed. | Match adjacent
d. Joints between edge members for acoustical tile and adjoining vertical surfaces. | Match adjacent
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted. | Match adjacent
f. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where non-planar tile surfaces meet. | As selected
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change. | As selected
h. 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. | As selected
b. Joints between new and existing exterior masonry walls. | Match adjacent
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Masonry joints where shelf angles occur.</td>
<td>Match adjacent</td>
</tr>
<tr>
<td>d. Expansion and control joints.</td>
<td>Match adjacent</td>
</tr>
<tr>
<td>e. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.</td>
<td>As selected</td>
</tr>
<tr>
<td>f. Voids where items pass through exterior walls.</td>
<td>Match adjacent</td>
</tr>
<tr>
<td>g. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.</td>
<td>Match adjacent</td>
</tr>
<tr>
<td>h. Metal-to-metal joints where sealant is indicated or specified.</td>
<td>As selected</td>
</tr>
<tr>
<td>i. Joints between ends of gravel stops, fasciae, copings, and adjacent walls.</td>
<td>As selected</td>
</tr>
</tbody>
</table>

### 2.1.3 Floor Joint Sealants

**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:

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Seats of metal thresholds for exterior doors.</td>
<td>As selected</td>
</tr>
<tr>
<td>b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.</td>
<td>As selected</td>
</tr>
</tbody>
</table>

### 2.1.4 Acoustical Sealants

Rubber or polymer based acoustical sealant in accordance with **ASTM C919** to have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with **ASTM E84**. Provide non-staining acoustical sealant with a consistency of 250 to 310 when tested in accordance with **ASTM D217**. Acoustical sealant must remain flexible and adhesive after 500 hours of accelerated weathering as specified in **ASTM C734**.
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.

2.5 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 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions and ASTM C1193, Method A or ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit field adhesion test report indicating tests, locations, dates, results, and remedial actions taken.

3.2 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.

3.2.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finished work, scraping and wire brushing. Remove
3.2.2 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.

3.2.3 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.

3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.4 APPLICATION

3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

<table>
<thead>
<tr>
<th>JOINT WIDTH</th>
<th>JOINT DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>Maximum</td>
</tr>
</tbody>
</table>

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.
3.4.2 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.

3.4.3 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.

3.4.4 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.

3.4.5 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.

3.4.6 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.

3.4.7 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.

3.5 PROTECTION AND CLEANING

3.5.1 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.
3.5.2 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 --
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 2015) 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 A924/A924M (2016a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process


ASTM C612 (2014) Mineral Fiber Block and Board Thermal Insulation


BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2014) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)


NFPA 80 (2016) Standard for Fire Doors and Other
1.2 SUBMITTALS

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

SD-02 Shop Drawings

Doors
Frames

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors
Schedule of frames

Submit door and frame locations.

SD-03 Product Data

Doors
Frames

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. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

Where colors are not indicated, submit manufacturer's standard colors and patterns for selection.

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.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated.

2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design(s), materials, construction, gages, and finish shall be as specified for standard steel doors and shall comply with the requirement of NAAMM HMMA HMM. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage. Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion. Prepare doors to receive hardware specified in Section 08 71 00 DOOR HARDWARE. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

2.3 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with SDI/DOOR A250.4 and shall have met the requirements for Level C. Prepare doors to receive specified hardware. Doors shall be 1-3/4 inch thick.
Provide insulated steel doors and frames where indicated.

2.4 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

c. Mineral board: ASTM C612, Type I.

2.5 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors unless otherwise indicated.

2.5.1 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.

2.5.2 Knock-Down Frames (if necessary)

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.

2.5.3 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.

2.5.4 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.5.5 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.
2.5.5.1 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.

2.5.5.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member.

2.6 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

2.6.1 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.

2.7 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

2.8 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 gasketing, 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.
2.9 FINISHES

2.9.1 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.

2.9.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate 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.

2.10 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.

2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

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. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing.

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 Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80.
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 --
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.

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A (2013) Interior Architectural Wood Flush Doors

1.2 SUBMITTALS

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

SD-02 Shop Drawings
Doors
Submit drawings or catalog data showing each type of door unit. Indicate within drawings and data the door types and construction, sizes, thickness.

SD-03 Product Data
Doors
Accessories
Sample Warranty

SD-04 Samples
Doors
Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door Finish Colors
Submit a minimum of three color selection samples.

SD-11 Closeout Submittals
Warranty
1.3 **CERTIFICATIONS**

1.4 **DELIVERY, STORAGE, AND HANDLING**

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 4 inch thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. Replace defective or damaged doors with new ones.

1.5 **WARRANTY**

Warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

**PART 2 PRODUCTS**

2.1 **DOORS**

Provide doors of the types, sizes, and designs indicated free of urea-formaldehyde resins.

2.1.1 Flush Doors

Conform to ANSI/WDMA I.S.1A for flush doors. Provide hollow core doors with lock blocks and 1 inch minimum thickness hinge stile. Hardwood stile edge bands of doors receives a natural finish, compatible with face veneer. Provide mill option for stile edge of doors scheduled to be painted. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware.

2.1.1.1 Interior Flush Doors

Provide particleboard core, Type II flush doors conforming to ANSI/WDMA I.S.1A with faces of sound grade hardwood or hardboard for painted finish.

2.2 **ACCESSORIES**

2.2.1 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings. See drawings for locations. Provide moldings for doors to receive natural finish of the same wood species and color as the wood face veneers.

2.3 **FABRICATION**

2.3.1 Quality and Construction

Identify the standard on which the construction of the door was based and identify doors having a Type I glue bond.

2.3.2 Preservative Treatment

Treat doors scheduled for restrooms, janitor closets and other possible wet locations including exterior doors with a water-repellent preservative treatment and so marketed at the manufacturer's plant.
2.3.3 Adhesives and Bonds

ANSI/WDMA I.S.1A. Use Type I bond for exterior doors and Type II bond for interior doors. Provide a nonstaining adhesive on doors with a natural finish.

2.3.4 Prefitting

Provide factory prefinished factory prefitted doors for the specified hardware, door frame and door-swing indicated. Machine and size doors at the factory by the door manufacturer in accordance with the standards under which the doors are produced and manufactured. The work includes sizing, beveling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules to coordinate the work.

2.3.5 Finishes

2.3.5.1 Field Painting

Factory prime or seal doors, and field paint.

2.3.5.2 Color

Provide door finish colors as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a $\frac{1}{16}$ inch minimum, $\frac{1}{8}$ inch maximum clearance at sides and top, and a $\frac{3}{16}$ inch minimum, $\frac{1}{4}$ inch maximum clearance over thresholds. Provide $\frac{3}{8}$ inch minimum, $\frac{7}{16}$ inch maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of $\frac{1}{8}$ inch in 2 inch. Door warp must not exceed $\frac{1}{4}$ inch when measured in accordance with ANSI/WDMA I.S.1A.

--- End of Section ---
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 2015) 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 A666 (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar


MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)


1.2 SUBMITTALS

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

SD-02 Shop Drawings

Access Doors And Panels

SD-03 Product Data

Access Doors And Panels

Hardware Including Locks and Keys

Accessories

SD-04 Samples

Finishes

SD-06 Test Reports

Fire-rating(s) of Assemblies

1.3 MISCELLANEOUS REQUIREMENTS

For access doors and panels provide the following:

1.3.1 Shop Drawings

For field assembled access doors and panels, provide plans, elevations, sections, and details for each type of access door and panel assembly. Indicate frame, surface and edge construction, materials, and accessories. Indicate types of finished surfaces and details for panel edge conditions. Provide a door schedule with a unique number for each access door and panel, specific location in the project, location of hinges and hardware for each door. Indicate fire-rating(s) of assemblies.

1.3.2 Product Data

For shop assembled access doors and panels, provide literature indicating sizes, types, frame and edge construction, finishes, hardware, accessories such as gaskets, seals and weatherstripping, and location of each door and panel in the project. Indicate fire-ratings of assemblies. Provide details of adjoining work for each condition indicated.

1.3.3 Finish Samples

Submit two color charts from manufacturer's standard color and finish options for each type of frame and panel assembly finish indicated.
1.3.4 Test Reports

Provide test reports for fire-rated assemblies when tested in accordance with NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically and NFPA 288 for fire-rated access door assemblies installed horizontally.

1.4 PERFORMANCE REQUIREMENTS

1.4.1 Structural Requirements

Provide floor access assemblies to support live loads indicated for floors. Deflection must not exceed 1/180 of span.

1.4.2 Fire-Rating Requirements

Provide access panels with a minimum fire-rating of as indicated on the Drawings.

1.4.3 Access Panels for Wet Areas

Provide panel assemblies that will be located in wet areas with corrosion resistant finishes and hardware and water resistant gasketing.

1.5 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 Steel Plates, Shapes, and Bars

Provide in accordance with ASTM A36/A36M.

2.1.2 Sheet Steel

Provide cold rolled steel sheet substrate in accordance with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

2.1.3 Stainless Steel

Provide in accordance with ASTM A666, type 302 or 304.

2.1.4 Metallic Coated Steel Sheet

Provide in accordance with ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.1.5 Hardware

Provide automatic closing devices. Provide latch releases operable from insides of doors. Provide anchors in accordance with applicable fire test parameters.
2.1.6 Hinges

Provide concealed spring hinges, 175 degrees of opening, with removable hinge pins. Provide hinges of same steel as door and frame or in accordance with manufacturer's written recommendations. If providing non-continuous hinges, provide in numbers required to maintain alignment of door panel with frame. Provide coatings as necessary to permanently protect dissimilar metals from contact with one another; see Part 3 herein for more information.

2.1.7 Locks

Unless otherwise indicated, provide flush screwdriver operated cam lock. Provide plastic sleeve or stainless steel bushings to protect holes in surface finishes for screwdriver to access lock.

2.1.8 Accessories

Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors in types as recommended by manufacturer's written installation instructions for each substrate indicated. Provide shims, bushings, clips, gaskets, and other devices as necessary for a complete installation.

2.2 FABRICATION

2.2.1 Thickness, Size, Edges

Fabricate frames for access doors of steel not lighter than 16 gage with welded joints and anchorage for securing to adjacent construction. Provide doors a minimum of 18 x 18 inches and of not lighter than 16 gage steel, with stiffened edges and welded attachments. Provide with eased (lightly rounded) edges, without burrs, snags or sharpness and exposed welds ground smooth.

2.2.2 Welding

Provide in accordance with AWS D1.1/D1.1M.

2.3 ACCESS ASSEMBLY TYPES

Unless indicated otherwise, provide flush-face steel access doors and panels with steel frames and flanges.

2.3.1 Fire-rated Doors (As Necessary)

2.3.1.1 Door Construction

Provide ceiling access door construction in accordance with ASTM E119 or UL 263. Provide wall access doors in accordance with NFPA 252 or UL 10B.

2.3.1.2 Labels

Provide class B opening according to UL 10B or test by another nationally recognized laboratory, approved by the Contracting Officer. Provide fire-rating as indicated herein, with a maximum temperature rise of 216 degrees F.
2.3.1.3 Door Panel and Frame

Steel sheet, with mineral fiber insulation core, insulated sandwich type construction.

2.4 FINISHES

Provide steel frames and panel surfaces with a baked enamel. Provide manufacturer's standard two coat finish system consisting of one coat primer and one thermoset topcoat. Provide dry film thickness in 2 mils minimum. Provide exposed fastenings that approximately match the color and finish of the each material to which fastenings are applied.

PART 3 EXECUTION

3.1 PREPARATION

Field verify all measurements prior to fabrication. Verify access door locations and sizes provide required maintenance access to installed building services components. Protect existing construction and completed work from damage during installation.

3.2 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, in accordance with manufacturer's written instructions. Include materials and parts as necessary for a complete installation of each item. Conceal fastenings where practicable. Poor matching of holes to fasteners is cause for rejection of the work.

3.3 ACCESS LOCATIONS

Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions.

3.4 ACCESS LOCATIONS IN WET AREAS

When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies as indicated in Part I herein.

3.5 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action.

3.6 ADJUSTMENT

Adjust hardware so that door panel opens freely. Adjust door when closed center door panel in frame.

3.7 ENVIRONMENTAL CONDITIONS

Do not paint surfaces when damp or exposed to weather, when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.
17-0016, Interior and Exterior Repairs, Bldg. 523

SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
11/16

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.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501 (2015) Methods of Test for Exterior Walls
AAMA 800 (2010) Voluntary Specifications and Test Methods for Sealants

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM E1886 (2013a) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
17-0016, Interior and Exterior Repairs, Bldg. 523

**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

**ASTM E330/E330M**
(2014) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

**ASTM E331**

**ASTM E783**

**ASTM F1642**

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

**ANSI/BHMA A156.10**
(2011) Power Operated Pedestrian Doors

**ANSI/BHMA A156.4**
(2013) Door Controls - Closers

INTERNATIONAL CODE COUNCIL (ICC)

**ICC IBC**

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

**FS TT-P-645**
(Rev C) Primer, Paint, Zinc-Molybdate, Alkyd Type

UNDERWRITERS LABORATORIES (UL)

**UL 325**
(2013; Reprint Dec 2016) UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Pre-Installation Meetings

Conduct a meeting before installation begins to verify the project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

Within 30 days of the Contract Award, submit the following for review and approval by the Contracting Officer:

a. **List of product installations**

b. **Sample warranty**
c. Finish and color samples
d. Manufacturer's catalog data

Concurrently submit certified test reports showing compliance with specified performance characteristics and UL 325 for the following:

a. Wind Load (Resistance) in accordance with AAMA 501
b. Deflection in accordance with ASTM F1642
c. Condensation Resistance and Thermal Transmittance Performance Requirements in accordance with AAMA 1503
d. Water Infiltration in accordance with ASTM E331
e. Structural Requirements in accordance with ASTM F1642

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals
   Sample Warranty
   List of Product Installations

SD-02 Shop Drawings
   Installation Drawings
   Fabrication Drawings

SD-03 Product Data
   Manufacturer's Catalog Data
   Finish

SD-04 Samples
   Finish and Color Samples

SD-06 Test Reports
   Certified Test Reports
   Deflection
   Air Infiltration
   Condensation Resistance and Thermal Transmittance
   Water Infiltration

SD-08 Manufacturer's Instructions
17-0016, Interior and Exterior Repairs, Bldg. 523

Manufacturer's Instructions

SD-11 Closeout Submittals

Manufacturer's Product Warranty

1.4 QUALITY CONTROL

1.4.1 Qualifications

1.4.1.1 Installer Qualifications

Provide documentation of the installer's experience in performing the work specified in this section.

Ensure that the installers have specialized in work similar to that required for this project, and that they are acceptable to product manufacturer.

1.4.1.2 Manufacturer Qualifications

Ensure that manufacturers meet the requirements specified in this section and project drawings.

Ensure that the manufacturer is capable of providing field service representation during construction, approving acceptable installers and approving application methods.

1.4.2 Single-Source Responsibility

When aluminum entrances are part of a building enclosure system, that includes storefront framing, windows, a curtain wall system, and related products, provide building enclosure system products from a single-source manufacturer.

Use a single source manufacturer with sole responsibility for providing design, structural engineering, and custom fabrication for door portal systems and for supplying components, materials, and products. Do not use products provided from numerous sources for assembly at the site. Ensure that the following work items and components are fabricated or supplied by a single source are:

a. Door assemblies to be installed in door portals as specified in Section 08 41 13 ALUMINUM-FRAMED ENTRANCE AND STOREFRONTS.

b. Door operating hardware to be installed on or within door portals as specified in Section 08 71 00 DOOR HARDWARE.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Ordering

To avoid construction delays, comply with the manufacturer's lead-time requirements and instructions for ordering.

1.5.2 Packing, Shipping, Handling and Unloading

Deliver materials in the manufacturer's original, unopened, undamaged
containers with identification labels intact.

1.5.3 Storage and Protection

Store materials in a way that protects them from exposure to harmful weather conditions. Avoid damaging the storefront material and components during handling. Protect storefront material against damage from elements, construction activities, and other hazards before, during, and after storefront installation.

Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sunlight. Do not leave coating residue on surfaces.

1.6 PROJECT / SITE CONDITIONS

1.6.1 Field Measurements

Verify actual measurements or openings by taking field measurements before fabrication; record these measurements on shop drawings. To avoid construction delays, coordinate field measurements, and fabrication schedule with construction progress.

1.7 WARRANTY

Provide a written manufacturer's warranty, executed by a company official, warranting against defects in materials and products for 5 years from the date of shipment. Warrant that the door corner construction is for the life of the project. Provide a written installer's warranty, warranting work to be watertight and free from defective materials, defective workmanship, and glass breakage as a result of defective design, and agreeing to replace components that fail within 5 years.

The warranty states the following:

a. Watertight and airtight system installation is completed within specified tolerances.

b. The completed installation remains free of rattles, wind whistles and noise caused by thermal movement and wind pressure.

c. System is structurally sound and free from distortion.

d. Glass and glazing gaskets will not break or "pop" from frames as a result of design, wind load pressure, movement caused by expansion or contraction, or structural loading.

e. Glazing sealants and gaskets remain free of abnormal deterioration or dislocation as a result of sunlight, weather, or oxidation.

Provide written warranty stating that the organic coating finish will not fade more than 10 percent or show chalking, yellowing, peeling, cracking, pitting, corroding or variations in color, or gloss deterioration beyond the manufacturer's descriptive standards for 5 years from the shipment date and agreeing to promptly correct defects.

Provide a written thermal integrity warranty for 5 years from ship date against thermal barrier system failure resulting from the following:

a. Longitudinal and transverse thermal barrier shrinkage.
b. Thermal barrier cracking.
c. Structural failure of the thermal barrier material.
d. Loss of adhesion or loss of prescribed edge pressure on glazing material, resulting in excessive air and water infiltration.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide aluminum entrances, with glass and glazing, door hardware, and components.

Aluminum entrances include impact resistance entrances; medium stile, 3 1/2 inch vertical face dimension, 2 inch depth, for interior structural silicone glaze, for high-traffic/impact-resistant applications.

2.1.1 Design Requirements for Aluminum (Entrances and Components)

Provide a door portal system designed to withstand the following loads without breakage, loss, failure of seals, product deterioration, or other defects.

a. Dead and Live Loads: Determined by ASCE 7 and calculated in accordance with applicable codes.

b. Seismic Loads: Design and install the system to comply with the seismic requirements for the project location in accordance with Section 1613 of the International Building Code, ICC IBC.

c. Wind Loads: Design and install the system so that the effects of wind load acting inward and outward normal to the plane of the wall are in accordance with ASTM E330/E330M.

d. Thermal Loads And Movement:
   (1) Ambient Temperature Range: 120 degrees F
   (2) Material Surfaces Range: 180 degrees F

e. Water and Air Resistance: Provide weatherstripping, exterior gaskets, sealants, and other accessories to resist water and air penetration.

f. Impact-Protective Systems Provide an impact-protective system in accordance with ASTM E1886.

2.1.1.1 Material Standard

ASTM B221; 6063-T5 alloy and tempered.

Provide door stile and rail face dimensions of the entrance doors as follows:

<table>
<thead>
<tr>
<th>Vertical Stile</th>
<th>Top Rail</th>
<th>Bottom Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1/2 inches</td>
<td>3-1/2 inches</td>
<td>6-1/2 inches</td>
</tr>
</tbody>
</table>

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Provide major portions of the door members at **0.125 inches** nominal in thickness and glazing molding at **0.050 inches** thick.

2.1.1.2 Sealants

Provide either ethylene propylene diene monomer (EPDM) elastomeric extrusions or thermoplastic elastomer glazing gaskets. Structural silicone sealant is required.

Internal Sealants: Provide sealants that according to the manufacturer will remain permanently elastic, tacky, non-drying, non-migrating, and weather tight.

2.1.1.3 Thermal Barrier

Use a rigid, structural thermal barrier to separate all exterior aluminum from interior aluminum. For purposes of this specification, a structural thermal barrier is defined as a system that transfers shear during bending and, therefore, promotes composite action between the exterior and interior extrusions. Do not use a nonstructural thermal barrier. Ensure that the thermal barrier provides a structural connection between the two sides of the door.

2.2 FABRICATION

Provide the following information when submitting **fabrication drawings** for custom fabrications:

a. Indicate elevations, detailed design, dimensions, member profiles, joint locations, arrangement of units, and member connections.

b. Show the following items:
   
   (1) Details of special shapes.

   (2) Reinforcing.

   (3) Anchorage system.

   (4) Interfacing with building construction.

   (5) Provisions for expansion and contraction.

   (6) Thermal breaks.

c. Indicate typical glazing details, locations of various types and thickness of glass and internal sealant requirements as recommended by the sealant manufacturer.

d. Clearly indicate locations of exposed fasteners and joints.

e. Clearly show where and how the manufacturer's system deviates from Contract drawings and these specifications.

2.2.1 Entrance System Fabrication

Provide door corner construction consisting of mechanical clip fastening, SIGMA deep penetration plug welds and **1 1/8 inch** long fillet welds inside and outside all four corners. Provide a hook-in type exterior glazing stop.
with EPDM glazing gaskets reinforced with non-stretchable cord. Provide an interior glazing stop that is mechanically fastened to the door member and that incorporates a silicone-compatible spacer used with silicone sealant. Accurately fit and secure joints and corners. Make joints hairline in appearance. Remove burrs and smooth edges. Prepare components with internal reinforcement for door hardware. Arrange fasteners and attachments so that they are concealed from view.

Separate dissimilar metals with protective coating or pre-formed separators in order to prevent contact and corrosion.

2.2.2 Shop Assembly

Fabricate and assemble units with joints only at the intersection of aluminum members with hairline joints; rigidly secure these units, and seal them in accordance with the manufacturer's recommendations.

2.2.2.1 Welding

Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by the manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected by the Contacting Officer.

2.2.3 Finish

Before fabrication, clean the units and give them a AA-M-10-C22-A31 clear (natural) anodized finish in accordance with the requirements of the AA DAF45.

2.2.4 Fabrication Tolerance

Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure these units, and seal them in accordance with the manufacturer's recommendations.

Fabricate aluminum entrances in accordance with the entrance manufacturer's prescribed tolerances.

2.2.4.1 Material Cuts

Square to 1/32 inch off square, over largest dimension; proportionate amount of 1/32 inch on the two dimensions.

2.2.4.2 Maximum Offset at Consecutive Members

1/64 inch in alignment between two consecutive members in line, end to end.

2.2.4.3 Maximum Offset at Glazing Pocket Corners

1/64 inch between framing members at glazing pocket corners.

2.2.4.4 Joints

Between adjacent members in same assembly: Joints are hairline and square to the adjacent member.
2.2.4.5 Variation

In squaring diagonals for doors and fabricated assemblies: 1/16 inch.

2.2.4.6 Flatness

For doors and fabricated assemblies: plus/minus 1/16 inch of neutral plane.

2.3 MATERIALS

2.3.1 Sealants

Refer to Section 07 92 00 JOINT SEALANTS. Ensure that all sealants conform to AAMA 800.

2.4 ACCESSORIES

2.4.1 Fasteners

Provide stainless steel fasteners in areas where the fasteners are exposed.

Use non-corrosive and compatible fasteners with components being fastened. Do not use exposed fasteners, except where unavoidable for application of hardware.

In areas where fasteners are not exposed, use aluminum, non-magnetic stainless steel, or other materials warranted by the manufacturer.

For exposed locations, provide countersunk Phillips head screws when items with a matching finish are fastened. For concealed locations, provide the manufacturer's standard fasteners.

Provide nuts or washers that have been designed with a means to prevent disengagement; do not deform fastener threads.

2.4.2 Perimeter Anchors

When steel anchors are used, provide insulation between steel material and aluminum material in order to prevent galvanic action.

2.4.2.1 Inserts and Anchorage Devices

Provide manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars, or tubes. Shop-coat steel assemblies after fabrication with an alkyd zinc chromate primer complying with FS TT-P-645.

2.4.3 Standard Entrance Hardware

2.4.3.1 Weatherstripping

Equip meeting stiles on pairs of doors with an adjustable astragal using wool pile with a polymeric fin.

Provide door weatherstripping on a single-acting offset pivot or butt-hung door and frame (single or pairs) consisting of a thermoplastic elastomer weatherstripping on a tubular shape with a semi-rigid polymeric backing.

Provide sill-sweep strips: Provide an EPDM blade gasket sweep strip in an
17-0016, Interior and Exterior Repairs, Bldg. 523

aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners. (Provide as necessary to meet specified performance tests.)

2.4.3.2 Threshold

Provide an extruded aluminum threshold, one piece per door opening, with ribbed surface.

2.4.3.3 Offset Pivots

Provide the manufacturer's standard top and bottom pivots with one intermediate offset pivot.

2.4.3.4 Panic Device

Provide the manufacturer's recommended standard panic hardware.

2.4.3.5 Closer

Provide a surface closer in accordance with ANSI/BHMA A156.4.

2.4.3.6 Security Lock or Dead Lock

Provide A/R MS 1850A lock with two A/R 1871 cylinder operated flush bolts.

2.4.3.7 Cylinder(s)/Thumb-turn

Provide the manufacturer's recommended standard.

2.4.3.8 Cylinder Guard

Provide the manufacturer's recommended standard.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Site Verification of Conditions

Verify that the condition of substrate previously installed under other sections is acceptable for product installation in accordance with the manufacturer's instructions.

Verify that openings are sized to receive the storefront system and that the sill plate is level in accordance with the manufacturer's acceptable tolerances.

3.2 PREPARATION

Field-verify dimensions before fabricating components for the door portal assembly.

Coordinate the erection of door portal with installation of surrounding wall and door assemblies. Ensure that the door portals can provide support and anchorage for assembly components.
3.2.1 Adjacent Surfaces Protection

Protect adjacent work areas and finish surfaces from damage during product installation.

3.2.2 Aluminum Surface Protection

Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

3.3 INSTALLATION

Submit installation drawings for review and approval.

Install the entrance system in accordance with the manufacturer's instructions and the AAMA storefront and entrance guide specifications manual. Attach the entrance system to the structure, allowing it to be adjusted to accommodate construction tolerances and other irregularities. Provide alignment attachments and shims to permanently fasten the system to the building structure. Align the assembly so that it is plumb and level, and free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.

Set thresholds in a bed of mastic and secure the thresholds. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or a bituminous coating. Shim and brace the aluminum system before anchoring the system to the structure. Verify that weep holes are open, and the metal joints are sealed in accordance with the manufacturer's installation instructions. Seal metal-to-metal joints using a sealant recommended by the system manufacturer.

3.3.1 Tolerances

Ensure that tolerances for wall thickness and other cross-sectional dimensions of entrance members are nominal and in compliance with Aluminum Standards and Data, published by the Aluminum Association.

3.3.2 Adjusting

Adjust operating hardware for smooth operation, and as recommended by the manufacturer.

3.3.3 Related Products Installation Requirements

3.3.3.1 Sealants (Perimeter)

Refer to Section 07 92 00 JOINT SEALANTS.

3.4 FIELD QUALITY CONTROL

3.4.1 Air Infiltration

Test air infiltration in accordance with ASTM E783

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. For single-acting offset pivot, butt hung, or continuous geared hinge entrances in the closed and locked position, test the specimen in
accordance with ANSI/BHMA A156.10, and ASTM E283 at a pressure differential of 1.57 psf for pairs of doors; ensure that maximum infiltration for a pair of 7 foot by 8 foot entrance doors and frame is 1.2 cfm/square foot.

b. Ensure the maximum allowable infiltration for a completed storefront system does not exceed 0.06 cfm/square foot when tested in accordance with ASTM E1424 at a differential static pressure of 6.24 psf.

3.4.2 Wind Loads

Provide a completed storefront system capable of withstanding wind pressure loads, normal to the wall plane indicated, as follows:

a. Exterior Walls
   (1) Positive Pressure: 70 psf
   (2) Negative Pressure: 90 psf

b. Interior Walls: (pressure acting in either direction) 70 psf

3.4.3 Deflection

Submit certified test reports showing that the maximum allowable deflection in a member when tested in accordance with ASTM E330/E330M with allowable stress is L/175 or 3/4 inches maximum.

3.4.4 Condensation Resistance and Thermal Transmittance

Submit certified test reports showing compliance with specified performance characteristics as follows:

a. U-Value Requirements:
   (1) Perform test in accordance with the AAMA 1503 procedure and on the configuration specified therein.
   (2) Thermal Transmittance ("U" Value) maximum 0.65 (6250) BTU/hr/sf/deg F at 15 mph exterior wind.

b. CRF Class Requirements:
   (1) Perform a test in accordance with AAMA 1503.

3.4.5 Water Infiltration

Submit certified test reports showing that the system is designed to provide no uncontrolled water when tested in accordance with ASTM E1105 at a static pressure of 8 psf.

3.5 ADJUSTING AND CLEANING

3.5.1 Protection

Protect the installed product's finish surfaces from damage during construction. Protect the aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
3.5.2 Cleaning

Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions before acceptance. Remove excess mastic, mastic smears, and other foreign materials. Remove construction debris from the project site and legally dispose of this debris.

3.6 WARRANTY

Submit three signed copies of the manufacturer's product warranty for the entrance system as follows:

a. Warranty Period: Five years from Date of Substantial Completion of the project, provided that the Limited Warranty begins no later than six months from the date of shipment by the manufacturer. In addition, support welded door corner construction with a limited lifetime warranty for the life of the door under normal use.

Ensure that the Warranty's language is identical to the "As Approved" version of the sample warranty submitted to and returned from the Contracting Officer.

-- End of Section --
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.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.13 (2012) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.16 (2013) Auxiliary Hardware
ANSI/BHMA A156.2 (2011) Bored and Preassembled Locks and Latches
ANSI/BHMA A156.21 (2014) Thresholds
ANSI/BHMA A156.3 (2014) Exit Devices
ANSI/BHMA A156.7 (2016) Template Hinge Dimensions

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2016) Standard for Fire Doors and Other Opening Protectives

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)

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
   Hardware Schedule; 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 drawings indicating all hardware assembly components and interface with adjacent construction.

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:

<table>
<thead>
<tr>
<th>Hardware Item</th>
<th>Quantity</th>
<th>Size</th>
<th>Reference Publication Type No.</th>
<th>Finish Mfr Name and Catalog No.</th>
<th>Key Control Symbols</th>
<th>UL Mark (If fire-rated and listed)</th>
<th>BHMA Finish Designation</th>
</tr>
</thead>
</table>

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

1.6.1 Requirements

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

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

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

c. Tabulation showing which key fits which door.

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

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

1.7 QUALITY ASSURANCE

1.7.1 Hardware Manufacturers and Modifications

a. The following specified manufacturers and products are intended to establish expected quality, design, function, and finish to be provided under this section of the specifications.

b. All Other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Door Hardware Contractor, subject to the approval of the Government.

1.7.2 Key Shop Drawings Coordination Meeting

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

1.8 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

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

Door Hardware: All applicable door hardware shall have been satisfactorily tested for and meet all requirements for positive pressure door opening in accordance with IBC 2003.
Hollow Metal Doors: Provide acceptable positive pressure sealing for all hollow metal labeled doors. Sealing mechanism shall not interfere with normal door operation or function and shall be vandal-resistant.

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. Coordinate electrified door hardware components with corresponding components specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

2.3.1 Hinges

a. All hinges and pivots, including single and double acting types, pocket hinges, electric hinges and continuous aluminum geared hinges to be of one manufacturer for continuity and consideration of warranty.

b. Unless otherwise specified, provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for exterior doors, outswinging doors, and secured areas as called for in this specification.

c. Exterior Door Hinges: Provide out-swinging door hinges of Wrought steel, polished and plated to US26D with non-removable pins or security studs as called for in this specification. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 18 inches or fraction thereof.

d. Interior Door Hinges: Wrought steel, polished and plated to US26D unless specified otherwise. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 18 inches or fraction thereof.

<table>
<thead>
<tr>
<th>Door Thickness</th>
<th>Door Width</th>
<th>Hinge Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4&quot;</td>
<td>to 36&quot;</td>
<td>4 1/2&quot;</td>
</tr>
<tr>
<td>1-3/4&quot;</td>
<td>over 36&quot;to 48&quot;</td>
<td>5&quot; (0.180)</td>
</tr>
</tbody>
</table>

e. Where required to clear trim or permit doors to swing 180 degrees, furnish hinges of sufficient throw. Provide heavy weight hinges on all doors over 36 inches in width. At labeled doors, provide ball bearing-type hinges. For all doors equipped with closers, provide ball bearing-type hinges.

f. The following are of acceptable products by Bommer Industries:

A8112   BB5000
2.3.2 Locks and Latches

2.3.2.1 Mortise Locks and Latches

2.3.2.1.1 Mortise Locksets, Latchsets and Deadlocks

a. To the maximum extent possible, locksets, latchsets, and deadlocks shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pair of wood doors shall be furnished with wrought boxes. Lock and latch set trim (handles, roses and escutcheons) shall be of a simple design in accordance with manufacturer's standard practice.

B. Handles, pulls, latches, locks, and other operating devices on accessible doors shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate. Lever-operated mechanisms, push-type mechanisms, and U-shaped handles are acceptable designs. As a tactile warning to blind persons, provide levers with knurled surface texture on the access side of door, where openings are identified on the Door Schedule or detailed in the Hardware Types.

c. Locksets with latch bolts, regardless of trim, shall be listed by Underwriters Laboratories for "A" and lesser labeled door and conform to the standards of U.L. 10c and U.B.C. 7-2 (1997) positive pressure testing, single or pair. Lock trim, lever, sectional, type shall be through-bolted to assure correct alignment and proper operation.

d. Lock Mechanisms shall be metal throughout with all functions available in one size case; full ¾-inch throw anti-friction latch bolt; one-inch dead bolt with hardened-steel insert; and available for a minimum door thickness of 1-3/8 inches. Internal parts shall be heavy-gauge steel, zinc dichromate plated, and nickel-steel hubs.

e. Locksets shall conform to Federal Specification, Type 86 and 86m and be certified as meeting ANSI A156.2 Grade I requirements. BHMA Series 1000, Operational and Security Grade 1.

1. Lock Backset shall be 2-3/4.

2. Cases shall be minimum .090 inches thick, steel, zinc dichromate plates or castrol dipped; closed on all sides.

3. Strikes shall be wrought-box type for locksets, latchsets, and deadlocks, with lip extensions sufficient to protect adjacent trim.

4. Reinforcing Units shall be furnished for locksets, latchsets, and deadbolts in steel doors.

5. Accessories shall be provided to match cylinders and dummy trim as scheduled.

6. Locksets shall have a ten (10) year warranty.

2.3.2.2 Bored Locks and Latches

Provide in accordance with ANSI/BHMA A156.2, Series 4000, Grade 1.
2.3.3 Exit Devices

a. All exit devices and trim, including electrified items, to be of one manufacturer specified and in the hardware sets for continuity of design and consideration of warranty. Electrified devices and trim to be the same series and design as mechanical devices and trim.

b. Exit Devices to be "UL" listed for life safety. All exit devices for labeled doors shall have "UL" label for "Fire Exit Hardware". All devices mounted on labeled wood doors shall be through-bolted or per the manufacturer's listing requirements. All devices to conform to NFPA 80 and NFPA 101 requirements.

1. Labeled Exit Devices/Positive Pressure: All exit devices for labeled doors shall be have applicable factory-applied UL stamp and shall comply with and shall have been satisfactorily tested for compliance with IBC-7-12-1997 or UL 10C requirements for positive pressure.

c. All exit devices to be touch-pad type heavy duty with one piece removable covers.

d. All devices shall have deadlocking latchbolts with ¾" throw, where applicable.

e. All trim to be through-bolted to the lock stile case. Center case shall be through-bolted to outside trim, and hinge end shall be through-bolted.

Lever design to be the same as specified with locksets.

f. Lever trim shall be vandal resistant free wheeling, clutch type, or break away to deter lever abuse.

g. All metal end caps to be standard with all exit devices.

h. Unless specified otherwise, all vertical rod devices on metal doors shall be concealed and have "latch retraction" hold back on top latch. Bottom latch shall have adjustable projection.

i. All devices shall be UL approved for all types and functions indicated in the Hardware Schedule.

j. Devices shall have published ten year warranty.

k. Finish: 630 (US32D).

l. Key Removable Mullion: Compatible with exit device and keyed to door. Use labeled mullions in labeled doors. Provide a mullion stabilizer on exterior doors.

m. When dummy exit push bars are specified, provide dummy push bars to match design and finish of adjacent exit device, and provide pulls on pull side of door to match those of adjacent exit device.

n. The following are acceptable Products by Dorma Architectural Hardware.

9300 x PRT03 Type 1 - F03 Grade 1
2.3.4 Cylinders and Cores

2.3.4.1 Cylinders and Keying

a. Furnish all locks and cylinders keyed to existing grandmaster key system as established by Government.

b. Supply each cylinder or lock with three change keys. Six master keys to be supplied for each master key group. Supply six grandmaster keys to be supplied for the project.

c. Tag all cylinders and keys to indicate their intended location and to enable the Owner, with a minimum of effort, to establish his key control system. Organize and install tagged keys in key cabinet according to Government's requirements.

d. Furnish all locks and cylinders construction master keyed. The use of permanent keying shall block out temporary construction keying and the completion of the project.

   1. Supply 10 construction master keys for the project.

e. Stamp all change keys with appropriate keyset symbol and DO NOT DUPLICATE, but do not stamp with key section or bitting number.

f. Furnish one each key cabinet similar to model AWC as manufactured by Telkee with a Capacity of 1 hook per cylinder installed, plus an additional 50 percent expansion. Organize, label, tag, and install all tagged keys in the cabinet prior to occupancy. Organize amid install keys in an order and sequence acceptable to the Government.

g. All keying will be coordinated with the Government as required. Supplier shall meet with Government to finalize keying requirements and to obtain final instructions in writing. The hardware supplier shall coordinate the deactivation of the construction keying with the Government.

   1. Coordinate keying with the Government so that only one keyway is used, and each keyway is exhausted prior to using another keyway.

2.3.5 Lock Trim

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

2.3.5.1 Mortise Lock Trim

a. Lock trim shall be cast or forged solid metal construction lever of commercial plain design and shall meet the test requirement of ANSI/BHMA A156.2 or ANSI/BHMA A156.13.

b. Levers are to be cast material; hollow or filled tubes are not acceptable.

c. All hardware functions to be exactly as listed in the individual hardware sets with no exceptions.
d. The following are acceptable products by Dorma Architectural Hardware:

<table>
<thead>
<tr>
<th>LRB Design</th>
<th>F04 ML9050</th>
<th>F05 ML9070</th>
<th>F07 ML9080</th>
<th>F20 ML9953</th>
<th>E2171 DB863L 626</th>
</tr>
</thead>
</table>

e. Finish: 630

2.3.5.2 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. Provide lever handles return to within 1/2 inch of the door face.

2.3.6 Closers

2.3.6.1 Surface Mounted Door Closers

a. All closers for this project to be the product of a single manufacturer for continuity of design and consideration of warranty. Warranty shall be a minimum advertised 25 years and tested by independent testing laboratory for 10,000,000 cycles.

b. All closers to be heavy duty, non-handed, surface mounted, hydraulic type, minimum efficiency of 60%, with a one piece high strength cast alloy body and steel piston. Full rack and pinion constructed of heavy steel.

1. Labeled Closers/Positive Pressure: All closers for labeled doors shall be have applicable factory-applied UL stamp and shall comply with and shall have been satisfactorily tested for compliance with IBC-7-12-1997 or UL 10C requirements for positive pressure.

c. Size all closers in accordance with the manufacturer's recommendations at the factory for intended application, and sized to meet ADA opening force and requirement.

d. All closers to have adjustable spring power and separate tamper resistant, non-critical regulating screw valves for closing speed, latching speed, back check control and back check positioning as a standard feature.

e. All closer covers to be rectangular, full cover type of non-corrosive, finished to match closer and adjacent hardware.

f. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

1. All parallel arm mounted closers to be factory indexed to ensure proper installation.
2. Furnish heavy duty cold forged parallel arms for all parallel arm mounted closers.

g. Provide closers with special application and, heavy-duty arms as specified in the hardware sets or as otherwise called for to ensure a proper-operating, long-lasting opening.

h. The base of the closers shall be of a dimension so the base does not extend past the edges of the top rail of the door, the base of the closers is not visible through the glass from the exterior, and the mounting screws of the closer do not interfere with the glass. Drop plates for mounting the closer to narrower than required top door rails are not acceptable. Coordinate with the aluminum, wood, or steel door descriptions in applicable individual specifications.

i. Door Opening Force: Maximum force for pushing or pulling open a door shall comply with this paragraph. For hinged doors the force shall be applied perpendicular to the door at the door opener or 30 inches from the hinged side whichever is farther from the hinge.

1. Exterior hinged doors shall not exceed 8.5 lbf. Slight increases in opening force shall be allowed where 8.5 lbf. is insufficient to compensate for air pressure differentials.

2. Interior hinged doors shall not exceed 5.0 lbf.

3. Fire doors shall be adjusted to meet the minimum opening force permitted by governing fire safety standards.

j. Except for classrooms, all labeled doors shall be equipped with the proper closer. Except for classroom doors, labeled doors that appear in the hardware sets without closers shall be brought to the Contracting Officers attention for clarification.

k. The following is a list of acceptable Products: Dorma Architectural Hardware:

   - C02011-PT1-PT4C/D/H  8916 - AF89 x SNB
   - C02021-PT1-PT4C/D/G/H  8916 - DS x SNB
   - C02011-PT1-PT4C/D/G/H  8916 - S-IS x SNB

l. Closer Finish: 689 Alum. with corrosion resistant primer SRI.

2.3.6.2 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.

2.3.7 Door Protection Plates

2.3.7.1 Push Plates, Door Pulls, and Kickplates

a. The following are acceptable Products by Burns Manufacturing:

   - Push Plate 4 x 16 J301  54
   - Pull Plate 4 x16 J405  5425B
b. The following are acceptable Products by Burns Manufacturing. Kick plates to be of 16 gauge (0.050) inches thick stainless steel (US32D). For doors with louvers or narrow bottom rails, kickplate height to be 1 inch less than the dimension shown from the bottom of the door to the bottom of the louver.

1. Kick Plates: 8" x 2" LDW. BHMA # J102.
2. Mop Plates: 4" x 2" LDW. BHMA # J103.
3. Armor Plates 16" x 2" LDW BHMA # J101.

c. Where required, armor plates, edge guards and other protective hardware are to be supplied in sizes as scheduled in the hardware sets.


2.3.7.2 Sizes of Kick Plates

2 inch less than door width for single doors; 1 inch less than door width for pairs of doors. Provide 8 inch kick plates for flush doors.

2.3.8 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.

2.3.8.1 Door Stops and Holders

a. Door stops are to be furnished for every door leaf every door to have either a floor, wall, or an overhead stop. Special arms on door closers do not constitute door stops.

1. Wall Stops: Wall stops are the preferred and shall be used where possible.

2. Floor Stops: Floor stops may be used where a wall, stop is not feasible, provided the floor stop is not in the open, does not interfere with activities, or does not pose a safety threat.

3. Overhead Stop: Use overhead stops where wall stops and floor stops are not feasible.

4. Where floor, wall, and overhead stops are not feasible or will not work, use closers with a spring cushion on the stop arm and a back check.

b. Place door stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.

c. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass or bronze with no plastic parts.

d. Finish: Wall or Floor mounted stops shall be furnished in a 626 (US26D) finish. Where available 630 (32D) may be used.

e. The following are acceptable Products by Burns Manufacturing.
f. The following are acceptable Products by Dorma Architectural Hardware:

1. OVERHEAD STOPS/HOLDERS:
   Heavy Duty Stop C02541 900S Series

2.3.8.2 Door Silencers

a. Provide two at each pair of doors and three for each single door. Acceptable silencers are by Burns Manufacturing.
   Door Silencers L03011 500

2.3.8.3 Flush Bolts and Coordinators

a. Provide Flush bolts with Dust Proof Strikes were required as scheduled in the hardware sets. The following are acceptable Products by Burns Manufacturing:
   Manual Flush Bolt L14081 590 - 12"
   Dust Proof Strike L14021 545

b. Where required for specific fire-rated egress applications furnish appropriate Automatic Flush Bolts for wood door and hollow metal doors.

2.3.9 Thresholds

Provide in accordance with ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.9.1 Thresholds and Gasketing

a. All thresholds must be in accordance with the requirements of the ADA and ANSI A1 17.1. Provide thresholds with machine screws and lead anchors. Supply all necessary anchoring devices for weatherstripping and sound seals.

b. The following is a list of acceptable Products by Pemko Manufacturing:
   Threshold (Flat Saddle) J32130 171A
   Door Sweep R3A545 3452ANB
   Weatherstrip R3C265 315CR
   (Furnish Length as Required (LAR))

c. Furnish as listed above or as specified in the hardware sets.

2.3.10 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.

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 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.

3.4 HARDWARE SETS
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<tr>
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<th>Grade/Function</th>
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**HW-8**
(Door A116, A134, A231)

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**HW-9**
(Door A215)
Vault Door To Remain

**HW-10**
(Doors A120, A219)

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**HW-11**
(Door A126, A223, A243)

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**HW-12**
(Doors A204, A207)

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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

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


1.2   SUBMITTALS

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
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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 Galvanized Steel Sheet

ASTM A653/A653M, coating designation G90.

2.1.2 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

2.1.4 Cold Rolled Steel Sheet

ASTM A1008/A1008M, Class 1, with matte finish. Use for interior louvers only.

2.2 METAL WALL LOUVERS

Weather resistant type, with bird screens and made to withstand a wind load of not less than 30 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.

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.

2.2.2 Formed Metal Louvers

Formed of zinc-coated steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 0.08 inch thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide Mullions 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.
2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. For steel louvers, provide 1/2 inch square mesh, 12 or 16 gage zinc-coated steel; 1/2 inch square mesh, 16 gage copper; or 1/4 inch square mesh, 16 gage zinc-coated steel or copper 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 and zinc-coated or stainless steel screws and fasteners for steel 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 anodic coating. Color shall be as selected by Architect from manufacturer's standard colors.

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 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 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 --
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SECTION  09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

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 C 645 (2009a) Nonstructural Steel Framing Members

ASTM C 754 (2009a) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

ASTM C 841 (2003; R 2008e1) Installation of Interior Lathing and Furring


NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM ML/SFA 920 (1991) Metal Lathing and Furring

UNDERWRITERS LABORATORIES (UL)


1.2   SUBMITTALS

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

SD-02 Shop Drawings

Metal support systems

Submit for the erection of metal framing. 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; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841, and ASTM C 847.

2.1.2 Non-loadbearing Wall Framing

NAAMM ML/SFA 920.

2.1.2.1 Materials for Attachment of Gypsum Wallboard

2.1.2.1.1 Suspended and Furred Ceiling Systems

ASTM C 645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C 645, but not thinner than 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures.

2.1.2.3 Furring Structural Steel Columns

ASTM C 645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841, except as indicated otherwise.

3.1.2 Non-loadbearing Wall Framing

NAAMM ML/SFA 920, except provide framing members 16 inches o.c. unless indicated otherwise.
3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 754, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2.2 Non-loadbearing Wall Framing and Furring

ASTM C 754, 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 --
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 C475/C475M  (2015) Joint Compound and Joint Tape for Finishing 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

FM GLOBAL (FM)


GYPSUM ASSOCIATION (GA)

GA 214  (2010) Recommended Levels of Gypsum Board Finish

1.2 SUBMITTALS

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

- **SD-03 Product Data Water-Resistant Gypsum Backing Board**
  - **Accessories**
    - Submit for each type of gypsum board and for cementitious backer units.
  - **Gypsum Board**
  - **SD-07 Certificates**
    - **Asbestos Free Materials**
      - Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

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 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 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.

1.6 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.

2.1.1 Gypsum Board

2.1.1.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Regular Water-Resistant Gypsum Backing Board

ASTM C1396/C1396M

2.1.2.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.3 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.
2.1.3.1 Embedding Compound
Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.3.2 Finishing or Topping Compound
Specifically formulated and manufactured for use as a finishing compound.

2.1.3.3 All-Purpose Compound
Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.3.4 Setting or Hardening Type Compound
Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.3.5 Joint Tape
Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.4 Fasteners

2.1.4.1 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.

2.1.5 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.

2.1.6 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 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 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with ASTM C840, System XI or GA 216.

3.2.3 Glass Mat Covered or Fiber Reinforced Gypsum Sheathing

Apply glass mat covered or fiber reinforced gypsum sheathing in accordance to gypsum association publications GA 253. Follow gypsum sheathing manufacturer's requirements of design details for joints and fasteners and be properly installed to protect the substrate from moisture intrusion. Do not leave exposed surfaces of the glass mat covered or fiber reinforced gypsum sheathing beyond the manufacturer's recommendation without a weather barrier cladding. Provide continuous asphalt impregnated building felt over sheathing surface in shingle fashion with edges and ends lapped a minimum of 6 inch. Properly flash the openings. Seal all joints, seams, and penetrations with a compatible silicone sealant.

3.2.4 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C840, System XIII or GA 216.

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. Finish walls and ceilings to receive a heavy-grade wall covering or heavy textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 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

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. 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 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

3.7 SHAFTWALL FRAMING

Install the shaftwall system in accordance with the system manufacturer's published instructions. Coordinate bucks, anchors, blocking and other items placed in or behind shaftwall framing with electrical and mechanical work. Patch or replace fireproofing materials which are damaged or removed during shaftwall construction.

-- End of Section --
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)


ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M (2016b) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete


ASTM C648 (2004; R 2009) Breaking Strength of Ceramic Tile

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**ASTM D226/D226M**  

**ASTM D4068**  
(2015) Chlorinated Polyethylene Sheeting for Concealed Water-Containment Membrane

**MARBLE INSTITUTE OF AMERICA (MIA)**

**MIA Design Manual**  

**TILE COUNCIL OF NORTH AMERICA (TCNA)**

**TCNA Hdbk**  

1.2 **SUBMITTALS**

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

**SD-03 Product Data**

*Tile;*

*Setting-Bed Mortar, Grout, and Adhesive;*

*Reinforcing Wire Fabric*

**SD-04 Samples**

*Tile;*

*Accessories Transition Strips;*

*Grout;*

**SD-07 Certificates**

*Tile Mortar, Grout, and Adhesive*

**SD-08 Manufacturer's Instructions**

*Maintenance Instructions*

**SD-10 Operation and Maintenance Data**

*Installation;*
1.3 QUALITY ASSURANCE

Installers to be from a company specializing in performing this type of work and have a minimum of two years experience. Each type and color of tile to be provided from a single source. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.4 DELIVERY, STORAGE, AND HANDLING

Ship tiles in sealed packages and clearly marked with the grade, type of tile, producer identification, and country of origin. Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 50 degrees F and rising. Maintain temperature above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.7 EXTRA MATERIALS

Supply an extra 2 percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Furnish tiles that comply with ANSI A137.1 and are standard grade tiles. Provide a minimum breaking strength of 125 lbs. for wall tile and 250 lbs. for floor tile in accordance with ASTM C648. Provide exterior building tile for cold climate projects that is approved by the manufacturer for exterior use when tested in accordance with ASTM C1026. Provide floor tiles with a wet dynamic coefficient of friction (DCOF) value of 0.42 or greater when tested in accordance with ANSI A137.1 requirements. Provide glazed floor tile with a Class III-Heavy Residential or Light Commercial classification as rated by the manufacturer when tested in accordance with ASTM C1027 for visible abrasion resistance as related to foot traffic. For materials like tile, accessories, and transition strips submit samples of sufficient size to show color range, pattern, type and joints. Submit manufacturer's catalog data.

2.1.1 Glazed Wall Tile

Furnish glazed wall tile that has cushioned edges and trim with lead-free bright finish. Provide nominal tile size(s) of 6 by 6 inch.
2.2 **SETTING-BED**

Submit manufacturer's catalog data. Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

2.2.6 Reinforcing Wire Fabric

Conform to ASTM A1064/A1064M for wire fabric. Provide 2 by 2 inch mesh, 16/16 wire or 1-1/2 by 2 inch mesh, 16/13 wire.

2.3 **WATER**

Provide potable water.

2.4 **MORTAR, GROUT, AND ADHESIVE**

Submit certificates indicating conformance with specified requirements. Conform to the following for mortar, grout, adhesive, and sealant:

2.4.1 Dry-Set Portland Cement mortar

*TCNA Hdbk.*

2.4.2 Ceramic Tile Grout

*TCNA Hdbk*; petroleum-free and plastic-free sand portland cement grout.

2.4.3 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Grout sealant must not change the color or alter the appearance of the grout.

2.5 **TRANSITION STRIPS**

Provide marble transitions appropriate for conditions. Categorize marble
Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble, white in color. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.

2.6 MEMBRANE MATERIALS


PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCNA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>WALLS</th>
<th>FLOORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry-Set Mortar</td>
<td>1/8 inch in 8 ft.</td>
<td>1/8 inch in 10 ft.</td>
</tr>
<tr>
<td>Organic Adhesives</td>
<td>1/8 inch in 8 ft.</td>
<td>1/16 inch in 3 ft.</td>
</tr>
<tr>
<td>Latex Portland Cement Mortar</td>
<td>1/8 inch in 8 ft.</td>
<td>1/8 inch in 10 ft.</td>
</tr>
<tr>
<td>Epoxy</td>
<td>1/8 inch in 8 ft.</td>
<td>1/8 inch in 10 ft.</td>
</tr>
</tbody>
</table>

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit manufacturer's preprinted installation instructions.

3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the TCNA Hdbk, method W223 and with grout joints as recommended by the manufacturer for the type of tile.
3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to TCNA Hdbk for workable mortar bed, materials, and installation of tile. Conform to TCNA Hdbk for cured mortar bed and materials.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use Dry-set to install tile in accordance with TCNA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.3.3 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk. Provide and apply manufacturer's standard product for sealing grout joints in accordance with manufacturer's recommendations.

3.4 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with TCNA Hdbk method, and with grout joints as recommended by the manufacturer for the type of tile. Install shower receptors in accordance with TCNA Hdbk method F121.

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCNA Hdbk for workable mortar bed materials and installation. Conform to TCNA Hdbk for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

3.4.2 Dry-Set and Latex-Portland Cement

Use dry-set or Latex-Portland cement mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCNA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk. Provide and apply manufacturer's standard product for sealing grout joints in accordance with manufacturer's recommendations.

3.4.4 Waterproofing

Shower pans are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.4.5 Concrete Fill

3.5 INSTALLATION OF TRANSITION STRIPS

Install transition strips where indicated, in a manner similar to that of the ceramic tile floor and as recommended by the manufacturer. Provide thresholds full width of the opening. Install head joints at ends not
exceeding 1/4 inch in width and grouted full.

3.6 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles. Submit copy of manufacturer's printed maintenance instructions.

-- End of Section --
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 C423 (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method


ASTM C834 (2014) Latex Sealants

ASTM E1414/E1414M (2011a; E 2014) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

ASTM E1477 (1998a; R 2013) Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers
1.2 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.2.1 Ceiling Attenuation Class and Test

Provide a ceiling system with an attenuation class (CAC) of 40 when determined in accordance with ASTM E1414/E1414M. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

1.2.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

1.2.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E1477 Test Method.

1.2.4 Other Submittals Requirements

The following shall be submitted:

a. Manufacturer's data indicating percentage of recycle material in acoustic ceiling tiles to verify affirmative procurement compliance.

b. Total weight and volume quantities of acoustic ceiling tiles with recycle material.

c. Manufacturer's catalog showing UL classification of fire-rated ceilings.

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giving materials, construction details, types of floor and roof constructions to be protected, and UL design number and fire protection time rating for each required floor or roof construction and acoustic ceiling assembly.

d. Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories requirements for the fire endurance rating listed in UL Fire Resistance may be submitted in lieu of test reports.

e. Certificate attesting that the mineral based acoustical units furnished for the project contain recycled material and showing an estimated percent of such material.

1.3 SUBMITTALS

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

SD-02 Shop Drawings
Approved Detail Drawings

SD-03 Product Data

SD-04 Samples
Acoustical Units
Acoustic Ceiling Tiles

SD-06 Test Reports
Ceiling Attenuation Class and Test

SD-07 Certificates
Acoustical Units
Acoustic Ceiling Tiles

1.4 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.
1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 50 tiles for each 1000 tiles installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

2.1.1 Affirmative Procurement

Mineral Wool, Cellulose, and Laminated Paperboard used in acoustic ceiling tiles are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). EPA's recommended Recovered Materials Content Levels for Mineral Wool, Cellulose, Structural Fiberboard and Laminated Paperboard are:

<table>
<thead>
<tr>
<th>Product</th>
<th>Material</th>
<th>Percent of Post Consumer Materials</th>
<th>Percent of Total Recovered Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laminate Paperboard</td>
<td>Post Consumer Paper</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Rock Wool</td>
<td>Slag</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Cellulose</td>
<td>Post Consumer</td>
<td>75</td>
<td>75</td>
</tr>
</tbody>
</table>

a. The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

b. Submit recycled material content data for acoustic ceiling tiles indicating compliance with affirmative procurement.

c. Submit total weight and volume quantities of acoustic ceiling tiles with recycle material.

2.1.2 Humidity Resistant Composition Units

2.1.2.1 Type

Non-asbestos mineral or glass fibers bonded with ceramic, moisture resistant thermo-setting resin, or other moisture resistant material and
having a factory applied white paint finish. Provide panels that do not sag or warp under conditions of heat, high humidity or chemical fumes.

2.1.2.2 Flame Spread
Class: A, 25 or less

2.1.2.3 Pattern
D

2.1.2.4 Minimum NRC
Minimum .55 when tested on Mounting Type E-400 of ASTM E795.

2.1.2.5 Minimum Light Reflectance Coefficient
LR-1, 0.75 or greater

2.1.2.6 Nominal Size
24 x 24 inch

2.1.2.7 Edge Detail
Square

2.2 SUSPENSION SYSTEM

Provide suspension system conforming to ASTM C635/C635M for intermediate-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the guidance in UFC 3-310-04 and ASTM E580/E580M.

2.3 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires
Conform wires to ASTM A641/A641M, Class 1, 0.11 inch in diameter.

2.3.2 Straps
Provide straps of 1 by 3/16 inch galvanized steel 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.

2.3.3 Rods
Provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.
2.3.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum 1/4 inch.

2.4 ADHESIVE

Use adhesive as recommended by tile manufacturer.

2.5 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.6 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components SELECTED FROM MANUFACTURERS LIST OF COLORS.

2.7 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.
3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --
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 D4078 (2002; R 2015) Water Emulsion Floor Polish


ASTM F1482 (2015) Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring


ASTM F1869 (2016) Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride


ASTM F710 (2011) Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

1.2 SYSTEM DESCRIPTION

1.3 SUBMITTALS

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

SD-02 Shop Drawings
   Resilient Flooring and Accessories

SD-03 Product Data
   Vinyl Composition Tile
   Wall Base
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.

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 VINYL COMPOSITION TILE

Conform to ASTM F1066 Class 2, (through pattern tile), Composition 1, asbestos-free, 12 inch square and 1/8 inch thick. Provide color and pattern uniformly distributed throughout the thickness of the tile.
2.2 WALL BASE

Conform to ASTM F1861, Type TV (thermoplastic vinyl), Style A (straight - installed with carpet) and Style B (coved - installed with resilient flooring). Provide 4 inch high and a minimum 1/8 inch thick wall base. Provide preformed corners in matching height, shape, and color.

2.3 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer and comply with local indoor air quality standards. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

2.4 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Comply with ASTM F1482 for panel type underlayment products. Use the following substrates:

   a. Concrete.

2.5 POLISH/FINISH

Provide polish finish as recommended by the manufacturer and conform to ASTM D4078 for polish.

2.6 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

2.7 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories selected from manufacturer's standard colors. Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit manufacturer's descriptive data and three samples of each indicated color and type of flooring, base, mouldings, 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 **SURFACE PREPARATION**

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within 3/16 inch in 10 feet. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Comply with ASTM F710 for concrete subfloor preparation. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayment, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Comply with ASTM F1482 for panel type underlayment. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

3.3 **MOISTURE, ALKALINITY AND BOND TESTS**

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing in accordance with ASTM F1869 or ASTM F2170, unless otherwise recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

3.4 **PLACING VINYL COMPOSITION, LINOLEUM AND SOLID VINYL TILES**

Install tile flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

3.5 **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.
3.6 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry/clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and/or finish in accordance with manufacturer's written instructions.

3.7 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --
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 ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 107 (2013) Colorfastness to Water
AATCC 134 (2011; E 2013) Electrostatic Propensity of Carpets
AATCC 16 (2004; E 2008; E 2010) Colorfastness to Light
AATCC 165 (2013) Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method
AATCC 174 (2011) Antimicrobial Activity Assessment of Carpets

ASTM INTERNATIONAL (ASTM)

ASTM D3278 (1996; R 2011) Flash Point of Liquids by Small Scale Closed-Cup Apparatus

CARPET AND RUG INSTITUTE (CRI)

CRI CIS (2011) Carpet Installation Standard

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

16 CFR 1630 Standard for the Surface Flammability of Carpets and Rugs (PF 1-70)

1.2 SUBMITTALS

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

SD-02 Shop Drawings
Installation Drawings
Moldings
1.3 CERTIFICATIONS

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area protected from damage, soiling, and moisture, and maintain at a temperature above 60 degrees F for 2 days prior to installation. Do not store carpet near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.5 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 60 degrees F and below 90 degrees F for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 55 degrees F thereafter for the duration of the contract.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties.
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including minimum ten year wear warranty, two year material and workmanship and ten year tuft bind and delamination.

PART 2   PRODUCTS

2.1   CARPET

   Furnish first quality carpet; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Submit manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's catalog data for 1) Carpet and 2) Moldings. Also, submit samples of the following:

a. Carpet: Two "Production Quality" samples 18 by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified

b. Moldings: Two pieces of each type at least 12 inches long

2.1.1   Physical Characteristics for Modular Tile Carpet

2.1.1.1   Carpet Construction

   Bonded textile composite

2.1.1.2   Type

   Modular tile 24 by 24 inch square.

2.1.1.3   Pile Type

   Wear layer of abrasion and ravel resistant, knitted fabric, thermally fused to a polyester felt cushioned backing layer. (Basis of design, 'Kinetex' by J&W Flooring Group.

2.1.1.4   Wear Layer Fiber

   Solution dyed polyester.

2.1.1.5   Total Weight

   4.5 oz - 5.2 oz per square foot.

2.1.1.6   Total Thickness

   Minimum 0.205 inch

2.1.1.7   Dye Method

   Solution dyed

2.1.1.8   Backing Materials

   Thermally fused bonded polyester felt cushion.
2.2 PERFORMANCE REQUIREMENTS

2.2.1 Static Control

Provide static control to permanently regulate static buildup to less than 3.0 kV when tested at 20 percent relative humidity and 70 degrees F in accordance with AATCC 134.

2.2.2 Flammability and Critical Radiant Flux Requirements

Comply with 16 CFR 1630. Provide carpet in corridors and exits with a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E648.

2.2.3 Colorfastness to Crocking

Comply dry and wet crocking with AATCC 165 and with a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

2.2.4 Colorfastness to Light

Comply colorfastness to light with AATCC 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and with a minimum 4 grey scale rating after 40 hours.

2.2.5 Colorfastness to Water

Comply colorfastness to water with AATCC 107 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

2.2.6 Antimicrobial

Nontoxic antimicrobial treatment in accordance with AATCC 174 Part I (qualitative), guaranteed by the carpet manufacturer to last the life of the carpet.

2.3 ADHESIVES AND CONCRETE PRIMER

Comply with applicable regulations regarding toxic and hazardous materials. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 140 degrees F in accordance with ASTM D3278.

2.4 MOLDINGS

Provide carpet moldings where floor covering material changes or carpet edge does not abut a vertical surface. Provide an aluminum molding, pinless clamp-down type, designed for the type of carpet being installed. Provide natural color anodized finish. Provide a heavy-duty vinyl molding designed for the type of carpet being installed. Provide floor flange of a minimum 1 1/2 inches wide. Provide color to match resilient base.

2.5 TAPE

Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in installation. Seam sealant must have a maximum VOC content of no more than 50 grams/liter. Do not use sealants that contain
PART 3 EXECUTION

3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content and excessive alkalinity in accordance with CRI CIS. Submit three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with the carpet manufacturer's instructions. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

3.4 INSTALLATION

Perform all work by manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions and CRI CIS. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet. Submit three copies of installation drawings for 1) Carpet and 2) Moldings indicating areas receiving carpet, carpet types, patterns, direction of pile, location of seams, and locations of edge molding.

Do not install building construction materials that show visual evidence of biological growth.

3.4.1 Modular Tile Installation

Install modular tiles with pre-applied releasable adhesive and snug joints. Use 1/4 turn installation method.

3.5 CLEANING AND PROTECTION

Submit three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting
and cleaning methods, and cleaning cycles.

3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean.

3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover. Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer.

3.6 MAINTENANCE

3.6.1 Extra Materials

Provide extra material from same dye lot consisting of and for future maintenance. Provide a minimum of 5 percent of total square yards of each carpet type, pattern, and color.

-- End of Section --
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) Documentation of the Threshold Limit Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)


MASTER PAINTERS INSTITUTE (MPI)

MPI 107   (Oct 2009) Rust Inhibitive Primer (Water-Based)

MPI 134   (Oct 2009) Galvanized Primer (Waterbased)

MPI 141   (Oct 2009) Interior High Performance Latex MPI Gloss Level 5


MPI 23   (Oct 2009) Surface Tolerant Metal Primer

MPI 4   (Oct 2009) Interior/Exterior Latex Block Filler

MPI 47   (Oct 2009) Interior Alkyd, Semi-Gloss, MPI Gloss Level 5

MPI 50   (Oct 2009) Interior Latex Primer Sealer
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MPI 54  
(Oct 2009) Interior Latex, Semi-Gloss, MPI Gloss Level 5

MPI 77  
(Oct 2009) Epoxy Gloss

MPI 79  
(Oct 2009) Alkyd Anti-Corrosive Metal Primer

MPI 94  

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01  

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4  
(2007; E 2004) Brush-Off Blast Cleaning

SSPC PA 1  
(2000; E 2004) Shop, Field, and Maintenance Painting of Steel

SSPC PA Guide 3  

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  

SSPC SP 3  
(1982; E 2004) Power Tool Cleaning

SSPC SP 6/NACE No.3  
(2007) Commercial Blast Cleaning

SSPC VIS 1  

SSPC VIS 3  

SSPC VIS 4/NACE VIS 7  

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1  

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U.S. DEPARTMENT OF DEFENSE (DOD)


U.S. GENERAL SERVICES ADMINISTRATION (GSA)


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

29 CFR 1910.1000 Air Contaminants

1.2 SUBMITTALS

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-02 Shop Drawings

Piping identification

Submit color stencil codes

SD-03 Product Data

Local/Regional Materials

Materials

Coating

Manufacturer's Technical Data Sheets

Indicate VOC content.

SD-04 Samples

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Color

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

Qualification Testing laboratory for coatings

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:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

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 MILITARY BASES 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
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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.

1.4.1.2 Testing Procedure

Provide Batch Quality Conformance Testing for specified products, as defined by and performed by MPI. As an alternative to Batch Quality Conformance Testing, the Contractor may provide Qualification Testing for specified products above to the appropriate MPI product specification, using the third-party laboratory approved under the paragraph "Qualification Testing" laboratory for coatings. The qualification testing lab report shall include the backup data and summary of the test results. The summary shall list all of the reference specification requirements and the result of each test. The summary shall clearly indicate whether the tested paint meets each test requirement. Note that Qualification Testing may take 4 to 6 weeks to perform, due to the extent of testing required.

Submit name, address, telephone number, FAX number, and e-mail address of the independent third party laboratory selected to perform testing of coating samples for compliance with specification requirements. Submit documentation that laboratory is regularly engaged in testing of paint samples for conformance with specifications, and that employees performing testing are qualified. If the Contractor chooses MPI to perform the Batch Quality Conformance testing, the above submittal information is not required, only a letter is required from the Contractor stating that MPI will perform the testing.
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 29 SAFETY AND OCCUPATIONAL HEALTH 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.

1.8 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.

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.

1.9 SUSTAINABLE DESIGN REQUIREMENTS

1.9.1 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.

1.10 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs.

1.11 COLOR SELECTION
Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

1.12 LOCATION AND SURFACE TYPE TO BE PAINTED

1.12.1 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.

1.12.1.1 Exterior Painting

Includes new surfaces, existing coated surfaces, and existing uncoated surfaces, of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.12.1.2 Interior Painting

Includes new surfaces, existing uncoated surfaces, and existing coated surfaces of the building 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 metal deck; and

b. Other contiguous surfaces.

1.12.2 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.

1.12.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new and existing 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.

1.12.3.1 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. In lieu of red enamel finish coat, provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals.

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. Provide piping with 2 inch wide red enamel bands or self-adhering red plastic bands spaced at maximum of 20 foot intervals throughout the piping systems.
1.12.4 Definitions and Abbreviations

1.12.4.1 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.

1.12.4.2 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.

1.12.4.3 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.

1.12.4.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.12.4.5 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.

1.12.4.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.12.4.7 EXT

MPI short term designation for an exterior coating system.

1.12.4.8 INT

MPI short term designation for an interior coating system.

1.12.4.9 micron / microns

The metric measurement for 0.001 mm or one/thousandth of a millimeter.
1.12.4.10 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.

1.12.4.11 mm

The metric measurement for millimeter, 0.001 meter or one-one-thousandth of a meter.

1.12.4.12 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:

<table>
<thead>
<tr>
<th>Gloss Level</th>
<th>Description</th>
<th>Units at 60 degrees</th>
<th>Units at 85 degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Matte or Flat</td>
<td>0 to 5</td>
<td>10 max</td>
</tr>
<tr>
<td>G2</td>
<td>Velvet</td>
<td>0 to 10</td>
<td>10 to 35</td>
</tr>
<tr>
<td>G3</td>
<td>Eggshell</td>
<td>10 to 25</td>
<td>10 to 35</td>
</tr>
<tr>
<td>G4</td>
<td>Satin</td>
<td>20 to 35</td>
<td>35 min</td>
</tr>
<tr>
<td>G5</td>
<td>Semi-Gloss</td>
<td>35 to 70</td>
<td></td>
</tr>
<tr>
<td>G6</td>
<td>Gloss</td>
<td>70 to 85</td>
<td></td>
</tr>
<tr>
<td>G7</td>
<td>High Gloss</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gloss is tested in accordance with ASTM D523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.12.4.13 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.

1.12.4.14 Paint

See Coating definition.

1.12.4.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.12.4.16 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.

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. 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.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12/NACE No.5. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4/NACE VIS 7.

3.3.3 Galvanized Surfaces

a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, or non-alkaline detergent solution 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.

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.

3.4 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, 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.
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.

3.4.2 Gypsum Board, Plaster, and Stucco

a. Surface Cleaning: 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.

3.5 APPLICATION

3.5.1 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.

3.5.2 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.

3.5.3 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.

3.5.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table
Division 4. Exterior Concrete and Masonry Units Paint Table
Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table
Division 3. Interior Concrete Paint Table
**Table**
Division 4. Interior Concrete Masonry Units Paint Table
Division 5. Interior Metal, Ferrous and Non-Ferrous 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.

3.6 **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.

3.7 **COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES**

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.
3.8 **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.

3.9 **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.

3.10 **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.

3.11 **PAINT TABLES**

3.11.1 **EXTERIOR PAINT TABLES**

DIVISION 4: EXTERIOR CONCRETE AND MASONRY UNITS PAINT TABLE

A. Existing Concrete:

1. Concrete Sealer - Concrete Sealer is a water-based, acrylic, micro-emulsion coating containing 15 percent solids minimum by weight with the following minimum performance properties:
   
   1. VOC compliant in SCAQMD: 62 g/L.
   2. Specific Gravity: 1.01.
   4. Viscosity: < 100 CPS.
   6. Flash Point: N/A.

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
STEEL / FERROUS SURFACES

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. 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
   MPI REX 5.1C-G5 (Semigloss)
   Spot Primer:        Intermediate:       Topcoat:
   MPI 79             MPI 163                 MPI 163
   System DFT: 5 mils

C. 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

3.11.2 INTERIOR PAINT TABLES

DIVISION 3: INTERIOR CONCRETE PAINT TABLE

A. Existing, previously painted concrete floors in following areas:

1. Epoxy
   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.

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. New and uncoated Existing Concrete masonry:

1. MPI INT 4.2D-G5 (Semigloss)
   Filler         Primer:             Intermediate:       Topcoat:
   MPI 4          N/A                 MPI 141            MPI 141
   System DFT: 11 mils

   Fill all holes in masonry surface

B. Existing, previously painted Concrete masonry:

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DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE
1. MPI RIN 4.2K-G5 (Semigloss)
   Spot Primer:        Intermediate:       Topcoat:
   MPI 50             MPI 141             MPI 141
   System DFT: 4.5 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), and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. MPI INT 5.1E-G5 (Semigloss)
   Primer:        Intermediate:       Topcoat:
   MPI 79         MPI 47             MPI 47
   System DFT: 5.25 mils

DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE
A. New and Existing, previously painted Wallboard not otherwise specified:

1. New; MPI INT 9.2A-G5 (Semigloss) / Existing; RIN 9.2A-G5 (Semigloss)
   Primer:        Intermediate:       Topcoat:
   MPI 50         MPI 54             MPI 54
   System DFT: 4 mils

-- End of Section --
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.

INTERNATIONAL CODE COUNCIL (ICC)


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)


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

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

SD-02 Shop Drawings
   Detail Drawings;

SD-03 Product Data
   Installation;
   Warranty;

SD-04 Samples
   Interior Signage;

SD-10 Operation and Maintenance Data
   Approved Manufacturer's Instructions;
   Protection and Cleaning;
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 and Changeable message strip 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, plaques, directories, and dimensional letters 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 extruded engineered PVC/Acrylic alloy with integral background colors and high impact resistance and shall conform to the following:

a. Panel depth: 0.25 inch thickness

b. Construction: One-piece, added on or engraved characters not acceptable.

c. Panel Appearance: high contrast semi-matte colors for graphics, copy, and background. All integral colors shall be UV stabilized resins utilizing industrial grade pigments.
d. Surface texture: Matte non-glare.

e. Sign size, shape, font, and layout conform to that which is indicated on the drawings.

f. Integral Windows: Where indicated provide the following:

1. Subsurface, lateral slot, separate changeable graphic insert plaque construction in compliance with indicated materials, thickness, finish, colors, designs, shapes, sizes and details.

2. Graphic insert: die-cut paper as supplied by manufacturer and laser printed in accordance with manufacturer's proprietary insert template software.

3. Visible window opening size and location as indicated on drawings.

4. Insert format: 1-1/4" x sign width
   Lens: Clear, 0.080 inch thick, matte first surface.

g. Signs located on the exterior of the building shall be rated for exterior use and shall not warp, fade, or degrade in any way due to exposure to sunlight, heat, cold and/or moisture.

2.2.2 Type of Mounting For Signs

a. All mounting materials shall be approved by the sign manufacturer for the mounting surface.

b. Surface mounted on painted concrete masonry: sign shall be mounted with 1/16" thick vinyl foam tape and silicone adhesive.

c. Surface mounted on unpainted brick masonry: sign shall be mounted with 1/16" thick vinyl foam tape rated for exterior installation and silicone adhesive.

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 STAIR SIGNAGE

Provide signs on stairs serving three or more stories with special signage within the enclosure at each floor landing conforming to NFPA 101. Indicate the floor level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair enclosure. Also, state the floor level of, and the direction to, exit discharge. Locate the signage inside the enclosure in a position that is visible when the door is in the open or closed position and install in conformance with 36 CFR 1191. The floor level designation shall also be tactile in accordance with ICC A117.1 COMM.
2.4 FABRICATION

2.4.1 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.

2.5 TYPEFACE

ADA-ABA compliant font for Room Signs Helvetica Regular.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed plumb and true and in accordance with approved manufacturer's instructions at locations shown on the drawings. Mounting height and mounting location shall conform to 36 CFR 1191. 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. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 1/16" thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 5 mil green flatstock treated with silicone. Foam pads shall be sized for the signage in accordance with signage manufacturer's recommendations.

3.1.2 Protection and Cleaning

Protect the work against damage during construction.

-- End of Section --
17-0016, Interior and Exterior Repairs, Bldg. 523

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)

ASTM INTERNATIONAL (ASTM)

INTERNATIONAL CODE COUNCIL (ICC)

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 SYSTEM DESCRIPTION

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 Fabrication Drawings for metal toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory. Submit manufacturer's Cleaning and Maintenance Instructions with Fabrication Drawings for review.
1.2.1 Sustainable Design Requirements

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Fabrication Drawings

Installation Drawings

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings for metal partitions and urinal screens. Installation drawings as specified.

SD-03 Product Data

Toilet Partition System

Cleaning and Maintenance Instructions

Colors And Finishes

Partition Panels and Doors

Anchoring Devices and Fasteners

Hardware and Fittings

Brackets

Door Hardware

Floor-Anchored Partitions

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

Toilet Enclosures

Urinal Screens

SD-04 Samples

Colors and Finishes

Manufacturer's standard color charts and color samples.

Partition Panels

Three samples showing a finished edge on two adjacent sides and core construction, each not less than 12-inch square

Hardware and Fittings

Anchoring Devices and Fasteners

Three samples of each item. Approved hardware samples may be
installed in the work if properly identified.

SD-07 Certificates

Certification

Documentation of product quality, as specified.

SD-10 Operation and Maintenance Data

When not labeled, identify types in Operation and Maintenance Manual.

SD-11 Closeout Submittals

Toilet Enclosures

Urinal Screens

1.4 REGULATORY REQUIREMENTS

Conform to ICC A117.1 code for access for the handicapped operation of toilet compartment door and hardware.

1.5 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.

1.6 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 one years after completion.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after fabrication, in conformance with ASTM A 385/A 385M and ASTM A 123/A 123M. Conceal all galvanized anchoring devices.

2.1.2 Brackets

Wall brackets shall be two-ear panel brackets, T-style, 1-inch stock. Provide stirrup style panel-to-pilaster brackets.

2.1.3 Hardware and Fittings

2.1.3.1 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 alkalies, 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.

a. Aluminum shall conform to ASTM B 221.

2.1.3.2 Finishes

a. Aluminum shall have a clear anodic coating conforming to AA DAF-45.

2.1.4 Door Hardware

2.1.4.1 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 have the
following type of return movement:

a. Gravity return movement

2.1.4.2 Latch and Pull

Latch and pull shall be a combination rubber-faced door strike and keeper
equipped with emergency access.

2.1.4.3 Coat Hooks

Coat hooks shall be combination units with hooks and rubber tipped pins.

2.2 PARTITION PANELS AND DOORS

Provide partition panels and doors not less than 1 inch thick with face
sheets not less than 0.0396 inch thick.

2.2.1 Toilet Enclosures

Conform toilet enclosures to CID A-A-60003, Type I, Style A, floor supported
. Furnish width, length, and height of toilet enclosures as shown.
Provide a width of 3/4". Finish surface of panels shall be solid phenolic,
Finish 4 ; water resistant; graffiti resistant; non-absorbent; . Enclosures shall contain a minimum of 20 percent post-consumer recycled plastic . 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.

2.2.2 Urinal Screens

Conform urinal screens to CID A-A-60003, Type III, Style A, floor supported .
Provide finish for surface of screens as solid phenolic, Finish 4 ; water
resistant; graffiti resistant; non-absorbent; . Screens shall contain a
minimum of 20 percent post-consumer recycled plastic . Furnish width
and height of urinal screens as shown. Provide thickness of 3/4". Secure
wall hung urinal screens with a minimum of three wall stirrup brackets.
Fabricate screens from the same types of panels and pilasters as the toilet
partitions. Use corrosion-resistant steel fittings and fasteners.
2.3 FLOOR-ANCHORED PARTITIONS

Pilasters shall be not less than 1-1/4 inch thick with face sheets not less than 0.0635 inch thick. Provide anchoring device at the bottom of the pilaster consisting of a steel bar not less than 1/2 by 7/8 inch welded to the reinforced face sheets and having not less than two 3/8 inch round anchorage devices for securing to the floor slab. Provide anchorage devices complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Trim piece at the floor shall be 3 inch high and fabricated from not less than 0.030 inch thick corrosion-resistant steel.

2.4 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Pilaster shoes shall be stainless steel. Height shall be 3 inches.

2.5 HARDWARE

Hardware for the toilet partition system shall conform to CID A-A-60003 for the specified type and style of partitions. Hardware shall be pre-drilled by manufacturer. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids. Hardware shall include: chrome plated non ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; black anodized aluminum door latch; door strike and keeper with rubber bumper; and cast alloy chrome plated coat hook and bumper. Latching devices and hinges for handicap compartments shall comply with 36 CFR 1191 and shall be chrome-plated steel or stainless steel door latches that operate without either tight grasping or twisting of the wrist of the operator. Screws and bolts shall be stainless steel, tamper proof type. Wall mounting brackets shall be continuous, full height, stainless steel, in accordance with toilet compartment manufacturer's instructions. Floor-mounted anchorage shall consist of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.

2.6 COLORS AND FINISHES

2.6.1 Colors

Provide manufacturer's standard color charts for color of finishes for toilet partition system components.

2.6.2 Finishes No.4 and No. 5

Provide solid plastic fabricated of solid phenolic core with melamine facing sheets 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: smooth, waterproof, non-absorbant, 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:

a. Acetic Acid (80 percent)  Hydrochloric Acid (40 percent)
b. Acetone  Hydrogen Peroxide (30 percent)
c. Ammonia (liquid)  Isopropyl Alcohol
d. Ammonia Phosphate  Lactic Acid (25 percent)
e. Bleach (12 percent)  Lime Sulfur
f. Borax              Nicotine

g. Brine               Potassium Bromide

h. Caustic Soda        Soaps

i. Chlorine Water      Sodium Bicarbonate

j. Citric Acid         Trisodium Phosphate

k. Copper Chloride     Urea; Urine

l. 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   METAL PARTITION FABRICATION

a. Fabricate metal Partition Panels, doors, screens, and pilasters required for the project from galvanized-steel face sheets with formed edges. Face sheets shall be pressure-laminated to the sound-deadening core with edges sealed with a continuous locking strip and corners mitered and welded. Ground all welds smooth. Provide concealed reinforcement for installation of hardware, fittings, and accessories. Surface of face sheets shall be smooth and free from wave, warp, or buckle.

b. Before application of an enamel coating system, solvent-clean galvanized-steel surfaces to remove processing compounds, oils, and other contaminants harmful to coating-system adhesion. After cleaning, coat the surfaces with a metal-pretreatment phosphate coating. After pretreatment, finish exposed galvanized-steel surfaces with a baked-enamel coating system as specified.

c. Provide an enamel coating system consisting of a factory-applied baked acrylic enamel coating system. Coating system shall be a durable, washable, stain-resistant, mar-resistant finish.

3.3   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.

3.4 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.

3.5 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 28 13

TOILET ACCESSORIES
07/06

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-03 Product Data

Finishes

Accessory Items

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

SD-04 Samples

Finishes

Accessory Items

One sample of each accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted.

SD-07 Certificates

Accessory Items

Certificate for each type of accessory specified, attesting that the items meet the specified requirements.

SD-10 Operation and Maintenance Data

1.2 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.

1.3 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 in accordance with paragraph SCHEDULE. 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.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless steel</td>
<td>No. 4 satin finish</td>
</tr>
<tr>
<td>Carbon steel, copper alloy, and brass</td>
<td>Chromium plated, bright</td>
</tr>
</tbody>
</table>

2.2   ACCESSORY ITEMS

Conform to the requirements for accessory items specified below.

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 finish. 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 Mirror, Metal (MM)

Provide a brightly polished stainless steel metal mirror of 0.037 inch minimum thickness, edges turned back 1/4 inch and recess fitted with tempered hardboard backing, and theft-proof fasteners. Provide size in accordance with paragraph SCHEDULE.

2.2.3 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 minimum 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.

2.2.4 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.

2.2.5 Toilet Tissue Dispenser (TTD)

Furnish Type II - surface mounted toilet tissue holder with two rolls of standard tissue mounted horizontally. Provide stainless steel, satin finish cabinet.

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 polysulphide 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, teflon 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.

3.3 SCHEDULE

See drawings for Accessory Schedule

-- End of Section --
SECTION 10 44 16

FIRE EXTINGUISHERS

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)


1.2 SUBMITTALS

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

   SD-02 Shop Drawings
   Cabinets
   SD-03 Product Data
   Cabinets
   Replacement Parts List

1.3 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing the brand name and the name and type of the material.

PART 2   PRODUCTS

Submit fabrication drawings consisting of fabrication and assembly details performed in the factory and product data for the following items: Accessories and cabinets.

2.1 SYSTEM DESCRIPTION

2.1.1 Material

Provide corrosion-resistant steel extinguisher shell.

2.1.2 Size

10 pounds extinguishers.
2.1.3 Accessories
   Forged brass valve
   Fusible plug
   Safety release
   Pressure gage

2.2 EQUIPMENT

2.2.1 Cabinets

2.2.1.1 Material
   Provide corrosion-resistant steel cabinets.

2.2.1.2 Type
   Provide semi-recessed cabinet for a 6-inch and 4-inch wall.
   Provide a fire rated cabinet where necessary, listed and labeled to comply
   with ASTM E814 for fire resistance wall rating.

2.2.1.3 Size
   Dimension cabinets to accommodate the specified fire extinguishers.

PART 3 EXECUTION

3.1 INSTALLATION
   Comply with the manufacturer's recommendations for all installations.

3.2 PROTECTION

3.2.1 Repairing
   Submit replacement parts list indicating specified items replacement part,
   replacement cost, and name, address and contact for replacement parts
   distributor.

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 --
PART 1   GENERAL

1.1   SUBMITTALS

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

SD-02 Shop Drawings
   Types
   Location

SD-03 Product Data
   Material

SD-04 Samples
   Color Chips

1.2   DELIVERY, HANDLING, AND STORAGE

Deliver lockers and associated materials in their original packages, containers, or bundles bearing the manufacturer's name and the name of the material. Protect from weather, soil, and damage during delivery, storage, and construction.

1.3   FIELD MEASUREMENTS

To ensure proper fits, make field measurements prior to the preparation of drawings and fabrication. Verify correct location.

1.4   QUALITY ASSURANCE

1.4.1   Color Chips

Provide a minimum of three color chips, not less than 3 inches square, of each color.

PART 2   PRODUCTS

2.1   TYPES

Locker must have the following type and size in the location and quantities indicated.

2.1.1   Double-Tier

Double-tier lockers must be as follows:

Type DTL-1: Double-tier locker 12 inches wide, 12 inches deep, and 72
17-0016, Interior and Exterior Repairs, Bldg. 523

inches high, attached to 6-inch high legs

2.2 MATERIAL

2.2.1 Frame
Frame shall be made from high impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components 1/2" thick with homogeneous color throughout. Frame shall include an integral continuous door stop/strike on both latch and hinge side vertical members. Cross members at top, bottom and between doors of multiple tier lockers are integral with vertical frame members for maximum frame rigidity. Frames shall have machined edges to accept assembly brackets for attaching to locker body components.

2.3 COMPONENTS

2.3.1 Coat Hooks
As per Manufacturer.

2.3.2 Hanger Rods
As Per Manufacturer

2.3.3 Doors
Doors shall be made from high impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components 1/2" thick with homogeneous color throughout. Wardrobe doors 20" high and higher include a solid plastic surface mounted handle with padlock hasp. Box doors 18" high and under shall include a thru-the-door finger pull. Doors shall include horizontal slots for ventilation.

2.3.3.1 Hinges
Hinges shall be heavy-duty continuous full height extruded aluminum with a powder coating to match the locker door and frame color. All doors to be right hand, side hinged.

2.3.3.2 Latching Mechanisms
The latching mechanism for wardrobe doors 20" high and higher shall be finger lift control type. Latching is achieved using a continuous full door height high impact HDPE plastic locking bar which when lifted, allows the opening and closing of the locker door. Gravity allows the locking bar to fall back into the locked position when the door is closed. Box lockers 18" high and under include a single-point thru-the-door finger pull with padlock hasp. All doors are prepared for use with a padlock.

2.3.4 Body
Sides, tops, bottoms, backs, and shelves shall be made from high impact, high density, polyethylene (HDPE) formed under pressure into solid plastic components 3/8" thick with homogenous color throughout. Body components shall have machined edges to accept assembly brackets.

2.3.5 Assembly Brackets
Lockers are easily assembled using specially engineered injection molded
PVC fittings which fit into machined body components. The snap-fit design provides a continuous connection between all body components and where body connects to the frame.

PART 3 EXECUTION

3.1 ASSEMBLY

Assemble lockers according to the locker manufacturer's instructions. Align lockers horizontally and vertically. Secure lockers to wall and base with screws as indicated. Bolt adjacent lockers together. Adjust doors to operate freely without sticking or binding and to ensure they close tightly.

3.2 FIELD QUALITY CONTROL

3.2.1 Repairing

Remove and replace damaged and unacceptable portions of completed work with new.

3.2.2 Cleaning

Clean surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner. Remove equipment, surplus materials, and rubbish from the site.

-- End of Section --
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)


FM GLOBAL (FM)


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (2016) Standard for the Installation of Sprinkler Systems


UNDERWRITERS LABORATORIES (UL)

UL 262 (2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service

UL 668 (2004; Reprint Jul 2016) UL Standard for Safety Hose Valves for Fire-Protection Service

UL 789 (2004; Reprint Feb 2013) Standard for Indicator Posts for Fire-Protection Service


1.2 SYSTEM DESCRIPTION

Design and provide new automatic wet pipe fire extinguishing sprinkler systems for complete fire protection coverage throughout the entire building.

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 light and ordinary hazard occupancy. 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 Outside Hose Allowances

Hydraulic calculations shall include a hose allowance of 250 gpm for outside hose streams.

1.3.5 Water Supply

Base hydraulic calculations on the water supply data shown on the fire protection contract drawings.

1.4 SUBMITTALS

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

Prepare 24 by 36 inch detail working drawings of sprinklers and piping. Floor plans shall be drawn to a scale not less than $\frac{1}{8}$" = 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
Fittings
Valves, including gate, check, and globe
Sprinklers
Pipe hangers and supports
Sprinkler Alarm Switches
Fire department connections
Mechanical couplings
Backflow Prevention Assembly

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

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.

SD-06 Test Reports

request to schedule Preliminary Tests

Preliminary Test Report

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. All items in the Preliminary Tests Report shall be signed by the Fire Protection Engineer.

request to schedule Final Acceptance Test

Final Acceptance Test Report

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

Inspection by Fire Protection Engineer

Concurrent with the Final Acceptance Test Report, certification by the Fire Protection Engineer that the sprinkler system is installed in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.

Fire Protection Engineer

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

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. Each service organization submitted shall be capable of providing 4 hour on-site response to a service call on an emergency basis.

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 III 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 UNDERGROUND PIPING COMPONENTS

2.1.1 Gate Valve and Indicator Posts

Installation shall comply with NFPA 24. Gate valves for use with indicator post shall conform to UL 262. Indicator posts shall conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

2.1.2 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold block letters continuously and repeatedly over the entire tape length. Warning and identification shall read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.2 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.

2.2.1 Steel Pipe

Pipe shall be rigid black steel. Steel piping shall be Schedule 10 or 40 for sizes less than 8 inches and Schedule 10 for sizes 8 inches or larger. 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. Roll grooving of galvanized pipe is prohibited.

2.2.2 Grooved Mechanical Joints and Fittings

Grooved couplings, fittings and grooving tools shall be products of the same manufacturer.

2.2.3 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 Pendent and Upright quick response sprinklers. Sprinklers shall have a white polyester 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. 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.

2.2.4 Valves

Provide valves of types approved for fire service. Valves shall open by counterclockwise rotation. Provide an OS&Y valve beneath each alarm. 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.

2.2.5 Pipe Supports

Provide Pipe hangers and supports in accordance with NFPA 13.

2.2.6 Fire Department Connections

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.2.7 Backflow Prevention Assembly

Provide listed reduced pressure principle valve assembly backflow preventer. Each check valve shall have a drain. Backflow prevention assemblies shall have current "Certificate of Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List. Listing of the specific make, model, design, and size in the FCCCHR List shall be acceptable as the required documentation."
2.3 ALARM INITIATING AND SUPERVISORY DEVICES

2.3.1 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 76.00 22 INTERIOR COMBINATION EMERGENCY COMMUNICATIONS SYSTEMS. Vane type Alarm actuating devices shall have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and shall instantly recycle.

2.3.2 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.

2.4 ACCESSORIES

2.4.1 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.

2.4.2 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 INSPECTION BY FIRE PROTECTION ENGINEER

The Fire Protection Engineer shall inspect the sprinkler system periodically during the installation to assure the sprinkler system is being provided and installed in accordance with the contract requirements and the approved sprinkler system submittal(s). The Fire Protection Engineer shall attend both the preliminary and final tests, and shall sign the test results. After the preliminary testing has been completed, the Fire Protection Engineer, shall certify in writing the system is ready for the final inspections and tests. This report shall document any discrepancies found and what actions will be taken to correct. Any discrepancy noted during the periodic site visits or the preliminary testing shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered.

3.2 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.
3.3 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.

3.3.1 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.

3.3.2 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.

3.3.3 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. Bushings are prohibited.

3.3.4 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.

3.3.5 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. Provide test connection piping to a drain location that can accept full flow where the discharge will be readily visible and where water may be discharged without property damage. Discharge to floor drains, janitor sinks or similar fixtures shall not be permitted. Provide discharge orifice of same size as corresponding sprinkler orifice. The penetration of the exterior wall shall be no greater than 2 feet above finished grade.

3.3.6 Backflow Preventer Test Connection

Provide downstream of the backflow prevention assembly UL 668 hose valves with 2.5 inch National Standard male hose threads with cap and chain.
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Provide one valve for each 250 gpm of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve."

3.3.7 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by NFPA 13.

3.3.8 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 3 feet above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with NFPA 13 and arranged to drain to the outside.

3.3.9 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.

3.4 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 Section 28 31 76.00 22 INTERIOR COMBINATION EMERGENCY COMMUNICATIONS SYSTEMS.

3.5 PIPE PAINTING AND COLOR CODE MARKING

Paint and color code mark sprinkler piping system as specified in Section 09 90 00 PAINTS AND COATINGS.

3.6 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.

3.6.1 Underground Piping

3.6.1.1 Flushing

Underground piping shall be flushed in accordance with NFPA 24.

3.6.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with
3.6.2 Aboveground Piping

3.6.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with NFPA 13.

3.6.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly shall be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor shall provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5 inch diameter hoses, playpipe nozzles, calibrated pressure gauges, and pitot tube gauge. The Contractor shall provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction) across the assembly shall be recorded. A metal placard shall be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate determined during the preliminary testing. The pressure drop shall be compared to the manufacturer's data and the readings observed during the final inspections and tests.

3.7 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.

An experienced technician regularly employed by the system installer shall be present during the inspection. The Fire Protection Engineer shall attend the final inspections and tests. 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 Mid Atlantic Division, Naval Facilities Engineering Command, Fire Protection Engineer, will witness formal tests and approve systems before they are accepted.

3.8 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 period of 4 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 --
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)


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


AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001 (2002) Atmospheric Type Vacuum Breakers

ASSE 1003 (2001; Errata, 2003) Performance Requirements for Water Pressure Reducing Valves


ASSE 1011 (2004; Errata 2004) Hose Connection Vacuum Breakers


ASSE 1013 (2005) Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers

ASSE 1018 (2001) Trap Seal Primer Valves - Potable, Water Supplied
ASSE 1020  (2004; Errata 2004; Errata 2004) Pressure Vacuum Breaker Assembly

ASSE 1037  (1990) Performance Requirements for Pressurized Flushing Devices (Flushometer) for Plumbing Fixtures

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 C606  (2006) Grooved and Shouldered Joints

AWWA C651  (2014) Standard for Disinfecting Water Mains

AWWA C652  (2002) Disinfection of Water-Storage Facilities

AWWA C700  (2002; R 2003) Standard for Cold Water Meters - Displacement Type, Bronze Main Case


AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M  (2004; Errata 2004) Specification for Filler Metals for Brazing and Braze Welding


ASME INTERNATIONAL (ASME)


ASME A112.19.5  (2005) Trim for Water-Closet Bowls, Tanks and Urinals

ASME A112.36.2M  (1991; R 2002) Cleanouts
ASME A112.6.1M (1997; R 2002) 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 B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.21 (2005) Nonmetallic Flat Gaskets for Pipe Flanges


ASME B31.1 (2016) Power Piping


ASME B40.100 (2006) Pressure Gauges and Gauge Attachments

ASME BPVC SEC IX (2007) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications


ASTM INTERNATIONAL (ASTM)


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<tr>
<th>Standard Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>ASTM D 2822</td>
<td>(2005) Asphalt Roof Cement</td>
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**CAST IRON SOIL PIPE INSTITUTE (CISPI)**

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**COPPER DEVELOPMENT ASSOCIATION (CDA)**

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<th>Standard Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>CDA A4015</td>
<td>(1994; R 1995) Copper Tube Handbook</td>
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</table>
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CSA GROUP (CSA)


FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)


INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO Z124.1.2 (2005) Plastic Bathtub and Shower Units

INTERNATIONAL CODE COUNCIL (ICC)


MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110 (1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends


MSS SP-73 (2003) Brazing Joints for Copper and Copper Alloy Pressure Fittings

MSS SP-78 (2005a) Cast Iron Plug Valves, Flanged and Threaded Ends

MSS SP-80 (2003) Bronze Gate, Globe, Angle and Check Valves
1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the
Government. The following shall be submitted 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
Flush valve urinals
Wall hung lavatories
Countertop lavatories
Mop sinks
Drinking-water coolers; G
Plastic shower stalls
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.

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.

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.

1.5.2 Plumbing Fixtures

Water flow and consumption rates shall at a minimum comply with requirements in PL 102-486.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC NCPC.

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.
Materials for various services shall be in accordance with TABLES I and II. 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 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Pipe threads (except dry seal) shall conform to ASME B1.20.1. Material or equipment containing lead shall not be used in any potable water system. 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 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 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums.

2.1.1 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 A 74, AWWA C606. For hubless type: CISPI 310


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 B 32.

g. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, 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 C 564.


l. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., 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 A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:


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.

l. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.
2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 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:

<table>
<thead>
<tr>
<th>Description</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends</td>
<td>MSS SP-110</td>
</tr>
<tr>
<td>Cast-Iron Plug Valves, Flanged and Threaded Ends</td>
<td>MSS SP-78</td>
</tr>
<tr>
<td>Bronze Check Valves</td>
<td>MSS SP-80</td>
</tr>
<tr>
<td>Backwater Valves</td>
<td>ASME A112.14.1</td>
</tr>
<tr>
<td>Vacuum Relief Valves</td>
<td>ANSI Z21.22</td>
</tr>
<tr>
<td>Water Pressure Reducing Valves</td>
<td>ASSE 1003</td>
</tr>
<tr>
<td>Water Heater Drain Valves</td>
<td>ASSE 1005</td>
</tr>
<tr>
<td>Trap Seal Primer Valves</td>
<td>ASSE 1018</td>
</tr>
<tr>
<td>Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers</td>
<td>ASME CSD-1, Safety Code No., Part CW, Article 5</td>
</tr>
</tbody>
</table>

2.3.1 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.

2.3.2 Yard Hydrants

Yard box or post hydrants shall have valve housings located below frost.
lines. Water from the casing shall be drained after valve is shut off. Hydrant shall be bronze with cast-iron box or casing guard. "T" handle key shall be provided.

2.3.3 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. 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.

2.3.4 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.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC NCPC. 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 and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.
2.4.1  Automatic Controls

Provide automatic, sensor operated faucets and flush valves to comply with ASSE 1037 and UL 1951 for lavatory faucets, urinals, and water closets. Flushing and faucet systems shall consist of solenoid-activated valves with light beam sensors. Flush valve for water closet shall include an override pushbutton. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

2.4.2  Flush Valve Water Closets

ASME A112.19.2M, 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 accessible water closets. Provide wax bowl ring including plastic sleeve. Water flushing volume of the water closet and flush valve combination shall not exceed 1.6 gallons per flush. Provide black solid plastic elongated open-front seat. 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.

2.4.3  Flush Valve Urinals

ASME A112.19.2M, white vitreous china, wall-mounted, wall outlet, integral trap, and extended side shields. Water flushing volume of the urinal and flush valve combination shall not exceed 1.0 gallon per flush. 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.

2.4.4  Accessible Flush Valve Type Urinals

ASME A112.19.2M, white vitreous china, wall-mounted, wall outlet, integral trap, 14 inches long from wall to front of flare, and ASME A112.19.5 trim. Provide large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold-open flush valve of chrome plated cast brass conforming to ASTM B 584, including vacuum breaker and angle (control-stop) valve with back check. The water flushing volume of the flush valve and urinal combination shall not exceed 1.0 gallon per flush. Furnish urinal manufacturer's certification of conformance. Provide ASME A112.6.1M concealed chair carriers. Mount urinal with front rim a maximum of 17 inches above floor and flush valve handle a maximum of 44 inches above floor for use by handicapped on wheelchair.

2.4.5  Wall Hung Lavatories

ASME A112.19.2M, white vitreous china, straight back type, minimum dimensions of 19 inches, wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets, and openings for

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concealed arm carrier installation. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor.

2.4.6 Countertop Lavatories

ASME A112.19.2M, white vitreous china, self-rimming, minimum dimensions of 19 inches wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets. 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. 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.

2.4.7 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, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, 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 spouts shall be mounted at 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.

2.4.8 Accessible Drinking Water cooler

AHRI 1010, dual height, ADA compliant, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled R134A refrigeration unit, 4.75 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet. Low bowl bubbler shall have 27 inch minimum knee clearance from front bottom of unit to floor and 36 inch maximum spout height above floor. High bowl/bubbler shall have 39 inch spout height. Bubblers shall also be controlled by push levers, by push bars, or touch pads one on each side or one on front and both sides of the cabinet.

2.4.9 Plastic Bathtub/Shower Units

IAPMO Z124.1.2 four piece white solid acrylic pressure molded fiberglass reinforced plastic bathtub/shower units. Units shall be scratch resistant, waterproof, and reinforced. Provide recessed type units approximately 60 inches wide, 30 inches front to rear, 72 inches high with 15 inches high rim for through-the-floor drain installation with unit bottom or feet firmly supported by a smooth level floor. Provide left or right drain outlet units as required. Units shall have built-in soap dish and minimum of 12 inch long stainless steel horizontal grab bar located on back wall for standing use. Units shall meet performance requirements of IAPMO Z124.1.2 and shall be labeled by NAHB Research Foundation, Inc. for compliance. Install unit in accordance with the manufacturer's written instructions. Finish installation by covering unit attachment flanges with wall board in accordance with unit manufacturer's recommendation. Provide smooth 100 percent silicone rubber white bathtub calk between the unit and the adjacent walls and floor surfaces.
2.4.10 Plastic Shower Stalls

IAPMO Z124.1.2 four piece white solid acrylic pressure molded fiberglass reinforced plastic shower stalls. Shower stalls shall be scratch resistant, waterproof, and reinforced. Provide recessed type shower stalls approximately 36 inches wide, 36 inches front to rear, 76 inches high, and 5 inch high curb with shower stall bottom or feet firmly supported by a smooth level floor. Provide PVC shower floor drains and stainless steel strainers. Shower stalls shall meet performance requirements of IAPMO Z124.1.2 and shall be labeled by NAHB Research Foundation, Inc. for compliance. Install shower stall in accordance with the manufacturer's written instructions. Finish installation by covering shower stall attachment flanges with dry-wall in accordance with shower stall manufacturer's recommendation. Provide smooth 100 percent silicone rubber white bathtub calk between the top, sides, and bottom of shower stalls and bathroom walls and floors.

2.4.11 Precast Terrazzo 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.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR Manual. 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.

2.6 DRAINS

2.6.1 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 C 564 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.
2.6.2 Bathtub and Shower Faucets and Drain Fittings

Provide single control pressure equalizing bathtub and 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 2.2 GPM at 80 PSI per Energy Star requirements. Provide tub spouts with union connections in each supply to faucet. Provide push-pull stopper drain fittings for above-the-floor drain installations. The top of drain pop-ups, drain outlets, tub overflow outlet, and control handle for pop-up drain shall be chromium-plated or polished stainless steel. Provide 1.5 inch copper alloy adjustable tubing with slip nuts and gaskets between bathtub overflow and drain outlet; chromium-plated finish is not required. Provide bathtub and shower valve with ball type control handle.

2.6.3 Area Drains

Area drains shall be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain shall be circular or square with a 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Drains shall be cast iron with manufacturer's standard coating. Grate shall be easily lifted out for cleaning. Outlet shall be suitable for inside caulked connection to drain pipe. Drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping where noted on the drawings. Primer shall meet ASSE 1018.

2.7 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409. Traps shall be without a cleanout. 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.

2.8 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.
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2.8.1 Automatic Storage Type

Heaters shall be complete with control system and shall have ASME rated combination pressure and temperature relief valve.

2.8.1.1 Gas-Fired Type

Gas-fired water heaters shall conform to CSA/AM Z21.10.1 when input is 75,000 BTU per hour or less or CSA/AM Z21.10.3 for heaters with input greater than 75,000 BTU per hour.

2.9 PUMPS

2.9.1 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. 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 electrical disconnecting means. Fractional horsepower pump motors shall have integral thermal overload protection in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Guards shall shield exposed moving parts.

2.10 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 shall be indicating, round or straight reading type. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

2.11 MISCELLANEOUS PIPING ITEMS

2.11.1 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.

2.11.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of 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 sleeves or core-drilled holes with UL listed fill, void, or cavity material.
2.11.2.1 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.

2.11.3 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.11.4 Pipe Hangers (Supports)

Provide MSS SP-58 and MSS SP-69, 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.

2.11.5 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. Plastic pipe shall not be installed in air plenums. 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-01. 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 gate valve or 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 as allowed by NCPC. 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 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 3/4 inch
brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 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, changes in direction, etc., where indicated and/or 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.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 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 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 125 psig working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 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.

3.1.3.1 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.

3.1.3.2 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.3.3 Copper Tube and Pipe

  a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, 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. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

3.1.3.4 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.

3.1.4 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.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.
3.1.5.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. 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 C 920 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 concrete 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 and MSS SP-69, 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-69 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-69 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 or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. 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 that 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 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 plastic.

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- and Oil-Fired Water Heater

Installation shall conform to NFPA 54 for gas fired and NFPA 31 for oil fired.

3.2.3 Heat Traps

Provide integral, factory manufactured or piping arranged heat traps on piping to and from each water heater and hot water storage tank on both hot and cold water connection. Piping arranged heat trap shall incorporate a minimum 12 inch deep loop to restrict natural tendency of hot water to rise during standby periods.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.5 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.

3.2.6 Direct Fired and Domestic Water Heaters

Notify the Contracting Officer when any direct fired domestic water heater over 117,124.2 Watts (400,000 BTU/hour) is operational and ready to be inspected and certified.

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 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, 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.

3.3.4.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick
minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

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.

3.3.7 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 D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.3.8 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.3.8.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 6 inches for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.
3.4 WATER METER REMOTE READOUT REGISTER

The remote readout register shall be mounted at the location indicated or as directed by the Contracting Officer.

3.5 IDENTIFICATION SYSTEMS

3.5.1 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 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.

3.7 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.

3.7.1 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.

3.7.1.1 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 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, 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.

3.7.1.2 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.

3.8 TESTS, FLUSHING AND DISINFECTION

3.8.1 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 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. (Pressure tests shall use water - do not use air pressure)

3.8.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the 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). Report form for each assembly shall include, as a minimum, the following:

<table>
<thead>
<tr>
<th>Data on Device</th>
<th>Data on Testing Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Assembly</td>
<td>Name</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Address</td>
</tr>
</tbody>
</table>

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If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.8.2 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.

3.8.3 System Flushing

3.8.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with hot 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.

3.8.3.2 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.

3.8.4 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. Coordinate operational test and equipment installation with commissioning as specified in Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS. 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.

j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals.

The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.8.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. 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). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean 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. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until 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.
3.9 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

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, overall efficiency.

ET = Thermal efficiency with 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/sq. ft. based on 80 degrees F delta T, or in percent per hour based on nominal 90 degrees F delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

3.11.1 Storage Water Heaters

3.11.1.1 Gas

a. Storage capacity of 100 gallons or less, and input rating of 75,000 Btu/h or less: minimum EF shall be 0.80-0.0019V per 10 CFR 430.

b. Storage capacity of more than 100 gallons - or input rating more than 75,000 Btu/h: Et shall be 77 percent; maximum SL shall be 1.3+38/V, per CSA/AM Z21.10.3.

-- End of Section --
PART 1  GENERAL

Section 22 00 00 PLUMBING, GENERAL PURPOSE applies to work specified in this section.

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)


1.2 SUBMITTALS

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

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Adhesives

Coatings

Insulating Cement

Insulation Materials
1.3 QUALITY CONTROL

1.3.1 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the material meets all other requirements of this section. The minimum recycled material content of the following insulation types are:

a. Rock Wool - 75 percent slag by weight
b. Fiberglass - 20-25 percent glass cullet by weight
c. Plastic Rigid Foam - 9 percent recovered material
d. Polyisocyanurate/Polyurethane - 9 percent recovered material
e. Rigid Foam - 9 percent recovered material

Submit recycled materials 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.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Performance Requirements

Provide noncombustible thermal-insulation system materials, as defined by NFPA 220. Provide adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, except cellular elastomers, with a flame-spread classification (FSC) of 25 or less, and a smoke-developed classification (SDC) of 50 or less. Determine these maximum values in accordance with ASTM E84. Provide coatings and sealants that are nonflammable in their wet state.
Provide adhesives, coatings, and sealants with published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

2.2 COMPONENTS

2.2.1 Insulation

2.2.1.1 Mineral Fiber Insulation

Provide mineral fiber insulation conforming to ASTM C592 ASTM C553 ASTM C547 and suitable for surface temperatures up to 370 degrees F. Provide insulation with a density not less than 4-pound per cubic foot and with thermal conductivity not greater than 0.26 Btu-inch per hour per square foot per degree F at 150 degrees F mean.

2.2.1.2 Cellular Elastomer Insulation

Provide cellular elastomer insulation conforming to ASTM C534/C534M. Ensure the water vapor permeability does not exceed 0.30 grain per foot per inch per hour per square foot mercury pressure difference for 1-inch thickness of cellular elastomer.

2.2.1.3 Cellular Glass Insulation

Conform to ASTM C552, Type II, Grade 2, pipe covering for Cellular Glass. Substitutions for this material are not permitted. Ensure minimum thickness is not less than 1-1/2 inches.

2.2.1.4 Fiberglass Insulation

Conform to ASTM C547. Ensure the apparent thermal conductivity does not exceed 0.54 Btu-inch per hour per square foot per degree F at 200 degrees F mean.

Fiber glass pipe insulation having an insulating efficiency not less than that of the specified thickness of mineral fiber pipe insulation may be provided in lieu of mineral fiber pipe insulation for aboveground piping.

2.2.2 Adhesives

2.2.2.1 Vapor-Barrier Material Adhesives

Ensure adhesives conform to the requirements of ASTM C916, Type I, when attaching fibrous-glass insulation to metal surfaces or attaching insulation to itself, to metal, and to various other substrates.

2.2.2.2 Cellular Elastomer Insulation Adhesive

For cellular elastomer insulation adhesive, provide a solvent cutback chloroprene elastomer conforming to ASTM C916, Type I, and is approved by the manufacturer of the cellular elastomer for the intended use.

2.2.3 Caulk

Provide elastomeric joint sealant in accordance with ASTM C920, Type S, Grade NS, Class 25, Use A.
Corner Angles

Provide a nominal 0.016 inch thick aluminum 1 by 1 inch corner angle piping insulation with factory applied kraft backing. Ensure aluminum conforms to ASTM B209, Alloy 3003.

Jacketing

Aluminum Jacket

Provide aluminum jackets conforming ASTM B209, Temper H14, minimum thickness of 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on the inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves, and flanges.

2.2.5.2 Asphalt-Saturated Felt

Provide asphalt-saturated felt conforming to ASTM D226/D226M, without perforations, minimum weight of 10 pounds per 100 square feet.

2.2.5.3 Stainless Steel Jacket

Provide stainless steel jackets conforming to ASTM A240/A240M; Type 304, minimum thickness of 0.010 inch, smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated stainless steel covers for insulation on fittings, valves, and flanges.

2.2.5.4 Glass Cloth Jacket

Provide plain-weave glass cloth conforming to ASTM D579/D579M, Style 141, weighing not less than 7.23 ounces per square yard before sizing. Factory apply cloth wherever possible.

Provide leno weave glass reinforcing cloth, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of 45 and 30 pounds per inch of width, respectively, and a weight of not less than 1.5 ounces per square yard.

2.2.5.5 PVC Jacket

Provide 0.010 inch thick, factory-premolded polyvinylchloride, one-piece fitting that is self-extinguishing, with high-impact strength and moderate chemical resistance. Ensure jacket has a permeability rating of 0.01 grain per hour per square foot per inch of mercury pressure difference, determined in accordance with ASTM E96/E96M. Provide manufacturer's standard solvent-weld type vapor-barrier joint adhesive.

Ensure conformance to ASTM C1136 for, Type I, low-vapor transmission, high-puncture resistance vapor barriers.
2.2.6 Coatings

2.2.6.1 Outdoor Vapor-Barrier Finishing

Provide a nonasphaltic, hydrocarbon polymer, mastic coating. Ensure the coating conforms to the requirements of ASTM C1136 and ASTM C921.

2.2.6.2 Indoor Vapor-Barrier Finishing

Provide a pigmented resin and solvent compound coatings conforming to ASTM C1136, Type II.

2.2.6.3 Outdoor and Indoor Nonvapor-Barrier Finishing (NBF)

Provide a pigmented polymer-emulsion as recommended by the insulation material manufacturer for the surface to be coated.

2.2.6.4 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.

2.2.6.5 Cellular-Elastomer Finishing

Provide a polyvinylchloride lacquer coating recommended by the manufacturer of the cellular elastomer finish.

2.2.6.6 Coating Color

Provide white for the coating color.

2.3 MATERIALS

Submit manufacturer's catalog data for the following items:

a. Adhesives
b. Coatings
c. Insulating Cement
d. Insulation Materials
e. Jetacking
f. Tape

Provide compatible materials that do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state. Meet ASTM C795 requirements for materials to be used on stainless steel surfaces. Provide materials that are asbestos free.
PART 3 EXECUTION

Apply insulation only to the system or component surfaces that have previously been tested and approved by the Contracting Officer.

3.1 PREPARATION

Submit installation drawings for pipe insulation, conforming with the adhesive manufacturer's written instructions for installation. Submit installation manual clearly stating the manufacturer's instructions for insulation materials.

Clean surfaces to remove oil and grease before insulation adhesives or mastics are applied. Provide solvent cleaning required to bring metal surfaces to such condition.

3.2 INSTALLATION OF INSULATION SYSTEMS

Apply materials in conformance with the recommendations of the manufacturer.

Install smooth and continuous contours on exposed work. Smoothly and securely paste down cemented laps, flaps, bands, and tapes. Apply adhesives on a full-coverage basis.

Install insulation lengths tightly butted against each other at joints. Where lengths are cut, provide smooth and square and without breakage of end surfaces. Where insulation terminates, neatly taper and effectively seal ends, or finish as specified. Direct longitudinal seams of exposed insulation away from normal view.

Use insulation meeting maximum value conductance as tested at any point, do not use an average. Meet or exceed the specified maximum conductance by adding additional insulation thickness.

3.2.1 Hot-Water Return Piping

Install a mineral fiber insulation with glass cloth jacket, Type T-2, with a thickness of not less than 1/2 inch. Insulate aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces.

3.2.2 Cold-Water and Condensate-Drain Piping

Insulate aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces.

Provide 3/8 inch mineral fiber insulation with glass cloth jacket, Type T-2, with a thickness of not less than 3/8 inch.

Install a cellular-elastomer insulation conforming to ASTM C534/C534M, with a water-vapor permeability not exceeding 0.1 grain per square foot per hour per inch mercury pressure-differential for 1 inch thickness.

Provide flexible cellular-elastomeric thermal insulation for cold water piping, Type T-3, with a thickness of 1/2 inch. Use expanded, closed-cell pipe insulation only aboveground, not for underground piping.
3.3 APPLICATION

3.3.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket

Apply factory and field attached vapor barrier jacket to piping insulated with mineral fiber. Maintain vapor seal. Securely cement jackets, jacket laps, flaps, and bands in place with vapor-barrier adhesive. Provide jacket overlaps not less than 1-1/2 inches and jacketing bands for butt joints 3-inches in width.

Insulate exposed-to-view fittings and valve bodies with preformed mineral-fiber of the same thickness as the pipe-barrel insulation. Temporarily secure fitting insulation in place with light cord ties. Apply a 60-mil coating of white indoor vapor-barrier coating and, while still wet, wrap with glass lagging tape with 50 percent overlap, and smoothly blend into the adjacent jacketing. Apply additional coating as needed with rubber-gloved hands to smooth fillets or contour coating. Allow to fully cure before the finish coating is applied. Field fabricate and install insulation for concealed fittings and special configurations. Build up insulation from mineral fiber and a special mastic consisting of a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Where standard vapor-barrier jacketing cannot be used, make the surfaces vapor tight by using coating and glass lagging cloth or tape as previously specified.

In lieu of materials and methods previously specified, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Make seams vapor tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. Hold all jacket ends in place with AISI 300 series corrosion-resistant steel straps, 15-mils thick by 1/2-inch wide.

Set pipe insulation into an outdoor vapor-barrier coating applied intermittently over a minimum length of 6 inches at maximum 12 feet spacing. Seal the ends of the insulation to the jacketing with the same coating material to provide an effective vapor-barrier stop.

Do not use staples as a means to apply insulation. Install continuous vapor-barrier materials over all surfaces, including areas inside pipe sleeves, hangers, and other concealment.

Provide piping insulation at hangers consisting of 13-pounds per cubic foot density; fibrous-glass inserts or expanded, rigid, closed-cell, polyvinylchloride. Where required, seal junctions with vapor-barrier jacket, glass-cloth mesh tape, and vapor-barrier coating.

Expose white-bleached kraft paper side of the jacketing to view.

Finish exposed-to-view insulation with not less than a 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.3.2 Type T-2, Mineral Fiber with Glass Cloth Jacket

Apply factory attached presized, white, glass cloth jacket to piping insulated with mineral fiber. Securely cement jackets, jacket laps, flaps, and bands in place with vapor-barrier adhesive. Provide jacket overlaps not less than 1-1/2 inches and jacketing bands for butt joints 3 inches wide.
Insulate exposed-to-view fittings with preformed mineral-fiber of the same thickness as the pipe insulation. Temporarily secure in place with light cord ties. Install impregnated glass lagging tape with indoor vapor-barrier on 50 percent overlap basis. Blend tape smoothly into the adjacent jacketing. Apply additional coating as needed, using rubber gloved hands to a smooth fillets or contour coatings. Tape ends of insulation to the pipe at valves 2 inches and smaller. Field fabricate and install insulation for concealed fittings and special configurations. Build up insulation from mineral fiber and a mixture of insulating cement and lagging adhesive, diluted with 3 parts water. Finish surfaces with glass cloth or tape lagging.

Cover all valves 2-1/2 inches and larger and all flanges with preformed insulation of the same thickness as the adjacent insulation.

In lieu of materials and methods specified above, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Hold all jacket ends in place with AISI 300 series corrosion-resistant steel straps, 15 mils thick by 1/2-inch wide. Provide fitting insulation, thermally equivalent to pipe-barrel insulation to preclude surface temperatures detrimental to polyvinylchloride.

3.3.3 Type T-3, Cellular Elastomer

Cover piping-system surfaces with flexible cellular-elastomer sheet or preformed insulation. Maintain vapor seal. Cement insulation into continuous material using a solvent cutback chloroprene adhesive recommended by the manufacturer for the specific purpose. Apply adhesive to both of the contact surfaces on a 100-percent coverage basis to a minimum thickness of 10-mils wet or approximately 150 square feet per gallon of undiluted adhesive.

Set cold water piping insulation into an outdoor vapor-barrier coating applied intermittently over a minimum length of 6 inches at maximum intervals of 12 feet. At piping supports, ensure insulation is continuous by using outside-carrying type clevis hangers with insulation shield. Install Wood dowel load-bearing inserts between the pipe and insulation shields to prevent insulation compression.

Insulate hot-water, cold-water, and condensate drain pipes to the extent shown with nominal 1/2-inch thick, fire retardant (FR), cellular elastomer, preformed pipe insulation. Seal joints with adhesive.

At pipe hangers or supports where the insulation rests on the pipe hanger strap, cut the insulation with a brass cork borer and insert a No. 3 superior grade cork. Seal seams with approved adhesive. Insulate sweat fitting with miter-cut pieces of cellular elastomer insulation of the same nominal pipe size and thickness as the insulation on the adjacent piping or tubing. Join miter-cut pieces with approved adhesive. Slit and snap covers over the fitting, and seal joints with approved adhesive.

Insulate screwed fittings with sleeve-type covers formed from miter-cut pieces of cellular elastomer thermal insulation having an inside diameter large enough to overlap adjacent pipe insulation. Lap pipe insulation against fittings, and overlap not less than 1 inch. Use adhesive to join cover pieces and cement the cover to the pipe insulation.
Finish surfaces exposed to view or ultraviolet light with not less than a 2 mil minimum dry-film thickness application of a polyvinylchloride lacquer recommended by the manufacturer. Apply in not less than two coats.

3.3.4 Type T-4, Cellular Glass with Vapor-Barrier Jacket

Apply factory and field attached vapor barrier jacket to piping insulated with cellular glass. Maintain vapor seal. Securely cement jackets, jacket laps, flaps, and bands in place with vapor-barrier adhesive. Provide jacket overlaps not less than 1-1/2 inches. Provide jacket bands for butt joints of not less than 3 inches width. Provide insulation continuous through hangers. Bed insulation in an outdoor vapor-barrier coating applied to all piping surfaces.

Insulate flanges, unions, valves, anchors, and fittings with factory premolded or prefabricated or field fabricated segments of insulation of the same material and thickness as the adjoining pipe insulation. When segments of insulation are used, provide elbows with not less than three segments. For other fittings and valves, cut segments to the required curvature or nesting size.

Secure segments of the insulation in place with twine or copper wire. After the insulation segments are firmly in place, apply a vapor-barrier coating over the insulation in two coats with glass tape imbedded between coats. Vary the tint of the first coat from the expected white color of the second coat to ensure the complete application of the two coats. Apply coatings to a total dry-film thickness of 1/16 inch minimum. Overlap glass tape seams not less than 1 inch and tape ends not less than 4 inches.

In lieu of materials and methods specified above, fittings may be wrapped with 3/8-inch thick, vapor-barrier, adhesive-coated strips of cellular elastomer insulation. Install insulation under tension, compressed to 25 percent of original thickness, and wrapped until overall thickness is equal to adjacent insulation. Secure cellular elastomer in place with twine and sealed with vapor-barrier coating applied to produce not less than 1/16 inch dry-film thickness. Cover fittings with premolded polyvinylchloride jackets. Make seams vapor-tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. Hold jacket ends in place with AISI 300 series corrosion-resistant steel straps, 15-mils thick by 1/2-inch wide.

To prevent condensation, insulate anchors secured directly to piping for not less than 6 inches from the surface of the pipe insulation.

Install white-bleached kraft paper side of jacket exposed to view.

Finish exposed-to-view insulation with not less than a 6-mil dry-film thickness of nonvapor-barrier coating suitable for painting.

3.3.5 Type T-5, Calcium Silicate with Glass Cloth Jacket (Piping)

Apply factory attached presized, white glass cloth jacket to piping insulated with calcium silicate. Field apply jackets when required. Securely cement jackets, jacket laps, flaps, and bands in place with vapor-barrier adhesive. Ensure jacket overlap is not less than 1-1/2 inches and jacketing bands for butt joints are 4 inches wide. Fabricate fittings from segmented pipe barrel sections bedded in general purpose insulating cement and wired in place. Fill voids with a general purpose insulating cement with not less than 1/4 inch thick, final coating. Apply glass
lagging tape with a minimum overlap of 50 percent glass lagging tape with lagging adhesive, blended smoothly into adjacent jacketing. Apply additional adhesive as needed using rubber-gloved hands to smooth filets and contour coatings.

3.3.6 Type T-6, Mineral Fiber with Aluminum Jacket

Apply factory or field attached aluminum jacket to piping insulated with mineral fiber.

Insulate fittings and valve bodies with preformed mineral-fiber of the same thickness as the pipe-barrel insulation. Temporarily secure fitting insulation in place with light cord ties. Apply a 60-mil coating of vapor-barrier mastic, and while still tacky, wrap with glass lagging tape.

Apply additional mastic as needed using rubber-gloved hands to smooth fillets or contour coatings. Field fabricate and install insulation for special configurations. Build up insulation from mineral fiber and a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Only where standard aluminum jacketing cannot be used, make the surfaces vapor-tight by using mastic and glass lagging cloth or tape as specified above with an added finish coat of mastic.

Set pipe insulation into outdoor vapor-barrier coating applied intermittently over a minimum length of 6-inches with a maximum coating application of 12-foot. Seal ends of the insulation to the jacketing with the same coating material to provide effective vapor barrier stops.

Install continuous vapor barrier over all surfaces, including areas inside pipe sleeves, hangers, and other concealment.

Apply piping insulation to both sides of pipe hangers. Insulate junctions with a special mastic mixture, glass cloth mesh tape, and mastic as previously specified.

Securely cement jacket laps, flaps, and bands in place with aluminum jacket sealant. Provide 6 inch wide minimum jacketing bands for butt joints.

Wherever possible, lap joints against the weather so that the water runs off the lower edge and in accordance with the pipe drainage pitch. Locate longitudinal laps on horizontal lines 45 degrees below the horizontal centerline and alternately staggered 1 inch. Lap jacketing material a minimum of 2 inches, circumferentially sealed with mastic, and strapped to provide a waterproof covering throughout. Locate straps 8 inches on center and pull up tight to hold jacketing securely in place. Use screws in addition to straps when necessary to obtain a waterproof covering. Place extra straps on each side of supporting devices and at openings. Where flanging access occurs, strap a chamfer sheet to the pipe at jacketing.

Stiffen exposed longitudinal edges of aluminum jacketing by bending a 1 inch hem on one edge.

Provide expansion joints for maximum and minimum dimensional fluctuations.

To prevent corrosion, do not allow the aluminum jacketing to come in direct contact with other types of metal.

At openings in jacket, apply an outdoor vapor-barrier coating for 2 inches in all directions. Apply jacketing while waterproofing is tacky.
Use screws at each corner of each sheet, at fitting jackets, and as necessary for the service. Place Number 7, 3/8 inch long, binding-head aluminum sheet metal screws through the mastic seal.

3.3.7 Type T-7, Calcium Silicate with Glass Cloth Jacket (Surfaces)

Cover surfaces with insulation block bedded in an insulating cement and covered with glass cloth jacketing.

Clean surfaces with a chlorinated solvent. Mix general purpose insulating cement with 3 parts water to 1 part nonvapor-barrier adhesive to bring to application consistency. Set block into bedding and joints and fill spaces with a bedding mix and wrap with galvanized chicken wire mesh well laced into an envelope. Trowel a 3/8 inch thick coating of bedding mix jacket on the nonvapor-barrier adhesive and glass cloth. Finish surfaces with not less than a 6-mil dry-film thickness of nonvapor-barrier coating.

Aluminum sheet jacketing may be used in lieu of glass cloth.

3.3.8 Type T-9, Cellular Elastomer

Clean pump surfaces with solvent. Apply not less than 1 inch of general purpose insulating cement, mixed with nonvapor-barrier adhesive diluted with 3 parts water, to achieve smooth surface and configuration contours. After all water has been removed, cover surfaces with 1/2 inch thick cellular elastomer insulation, attached and joined into a continuous sheet with an outdoor vapor-barrier coating recommended by the insulation manufacturer for the specific purpose. Apply coating to both of the contact surfaces on a 100-percent coverage basis with a minimum thickness of 10 mils wet. Blend coating into the adjacent flange insulation. Cover joint with a band of cellular elastomer equal to the flange assembly width. Use same coating to seal insulation to the casing at penetrations and terminations. Insulate pumps in a manner that permits insulation to be removed to repair or replace pumps.

Finish insulation with a 2 mil minimum dry-film application of a polyvinylchloride lacquer coating recommended by the manufacturer and applied in not less than two coats.

3.4 CLOSEOUT ACTIVITIES

Final acceptance of the performed work is dependent upon providing Record Drawings details to the Contracting Officer. Include construction details, by building area, the insulation material type, amount, and installation method. An illustration or map of the pipe routing locations may serve this purpose.

Provide a cover letter/sheet clearly marked with the system name, date, and the words "Record Drawings Insulation/Material" for the data. Forward to the Systems Engineer Condition Monitoring Office Predictive Testing Group for inclusion in the Maintenance Database.

-- End of Section --
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)


1.2   RELATED REQUIREMENTS

This section applies to all sections of Division 15, "Mechanical" of this project specification, unless specified otherwise in the individual section. Refer to Section 01 91 13, "General Commissioning Requirements" for commissioning requirements.

1.3   QUALITY ASSURANCE

1.3.1   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.

1.3.2   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.

1.3.3   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.
1.3.4 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.

1.3.5 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.

1.3.5.1 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."

1.3.5.2 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, 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 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall 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 shall 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 shall be included under the section that specified that motor or equipment. 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."
1.6 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.

1.7 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 EQUIPMENT INVENTORY UPDATE

Submit information for each piece of equipment removed and supplied for use of Camp Lejeune to update the Maximo equipment inventory. For the purposes of this paragraph, inventoried equipment is defined as equipment listed on the Maximo Equipment Inventory Update form.

1.8.1 Requirements

The contractor shall prepare and submit one Maximo Equipment Inventory Update form for each individual item of inventoried equipment that is demolished, removed, replaced, or installed. (ex: three new condensing units would require the submission of three Equipment Inventory Update forms. The replacement of two existing air handling units with two new air handling units would require the submission of two Equipment Inventory Update forms). The contractor shall prepare and submit a VAV/TAB Room Number List for each VAV/Tab model installed in a single building. Only one Maximo Equipment Inventory Update form is required for each model of VAV or TAB in a single building.

1.8.1.1 Demolition of all equipment in a structure or facility

When all the inventoried equipment in a building or structure is demolished or removed, and not replaced, an Equipment Inventory Update form is not required.

1.8.1.2 Standards

The contractor shall provide accurate, complete, and legible information on all required forms. All required forms shall be completed and delivered to
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the Contracting Officer on or before the Beneficial Occupancy Date. All information on Equipment Inventory Update forms shall be obtained by visual inspection of equipment data plate(s).

1.8.1.3 Form Preparation

Each required Maximo Equipment Inventory Update form shall contain the following information:

(1) The name and telephone number of an individual who can be contacted for clarification or additional information pertaining to the data on the form.

(2) The date of data collection

(3) The building or structure identification number and the specific location of the equipment within the structure (ex: 3d deck mech room)

(4) A check adjacent to the description of the new or replacement item, and a check adjacent to the supplemental description if applicable (ex: circulating pump and HVAC or steam)

(5) The Maximo number or serial number of the demolished or removed item, if applicable

(6) All applicable data from the equipment data plate

Each Room Number List form shall contain the following information:

(1) The name and telephone number of the individual providing the information

(2) The date the form was completed

(3) The building or structure identification number

(4) A check in the box adjacent to each applicable room number

PART 2   PRODUCTS

Not used.

PART 3   EXECUTION

3.1 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.

3.1.1 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 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, 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.

3.1.2 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.
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-- End of Section --
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.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1  1989 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)


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

SMACNA TAB HVAC Sys  1993 HVAC Systems - Testing, Adjusting and Balancing

1.2 DESCRIPTION OF WORK

The work includes testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

1.2.1 Air Distribution Systems

Systems shall be tested, adjusted, and balanced (TAB'd) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems under Section 23 07 00, "Insulation for Mechanical Systems."

1.3 DEFINITIONS

a. Field check group: One or more systems of the same basic type; the subgroup of a "field check group" is a "system."

b. Out-of-tolerance data: Pertains only to field checking of certified DALT or TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 5 to minus 5 percent of the design for a specific parameter.
1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

**SD-06 Test Reports**

**TAB Report**

1.4.1 **TAB Report**

Submit TAB report with any/all known deficiencies in operation, performance, or air flow are clearly identified. The report shall be reported in the specified format including the following data:

a. **Report Format**: Submit completed report forms for each of the following; as a minimum, report all data as contained on standard NEBB Procedural Stds, AABC MN-1, OR SMACNA TAB HVAC Sys report forms as contained within the referenced standards:

(1) **Air Systems**
   
   (a) Fan report for rooftop units, exhaust fans, fan coil units, heat pumps, packaged terminal units.
   
   (b) Duct traverse supply/return/exhaust/relief ducts.
   
   (c) Terminal supply, return, and exhaust outlets.
   
   (d) DX cooling coils - reports entering/leaving, wet/dry bulb temperatures.
   
   (e) Unit heaters.

The report shall be neatly bound with a waterproof cover. It shall contain a table of contents, with each page numbered. All report data shall be typed - handwritten data will not be acceptable.

b. **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 the TAB data was recorded.

c. **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.

1.5 QUALITY ASSURANCE

1.5.1 **Modifications of References**

Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this section. In the references referred to herein, 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."

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 TAB PROCEDURES

3.1.1 TAB Field Work

Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract design documents. Air systems and water systems shall be proportionately balanced and reported in the certified TAB report. Provide instruments and consumables required to accomplish the TAB work. Conduct TAB work, on the listed HVAC systems in conformance with the AABC MN-1, or NEBB Procedural Stds, except as modified by this section:

a. Workmanship: Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 5 percent of the design values, that is, the values specified or indicated on the contract documents.

3.1.2 Data From TAB Field Work

After all TAB work has been completed, prepare a handwritten, pre-final TAB report using all report forms complete as specified for the final certified TAB report. Except as approved otherwise by the Contracting Officer, in writing, the TAB work and the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph titled "Workmanship."

3.1.3 Quality Assurance For TAB Field Work

3.1.3.1 Field Check

Verbally notify the Contracting Officer that the field check of the pre-final, handwritten report can commence; give this verbal notice 48 hours in advance of when the field check of the pre-final report can commence. Do not schedule the field check of the pre-final report until the TAB work is accomplished to within the accuracy range specified in the paragraph titled "Workmanship" or written approval of the deviations from the requirements has been received from the Contracting Officer.

a. Recheck: During field check the Contractor shall recheck, in the presence of the Contracting Officer, random selections of all reported data recorded in the pre-final report.

b. Areas of Recheck: Points and areas of recheck shall be selected by the Contracting Officer.

c. Procedures: Measurements and test procedures shall be the same as was used for forming basis of the pre-final report.

d. Recheck Selections: Selections for recheck will not exceed 25
percent of the total number of reported data entries tabulated in
the pre-final report.

3.1.3.2 Retests

If random tests reveal a measured value which is an out-of-tolerance
quantity, the report is subject to disapproval at the Contracting Officers'
discretion. In the event the report is disapproved, all systems shall be
readjusted and tested; new data recorded; a new pre-final report submitted;
and a new field check conducted at no additional cost to the Government.

3.1.3.3 Out-of-Tolerance Quantity

Out-of-tolerance quantity pertains to field checking of the pre-final
report. The term is defined as measurement taken during field checking
which does not fall within the range of plus 5 to minus 5 percent of the
design for the specific parameter.

3.1.3.4 Report Acceptance

On completion, and approval, of the pre-final report field check, the
Contractor shall prepare, assemble, and submit the final certified TAB
report in the required format for final review/approval.

3.2 MARKING OF SETTINGS

Permanently mark the settings of HVAC adjustment devices including valves,
splitters, and dampers so that adjustment can be restored if disturbed at
any time. The permanent markings shall indicate the settings on the
adjustment devices which result in the data reported on the submitted
certified TAB report.

3.3 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark and identify the location
points of the duct test ports. If the ducts have exterior insulation,
these markings shall be made on the exterior side of the duct insulation.
The location of test ports shall be shown on the as-built mechanical
drawings with dimensions given where the test port is covered by exterior
insulation.

-- End of Section --
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)


ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1  1989 National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

AABC MN-4  (1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)


NEBB PROCEDURAL STANDARDS  (2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

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


1.2 DEFINITIONS


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 C 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 design for a specific parameter."

h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains below 45 degrees Fahrenheit, 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 above 85 degrees Fahrenheit dry bulb and 76 degrees Fahrenheit wet bulb of the project site's summer outdoor design temperature, throughout the period of TAB data recording. The season of maximum cooling load shall fall within June, July, August, or September.

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, TAB specialist.

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.

<table>
<thead>
<tr>
<th>Contract Term</th>
<th>AABC Term</th>
<th>NEBB Term</th>
<th>TABB Term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heating, Ventilating, and Air Conditioning</td>
<td>and Balancing of Environmental Systems</td>
<td>Systems Balance</td>
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<tr>
<td></td>
<td>Systems</td>
<td></td>
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<tr>
<td>TAB Specialist</td>
<td>TAB Engineer</td>
<td>TAB Supervisor</td>
<td>TAB Supervisor</td>
</tr>
<tr>
<td>Systems Readiness</td>
<td>Construction Phase Inspection</td>
<td>Field Readiness Check &amp; Preliminary Field</td>
<td>Field Readiness Check &amp; Prelim.</td>
</tr>
<tr>
<td>Check</td>
<td></td>
<td>Procedures</td>
<td>Procedures</td>
</tr>
</tbody>
</table>

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, including records of existing conditions.

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.

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 Related Requirements

Section 23 73 33 HEATING, VENTILATING, AND COOLING SYSTEM applies to work
specific requirements relating to Reliability Centered Maintenance (RCM) principals and Predictive Testing and Inspection (PTI), by the construction contractor to detect latent manufacturing and installation defects must be followed as part of the Contractor's Quality Control program. Refer to the paragraph titled "Sustainability" for detailed requirements.

Requirements for price breakdown of HVAC TAB work are specified in Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

Refer to Section 01 91 13, "General Commissioning Requirements" for commissioning requirements.

1.3.3 Projects with Phased Construction

This specification section is structured as though the HVAC construction, and thereby the TAB work, will be completed in a single phase. When the construction is completed in phases, the DALT work and TAB work must be planned, completed, and accepted for each construction phase, unless otherwise noted. At completion of the final phase, compile all reports and submit as one final document.

1.4 SUBMITTALS

All submitted documentation must be typed, neat and organized unless otherwise noted. 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:

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

ROICC, Jacksonville, North Carolina Area, 1005 Michael Road, Camp Lejeune, NC  28542-2521

SD-01 Preconstruction Submittals

Independent TAB Agency and Personnel Qualifications

TAB Design Review Report

Pre-Field TAB Engineering Report

DALT and TAB Work Execution Schedule

SD-03 Product Data

Equipment and Performance Data;

SD-06 Test Reports

Pre-Final DALT Report;

Final DALT Report;

Pre-Final TAB Report for Proportional Balancing
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Pre-Final TAB Report for Season 1;
Pre-Final TAB Report for Season 2;
Final TAB Report for Proportional Balancing
Final TAB Report for Season 1
Final TAB Report for Season 2

SD-07 Certificates

Independent TAB agency and personnel qualifications;

1.4.1 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.

1.4.2 Pre-Field TAB 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.

1.4.3 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.

1.4.4 Pre-Final DALT Report for COTR DALT Field Acceptance Testing

Report the data for the Pre-Final DALT Report meeting the following requirements:

a. 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.

1.4.5 Final DALT Report

On successful completion of all COTR field acceptance testing 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.

1.4.6 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 for final TAB Report. Handwritten report forms or report data are acceptable for pre-final TAB Report.

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.

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: DOAS-1, DOAS-2. 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 DX 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, 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, 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 louver.

(6) For air moving systems of 10,000 cfm and larger, 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 and also at the following locations:

Main Duct: Take readings at four locations along the full length of the main duct, 25 percent, 50 percent, 75 percent and 100 percent of the total duct length.

Floor Branch Mains: Take readings at floor branch mains served by a main duct vertical riser.

Branch Main Ducts: Take readings at branch main ducts.

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. Certification: Include the type name of the TAB supervisor and the dated signature of the TAB supervisor.

i. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, fan curves for fans TAB'd on the job.

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, construction, or commissioning. 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 the performance of clean rooms and clean air devices 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 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 all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and coordinate execution of the various work efforts by personnel from separate organizations.

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 paragraph entitled "TAB Personnel Qualification Requirements."

b. 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 measuring/balancing devices; the construction work schedule; and other applicable documents requested by TAB firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.

c. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.

d. Pre-DALT and TAB meetings: Arrange and conduct the Pre-DALT and TAB meetings. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.

e. 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 installer, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.

f. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.

g. 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. At a minimum, 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. 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) Provide new throwaway HVAC filters and/or clean washable HVAC filters within seven days before both Season 1 and Season 2 TAB field work.

(5) All fan belts on equipment involved in the TAB field work shall be checked, adjusted, and replaced as necessary to bring within the manufacturer's recommended tolerances within seven days before both Season 1 and Season 2 TAB field work.

(6) If Season 2 TAB field work is out of compliance, the Contractor shall be responsible for inspecting and cleaning all strainers, hot water, and chilled water coils as necessary, after which Season 2 TAB field work shall be repeated as necessary to prove compliance.

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 paragraph entitled "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 Specialist

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 pre-field engineering report, during the DALT or TAB field work.

g. 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.

h. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.

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.

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: Near the end of the TAB field work effort, visit the contract site to inspect the HVAC installation and the progress of the TAB field work. Review the TAB final report data and certify the TAB final report.

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.

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.

1.6 DALT AND TAB SUBMITTAL AND WORK SCHEDULE

1.6.1 Pre-Construction Submittals

Within 60 calendar days after date of contract award, submit the following:

Independent TAB Agency and Personnel Qualifications and Certificates

TAB Design Review Report

Pre-Field TAB Engineering Report

DALT and TAB Work Execution Schedule

1.6.2 Pre-DALT Meeting

A minimum of 30 calendar days prior to the start of DALT.

1.6.3 Pre-DALT Preliminary Notification

A minimum of 7 calendar days prior to the start of DALT notify the Contracting Officer in writing of the start of DALT.
1.6.4 DALT Field Work

1.6.5 Submit Pre-Final DALT Report

Within two working days after completion of DALT field work. Separate Pre-Final DALT reports may be submitted to allow phase testing from system to system.

1.6.6 COTR DALT Field Acceptance Testing

Upon approval of the Pre-Final DALT Report, schedule the DALT field check work with the Contracting Officer.

1.6.7 Submit Final DALT Report

Within 15 calendar days after completion of successful COTR DALT Field Acceptance Testing.

1.6.8 Pre-TAB Meeting

A minimum 30 calendar days prior to the start of TAB field work.

1.6.9 Pre-TAB Preliminary Notification

A minimum of 7 calendar days prior to the start of TAB notify the Contracting Officer in writing of the start of TAB.

1.6.10 HVAC Work Check Out List

Complete HVAC Work Check Out List for proportional balancing and Season 1 thermal performance prior to start of TAB work.

1.6.11 TAB Field Work

Tab Field Work for proportional balancing shall be completed a minimum of 90 calendar days prior to CCD.

1.6.12 Submit Pre-Final TAB for Proportional Balancing Report

Within seven working days after completion of TAB field work.

1.6.13 TAB Field Acceptance Testing for Proportional Balancing

Upon approval of the Pre-Final TAB Report, schedule the TAB work field check with the Contracting Officer. TAB for proportional balancing shall be approved prior to BOD.

1.6.14 Submit Final TAB Report for Proportional Balancing

Within 15 calendar days after completion of successful TAB Work Field Check.

1.6.15 Seasonal 1 Thermal Performance TAB Work

Normally, Season 1 thermal performance TAB work will be accomplished during TAB for proportional balancing. If it cannot be performed concurrently due to weather; the TAB for Season 1 will follow the same sequence as TAB for proportionally balanced. TAB for Season 1 shall be complete and TAB Field Acceptance Testing approved prior to BOD.
1.6.16 Pre-Season 2 TAB Preliminary Notification

A minimum of 7 calendar days prior to the start of TAB notify the Contracting Officer in writing of the start of TAB.

1.6.17 HVAC Work Check Out List

Complete HVAC Work Check Out List for Season 2 thermal performance prior to start of TAB work.

1.6.18 TAB Field Work for Proportional Balancing

TAB Field Work for proportional balancing shall be completed within 240 calendar days after commencement of the Season 1 TAB field work and when the ambient temperature is within Season 2 limits.

1.6.19 Submit Pre-Final TAB for Season 2 Report

Within seven working days after completion of TAB field work.

1.6.20 TAB Field Acceptance Testing for Season 2

Upon approval of the Pre-Final TAB Report, schedule the TAB work field check with the Contracting Officer. TAB for proportional balancing shall be approved prior to BOD.

1.6.21 Submit Final TAB Report for Proportional Balancing

Within 15 calendar days after completion of successful TAB Work Field Check.

1.6.22 Maximum Cooling Thermal Performance

Season of maximum cooling thermal performance shall be conducted in June - September.

1.7 WARRANTY

Furnish workmanship and performance warranty for the DALT and TAB system work performed for a period not less than 1 years from the date of Government acceptance of the work; issued directly to the Government. Include provisions that if within the warranty period the system shows evidence of major performance deterioration, or is significantly out of tolerance, resulting from defective TAB or DALT workmanship, the corrective repair or replacement of the defective materials and correction of the defective workmanship is the responsibility of the TAB firm. Perform corrective action that becomes necessary because of defective materials and workmanship while system TAB and DALT is under warranty 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time constitutes grounds for having the corrective action and repairs performed by others and the cost billed to the TAB firm. The Contractor must also provide a 1 year contractor installation warranty.

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 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

100% of the supply and outside air ductwork for the 100% outside air ductwork is subject to DALT. No VRF air handler ductwork shall be subject to DALT.

3.3.4  DALT Testing

Seal class A, leakage class: Round and oval = 3, rectangular duct = 6, test pressure of 1-inch, 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.

3.3.5  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
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 25 percent of the duct sections DALT'd.

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 specified, 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.

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.

3.3.8 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 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 flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Provide a proportional balance of air flow.

That is, comply with the requirements of AABC MN-1 and AABC MN-4, NEBB PROCEDURAL STANDARDS, NEBB MASV, 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 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 DX 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, and unitary units:

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 Return Air Fans

Return air fan system including fan ducts, plenums, registers, diffusers,
grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.5 Fan Coils

Fan coil unit systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.4.3.6 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.3.7 Cabinet Heaters

3.4.3.8 Cooling Units

3.4.3.9 Energy Recovery Ventilators (ERV)

Energy Recovery Ventilator including pressure and dry/wet bulb temperature profiles of both air streams, outside air, supply air, return air, and exhaust air distribution.

3.4.3.10 Dedicated Outside Air Systems (DOAS)

Dedicated Outside Air Systems including pressure and dry/wet bulb temperature profiles of both air streams, outside air, supply air, return air, and exhaust air distribution.

3.4.3.11 Unit Heaters

3.4.4 TAB Work on Performance Tests With Seasonal Limitations

3.4.4.1 Performance Tests

Accomplish proportionate balancing TAB work on the air distribution systems, in other words, accomplish adjusting and balancing of the air flows, any time during the duration of this contract, subject to the limitations specified elsewhere in this section.

In addition to the TAB proportional balancing work on the air distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy within the seasons of maximum heating load and maximum cooling load.

3.4.4.2 Season Of Maximum Load

Visit the contract site for at least two TAB work sessions for TAB field measurements. Visit the contract site during the season of maximum heating load and visit the contract site during the season of maximum cooling load, the goal being to TAB the operational performance of the heating systems and cooling systems under their respective maximum outdoor environment-caused loading. During the seasonal limitations, TAB the operational performance of the heating systems and cooling systems.

3.4.4.3 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was
recorded. Record these temperatures at beginning and at the end of data taking.

3.4.5 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within specified tolerance. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air flow rates specified or indicated. The Contractor is responsible for cleaning strainers and coils (interior and exterior as necessary) if required to obtain air flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.6 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 entitled "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.

3.4.7 TAB Reports

After completion of the TAB field work, prepare the Pre-Final TAB Report for TAB supervisor's review and certification, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms is to be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report is considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

3.4.8 Quality Assurance - COTR TAB Field Acceptance Testing

3.4.8.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COTR, random selections of data (air quantities, air motion) 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 return fans, and air handling units (central stations).

Group 2: 25 percent of the AHU terminal units 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 return fans.

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 Design Value, 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. Further, if any data on the TAB Report for a given field acceptance test group is out-of-tolerance, then field test data for one additional field test group as specified herein. Continue this increase field test work until out-of-tolerance data ceases to be found. This additional field testing is up and above the original 25 percent of the of reported data entries to be field tested.

If there are no more similar field test groups from which to choose, additional field testing from another, but different, type of field testing group must be tested.

3.4.8.2 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.

3.4.9 Final TAB Report

After acceptance of the TAB Field Acceptance testing, submit a Final TAB Report including all adjustments/revisions made. The Final Report shall be neat, legible and type written.

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.
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 B 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate


ASTM C 534 (1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form


ASTM C 916 (1985; R 1990) Adhesives for Duct Thermal Insulation


ASTM E 96 (1997; Rev A) Water Vapor Transmission of Materials
1.2 SYSTEM DESCRIPTION

Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing piping systems.

1.2.1 Air Distribution System

Obtain Contracting Officer's written approval of systems under Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC before applying field-applied insulation to air distribution systems.

1.2.2 Piping Systems

Obtain Contracting Officer's written approval of HVAC water distribution systems under Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC before applying field-applied insulation to HVAC water distribution systems. At the Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are tested, adjusted, and balanced (TAB'd). Piping insulation shall terminate immediately adjacent to each flow control valve, automatic control valve, or device. For chilled water and chilled-hot water piping, the ends of pipe insulation and the space between ends of pipe insulation and piping shall be sealed with waterproof vapor barrier coating. After systems are TAB'd, the control valves and devices shall be insulated.

1.3 DEFINITIONS

1.3.1 Finished Spaces

Spaces used for habitation or occupancy where rough surfaces are plastered, panelled, or otherwise treated to provide a pleasing appearance.
1.3.2 Unfinished Spaces

Spaces used for storage or work areas where appearance is not a factor, such as unexcavated spaces and crawl space.

1.3.3 Concealed Spaces

Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

1.3.4 Exposed

Open to view. For example, pipe running through a room and not covered by other construction.

1.3.5 Conditioned Space

An area, room or space normally occupied and being heated or cooled for human habitation by any equipment.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-03 Product Data

- Piping insulation
- Piping insulation finishes
- Heating, ventilating, and air conditioning systems insulation
- Duct insulation finishes
- Accessory materials
- Adhesives, sealants, and coating compounds

1.5 QUALITY ASSURANCE

Every package or standard container of insulation, jackets, cements, adhesives, and coatings delivered to the project site shall have the manufacturer's stamp or label attached giving name of manufacturer, brand and description of material. Insulation packages and containers shall be asbestos-free.

PART 2 PRODUCTS

2.1 PIPING INSULATION

Piping systems, except buried pipe requiring insulation, types of insulation required, and insulation thickness shall be as listed in Tables I herein. Unless otherwise specified, insulate all fittings, flanges, and valves, except valve stems, hand wheels, and operators. Provide factory premolded, precut, or field-fabricated insulation of the same thickness and conductivity as insulation on adjacent piping. Insulation exterior shall be factory cleanable, grease resistant, non-flaking and non-peeling. Pipe insulation shall conform to the referenced publications.
2.1.1 Pipe Insulation Beyond Building Walls

For 5 feet beyond the exterior side of building walls, conform to ASHRAE 90.1 - 2013 in tunnels, in manholes, under and above piers, in trenches on piers, and for aboveground piping.

2.1.2 Flexible Unicellular Insulation

2.1.2.1 Recommended Adhesive

ASTM C 534. Provide adhesive as recommended by insulation manufacturer or conforming with MIL-A-24179, Type II, Class 1.

2.1.2.2 Polyolefin thermoplastic

Polyolefin thermoplastic meets ASTM C 534, except density.

2.1.2.3 Adhesive For Finishing Flexible Unicellular Insulation

MIL-A-3316, Class 1, Grade A.

2.1.2.4 Glass Cloth For Finishing Flexible Unicellular Insulation

MIL-C-20079, Type I, Class 1, 3, or 5.

2.1.3 Piping Insulation Finishes

2.1.3.1 All-Purpose Jacket

Provide a factory applied all-purpose jacket when field applied jacketing is not specified. All purpose jackets shall include integral vapor barrier as required by service. Provide jackets in exposed locations with a white surface suitable for field painting. Allow a maximum water vapor permeance of 0.05 perm in accordance with ASTM E 96, a puncture resistance of not less than 50 Beach units, and a minimum tensile strength of 35 pounds-force per inch of width in accordance with ASTM D 828.

2.1.3.2 Vapor-Barrier Material

ASTM C 1136. Resistant to flame, moisture penetration, and mold growth. Provide vapor-barrier material on pipe insulation as required in Table I.

2.1.3.3 Metal Jackets

a. Aluminum Jackets: ASTM B 209, Temper H14, minimum thickness of 27 gage (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves and flanges.

b. Piping, Fittings, Flanges, and Valves in Outside Locations: Finish elbows and curved piping with factory-fabricated metal covers. Finish tees, flanges, and valves with metal covers. Covers shall be same thickness and material as jackets on adjacent piping.
2.2 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS INSULATION

Provide insulation on ducts, plenums, mixing boxes, filter boxes, casings and diffusers of Heating, Ventilating and Air Conditioning Systems (HVAC).

2.2.1 Duct Insulation in Concealed Spaces

Blanket flexible mineral fiber insulation conforming to ASTM C 553, Type 1, Class B-3, .75 pound per cubic foot nominal, 3.0 inches thick, minimum installed R8. Provide flexible insulation in concealed spaces only.

2.2.2 Duct Insulation Not in Concealed Spaces

Mineral fiber in accordance with ASTM C 612, Class 2 (maximum surface temperature 400 degrees F), 6 pcf (pounds per cubic foot) average, 1.5 inch thick.

2.2.3 Duct Insulation Finishes

2.2.3.1 All-Purpose Jacket

Provide a factory applied all-purpose jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jackets with a white surface suitable for field painting. All-purpose jacket shall have a maximum water vapor permeance of 0.05 perm per ASTM E 96; a puncture resistance of not less than 50 Beach units; and a tensile strength of not less than 35 pounds-force per inch of width in accordance with ASTM D 828.

2.2.3.2 Vapor-Barrier Material

ASTM C 1136, for duct in equipment room and exposed areas and Type I or II in remaining areas. Material shall be resistant to flame, moisture penetration, and shall not support mold growth. Provide vapor barrier on HVAC duct insulation, except insulation for heating only.

2.3 EQUIPMENT

Insulate all equipment and accessories as specified in Table II. In outside locations, provide insulation one inch thicker than specified. Increase the specified insulation thickness for equipment only where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface. Factory applied insulation shall meet the flame spread and smoke-developed rating of 25/50.

2.4 ADHESIVES, SEALANTS, AND COATING COMPOUNDS

2.4.1 Insulation and Vapor Barrier Adhesive

Provide ASTM C 916, Type I or Type II adhesive for securing insulation to metal surfaces and for vapor barrier lap only in building interior. Provide Type I when an adhesive in which the vehicle is nonflammable in the liquid (wet) state and which will pass the edge-burning test is required. Provide Type II when an adhesive in which the vehicle is nonflammable in the liquid (wet) state and which will not pass the edge-burning test is required.
2.4.2  Lagging Adhesive

MIL-A-3316, Class 1, for bonding fibrous glass cloth to unfaced fibrous glass insulation; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation, or Class 2, for attaching fibrous glass insulation to metal surfaces.

2.4.3  Mineral Fiber Insulation Cement

ASTM C 195, thermal conductivity 0.85 maximum at 200 degrees F mean when tested in accordance with ASTM C 177.

2.4.4  Vapor Barrier Coating

MIL-C-19565, Type II, indoor only above surface temperature 60 degrees F, color white.

2.4.5  Weatherproof Coating

For outside applications provide a weatherproof coating recommended by the manufacturer of the insulation and jackets.

2.4.6  Flexible Unicellular Insulation Adhesive

MIL-A-24179, Type II, Class 1 or Type III.

2.5  ACCESSORY MATERIALS

2.5.1  Staples

ASTM A 167, Type 304 stainless steel outside-clinch type.

2.5.2  Insulation Bands

1/2 inch wide; 0.24 gage galvanized steel or 0.26 gage stainless steel or 0.24 gage aluminum.

2.5.3  Bands for Metal Jackets

3/8-inch minimum width; 0.26 gage stainless steel or 0.24 gage aluminum.

2.5.4  Anchor Pins

Provide anchor pins and speed washers recommended by insulation manufacturer.

2.5.5  Glass Cloth and Tape

MIL-C-20079, Type I, Class 1 or Class 3 cloth, and Type II, Class 1 or tape; 20 by 20 maximum size mesh. Tape shall be 4-inch wide rolls. Class 3 tape shall be 4.5 ounces per square yard. In lieu of glass cloth and tape, open weave glass membrane may be provided.

2.5.6  Wire

Soft annealed stainless steel, 0.047-inch nominal diameter.
PART 3 EXECUTION

3.1 PREPARATION

Do not insulate materials until system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Insulate return ducts, outside air intakes and supply ducts to the room outlets, flexible runouts, plenums, casings, mixing boxes, filter boxes, coils, fans, and the portion of air terminals not in the conditioned spaces. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handles, safety reliefs, and other such items. Allow adequate space for pipe expansion. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems. Extend surface finishes to protect surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during application of finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:

a. Factory preinsulated flexible ductwork;

b. Vertical portion of interior roof drain pipelines, chrome plated pipes, and fire protection pipes;

c. Vibration isolating connections;

d. Adjacent insulation;

e. ASME stamps;

f. Fan name plates; and

g. Access plates in fan housings.

3.2 PIPING INSULATION

3.2.1 Flexible Unicellular Insulation

Bond cuts, butt joints, ends, and longitudinal joints with adhesive, miter 90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral fiber insulation inert and sheet metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Tape all butt joints with adhesive backed insulation tape. On elastomeric insulation (Rubatex, Armorflex) located outside provide weather covering as follows:

(1) Coat entire surface of insulation with MIL-A-3316
(2) While the adhesive is tacky, apply a layer of MIL-C-20079 glass cloth. Stretch tightly and overlap all joints by a minimum of 2-inches. Glass cloth at elbows and fittings shall be mitered.

(3) Apply a final coat of MIL-A-3316 adhesive.

3.2.2 Hangers and Anchors

Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide galvanized steel shields protection saddles. Band and secure insulation protection shields without damaging pipe insulation. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Insulation inserts shall be of calcium silicate, cellular glass (minimum 8 pcf), molded glass fiber (minimum 8 pcf), or other approved material of the same thickness as adjacent insulation. Inserts shall have sufficient compressive strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insert shall be installed to prevent condensation. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation with vapor barrier coating, Type II or for exterior work, manufacturer's recommended weatherproof coating, as applicable. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe. Where anchors are secured to chilled piping that is to be insulated, insulate the anchors the same as the piping for a distance not less than four times the insulation thickness to prevent condensation. Vapor seal insulation around anchors.

3.2.3 Sleeves and Wall Chases

Where penetrating interior walls, extend a metal jacket 2 inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend a metal jacket from a point below the back-up material to a point 10 inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall.

3.2.4 Piping Exposed to Weather

3.2.4.1 Metal Jackets

Install over the insulation. Metal jackets shall have side and end lap at least 2 inches wide with the cut edge of the side tap turned inside one inch to provide a smooth edge. Overlap the jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9-inch centers or with screws at not more than 5-inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by the insulation manufacturer for weatherproofing.

3.2.4.2 Flanges, Unions, Valves, Fittings, and Accessories

Insulate and finish as specified for the applicable service. Apply two coats of an emulsion type weatherproof mastic for hot service and vapor barrier mastic for cold service recommended by the insulation manufacturer. Embed glass tape in the first coat. Overlap tape not less...
than one inch and the adjoining metal jacket not less than 2 inches. Factory preformed metal jackets may be provided in lieu of the above for hot service.

3.3 DUCTS PLENUMS AND CASINGS (HVAC) INSULATION

3.3.1 Rigid Insulation

Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins, after clips are sealed with coating compound for inside work or manufacturer's recommended weatherproof coating for outside work, and reinforced with open weave glass membrane.

3.3.2 Flexible Blanket Insulation

Apply insulation with all joints tightly butted. Secure insulation to ductwork with adhesive in 6-inch wide strips on 12-inch centers. Staple laps of jacket with outward clinching staples. Sealing shall be in accordance with paragraph 3.3.3 below. For ductwork over 24 inches on horizontal duct runs, provide pins, washers and clips. Provide pins on sides of vertical ductwork being insulated. Space pins and clips on 18-inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers. Install speed washers with pins and pin trimmed to washer. Sagging of flexible duct insulation will not be permitted. Cut off protruding ends of pins after clips are secured and sealed with coating compound for inside work. For warm air ducts, overlap insulation not less than 2 inches at joints and secure the laps with outward clinch staples on 4-inch centers. In cold air ducts, vapor seal all joints and staple as specified.

3.3.3 Insulation Finishes and Joint Sealing

Fill all breaks, punctures, and voids with vapor barrier coating compound for inside work or manufacturer's recommended weatherproof coating for outside service. Vapor seal all joints by embedding a single layer of 3-inch wide open weave glass membrane, 20 by 20 mesh maximum size between two 1/16-inch wet film thickness coats of vapor barrier coating compound. Draw glass fabric smooth and tight with a 1 1/2-inch overlap. At jacket penetrations such as hangers, thermometers, and damper operating rods, fill voids in the insulation with vapor barrier coating. Brush a coat of vapor barrier coating where required on HVAC ducts. Provide vapor barrier jacket continuous across seams, reinforcing, and projections. Where height of projections is greater than insulation thickness, carry insulation and jacket over the projection. For joints for heating only systems, provide insulation with two coats of fire resistant adhesive with glass fabric mesh embedded between coats.

3.3.4 Metal Jackets for Outside Ductwork

Ensure metal-jacket side and end laps at least 2 inches wide, with the cut edge of the side lap turned under one inch to provide a smooth edge. Place horizontal laps to shed water. Seal vertical laps with insulation manufacturer's recommended weatherproof coating. Secure jackets in place.
with aluminum or stainless steel bands on 9-inch centers aluminum or stainless steel screws on 5-inch centers. Where ducts penetrate exterior walls, continue the increased thickness required for ductwork exposed to weather and the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall. Where metal jacket abuts an uninsulated surface, seal joints with a weatherproof mastic recommended by the insulation manufacturer. For rectangular ducts, provide corner angles to exposed corners of the insulation. Apply two coats of weatherproof coating recommended by the insulation manufacturer to the entire surface with a layer of glass cloth embedded between coats. Ensure glass cloth overlaps not less than 2 inches at joints and adjoining surface. Each coat of weatherproof coating shall be 1/16-inch minimum thickness.

3.3.5 Access Plates and Doors

On acoustically lined ducts, plenums, and casings, provide insulation on access plates and doors. On externally insulated ducts, plenums, and casings, provide insulation-filled hollow steel panels and doors for access openings. Bevel insulation around access plates and doors.

3.4 EQUIPMENT INSULATION

3.4.1 General Procedures

Apply equipment insulation suitable for temperature and service in rigid block or semirigid board or flexible form to fit as closely as possible to equipment. Groove or score insulation where necessary to fit the contours of equipment. Stagger end joints where possible. Bevel the edges of the insulation for cylindrical surfaces to provide tight joints. Join sections of cellular glass insulation with bedding compound. After the cellular glass insulation is in place on areas to be insulated, except where metal-encased, fill joints, seams, chipped edges, or depressions with bedding compound to form a smooth surface. Fill mineral fiber joints with insulating cement. Bevel insulation around name plates, ASME and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Protect exposed insulation corners with corner angles under wires and bands.

3.4.2 Cold Equipment (Except Pumps)

Secure insulation with 16-gage, galvanized steel or copper clad wire or with 3/4-inch wide 20-gage stainless steel bands spaced on 12-inch centers. Seal joints with joint sealer. Cover non-removable irregular surfaces such as corner angles with a smoothing coat of insulating cement. Provide removable heat exchanger head covers with a male-female shiplap type joint. Apply two coats of vapor barrier coating with a layer of glass cloth embedded between coats. The dry film thickness of the finish shall be 1/32-inch minimum.

3.5 PAINTING AND IDENTIFICATION

Paint in accordance with Section 09 90 00, "Paints and Coatings." Piping identification shall be as specified in other sections.

3.6 FIELD INSPECTION

Visually inspect to ensure that materials provided conform to specifications. Inspect installations progressively for compliance with
requirements.
# TABLE I

## Piping Insulation Wall Thickness

<table>
<thead>
<tr>
<th>Service</th>
<th>Material</th>
<th>1/4</th>
<th>1/4</th>
<th>1 1/2-3</th>
<th>3 1/2-5</th>
<th>6- &amp; Larger</th>
<th>Vapor Barrier Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water &amp; Dual Temp.</td>
<td>Flexible</td>
<td>3/4</td>
<td>1/2</td>
<td>1.5</td>
<td>1.5</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>&amp; Refrigerant Suction Pipe</td>
<td>Unicellular</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Cold Water, Drains</td>
<td>Polyisocyanurate</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>and Horizontal Roof Drains</td>
<td>Cellular Glass</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Polyisocyanurate</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calcium Silicate</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cellular Phenolic</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flexible Unicell-</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Cellular</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating Hot Water &amp; Pipes</td>
<td>Polyisocyanurate</td>
<td>1</td>
<td>(1.5)</td>
<td>(1.5)</td>
<td>(2)</td>
<td>(2)</td>
<td>No</td>
</tr>
<tr>
<td>(150 to 200 Degrees F)</td>
<td>Calcium Silicate</td>
<td>1.5</td>
<td>(2.5)</td>
<td>(2.5)</td>
<td>(2.5)</td>
<td>(3)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Cellular Glass</td>
<td>1.5</td>
<td>(2.5)</td>
<td>(2.5)</td>
<td>(2.5)</td>
<td>(3)</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Cellular Phenolic</td>
<td>1</td>
<td>(1.25)</td>
<td>(1.25)</td>
<td>(1.25)</td>
<td>(1.25)</td>
<td>No</td>
</tr>
</tbody>
</table>
TABLE I

Piping Insulation Wall Thickness

<table>
<thead>
<tr>
<th>Tube And Pipe Size (Inches)</th>
<th>1/4-1/4</th>
<th>1 1/2-3</th>
<th>3 1/2-5</th>
<th>6- &amp; Larger</th>
<th>Vapor Barrier Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Material</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Thickness in parenthesis are for:

(1) Cold piping - crawl spaces, mechanical rooms, and outside locations
(2) Hot Piping - outside locations, not including tunnels and crawl spaces.
(3) NP - Not permitted.
TABLE II

Insulation For Equipment

<table>
<thead>
<tr>
<th>Material</th>
<th>Spec</th>
<th>Type</th>
<th>Class</th>
<th>Vapor Barrier Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible Mineral Fiber,</td>
<td>ASTM C 553</td>
<td>I</td>
<td>B-3</td>
<td>Yes*/No</td>
</tr>
<tr>
<td>Rigid Mineral Fiber,</td>
<td>ASTM C 612</td>
<td>2</td>
<td></td>
<td>Yes*/No</td>
</tr>
<tr>
<td>or Cellular Glass</td>
<td>ASTM C 552</td>
<td>I</td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

*Yes for chilled water and brine service and no for other services.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Recommended</th>
<th>Wall Thickness</th>
<th>Vapor Barrier Required</th>
</tr>
</thead>
</table>

*Exact insulation thickness may be determined by proposed condition of use.
TABLE III

<table>
<thead>
<tr>
<th>Service And Surface Material Temperature Range (Degrees F)</th>
<th>Outside Diameter (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1/4-1-1/4</td>
</tr>
<tr>
<td></td>
<td>1-1/2-3</td>
</tr>
<tr>
<td></td>
<td>3-1/2-5</td>
</tr>
<tr>
<td></td>
<td>6-10</td>
</tr>
<tr>
<td></td>
<td>11-36</td>
</tr>
</tbody>
</table>

-- End of Section --
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 135.1     (Errata 1 2015; INT 1 2013; Addenda O 2014) Method of Test for Conformance to BACnet

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1        (1999) Local Area Network: Token Bus

ASME INTERNATIONAL (ASME)

ASME B31.1       (2016) Power Piping

ASTM INTERNATIONAL (ASTM)


CONSUMER ELECTRONICS ASSOCIATION (CEA)


INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)


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)


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code

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


UNDERWRITERS LABORATORIES (UL)

UL 1449 (2014; Reprint Mar 2016) UL Standard for Safety Surge Protective Devices

UL 506 (2008; Reprint Oct 2013) Specialty Transformers

UL 508A (2013; Reprint Jan 2014) Industrial Control Panels


1.2 RELATED REQUIREMENTS

Refer to Section 01 91 13, "General Commissioning Requirements" for commissioning requirements, Division 22 for coordination with plumbing equipment, Division 26 for electrical coordination.

1.3 DEFINITIONS

1.3.1 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.
1.3.2 ARCNET

ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it’s possible to determine the maximum delay before a device is able to transmit a message.

1.3.3 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.

1.3.4 BACnet Building Controller (B-BC)

ASHRAE 135 building controller that is the main interface for the building control system.

1.3.5 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".

1.3.6 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.

1.3.7 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.

1.3.8 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.3.9 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".

1.3.10 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.3.11 BAS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, technical support, control parameters, and daily operation. The BAS Owner
for this project is Camp Lejeune Public Works.

1.3.12 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.

1.3.13 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.3.14 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.

1.3.15 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.

1.3.16 Broadcast

A message sent to all devices on a network segment.

1.3.17 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".

1.3.18 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.

1.3.19 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, 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.

1.3.20 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".
1.3.20.1 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).

1.3.20.2 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.

1.3.20.3 Plant Controllers

Plant controllers are typically used to control various equipment in mechanical rooms such as pumps, heat exchangers, and chillers.

1.3.20.4 BACnet Building Controller (B-BC) also known as Supervisory Building Controller (SBC)

The BACnet Building Controller is used to coordinate all equipment in a building, input scheduling, and is used as a connection point for transferring configuration files to the other controllers. The SBC shall communicate with other controllers and equipment through a BACnet MS/TP bus. Depending on approvals and capabilities, the SBC may be used as a point of connection between the Camp Lejeune EMCS network (IP) and the building level control network (BACnet MS/TP).

1.3.21 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.

1.3.22 DDC System

A 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.

1.3.23 Energy Management & Control System (EMCS)

The EMCS at Camp Lejeune 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 EMC receives real time electrical utility pricing data and automatically manages to Camp Lejeune's energy target. The existing EMCS consists of two servers, 1) Johnson Controls Incorporated (JCI) Metasys Extended Architecture (ADX server), and 2) Niagara AX supervisor (JCI FX web supervisor). Both of the systems communicate over the MRAN and either may be used to fulfill the requirements of this specification.
1.3.24 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media.

1.3.25 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.

1.3.26 Middleware (previously called Gateway)

Communication hardware and software connecting two or more different protocols, similar to human language translators. The Middleware translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a middleware has BACnet on one side and non-BACnet protocols on the other side.

1.3.27 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.

1.3.28 Hub

A common connection point for devices on a network.

1.3.29 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.

1.3.30 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".

1.3.31 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.3.32 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
1.3.33 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.3.34 LonTalk

CEA-709.1-D. A communication protocol developed by Echelon Corp. LonTalk is not permitted.

1.3.35 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.3.36 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.3.37 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.

1.3.38 Network

Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®. In general, networks within the building, all controllers and equipment will be BACnet MS/TP, unless noted otherwise.

1.3.39 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.

1.3.40 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.3.41 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.3.42 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.
Peer-to-Peer refers to devices where any device can initiate and respond to communication with other devices.

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.

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).

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.

Physical and virtual inputs and outputs. See also "Input/Output".

Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

A network component that connects two or more physical segments at the physical layer.

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. If a router is connected directly to the MRAN, it must be listed on the approved DIACAP equipment list and must be Marine Corps DADMS listed and approved.

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 or communications will not cause other network devices to fail. Internal time clocks and onboard scheduling are required to allow for stand-alone control. 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. Provide
stand-alone control routines to provide for energy saving sequences such as free cooling. Provide stand-alone control routines that operate without connection to the BACnet/IP and MS/TP networks during a loss of communication.

1.4 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph SUBCONTRACTOR SPECIAL REQUIREMENTS in Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. 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.

1.5 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

a. Remove entire existing system and provide entire new BACnet DDC system(s) including associated equipment and accessories.

b. All new devices are accessible using a Web browser interface and communicate using ASHRAE 135 BACnet communications without the use of gateways, unless gateways are shown on the design drawings and specifically requested by the Government. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

1.5.1 Design Requirements

1.5.1.1 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.

1.5.1.2 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 Camp Lejeune Standard naming conventions.

1.5.1.3 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, model, part number, firmware version, serial number, physical location (e.g. Building 4, room 112 overhead), and power requirements (i.e. AC/DC voltage and power draw). 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.

1.5.1.4 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
g. Control cabinet general layout, include all devices, point count, cable type (18/2, 18/3, etc), 24VAC VA power requirement for all devices including those powered from the cabinet.

1.5.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

1.5.1.6 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.

1.5.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.5.1.8 BACnet Communication Architecture Schematic

Provide a schematic showing the project's entire BACnet communication network, including Internet Protocol (IP), Media Access Control (MAC), BACnet network, Device ID, field bus address, BBMDs, any devices using BACnet FDR, and Firmware version / Operating System, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.
1.6 SUBMITTALS

Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications.

Submit the following 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
- List of I/O Points
- Control System Components List
- Control System Schematics
- HVAC Equipment Electrical Ladder Diagrams
- Component Wiring Diagrams
- Terminal Strip Diagrams
- BACnet Communication Architecture Schematic

SD-03 Product Data

Direct Digital Controllers

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

BACnet Gateways

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 Software

Include BACnet PICS for Operator Workstation software.

Notebook Computer

Sensors and Input Hardware

Output Hardware

Surge and Transient Protection

SD-05 Design Data
17-0016, Interior and Exterior Repairs, Bldg. 523

Performance Verification Testing Plan

Pre-Performance Verification Testing Checklist

SD-06 Test Reports

Performance Verification Testing Report

Bus Waveform Report

SD-07 Certificates

Contractor's Qualifications

SD-09 Manufacturer's Field Reports

Pre-PVT Checklist

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4

Controls System Operators Manuals, Data Package 4

SD-11 Closeout Submittals

Training Documentation

1.7 QUALITY ASSURANCE

1.7.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.7.2 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.

1.7.3 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.

1.7.4 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 500 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.

1.7.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.7.6 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.

1.7.7 Modification of References

The advisory provisions in ASME B31.1, NFPA 70 and the manufacturer's recommendations 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.

1.7.8 Project Sequence

The control system work for this project shall proceed in the following order:

a. Preparatory meeting for controls work.

b. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph SUBMITTALS.

c. Submit and receive approval for Performance Verification Testing (PVT) Plan.

d. Perform the control system installation work, including all field check-outs and tuning.

e. Provide support to TAB personnel as specified under the paragraph TEST AND BALANCE SUPPORT.

f. Submit and receive approval of the Controls System Operators Manual specified under the paragraph CONTROLS SYSTEM OPERATORS MANUALS.

g. Perform the Performance Verification Testing.

h. Submit and receive approval on the PVT Report.

i. PVT Report Acceptance test for Season 1.

j. 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.

k. Deliver the final Controls System Operators Manuals and VFD Service Manuals.

l. Conduct the Phase I Training and VFD on-site/hands-on training.
m. Conduct the Phase II Training.

n. Submit and receive approval of Closeout Submittals.

o. PVT Report Acceptance Test for Season 2.

PART 2  PRODUCTS

2.1  DDC SYSTEM

a. 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 MS/TP communications between the DDC system and native BACnet devices furnished with HVAC equipment and plant equipment including boilers, chillers, and variable frequency drives. Devices provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing and in accordance with ASHRAE 135.1 Method of Test for Conformance to BACnet. Controls provided integral to equipment shall be part of the DDC system and shall fully comply with this specification. Coordinate integration of integral controls into the system as a whole. BACnet over IP is not permitted within the DDC system.

b. Assist the Government in interfacing the new DDC system with the site's existing server and operator workstation and software. Create graphics, scheduling, alarming, and trending.

2.1.1  BACnet Building Controller (B-BC) (Previously referred to as a Supervisory Building Controller)

ASHRAE 135 building controller that is the main interface for the building control system. Provide either a Johnson Controls Incorporated NAE or NCE; OR a JACE based on the Niagara AX platform. The JACE (JAVA Application Control Engine) shall be minimally based on a Tridium 700 with expanded memory and embedded "workplace" software. Minimum software version for the JACE is 3.8.38 and the limit per trunk is 64 devices.

2.1.2  EMCS Interface

The Energy Management & Control System (EMCS) at Camp Lejeune is comprised of two separate systems. Both of the systems communicate over the basewide Marine Air-Ground Task Force Regional Area Network (MRAN). One uses the Johnson Controls Metasys extended architecture including an ADX server and NAE 8500(s). Connection from the building BAS is by a Johnson Controls Network Automation Engine (NAE) or Network Control Engine (NCE) to the ADX server, or by a LOYTEC Router connected to the DDC MS/TP bus and MRAN using BACnet over IP to communicate to the NAE 8500. The second system uses a Niagara AX web supervisor with a JACE in the building communicating using Fox protocol. Because of IT security and permissions, only these systems and equipment are permitted as part of the EMCS.

2.1.2.1  BACnet Building Controller

Provide either a Johnson Controls NAE, NCE, or a JACE. This will serve as both the BACnet Building Controller and the connection point between the buildings DDC and the EMCS.
2.1.2.2 LOYTEC Router

In addition to the BACnet Building Controller, provide a LOYTEC MP201 router to act as a BACnet MS/TP to BACnet IP gateway.

2.1.3 Direct Digital Controllers

Direct digital controllers shall be UL 916 rated.

2.1.3.1 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, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

2.1.3.2 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.

2.1.3.3 Stand-Alone Controllers

Provide stand-alone direct digital controllers with internal time clocks. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of any building communication failure. All I/O points specified for a piece of equipment shall be integral to its controller and serial connected expansion modules. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

2.1.3.4 Internal Clock

Provide internal clocks and scheduling for all Direct Digital Controllers. Provide controllers with BTL listed profiles for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. This includes but is not limited to VAV Controllers, Fan Coil controllers, Heat Pump controllers and any terminal controllers. BACnet Application specific controllers (B-ASC) will only be accepted for dedicated small exhaust system control such as restroom and mechanical room exhaust fans. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.3.5 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.
2.1.3.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.3.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.3.8 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.

2.1.3.9 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 on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.

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 send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. 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.

2.1.3.10 Digital Controller BACnet Internetwork

Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.
2.1.3.11 Communications Ports

a. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

b. BACnet routers supporting ARCnet shall also be capable of supporting MS/TP.

2.1.3.12 BACnet Gateways

Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

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. 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. Middleware 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. Middleware 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. Middleware shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.

d. Middleware 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. Middleware 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.

2.1.3.13 Digital Controller Cabinet

Provide each digital controller in a factory fabricated locked cabinet enclosure.

Cabinets located indoors shall protect against dust and have a minimum NEMA
17-0016, Interior and Exterior Repairs, Bldg. 523

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 including new steam boiler rooms 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.

2.1.3.14 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.

2.1.4 DDC Software

2.1.4.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. All software shall be licensed to Marine Corps Base, Camp Lejeune Complex for unrestricted use on Camp Lejeune Complex and reproduction for use on Camp Lejeune Complex. Software keys and "dongles" are not permitted. Provide programming 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. All logic programming and control functions shall be closed loop, command and feedback for fault detection and alarming when status != command.

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 (variable types include but are not limited to the following: local, global, real, and integer) 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.
2.1.4.2 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.

2.1.4.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.4.4 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.

2.1.4.5 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.

2.1.4.6 Timed Local Override

Provide an adjustable override time for each push of a timed local override button.

2.1.4.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.4.8 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.

2.1.4.9 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.

2.1.4.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. When a web server is connected to the BACnet internetwork, alarms/events shall report to web server as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved. 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.

2.1.4.11 Trending

Provide BACnet 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 BACnet system shall allow for Change-Of-Value (COV) subscription based trending at user defined thresholds.

The B-BC 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.

Additionally, provide trend on geothermal well field supply and return temperatures. Trend shall record temperature at 0600 and 1800. Allocate sufficient memory to store 13 months data.

2.1.4.12 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.

2.1.4.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.5 Notebook Computer

Provide a notebook computer, complete with the project's installed DDC software, applications database, and graphics 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, Windows based operating system, minimum 2.7 GHz processor with 3 MB Cache, discrete switchable graphics card with minimum 1 GB dedicated memory, 1 Terabyte hard drive, 6 GB DDR3 RAM, 2 USB 3.0 ports, 10/100/1000 network interface card, 802.11 b/g/n WLAN, 17-inch display, keyboard with numeric keypad, 6-hour battery with charger, internal or external 8X DVD+/-R/RW drive with double layer support with DVD creator software, and Microsoft Office Home and Business bundled software. Provide all original licenses, installation media, documentation, and recovery CDs capable of
restoring the original configuration. Provide a means to connect the notebook computer to the installed field bus. Provide the manufacturer’s 3-year accidental damage protection with 3-day on site response for 2 year warranty with the Government listed as the warranty owner.

2.1.6 Notebook Computer Software

2.1.6.1 Password Protection

System shall support role based access. At a minimum OS administrator, auditor, DDC operator and user roles must be defined. The system must be capable of enforcing role based access by location (e.g., Bob may alter operating parameters for Building 1 but not Building 2. Building 2 is Alice's responsibility).

Workstation shall be capable of DoD Common Access Card (CAC) login in addition to traditional username and password.

The lowest level only allow viewing 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.

2.1.6.2 Notebook Computer DDC Software

Provide the workstation software with the manufacturer's installation CDs and licenses. Configure the software according to the DDC system manufacturer's specifications, cybersecurity requirements, and in agreement with BACnet Operator Workstation (B-OWS) device standards found in ASHRAE 135, Annex L.

The workstation software shall permit complete monitoring, modification, archiving, programming and troubleshooting interface with the DDC system including BACnet building controller and field controllers. 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.

2.1.6.3 Web-Based User Interface (UI) and Graphics

Provide web-based graphics fully compatible with Internet Explorer 9+, Safari, Firefox, and Google Chrome. Web-based user interface shall be browser agnostic and shall not rely on proprietary client side scripting to function.

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. Web-based user interface shall not rely on additional third-party browser "plug-in" software like Adobe Flash. Java client side applets may be used if appropriately signed. If Java client side runtimes are used they shall not require deprecated or otherwise unsupported Java runtime environments.

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 Elevation: For buildings more than one story, provide an elevation view of the building with links to each of the building's floor plans. Simulate the building's architecture and include the building number and floor numbers. If possible, use an actual photograph of the building.

(2) 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.

(3) 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.

(4) 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.
(5) 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 (10k 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.

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.

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 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, unless current switches are shown on design drawings or point tables.

2.2.4 Motor Run Status

Unless otherwise noted, provide current switches to indicate run status of pumps and fans. Sensitivity of the switch on belt driven equipment should distinguish between loaded motor and unloaded motor such as a fan with a broken belt.
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 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 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 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.

2.2.7 Energy Metering

2.2.7.1 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).

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured galvanized steel dampers where indicated. Dampers shall be opposed blade for rectangular applications 10-inches and taller, and single blade for round dampers and rectangular dampers shorter than 10-inches. 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 0.064 inch 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 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. All actuators shall include a feedback loop for detecting actuator faults. The actuator shall report actual position back to the control system. Binary actuators shall provide open/closed status, at a minimum. Modulating actuators and process shall provide position feedback expressed (directly or through span conversion) as percent open/closed. Actuator status shall be derived from actuator position; however, effect may be used in cases where direct feedback is not practical such as VAV coils and dampers.

Use airflow sensors as a feedback loop for damper actuators. Use differential temperature as a feedback mechanism for VAV coil valve actuation.

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. Thermal type actuators 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.

2.4 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 direct digital controller or grouped terminal controllers and shall be installed externally to the device or devices being protected. 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.
2.4.2.2 MS/TP Communication Line Surge Protection

Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.

b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.

c. The device shall be installed at the distance recommended by its manufacturer.

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.

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

Provide in accordance with control manufacturer's recommendations and the following: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. 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.

2.4.3.3 Conduit

Conduit for controls less than 100 volts shall be colored blue. Junction box cover plates for controls shall be blue.

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems. All material and
equipment shall be installed in accordance with the manufacturer's recommendations for the intended purpose. Use the more stringent methods when manufacturer's recommendations, and plans & specification requirements differ. Use the "Preferred" method when alternative methods are given. The word "should" will be considered to mean "shall". Bring any conflicts between manufacturer's recommendations and plans & specification requirements to the Government's attention. All equipment shall be installed level and plum.

3.1.1 Pre-Installation Meeting

Prior to starting the installation, meet with the Contracting Officer's Technical Representative (COTR) and the BAS owner to develop a mutual understanding relative to the details of the DDC system requirements. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.1.2 Demolition

Remove and/or demolish all existing controls, cabling, conductors, conduit, controllers, power circuits and cabinets that are no longer needed after new work is installed.

3.1.3 BACnet Naming and Addressing

Coordinate with the EMCS Owner and provide unique naming and addressing consistent with existing buildings already loaded on the EMCS server. All DDC controllers shall have a Camp Lejeune unique instance number and all Supervisory Building Controllers shall have a Camp Lejeune unique name. Names are managed by the Government.

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 MS/Tp networks, assign addresses from 0 to 127. Instance numbers are to be obtained from Camp Lejeune Public Works Operations to ensure duplicates do not occur. Point of Contact:

Bill Schrader
Public Works Division/EMCS
1005 Michael Road / Building 1005
MCB Camp Lejeune, NC 28547
(910) 450-7846

For MS/TP, assign from 01 to 127.

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. Instance numbers must be field assignable. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

Each object on the Camp Lejeune EMCS has a unique point name, which is made up of the object or short name stored in the controller and the equipment identifier, which is stored in the supervisory building controller (SBC). The long point name combines this object name with the name stored in the SBC that describes the controller or location of the object. The device object name property field shall support 32 minimum printable characters. The point name follows the general convention:

```
Area.Building.Location.Equipment.Object Name
```

Example: Hadnot Point.HP512.Second Floor.AHU-3.ASTATIC-SP. See Attachments one through four for equipment names, object names, object groupings, and area names.

e. Object Name Property Text (Other than Device Objects)

The object name identifies the specific point. Only object names on the approved Camp Lejeune list shall be used. From the example above, the point name is: "ASTATIC-SP". See Attachment for the approved Camp Lejeune list. The object name property field shall support 32 minimum printable characters.

f. Object Description

The controller shall also store an alpha numeric description of the object name. The controller shall support a minimum of 30 printable characters. From the example above the object description is: "Actual Static Pressure Setpoint".

g. List of Attachments

Attachment 1 - Equipment Names
Attachment 2 - Object Names
Attachment 3 - Object Grouping
Attachment 4 - Area Names

3.1.4 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects in accordance with existing Camp Lejeune 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 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.

3.1.5 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.

<table>
<thead>
<tr>
<th>Priority Level</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual-Life Safety</td>
</tr>
<tr>
<td>2</td>
<td>Automatic-Life Safety</td>
</tr>
<tr>
<td>3</td>
<td>(User Defined)</td>
</tr>
<tr>
<td>4</td>
<td>(User Defined)</td>
</tr>
</tbody>
</table>
### Priority Level and Application

<table>
<thead>
<tr>
<th>Priority Level</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Critical Equipment Control</td>
</tr>
<tr>
<td>6</td>
<td>Minimum On/Off</td>
</tr>
<tr>
<td>7</td>
<td>(User Defined)</td>
</tr>
<tr>
<td>8</td>
<td>Manual Operator</td>
</tr>
<tr>
<td>9</td>
<td>(User Defined)</td>
</tr>
<tr>
<td>10</td>
<td>(User Defined)</td>
</tr>
<tr>
<td>11</td>
<td>Load Shedding</td>
</tr>
<tr>
<td>12</td>
<td>(User Defined)</td>
</tr>
<tr>
<td>13</td>
<td>(User Defined)</td>
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<td>14</td>
<td>(User Defined)</td>
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<tr>
<td>15</td>
<td>(User Defined)</td>
</tr>
<tr>
<td>16</td>
<td>(User Defined)</td>
</tr>
</tbody>
</table>

**b. Alarming**

1. Alarms 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.

### 3.1.6 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".
3.1.7 BACnet Routers and Protocol Gateways

Provide the quantity of BACnet routers 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 IP network. Configure BBMD tables to enable unicast forwarding of broadcast messaging across Layer-3 IP subnets.

3.1.8 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. Run all control wiring in rigid or flexible conduit, metallic tubing, or covered metal raceways. All control wiring located inside mechanical rooms shall be in conduit or metallic tubing.

c. 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.

d. Provide circuit and wiring protection required by NFPA 70.

e. Minimum conduit size is 3/4-inch, except 1/2-inch may be used from last junction box to the terminal device. Maximum conduit fill is 40% or the cable manufacturer's recommended amount whichever is less. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.

f. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.

g. 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. Labels shall fully encircle the wire, cable, or tube. The single line text shall run parallel to the wire, cable, or tube and shall be repeated so as to be viewable without twirling or twisting the wire. Locate the markers within 2 inches of each termination. Label shall include type of network and destination of cable (ex. BACnet/AHU-1). Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the work "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the methods shall be in accordance with UL 508A.

h. Conduit identification: All conduits shall be labeled at 36' from terminations, boxes, or bends. Labels shall be 3/8' black lettering on white background and indicate what system the conduit contains. Label shall be visible and legible from at least three sides with a minimum dimension of 1.9 inches x 4 inches.

i. Each terminal device shall have its own terminal conduit run. Device boxes or devices shall not be used as "pass thru" for wiring.

j. Conduit to equipment and devices shall be run tight to walls, and ceilings. Avoid conduit on the floor, i.e. conduit shall not block access to or past equipment. Flex conduit is to be used only when EMT or rigid conduit is not able to satisfy the application such as a
transition to a sensor or equipment. Flex conduit shall be limited to a maximum length of 3 ft.

k. 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.

l. BACnet Building Controllers (B-BC) shall be powered from a dedicated transformer for the B-BC only. Each control cabinet shall have a dedicated 24 volt transformer. The 120 VAC power branch circuit shall be dedicated to the DDC control system.

m. 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.

n. All terminations in panels shall be made at a terminal block. No wire nuts are allowed in panels.

o. 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.

p. The Contractor shall be responsible for correcting all associated MS/TP and SA bus wiring, termination, end of line, and ground loop problems.

q. Run wiring in panel enclosures in covered wire track.

3.1.9 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.

3.1.10 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.

c. Provide a dedicated analog output to each output device, such as variable frequency driven pump motors in an alternating arrangement.

3.1.11 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.

3.1.12 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.

3.1.12.1 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 54 inches above the floor to meet ADA requirements.

3.1.12.2 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.

3.1.12.3 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.

3.1.12.4 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.

3.1.13 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.14 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.15 Pressure Sensors

Locate pressure sensors as indicated.
3.1.16 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.

3.1.17 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 120 days advance notice of need. Provide one inch conduit and Cat 6 cable from the point of connection of the BAS to the point of connection to the MRAN (most likely in the telephone equipment room).

3.2 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.

3.3 INTERFACE WITH EXISTING EMCS

Provide 16 hours of assistance to the Government with interfacing the BAS to the Base wide EMCS. The Government will make the final connection of the BAS to the MRAN. This 16 hours does not include completion or corrections to the installed BAS as defined in the contract documents. This 16 hours is for assisting the interface and for making revisions to the BAS that may be needed outside of the contract requirements.

3.4 CONTROLS SYSTEM OPERATORS MANUALS

Provide four electronic and 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.

e. A copy of the project's approved final TAB Report.

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.

m. Submit any and all updated field controller files, and BACnet Building Controller data base during the acceptance and warranty periods or as a result of a latent defect.

3.4.1 Storage Cabinets

In one project mechanical room, typically near the BACnet Building Controller provide a wall-mounted storage cabinet with hinged doors. In addition to the number of manuals specified above, provide an additional copy of the manuals in the mechanical room storage cabinet. Provide cabinets large enough to hold the entire set of Controls System Operators Manuals, and the HVAC operation and maintenance manuals provided under Division 15 MECHANICAL. 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." 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 may be witnessed 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 BAS 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. It shall include each and all sequences of all controllers. Include sequence tested, intended test procedure, required assisted personnel (such as the mechanical contractor), the expected response, and the pass/fail criteria for every component tested. Include pass/fail column for test, and space for comments, signature and date lines for Contractor's PVT administrator and Contractor's QA representative. The PVT plan shall include the prescriptive pre-PVT check list in addition to the Contractor generated controller specific testing sequences. The final part of the PVT Report shall be 48 hour trends. Propose criteria for the trends, ie, change of state, change of value with the trigger value, time in the PVT Plan.

3.5.3 PVT Sample Size

Test all controllers unless otherwise directed. Trends will be reported on all central plant equipment and primary air handling unit controllers, and 20% of terminal controllers such as VAV boxes and fan coil units.
3.5.4 Pre-Performance Verification Testing Checklist

Submit the following as a part of the PVT Plan and the PVT Report. Each item shall include a column for the Contractor's initial/date. This form may be a general form applicable to all controllers and submitted only once in the PVT Plan. Each controller shall have an individual checklist with controller title and identified in the PVT Report.

a. Verify all mechanical installation work is successfully completed and started up by the appropriate personnel.

b. Verify all required control system components, wiring, and accessories are installed.

c. Verify the installed control system architecture matches approved drawings.

d. Verify all control circuits operate at the proper voltage and are free from grounds or faults.

e. Verify all required surge protection is installed.

f. Verify the A/C Power Table specified in the paragraph CONTROLS SYSTEM OPERATORS MANUALS is accurate.

g. Verify all DDC network communications function properly, including uploading and downloading programming changes.

h. Verify each digital controller’s programming is backed up.

i. Verify all wiring, components, and panels are properly labeled.

j. Verify all required points are programmed into devices.

k. Verify all valve and actuator zero and span adjustments are set properly. List each device and span for that device.

l. Verify all sensor readings are accurate and calibrated. List each sensor, sensor reading, and measured value.

m. Verify each control valve and actuator goes to normal position upon loss of power. List each device and normal position.

n. Verify each controller works properly in stand-alone mode by disconnecting the BACnet bus.

3.5.5 Conducting Performance Verification Testing

a. Conduct PVT after approval of the PVT Plan. Notify the Contracting Officer of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's mechanical design drawings, and the approved PVT Plan, conduct the PVT.

b. During testing, identify any items that do not meet the contract...
requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. 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 for values normally read over the network.

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 Workstation and Software Operation

For every user workstation or notebook provided:

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 Areas

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 (types of transition include but are not limited to the following: TO-OFF NORMAL and TO-NORMAL).

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

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.

3.5.12 Bus Waveform Report

Provide printed wave form of the MS/TP bus(es). Use an oscilloscope to test and record the wave form of each bus. This wave form is useful in identifying and troubleshooting bus problems such as inappropriate taps, grounds, end of line terminations and poor connections. Identify each graphic with bus name, location, date and time, and instrument used.

3.5.13 Performance Verification Testing Acceptance Testing

After acceptance of the PVT Report, demonstrate proper and stable operation of the DDC System. During the field acceptance testing, verify, in the presence of the COTR and BAS owner, random selections of sequences reported in the PVT Report. Equipment, controllers, devices, and sequences for field acceptance testing area to be selected by the COTR. Field acceptance testing includes verification of the PVT for the following equipment groups:

Group 1: All pumps, chillers, boilers, return fans, computer room units, and air handling units (rooftop and central stations).

Group 2: 25 percent of terminals such as VAV and fan coil units.

Group 3: 25 percent of supply fans, and exhaust fans.

If any of the acceptance testing is found to not operate correctly, terminate verification for the given group. Make the necessary corrections and prepare a revised PVT Report. Reschedule acceptance testing of the revised report with the COTR. After the PVT has been accepted, submit the revised controller files and BACnet Building Controller database.

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 and locations with the Contracting Officer and BAS Owner after receiving approval of the training course documentation.
Training shall take place at the job site 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 synopses 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:

- BACnet fundamentals (objects, services, addressing) and how/where they are used on this project
- This project's list of control system components
- This project's list of points and objects
- This project's device and network communication architecture
- This project's sequences of control, and:
- Alarm capabilities
- Trending capabilities
- Troubleshooting communication errors
- Troubleshooting hardware errors

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 walk-through tour of the mechanical system and the installed DDC components (components include but are not limited to the following: controllers, valves, dampers, surge protection, switches, thermostats, and sensors)
- A discussion of the components and functions at each DDC panel
c. Logging-in and navigating at each operator interface type

d. Using each operator interface to find, read, and write to specific controllers and objects

e. Modifying and downloading control program changes

f. Modifying setpoints

g. Creating, editing, and viewing trends

h. Creating, editing, and viewing alarms

i. Creating, editing, and viewing operating schedules and schedule objects

j. Backing-up and restoring programming and data bases

k. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics

l. Creating new graphics and adding new dynamic data displays and links

m. Alarm and Event management

n. Adding and removing network devices

-- End of Section --
17-0016, Interior and Exterior Repairs, Bldg. 523

SECTION 23 73 33
HEATING, VENTILATING, AND COOLING SYSTEM

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 in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)


AMCA 500 (1994) Test Methods for Louvers, Dampers and Shutters

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

ARI UD Directory of Certified Unitary Air Conditioning Equipment


AHRI 440 (2008) Performance Rating of Room Fan-Coils

ASME INTERNATIONAL (ASME)

ASME B16.3 (2011) Malleable Iron Threaded Fittings, Classes 150 and 300


ASME B16.18 (2012) Cast Copper Alloy Solder Joint Pressure Fittings

Solder Joint Pressure Fittings

ASME B16.23  (2011) Cast Copper Alloy Solder Joint Drainage Fittings - DWV


ASME B31.1  (2016) Power Piping


ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M  (1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 106  (1999e1) Seamless Carbon Steel Pipe for High-Temperature Service


ASTM A 194/A 194M  (2001a) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

ASTM A 525  (1991; Rev. B) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM A 653/A 653M  (2001a) Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality


ASTM B 280  (1999e1) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B 306  (1999) Copper Drainage Tube (DWV)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

1.2 SYSTEM DESCRIPTION

Provide new and modify existing heating, ventilating, and cooling (HVAC) systems complete and ready for operation. HVAC systems include equipment, ducts, and piping which is located within, on, under, and adjacent to buildings.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-02 Shop Drawings

Temperature control systems

Equipment layout drawings for:

(1) Dedicated Outside Air Unit

(2) VRF System

SECTION 23 73 33 Page 3
SD-03 Product Data

Split-system heat pumps
Variable refrigerant flow system fan-coil units
Exhaust fans
Fire dampers
Pipe hangers and supports
Flexible pipe connectors
Dampers
Diffusers, registers, and grilles
Outside air intake louvers
Flexible round ducts
Pipe and fittings

SD-06 Test Reports

Dedicated Outside Air Unit

SD-07 Certificates

Certification of welders' qualifications
Equipment field test plans

SD-08 Manufacturer's Instructions

Installation manual

SD-10 Operation and Maintenance Data

Dedicated Outside Air Unit, Data Package 3
Split-system heat pumps, Data Package 3
Exhaust fans, Data Package 2
Fire dampers, Data Package 1

Submit in accordance with Section 01 78 23, "Operation and Maintenance Data."

SD-11 Closeout Submittals

Dedicated outside air unit start-up report
Variable refrigerant flow system fan-coil units start-up report
Air filter inventory
1.3.1 Temperature Control Systems

Drawings shall include point-to-point electrical wiring diagrams.

1.3.2 Equipment layout drawings

Submit drawings showing equipment layout including foot print, piping, conduit, control cabinets, door swings, and power disconnects.

1.3.3 Installation Manual

Provide for each item of equipment.

1.3.4 Certification of Welders' Qualifications

Submit copy of Welder Qualification Tests (Form QW-482) prior to site welding.

1.3.5 Equipment Field Test Plans

Submit within 120 calendar days after contract award for the following equipment.

a. Dedicated Outside Air Unit

b. Heat pumps: packaged, split-system, and water-source; greater than 60,000 Btuh.

1.3.6 Air Filter Inventory

Submit an inventory of sizes and quantity of air filters required to be replaced. Inventory shall indicate location of each piece of equipment. Include sketches of drawings.

PART 2 PRODUCTS

2.1 EQUIPMENT

Dehydrate, purge, and charge refrigerant circuit with refrigerant and oil at factory. Factory oil and refrigerant charge shall be full amount required for operation, if within limits permitted by the Department of Transportation; otherwise, a holding charge shall be furnished. Field charging, where only a holding charge is shipped, shall be accomplished without breaking permanent refrigerant connections. Equipment using R-11, R-12, R-13, R-113, R-114, R-115, R-500, or R-502 as a refrigerant will not be permitted. Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Program. Refrigerants that operate anywhere in the cycle below 20 psia will not be permitted. Efficiency of equipment shall meet the minimum's of Table 15701-1.

2.1.1 Split-System Heat Pumps

Provide units designed, tested, and rated in accordance with ARI 210/240 or ARI 340/360. Units shall be ARI certified or rated in ARI UD. Outside unit shall include compressor and condenser. Provide guards to protect condenser fins. Unit shall include blower fan, evaporator coil, filters,
and controls. Provide additional heating section when indicated. Insulate interior of inside unit casing with manufacturer's standard insulation. Insulate interior of inside unit casing with manufacturer's standard insulation.

a. Filter section: Provide UL listed throwaway 1 inch thick fiberglass filters, standard dust-holding capacity, 350 fpm maximum face velocity. Provide gasketed hinged access panel with quick opening half-twist latches at end of filter rack.

b. Safety controls: Provide low refrigerant pressure protection and pressure relief device. Provide compressor motor with thermal and overload protection, 5 minute anti-recycle timer, and start capacitor kit. Provide compressor with electrical crankcase heater and internal high pressure protection. The above safety controls are not required when scroll compressors are provided.

c. Supplemental heater section: Provide UL listed electric resistance heaters including internal fusing integral with indoor unit; fan shall run until heater cools. Locate downstream of indoor coil. Provide controls to operate heater only when indoor thermostat is in heating mode and outdoor thermostat indicates outside temperature is below 35 degrees F or unit balance point, whichever is higher; and when unit is in defrost mode at any outside temperature.

d. Space temperature controls: Provide controls under Section 23 09 23.13, "BACnet Direct Digital Control Systems for HVAC."

e. Special corrosion protection: Provide condenser coils constructed of copper tubes and plate copper fins or copper tubes and plate aluminum fins with phenolic coating factory applied to entire coil by immersion dipping and baking to 1.5 mil minimum dry film thickness. Rating of units shall be after application of phenolic coating.

2.1.2 Dedicated Outside Air Unit

2.1.2.1 Indoor Air Handling Units

2.1.2.1.1 Manufacturer

a. Products shall be provided with:

   (1) R-410A refrigerant
   (2) ECM driven direct drive backward curved plenum supply fans
   (3) Double wall cabinet construction
   (4) Insulation with a minimum R-value of 6.25
   (5) Double sloped stainless steel drain pans
   (6) Hinged access doors with lockable handles
   (7) LED service lights in the control panel
   (8) Designed, engineered, and manufactured in the United States
(9) All other provisions of the specifications must be satisfactorily addressed

2.1.2.1.2 Air Handling Units

a. General Description

(1) Indoor air handling units shall include filters, supply fans, DX evaporator coil, electric heaters, exhaust fans, energy recovery wheel, and unit controls.

(2) Unit shall have a draw-through supply fan configuration and discharge air vertically.

(3) Unit shall be shipped in four sections and factory tested including leak testing of the DX coil, and run testing of the supply fans and factory wired electrical system. Run test report shall be supplied with the unit.

(4) Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

(5) Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.

(6) Installation, Operation and Maintenance manual shall be supplied within the unit.

(7) Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.

(8) Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

b. Construction

(1) All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.

(2) Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.

(3) Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel and prevents exterior condensation on the panel.

(4) Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping
and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

(5) Access to filters and energy recovery wheel shall be through hinged access door with quarter turn fasteners.

(6) Access to cooling coil shall be through hinged access door with lockable quarter turn handles.

(7) Access to external control panel shall be through hinged access door with tooled entry.

(8) Access to supply fan and exhaust fan shall be through an access door with removable pin hinges and lockable quarter turn handles.

(9) Access doors shall be flush mounted to cabinetry.

(10) Units with a cooling coil shall include sloped 304 stainless steel drain pan. Drain pan connection shall be on the right hand side of unit.

(11) Cooling coil shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.

(12) Unit shall include a 5-inch forklift base.

(13) Unit shall include interior corrosion protection which shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure. Air tunnel, fans and dampers shall all include the corrosion protection.

(14) Unit shall include exterior corrosion protection which shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

c. Electrical

(1) Unit shall be provided with an external control panel with separate low voltage control wiring with conduit and high voltage power wiring with conduit between the control panel and the unit. Control panel shall be field mounted.

(2) Unit shall be provided with standard power block for connecting power to the unit.

(3) Unit shall include a factory installed 24V control circuit transformer.

(4) Unit shall include high and low voltage quick connects for easy wiring at installation.

(5) Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.
d. Supply Fans

(1) Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

(2) Blower and motor assembly shall be dynamically balanced.

(3) Motor shall be a high efficiency electronically commutated motor (ECM).

(4) Blower and motor assembly shall be mounted on rubber isolators.

(5) ECM driven supply fan CFM setpoint shall be set with factory installed potentiometer within the control compartment.

(6) ECM driven supply fan speed shall be controlled with the factory installed WattMaster controller.

e. Exhaust Fans

(1) Unit shall include direct drive, unhoused, backward curved, plenum exhaust fans.

(2) Blower and motor assembly shall be dynamically balanced.

(3) Motor shall be a high efficiency electronically commutated motor (ECM).

(4) Blower and motor assembly shall utilize neoprene gasket.

(5) ECM driven exhaust fan speed shall be controlled with the factory installed WattMaster controller.

f. Cooling Coil

(1) Evaporator Coil

(a) Coil shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

(b) Coil shall two circuits and interlaced circuitry.

(c) Coil shall be 6 row high capacity and 12 fins per inch.

(d) Coil shall be hydrogen or helium leak tested.

(e) Coil shall be furnished with factory installed thermostatic expansion valves. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

(f) Coil shall have right hand external piping connections. Liquid and suction connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.
(g) Coil shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 and 250 hours respectively (ASTM D2247-92 and ASTM ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 6,000 hours salt spray per ASTM B117-90. Coated coil shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard limited parts warranty. The remaining period of the warranty shall be covered by Luvata Electrofin. The Luvata Electrofin written instructions for installation, operation, coil cleaning, maintenance, and recording keeping must be followed. Refer to the Luvata Electrofin Terms and Conditions of Sale.

g. Refrigeration System

(1) Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.

(2) Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, check valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal that enables the dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Modulating reheat valves and receiver shall be factory installed in the matching condensing unit. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

(3) The lead refrigerant circuit shall be provided with external hot gas bypass to protect against evaporator frosting at low suction pressure and to prevent excessive compressor cycling. Hot gas bypass valve shall be factory installed in the matching condensing unit. Hot gas bypass line connection shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.

(4) Unit shall be configured as heat pump. Refrigeration circuit shall be equipped with a thermal expansion with an external check valve on the indoor coil.

(5) Reversing valve, outdoor coil thermal expansion valve, bi-flow filter drier, and liquid line receiver shall be factory installed in the matching condensing unit.

h. Electric Heating
(1) Unit shall include an electric heater consisting of electric heating coils, fuses, contactors, and a high temperature limit switch, with capacities as shown on the plans.

(2) Electric heating coils shall be located in the reheat position downstream of the supply fan.

(3) Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). Controller shall provide the heating control signal to control the amount of heating.

i. Filters

(1) Unit shall include 4 inch thick, pleated panel filters with an ASHRAE efficiency of 85% and a MERV rating of 13, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE efficiency of 30% and MERV rating of 10, upstream of the 4 inch standard filters.

(2) Unit shall include a clogged filter switch.

(3) Unit shall include factory installed Magnehelic gauge measuring the pressure drop across the filter rack.

j. Energy Recovery

(1) Unit shall contain an energy recovery cabinet with back outside air and exhaust air opening and top return air and supply air opening.

(2) Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Dampers shall be controlled by a fully modulating actuator.

(3) Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.

(4) Wheel frame shall slide out for service and removal from the cabinet.

(5) The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.

(6) Wheels shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.
(7) Wheels shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

(8) All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

(9) The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

(10) Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

(11) Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE efficiency of 30% and MERV rating of 10, upstream of the wheels.

(12) Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

(13) Energy recovery wheel shall include a 1% mechanical purge that uses the outdoor air stream to flush potential exhaust air carryover.
(14) Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contracts for field indication of wheel rotation.

k. Controls

(1) Unit shall be provided with an external control panel with separate low voltage control wiring with conduit and high voltage power wiring with conduit between the control panel and the unit. Control panel shall be field mounted.

(2) Factory Installed and Factory Provided Controller

(a) Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.

(b) Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

(c) Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

(d) Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

(e) Make Up Air Controller

1. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.

2. Hot gas bypass shall be required on the lead refrigeration circuits of systems without variable capacity compressors.

3. Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.

(f) Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

1. Accessories

(1) Unit shall be provided with a smoke detector sensing the
return air of the unit, wired to shut off the unit's control circuit.

(2) Unit shall be provided with remote safety shutdown terminals for wiring to a field installed smoke detector, firestat, or building safety automatic shutdown system.

2.1.2.2 Condensers/Condensing Units

2.1.2.2.1 Manufacturer

a. Products shall be provided by:

(1) R-410A refrigerant

(2) Hinged access doors with lockable handles

(3) Variable capacity compressor with 10-100% capacity

(4) 2,500 hour salt spray tested exterior corrosion protection

(5) Designed, engineered, and manufactured in the United States of America

(6) All other provisions of the specifications must be satisfactorily addressed

2.1.2.2.2 Condensing Units

a. General Description

(1) Air-Source heat pump condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction and liquid connection valves, accumulator, receiver, reversing valve, filter drier with check valve, and thermal expansion valve.

(2) Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the control compartment.

(3) Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.

(4) Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.

(5) Installation, Operation and Maintenance manual shall be supplied within the unit.

(6) Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.

(7) Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.
b. Construction

(1) Unit shall be completely factory assembled, piped, and wired and shipped in one section.

(2) Unit shall be specifically designed for outdoor application.

(3) Access to compressors and control components shall be through hinged access doors with quarter turn, lockable handles.

(4) Access to condenser coils and fans is through removable access panels.

(5) Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

(6) Unit shall include lifting lugs.

(7) Unit shall include forklift slots.

c. Electrical

(1) Unit shall be provided with standard power block for connecting power to the unit.

(2) Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.

(3) Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

(4) Unit shall be provided with factory installed and factory wired 115V, 12 amp GFI outlet in the unit control panel.

(5) Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage, or on phase reversal.

(6) Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

d. Refrigeration System

(1) Unit shall be provided with two independently circuited R-410A scroll compressors with thermal overload protection. Lead compressor shall be a variable capacity scroll capable of modulation from 10-100% of its capacity.

(2) Each compressor shall be furnished with a crankcase heater and carry a 1 year non-prorated warranty, from the date of original equipment shipment from the factory.

(3) Compressors shall be mounted in an isolated service
compartment which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.

(4) Compressors shall be isolated from the base pan with the compressor manufacturer’s recommended rubber vibration isolators and mounted on an elevated compressor deck, to reduce any transmission of noise from the compressors into the building area.

(5) Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided and installed. Field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas bypass line, insulated hot gas reheat line, and insulated suction line.

(6) Unit shall include a factory holding charge of R-410A refrigerant and oil.

(7) Unit shall include 2 stages of capacity control.

(8) The unit shall be capable of stable cooling operation to a minimum of 55°F outdoor temperature.

(9) Lead refrigeration circuit shall be provided with modulating hot gas reheat valves, electronic controller, liquid line receiver, supply air temperature sensor and a dehumidification control signal terminal that enables the dehumidification mode of operation, and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. The matching indoor air handler must include a hot gas reheat coil.

(10) Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall each be equipped with a liquid line filter drier with check valve, reversing valve, accumulator, receiver, and thermal expansion valve. Reversing valve shall de-energize during the heat pump heating mode of operation.

(11) Refrigeration circuits with non-variable compressors shall be provided with external hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.

(12) Each refrigeration circuit shall be equipped with a liquid line sight glass.

(13) Each refrigeration circuit shall be equipped with suction and discharge compressor isolation valves.

(14) Units shall be provided with a suction pressure transducer on each refrigeration circuit.

(15) Unit shall be provided with a compressor sound blanket.

e. Fans

(1) Condenser fan shall be vertical discharge, axial flow, direct
drive fans.

(2) Fan motor shall be weather protected, single phase, direct drive, and open drip proof with inherent overload protection.

(3) Electronically commutated motor driven variable speed condenser fans shall be provided for head pressure control and allow operation down to 35°F.

g. Coils

(1) Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.

(2) Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

(3) Coils shall be hydrogen or helium leak tested.

(4) Coil shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 6,000 hours salt spray per ASTM D117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard limited parts warranty. The remaining period of the warranty shall be covered by Luvata Electrofin. The Luvata Electrofin written instructions for installation, operation, coil cleaning, maintenance, and record keeping must be followed. Refer to the Luvata Electrofin Terms and Conditions of Sale.

2.1.3 Exhaust Fans

AMCA 210 with AMCA seal. Provide centrifugal type exhaust fans with aluminum housing, fan wheel, and bird screen. Motors shall be completely shielded from the airstream. Provide exhaust opening and gravity closing type automatic backdraft dampers. Provide NRCA R&W Manual roof curb for roof mounted exhaust fans as recommended by fan manufacturer.

2.2 ELECTRICAL

2.2.1 Electrical Motors, Controllers, Contactors, and Disconnects

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 26 20 00, "Interior Wiring Systems." Provide electrical connections under Section, 26 20 00, "Interior Wiring Systems." Provide controllers and contactors with maximum
of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

2.2.2 Electrical Work

Provide under Section 26 20 00, "Interior Wiring Systems." Provide control wiring under Section 23 09 23.13, "BACnet Direct Digital Control Systems for HVAC."

2.3 METAL DUCT SYSTEMS

Provide shop-fabricated, zinc-coated steel ducts conforming to ASTM A 525 or ASTM A 653/A 653M coating designation G60. Fabricate, construct, brace, reinforce, install, support, and seal ducts and accessories, and test ducts in accordance with SMACNA HVAC Duct Const Stds and SMACNA Leakage Test Mn1. Cover duct transverse joints with single component synthetic rubber type compound suitable for use with passivated coating on zinc-coated steel. Lap joints in direction of flow. Provide ducts straight and smooth on inside with neatly finished airtight joints. Provide air supply and return openings in ducts with air diffusers, registers, or grilles.

2.3.1 Flexible Duct Connectors

Provide airtight flexible duct connectors at duct connections to each air-conditioning unit, air-handling unit, exhaust fan, and ventilating fan. Support connectors at each end with metal angle frame bands, securely bolt in place. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene.

2.3.2 Turning Vanes

Provide fabricated tees and square elbows with turning vanes in accordance with SMACNA HVAC Duct Const Stds for vanned elbows. Turning vanes shall be single wall with trailing edges.

2.3.3 Dampers

Provide factory manufactured opposed blade adjustable manual dampers where indicated for duct heights of 12 inches and larger. Provide factory manufactured single leaf dampers for duct heights less than 12 inches. Provide damper shafts with 2 inch standoffs to clear 2 inches of duct insulation with bearings at both ends of the shafts. Provide adjustment quadrant with indicator and locking devices. Provide galvanized steel dampers one gage heavier than duct in which dampers are installed.

2.3.4 Diffusers, Registers, and Grilles

Provide factory-fabricated metal units with edges rolled or rounded where exposed to view, and factory primed with white enamel finish. Provide each diffuser and register with factory-fabricated, group-operated, adjustable, opposed-blade, air-volume-control dampers, key or screwdriver operated from the face of unit without the use of a tool. Provide each unit with rubber or plastic installation gaskets. Diffusers in same room shall have same face design.

a. Diffusers: Provide round, square, or rectangular diffusers as
indicated. Ceiling diffusers shall be designed to deliver air in a horizontal direction. Provide baffles or other devices as required for proper air distribution pattern.

b. Registers: Provide double deflection supply registers arranged to control air direction, throw, and drop. Exhaust and return air registers shall have single set of nondirectional face bars or vanes having the same appearance as supply registers. Provide face bars or vanes spaced not more than 0.75 inch on center and not less than 0.62 inch depth.

c. Grilles: Provide as specified for registers without air-volume-control dampers.

2.3.5 Outside Air Intake Louvers

Louvers shall bear AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500. Maximum pressure drop shall be 0.1 inch WG, unless indicated otherwise. Louvers shall have maximum water penetration of 0.20 ounce per square foot of free area at free velocity of 800 fpm. Provide aluminum alloy with anodized finish frames and blades assembled with stainless steel screws, including 0.5-inch mesh aluminum screen mounted in extruded aluminum frame.

2.3.6 Access Doors

Provide for access to volume dampers, fire dampers, plenum chambers, and where indicated. Provide each door with double wall zinc-coated steel construction, gasketed airtight, with continuous hinges and cam latches. Insulate access doors with one-inch thick rigid insulation. Provide 12 inch by 12 inch door, except where larger sizes are indicated, or provide 12 inches by height of duct when duct is less than 12 inches high.

2.3.7 Fire Dampers

UL 555 and NFPA 90A. Dampers shall be listed in UL Bld Mat Dir. Dampers when open shall not protrude into the ducts.

2.3.8 Flexible Round Ducts

UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Fire hazard rating of duct assembly shall not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of 2 inches W.G. positive and 1.5 inches W.G. negative. Flexible round duct length shall 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.

a. Inner duct core: Flexible core shall be interlocking spiral or helically corrugated and constructed of zinc-coated steel, aluminum, or stainless steel; or shall be constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

b. Insulation: Inner duct core shall be insulated with mineral fiber blanket type flexible insulation, minimum of one inch thick. Insulation shall be covered on exterior with manufacturer's
2.4 PIPING SYSTEMS

Provide the following pipe and fittings. Provide dielectric fittings, unions or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions or flanges. Water piping sizes 4 inches and smaller shall be copper tubing. Water piping sizes larger than 4 inches shall be copper tubing or steel piping. If steel piping is provided, provide a solids-from-water separator.

2.4.1 Soldered Joint Copper Tubing

Provide ASTM B88, Type L for aboveground piping, Type K for buried piping, with ASME B16.18 or ASME/ANSI B16.22 solder joint fittings, unions, and flanges; provide adapters as required. Provide ASTM B42 copper pipe nipples with threaded end connections. Provide ASTM B32, 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder.

2.4.2 Copper Tubing Piping Systems

Provide copper tubing for the following piping systems, except water piping sizes larger than 4 inches shall be copper tubing or steel piping.

a. Chilled water, chilled-hot water, and hot water piping.

b. Cold drain piping from drain pans.

2.4.3 Copper Cold Drain Piping

Provide copper tubing in accordance with paragraph entitled "Copper Tubing" for piping sizes one inch and smaller. Provide ASTM B 306 copper tubing and ASME B16.23 solder joint fittings for piping sizes larger than one inch. In lieu of copper tubing, 1.25 inch Schedule 40 polyvinyl chloride (PVC) plastic pipe, fittings, and solvent cement may be provided.

2.4.4 Copper Refrigerant Tubing


2.4.5 Steel Piping Systems

Provide steel piping for the following piping systems.

a. Gas piping.

2.4.5.1 Steel Pipe

Provide ASTM A 53/A 53M Type E or Type S, or ASTM A 106 steel pipe; except ASTM A 53/A 53M, Type F steel pipe may be provided for water pipe sizes larger than 4 inches and for steam pipe less than 100 psig. Provide Weight
Class STD or Schedule No. 40 black steel pipe for welding end connections. Provide Weight Class XS or Schedule No. 80 black steel pipe for threaded end connections and for condensate piping.

2.4.5.2 Steel Pipe Fittings

Provide ASME B16.3 or ASME B16.11 threaded fittings, and ASME/ANSI B16.39 threaded unions. Provide ASME B16.9 buttwelding fittings of the same material and weight as the piping in which fittings are installed; provide backing rings compatible with piping materials being buttwelded. Provide ASME B16.11 socket welding fittings.

2.4.5.3 Steel Pipe Unions

Provide ASME/ANSI B16.39, Class 150, unions with threaded end connections on one side of threaded valve in steel piping systems.

2.4.5.4 Steel Pipe Flanges

Provide ASME B16.5, Class 150 welding neck flanges. Extend bolts no less than two full threads beyond the nut with the bolts tightened to the required torque.

a. Gaskets: Provide one piece factory cut gaskets suitable for the intended service. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.


d. Washers: Provide steel flat circular washers under bolt heads and nuts.

2.4.5.5 Direct Buried Steel Piping

Provide pipe and fittings with exterior coal tar epoxy painting system.

2.5 PIPING ACCESSORIES

2.5.1 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69, 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.

2.5.2 Thermometers

Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 3 inch diameter dial with glass face gasketed within the case; and accuracy within 2 percent of scale range. Provide scale range for intended service.
2.5.3 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one-inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of 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 sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.5.3.1 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.

2.5.3.2 Sleeves not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.5.4 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid where indicated. Connectors shall be suitable for the intended service.

2.5.5 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, 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.

2.6 TERMINAL UNITS

2.6.1 Variable Refrigerant Flow System Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan valve and piping package, outside air damper, air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models, leveling devices integral with the unit for vertical type units, and sound power levels as indicated. Obtain sound power level data or values for these units according to test procedures based on AHRI 350. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide fan-coil units that are certified as complying with AHRI 440, and meet the requirements of UL 1995.

2.6.1.1 Controls

Refer to Section 23 09 23.13 "BACnet Direct Digital Control Systems for HVAC".
2.6.1.2 Ducted Indoor Units

a. The ducted indoor fan coil shall be designed to mount above the ceiling. The unit shall have a 2000 step modulating expansion device.

b. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, the electronic modulating linear expansion device, control circuit board, and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.

c. The unit cabinet shall be a space saving, ceiling-concealed, ducted unit. The cabinet panel shall have provisions for a field installed filtered outside air intake.

d. The indoor unit fan shall consist of two or three Sirocco (or approved equal) fans, direct driven by a single motor. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall have high, medium, and low fan speeds. The fan speed shall be adjustable by an optional remote controller. The airflow shall also be capable of adjustment based on static pressure.

e. Return air shall be filtered by means of a factory installed return air filter.

f. The indoor coil shall be constructed as follows:

1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.

2. The tubing shall have inner grooves for high efficiency heat exchange.

3. All tube joints shall be brazed with phos-copper or silver alloy.

4. The coils shall be pressure tested at the factory.

5. A condensate pan and drain shall be provided under the coil.

6. The coil fins shall be coated with hydrophilic paints.

7. The optional field installed condensate lift mechanism shall be able to raise drain water 29.5 inches water column above the condensate pan.

8. Both refrigerant lines to the indoor units shall be insulated.

2.6.2 Training

Certified Manufacturer's Factory Representative shall provide Contractor Installation & Start-up/Commissioning Training. All associated costs, including travel costs, lodging, training fees, etc. shall be covered by the Contractor or equipment supplier.

Provide four (4) copies of Manufacturer's Troubleshooting & Diagnostic Hardware Device & Software Program Service Tool.
Provide Factory Certified Diagnostic Service Training for up to (10) Maintenance Technicians. All associated costs, including travel costs, lodging, training fees, etc. shall be covered by the Contractor or equipment supplier.

Manufacturer's Certified Factory Service Representative shall conduct routine (monthly, at a minimum) job site visits and produce Deficiency/Recommended Action Reports within 48-hours of visit to the Contractor and to the Government.

Manufacturer's Certified Factory Service Representative shall assist the Mechanical Contractor with complete Start-up & Commissioning of the VRF System.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 HVAC System

Installation of HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.1, ASME/ANSI B31.5, NFPA 70, and in accordance with the manufacturer's recommendations.

3.1.2 Connections to Existing Systems

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.2 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.

3.3 PIPING

Test, inspect, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing fittings; bushings will not be permitted. Install valves with stems horizontal or above. Provide flanges or unions at valves, traps, strainers, and connections to equipment; unions are not required in copper tubing piping systems.

a. Threaded connections: Provide Teflon pipe thread paste on male threads. Do not thread metal pipe into plastic piping.

b. Pipe hangers and supports: Provide additional pipe hangers and supports at in-line water pumps and flanged valves.

c. Piping to receive insulation: Provide temporary wood spacers between the pipe hangers and supports, and the pipe in order to properly slope the piping and establish final elevations. Provide temporary wood spacers of same thickness as insulation to
be provided under Section 23 07 00 "Insulation of Mechanical Systems". Support plastic piping every 4 feet. Support metal piping as follows.

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inches) under</th>
<th>1.25</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Tubing</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
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<tr>
<td>Steel Pipe</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>16</td>
</tr>
</tbody>
</table>

d. Cleaning of piping: Keep interior and ends of new piping and existing piping affected by Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

e. Demolition: Remove materials so as not to damage materials which are to remain. Replace existing work damaged by Contractor's operations with new work of same construction.

f. Tee Joints: Extracted tee joints may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to assure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

3.4 ADJUSTMENTS

Adjust controls and equipment so as to give satisfactory operation. Adjust entire water temperature control system and place in operation so that water quantities circulated are as indicated. Air duct systems shall be adjusted and balanced so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

3.5 PUMPS

After testing, adjusting, and balancing, trim the impellers on all pumps 10 hp and greater to actual flow conditions plus 10 percent discharge head. Readjust throttling device to correct flow rate.

3.6 INSTRUCTING OPERATING PERSONNEL

Upon completion of work and at time designated by Contracting Officer, provide services of competent technician for period of not less than one 8-hour working day for instruction of Government operating personnel in proper operation and maintenance of equipment.
3.7 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems prior to final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish fuel, water, electricity, instruments, connecting devices, and personnel for tests. Flush and clean piping and boiler before placing in operation. Clean equipment, piping, strainers, ducts, and filters.

3.7.1 Piping Systems Except for Refrigerant Piping

Before insulating, hydrostatically test each new piping system at not less than 188 psig. Maintain pressure for 2 hours with no leakage or reduction in gage pressure. Obtain approval before applying insulation.

3.7.2 Refrigerant Piping

Perform following when field piping connections are provided.

a. Pressure test: Test refrigerant piping using dry, oil-free nitrogen, and prove tight at 300 psig on the high side and 150 psig on the low side. Maintain pressure for 2 hours with no leakage or reduction in gage pressure

b. Evacuation: Using high vacuum pump and certified micron gage, reduce absolute pressure on both sides of system simultaneously to 300 microns. After reaching this point charge system with proper refrigerant until pressure of zero psig is obtained. Repeat evacuation-charging procedure for two more cycles, totaling to three evacuation-charging cycles. On final evacuation, secure pump and maintain 300 microns for 2 hours before charging with required final refrigerant.

3.7.3 Air Ducts

Obtain approval before applying insulation.

3.7.4 Equipment

3.7.4.1 Field Testing

Test each item of equipment in operation for continuous period of not less than 24 hours under every condition of operation in accordance with each equipment manufacturer's recommendation. Verify that the equipment operating parameters are within limits recommended by the manufacturer.

3.7.4.2 Equipment Requiring Field Test Plans

Furnish equipment field test plans developed by each equipment manufacturer detailing recommended field test procedures for each item of equipment. Field test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment will not be acceptable. The Contracting Officer will review and approve the field test plan for each item of equipment prior to commencement of field testing of the equipment.

a. Equipment Items to Test: Equipment requiring field test plans are
listed in paragraph "SD-08, Statements."

b. Coordinated Testing: Indicate in each field test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of equipment controls which interlock and interface with controls factory prewired or external controls for the equipment provided under Section 23 09 23.13, "BACnet Direct Digital Control Systems for HVAC".

c. Prerequisite Testing: Equipment for which performance testing is dependent upon the completion of the work covered by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC must have that work completed as a prerequisite to testing work under this section. Indicate in each field test plan when such prerequisite work is required.

d. Test Procedure: Indicate in each field test plan each equipment manufacturers published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing all automatic controls provided by the manufacturer. Each test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives. Procedures shall be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control. Controllers shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

e. Performance Variables: Each test plan shall list performance variables that are required to be measured or tested as part of the field test. Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Manufacturer shall furnish with each test procedure a description of acceptable results that have been verified. Manufacturer shall identify the acceptable limits or tolerances within which each tested performance variable shall acceptably operate.

f. Job Specific: Each test plan shall be job specific and shall address the particular item of equipment and particular conditions which exist with this contract. Generic or general preprinted test procedures are not acceptable.

g. Specialized Components: Each test plan shall include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.7.4.3 Equipment Requiring Field Test Reports:

a. Equipment Items for Reports: Equipment requiring field test reports are listed in paragraph "SD-12, Field Test Reports."

b. Manufacturer's Recommended Test: Conduct the manufacturer's recommend field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field testing.
c. Operational Test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.

d. Notice of Tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.

e. Report Forms: Type all data entries and writing on the test report forms. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director and the QC Manager. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.

f. Deficiency Resolution: The test requirements acceptably met; deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations and corrections retested in order to verify compliance.

3.7.5 Additional Field Testing

Provide testing, adjusting, and balancing (TAB) of ducts, piping, and equipment under Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.7.6 Testing and Balancing

Balance airflow in accordance with SMACNA and flows indicated. Submit written certificate to report the following:

a. Air-handling unit and condensing unit nameplate data, and actual voltage and ampere consumption.

b. Supply and return terminal airflow, and equipment used to measure airflow.

c. Air-handling unit in and out cfm and temperatures, rpm of fan if belt driven.

d. Ambient outside air temperature, date, and person testing, balancing, and reporting.

3.7.7 Testing EMCS Equipment

a. All EMCS equipment shall be given an operation test.

b. Items not operating properly shall be repaired or replaced and retested.
### Equipment Minimum Efficiency Requirements

Equipment must meet each rating listed.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Efficiency</th>
<th>Rating Condition</th>
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</thead>
<tbody>
<tr>
<td><strong>Air to Air Unitary</strong></td>
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<tr>
<td><strong>Air Conditioner</strong></td>
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<td>(Packaged and Split)</td>
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<tr>
<td>&lt;65 Mbtu/hr</td>
<td>12.0 SEER</td>
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<tr>
<td>65-135 Mbtu/hr</td>
<td>11.0 EER</td>
<td></td>
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<tr>
<td></td>
<td>11.4 IPLV</td>
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<tr>
<td>136-240 Mbtu/hr</td>
<td>10.8 EER</td>
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<tr>
<td></td>
<td>11.2 IPLV</td>
<td></td>
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<tr>
<td><strong>Air to Air Unitary</strong></td>
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<tr>
<td><strong>Heat Pump</strong></td>
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<td>(Packaged and Split)</td>
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<tr>
<td>&lt;65 Mbtu/hr</td>
<td>12.0 SEER</td>
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<td>7.7 HSPF</td>
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<td>10.1 EER</td>
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<td></td>
<td>10.4 IPLV</td>
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<td></td>
<td>3.2 COP</td>
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<td>136-240 Mbtu/hr</td>
<td>9.3 EER</td>
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<td>9.5 IPLV</td>
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<td></td>
<td>3.1 COP</td>
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<td><strong>Air Cooled</strong></td>
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<tr>
<td><strong>Condensing Units</strong></td>
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</tr>
<tr>
<td>Package Terminal</td>
<td>1.23</td>
<td>Full Load kW/ton ARI 550/590-98</td>
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<tr>
<td>Heat Pump</td>
<td>.90</td>
<td>IPLV kW/ton ARI 550/590-98</td>
</tr>
<tr>
<td><strong>Air Cooled</strong></td>
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<tr>
<td><strong>Condensing Units</strong></td>
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<tr>
<td>Window, not thru the wall</td>
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</tr>
<tr>
<td>&lt;20,000 btu/hr</td>
<td>10.7 EER</td>
<td>DOE test procedure</td>
</tr>
<tr>
<td>=&gt;20,000 btu/hr</td>
<td>9.42 EER</td>
<td>DOE test procedure</td>
</tr>
<tr>
<td>Package Terminal</td>
<td>10= (.16xCap/1000)*EER</td>
<td>ARI 310/380 @ 95 F Outdoor</td>
</tr>
<tr>
<td>Air Conditioner</td>
<td>12.2- (.2xCap/1000)*EER</td>
<td>ARI 310/380 @ 82 F Outdoor</td>
</tr>
<tr>
<td>Package Terminal</td>
<td>10- (.16xCap/1000)*EER</td>
<td>ARI 310/380 @ 95 F Outdoor</td>
</tr>
<tr>
<td>Heat Pump</td>
<td>12.2- (.2xCap/1000)*EER</td>
<td>ARI 310/380 @ 82 F Outdoor</td>
</tr>
<tr>
<td></td>
<td>2.9- (.026xCap/1000)*COP</td>
<td>ARI 310/380 @ 47 F Outdoor</td>
</tr>
</tbody>
</table>

*Capacity is cooling capacity in btu/hr. Use 7,000 if cap is less than 7,000, use 15,000 if cap is greater than 15,000.
TABLE 15701-1  
EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS  
Equipment must meet each rating listed  

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Efficiency</th>
<th>Rating Condition</th>
</tr>
</thead>
</table>

-- End of Section --
17-0016, Interior and Exterior Repairs, Bldg. 523

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

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)


INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)


NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2014) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 02, EXISTING CONDITIONS and Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. 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 20 00 INTERIOR DISTRIBUTION SYSTEM
Section 26 51 00 INTERIOR LIGHTING
Section 26 56 00 EXTERIOR LIGHTING
Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM

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
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 60 Hz, and 120/208 volts secondary, three phase, four wire.

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 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.12 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 and the additional requirements specified in the technical sections.

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 --
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)


INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)


NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)


NEMA 250 (2014) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA FU 1 (2012) Low Voltage Cartridge Fuses


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 2011) Industrial Control and Systems: Enclosures

NEMA KS 1 (2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)

NEMA MG 1 (2016) Motors and Generators


NEMA RN 1 (2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit


NEMA VE 1 (2009) Standard for Metal Cable Tray Systems

NEMA WD 1 (1999; R 2015) Standard for General Color Requirements for Wiring Devices

NEMA WD 6 (2016) Wiring Devices Dimensions Specifications


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code


TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-568-C.1 (2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard

TIA-569 (2015d) Commercial Building Standard for Telecommunications Pathways and Spaces

TIA-607 (2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer
Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1  (2005; Reprint Jul 2012) Standard for Flexible Metal Conduit

UL 1063 (2006; Reprint Jul 2012) Machine-Tool Wires and Cables

UL 1242 (2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel

UL 1449 (2014; Reprint Mar 2016) UL Standard for Safety Surge Protective Devices

UL 1660 (2014) Liquid-Tight Flexible Nonmetallic Conduit

UL 198M (2003; Reprint Feb 2013) Standard for Mine-Duty Fuses

UL 20 (2010; Reprint Feb 2012) General-Use Snap Switches


UL 360 (2013; Reprint Jan 2015) Liquid-Tight Flexible Steel Conduit


UL 44 (2014; Reprint Feb 2015) Thermoset-Insulated Wires and Cables

UL 467 (2013) Grounding and Bonding Equipment

UL 486A-486B (2013; Reprint Jan 2016) Wire Connectors

UL 486C (2013; Reprint Jan 2016) Splicing Wire Connectors

UL 499  (2012; Reprint Jul 2016) UL Standard for Safety Attachment Plugs and Receptacles

UL 50   (2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations

UL 508  (1999; Reprint Oct 2013) Industrial Control Equipment

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 651  (2011; Reprint Jun 2016) UL Standard for Safety Schedule 40 and 80 Rigid PVC Conduit and Fittings

UL 67   (2009; Reprint Dec 2016) UL Standard for Safety Panelboards

UL 797  (2007; Reprint Dec 2012) Electrical Metallic Tubing -- Steel


UL 83   (2014) Thermoplastic-Insulated Wires and Cables


UL 870  (2016) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings


UL 984  (1996; Reprint Sep 2005) Hermetic Refrigerant Motor-Compressors
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

Submit the following in accordance with Section 01 33 00.

SD-02 Shop Drawings
- Panelboards
- Cable trays
- Wireways
- Marking strips drawings

SD-03 Product Data
- Receptacles
- Circuit breakers
- Switches
- Enclosed circuit breakers
- Motor controllers
- Manual motor starters
- Telecommunications Grounding Busbar
- Surge protective devices
- Include performance and characteristic curves.

SD-06 Test Reports
- 600-volt wiring test
- Grounding system test
- Ground-fault receptacle test

SD-07 Certificates
- Fuses

SD-10 Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein.
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.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40 in accordance with NEMA TC 2, UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI C80.3.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.6 Flexible Metal Conduit

UL 1.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT

Die Cast compression type.

2.2.8 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.2.9 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.
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.

f. 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 Ladder-Type Cable Trays

Provide size as indicated.

2.4 OPEN TELECOMMUNICATIONS CABLE SUPPORT

2.4.1 Closed Ring Cable Supports

Provide closed ring cable supports in accordance with UL 2043. Provide galvanized closed ring cable supports as indicated.

2.5 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.5.1 Outlet Boxes for Telecommunications System

Provide the following:

a. Standard type 5 inches square by 2 1/8 inches deep.

2.6 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.7 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.
2.7.1 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.

2.7.1.1 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.

2.7.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.7.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

a. Grounding conductors: Green.


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.

2.7.2.2 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
2.7.3 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 or Type XHHW or RHW conforming to UL 44, 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.

2.7.4 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.

2.7.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with TIA-607 with No. 6 AWG minimum size, and sized at 2 kcmil per linear foot of conductor length up to a maximum size of 3/0 AWG.

2.7.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (TMGB) and the electrical service ground in accordance with TIA-607. Size the bonding conductor for telecommunications the same as the TBB.

2.7.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

2.7.6 Cord Sets and Power-Supply Cords

UL 817.

2.8 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.

2.9 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. Plates on finished walls: satin finish stainless steel or brushed-finish aluminum, minimum 0.03 inch thick.

d. Screws: machine-type with countersunk heads in color to match finish of plate.
e. Sectional type device plates are not be permitted.

f. Plates installed in wet locations: gasketed and UL listed for "wet locations."

2.10 SWITCHES

2.10.1 Toggle Switches

**NEMA WD 1, UL 20**, single 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: ivory thermoplastic.

b. Wiring terminals: screw-type, side-wired.

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.

2.10.2 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 enclosure as indicated per NEMA ICS 6.

2.11 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.

2.11.1 Fuseholders

Provide in accordance with UL 4248-1.

2.11.2 Cartridge Fuses, Current Limiting Type (Class R)

**UL 198M,** Class RK-1 time-delay type. Provide only Class R associated fuseholders in accordance with UL 4248-12.

2.12 RECEPTACLES

Provide the following:

a. **UL 498,** hospital grade, grounding-type.

b. Ratings and configurations: as indicated.

c. Bodies: ivory 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-wipe power contacts and double or triple-wipe ground contacts.

2.12.1 Switched Duplex Receptacles

Provide separate terminals for each ungrounded pole. Top receptacle: switched when installed.

2.12.2 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations". Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, polycarbonate, UV resistant/stabilized cover plate.

2.12.3 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.

2.12.4 Special Purpose Receptacles

Provide in ratings indicated.

2.13 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.
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 "above" or "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).

k. Type directories and mount in holder behind transparent protective covering.

l. Panelboards: listed and labeled for their intended use.

m. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.13.1 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 with conduit hubs welded to the cabinet.

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.

2.13.2 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.

2.13.3 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. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.13.3.1 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.

2.13.3.2 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.

2.13.3.3 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.

2.14 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.

2.15 MOTORS

Provide motors in accordance with the following:

a. NEMA MG 1.

b. Hermetic-type sealed motor compressors: Also comply with UL 984.

c. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.

d. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.

e. Rate motors for operation on 208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.

f. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.
g. Unless otherwise indicated, use continuous duty type motors if rated 1 HP and above.

h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.15.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.15.2 Premium Efficiency Polyphase Motors

Select polyphase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10. In addition, continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.15.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.15.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment, as specified herein. Power wiring and conduit: conform to the requirements specified herein. Control wiring: provided under, and conform to, the requirements of the section specifying the associated equipment.

2.16 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

a. UL 508, NEMA ICS 1, and NEMA ICS 2.

b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.

c. Provide controllers for motors rated 1-hp and above with electronic
phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.

d. Provide protection for motors from immediate restart by a time adjustable restart relay.

e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch with the controller.

f. Connections to selector switch: wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position.

g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: connected in motor control circuit in "hand" and "automatic" positions.

h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: made in accordance with indicated or manufacturer's approved wiring diagram.

i. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

j. Overload protective devices: provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.

k. Cover of combination motor controller and manual switch or circuit breaker: interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

l. Provide controllers in hazardous locations with classifications as indicated.

2.16.1 Control Wiring

Provide control wiring in accordance with the following:

a. All control wire: stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and passing the VW-1 flame tests included in those standards.

b. Hinge wire: Class K stranding.

c. Current transformer secondary leads: not smaller than No. 10 AWG.

d. Control wire minimum size: No. 14 AWG.

e. Power wiring for 480-volt circuits and below: the same type as control wiring with No. 12 AWG minimum size.
f. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.16.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

a. NEMA ICS 4.

b. Control circuit terminal blocks for control wiring: molded or fabricated type with barriers, rated not less than 600 volts.

c. Provide terminals with removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts.

d. Terminals: not less than No. 10 in size with sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal.

e. Terminal arrangement: subject to the approval of the Contracting Officer with not less than four (4) spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.

f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.

g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.16.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks: furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide each connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.16.3 Control Circuits

Control circuits: maximum voltage of 120 volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. Provide one fused secondary lead with the other lead grounded.
2.16.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.16.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers: include compelling relays and multiple-button, station-type with pilot lights for each speed.

2.16.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations: heavy duty, oil-tight design.

2.16.7 Pilot and Indicating Lights

Provide LED cluster lamps.

2.17 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single, Double, and Three pole designed for surface mounting with overload protection and pilot lights.

2.17.1 Pilot Lights

Provide yoke-mounted, seven element LED cluster light module. Color: green, red, amber in accordance with NEMA ICS 2.

2.18 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.

2.19 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires wireways, 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.

2.20 GROUNDING AND BONDING EQUIPMENT

2.20.1 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.

2.20.2 Ground Bus

Copper ground bus: provided in the electrical equipment rooms as indicated.
2.20.3 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.

2.21 **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.

2.22 **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.

e. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.

f. Minimum size of nameplates: one by 2.5 inches.

g. Lettering size and style: a minimum of 0.25 inch high normal block style.

2.23 **WARNING SIGNS**

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for panelboards 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.

2.24 FIRESTopping MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTopping.

2.25 WIREWAYS

UL 870. Material: steel galvanized 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with hinged- cover NEMA 3R enclosure per NEMA ICS 6.

2.26 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with UL 1449 at the service entrance, panelboards. 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)

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).

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.

2.27 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.


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 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.1.1 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.

3.1.2 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. 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.
3.1.2.1 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.

3.1.3 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. Run conduits in crawl space or under floor slab as if exposed.

3.1.3.1 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).

3.1.3.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

3.1.3.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS.
3.1.3.4 Underground Conduit

PVC, Type EPC-40. Convert nonmetallic conduit to steel conduit before rising through floor slab.

3.1.3.5 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab.

3.1.3.6 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.

3.1.3.7 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. Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 10 foot maximum intervals. 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.

3.1.3.8 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.
3.1.3.9 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.

3.1.3.10 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.

3.1.3.11 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with TIA-569.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room: installed and cabling length requirements in accordance with TIA-568-C.1. Size conduits, wireways, and cable trays in accordance with TIA-569 and as indicated.

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling): installed in accordance with TIA-569. Size conduits, wireways, and cable trays for telecommunications risers in accordance with TIA-569 and as indicated.

3.1.4 Cable Tray Installation

Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support as indicated. In addition, install and ground telecommunications cable tray in accordance with TIA-569, and TIA-607. Coat contact surfaces of aluminum connections with an antioxidant compound prior to assembly. Ensure edges, fittings, and hardware are finished free from burrs and sharp edges. Provide No. 2 AWG bare copper wire throughout cable tray system, and bond to each section. Use No. 1/0 aluminum wire if cable tray is aluminum. Install conductors that run though smoke and fire partitions in 4 inch rigid steel conduits with grounding bushing, extending 12 inches beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. 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.

3.1.5 Telecommunications Cable Support Installation

Install closed ring cable supports on 4 ft to 5 ft centers to adequately support and distribute the cable’s weight. Use these types of supports to support a maximum of 50 0.25 in diameter cables. Install suspended cables with at least 3 in of clear vertical space above the ceiling tiles and support channels (T-bars). Closed ring cable supports: suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.
3.1.6 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. 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. Threaded studs driven in by powder charge and provided with lockwashers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. 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.

3.1.6.1 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 5 inches square by 2 1/8 inches deep. Mount outlet boxes flush in finished walls.

3.1.6.2 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.

3.1.6.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.
3.1.7 Mounting Heights

Mount panelboards, enclosed circuit breakers, motor controller 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 indicated. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet.

3.1.8 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.

3.1.8.1 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.

3.1.9 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.

3.1.10 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.

3.1.11 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.12 Grounding and Bonding

Provide in accordance with NFPA 70. 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. Make ground connection to driven ground rods on exterior of building. 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. 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.

3.1.12.1 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, 2 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.

3.1.12.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, 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.

3.1.12.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. 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.

3.1.12.4 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.

3.1.12.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility. Install the TMGB as close to the electrical service entrance grounding connection as practicable. Provide a telecommunications grounding busbar (TGB) in all other telecommunications rooms and telecommunications equipment rooms. Install the TGB as close to the telecommunications room panelboard as practicable, when equipped. Where a panelboard for telecommunications equipment is not installed in the telecommunications room, locate the TGB near the backbone cabling and associated terminations. In addition, locate the TGB to provide for the shortest and straightest routing of the grounding conductors. Where a panelboard for telecommunications equipment is located within the same room or space as a TGB, bond that panelboard’s alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure to the TGB. Install telecommunications grounding busbars to maintain clearances as required by NFPA 70 and insulated from its support. A minimum of 2 inches separation from the wall is recommended to allow access to the rear of the busbar and adjust the mounting height to accommodate overhead or underfloor cable routing.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the TMGB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, bond the conductors to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum. Provide a telecommunications bonding backbone (TBB) that originates at the TMGB extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. Install the TBB conductors such that they
are protected from physical and mechanical damage. The TBB conductors should be installed without splices and routed in the shortest possible straight-line path. Make the bonding conductor between a TBB and a TGB continuous. Where splices are necessary, the number of splices should be a minimum. Make the splices accessible and located in telecommunications spaces. Connect joined segments of a TBB using exothermic welding, irreversible compression-type connectors, or equivalent. Install all joints to be adequately supported and protected from damage. Whenever two or more TBBs are used within a multistory building, bond the TBBs together with a grounding equalizer (GE) at the top floor and at a minimum of every third floor in between. Do not connect the TBB and GE to the pathway ground, except at the TMGB or the TGB.

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the TMGB or TGB: utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. Bond all metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the TMGB or TGB to the TMGB or TGB respectively. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; bond each TMGB and TGB to the vertical steel metal frame using a minimum No. 6 AWG conductor. Where the metal frame is external to the room and readily accessible, bond the metal frame to the TGB or TMGB with a minimum No. 6 AWG conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the TGB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building must be listed for the intended purpose.

3.1.13 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.

3.1.14 Government-Furnished Equipment

Contractor rough-in for Government-furnished equipment to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

3.1.15 Repair of Existing Work

Perform repair of existing work, demolition, and modification of existing electrical distribution systems as follows:

3.1.15.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping,
and equipment using skilled craftsmen of trades involved.

3.1.15.2 Existing Concealed Wiring to be Removed

Disconnect existing concealed wiring to be removed from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.15.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment includes equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

3.1.15.4 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring and power which are to remain but were disturbed during demolition back to original condition.

3.1.16 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. Where field painting of enclosures for panelboards, or the like is specified to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

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 **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.

3.5.4 **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 --
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)


INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C57.13 (2016) Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)


NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.20 (2010) Electricity Meters - 0.2 and 0.5 Accuracy Classes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) 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

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

SD-02 Shop Drawings

- Installation Drawings

SD-03 Product Data

- Electricity meters
- Current transformer
- Potential transformer
- External communications devices
- Configuration Software

SD-06 Test Reports

- Acceptance checks and tests
- System functional verification
- Building meter installation sheet, per building
- Completed meter installation schedule
- Completed meter data schedule
- Meter configuration template

Contractor shall fill in the meter configuration template and submit to the Activity for concurrence.

Meter configuration report

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

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

SD-11 Closeout Submittals

System functional verification
1.4 QUALITY ASSURANCE

1.4.1 Installation Drawings

Drawings shall be provided in hard-copy and PDF electronic format, and shall include but not be limited to the following:

a. Wiring diagrams with terminals identified of kilowatt meter, current transformers, potential transformers, communications interfaces, Ethernet connections. 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.

PART 2 PRODUCTS

2.1 ELECTRICITY METERS AND ACCESSORIES

2.1.1 Physical and Common Requirements

a. Provide metering system components in accordance with the Metering System Schedule shown on the drawings. Provide Meter configuration template.

b. Surge withstand capability shall conform to IEEE C37.90.1.

c. 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

2.1.2 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.
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 where indicated with characteristics as required to suit the application.

2.1.4 **Meter Requirements**

**Electricity meters** shall include the following features:


b. Provide meters as indicated.

c. Meter shall be a Class 20, transformer rated design.

d. Meter shall be rated for use at temperature from minus 40 degrees Centigrade to plus 70 degrees Centigrade.

e. 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.

f. 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

g. 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.

h. Enable switches for Time of Use (TOU), pulse and load profile measurement module at the factory.

i. 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.

j. Meters shall be 120-480 volts auto ranging.

k. 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.

l. 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.

m. Pulse module simple I/O board with programmable ratio selection.

n. 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.

o. 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).
p. Liquid crystal alphanumeric displays, 9 digits, blinking squares confirm register operation. 6 Large digits for data and smaller digits for display identifier.

q. Display operations, programmable sequence with display identifiers. Display identifiers shall be selectable for each item. Continually sequence with time selectable for each item.

r. 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.

s. 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. Voltage monitoring circuits shall be equipped with disconnect switches to isolate the meter from the voltage source.

2.1.6 Installation Methods

a. Meter shall be mounted as indicated.

2.2 COMMUNICATIONS INTERFACES

Meter shall have two-way communication capabilities.

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.

2.3 SPARE PARTS

Provide the following spare parts:

a. Power Meter - two for each type used with batteries.

b. Communications interface - one for each type used.

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 Configuration Software

The standard meter shall include the latest available version of firmware
and software. Meter shall either be programmed at the factory or shall be
programmed in the field. Meters shall have a password that shall be
provided to the contracting officer upon project completion. When field
programming is performed, turn field programming device over to the
Contracting Officer at completion of project. When interfacing software is
used for a meter that is different than the existing meters in use at the
Activity, turn the software over to the Contracting Officer at completion
of the project.

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/interval,
       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 --
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)


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code

NFPA 780 (2017) Standard for the Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 467 (2013) Grounding and Bonding Equipment

UL 96 (2016a) UL Standard for Safety Lightning Protection Components


1.2 RELATED REQUIREMENTS

1.2.1 Verification of Dimensions

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer before making any departures from the design.

1.2.2 System Requirements

Provide a system furnished under this specification consisting of the latest UL Listed products of a manufacturer regularly engaged in production of lightning protection system components. Comply with NFPA 70, NFPA 780, and UL 96.

1.2.3 Lightning Protection System Installers Documentation

Provide documentation showing that the installer is certified with a commercial third-party inspection company whose sole work is lightning protection, or is a UL Listed Lightning Protection Installer. In either case, the documentation must show that they have completed and passed the
requirements for certification or listing, and have a minimum of 2 years
documented experience installing lightning protection systems for DoD
projects of similar scope and complexity.

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Overall lightning protection system

Each major component

SD-06 Test Reports

Lightning Protection and Grounding System Test Plan

Lightning Protection and Grounding System Test

SD-07 Certificates

Lightning Protection System Installers Documentation

Component UL Listed and Labeled

Lightning protection system inspection certificate

Roof manufacturer's warranty

1.4 QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be
mandatory, as though the word "shall" or "must" has been substituted for
"should" wherever it appears. Interpret references in these standards to
"authority having jurisdiction," or words of similar meaning, to mean
Contracting Officer.

1.4.1 Installation Drawings

1.4.1.1 Overall System Drawing

Submit installation shop drawing for the overall lightning protection system.
Include on the drawings the physical layout of the equipment (plan view and
elevations), mounting details, relationship to other parts of the work, and
wiring diagrams.

1.4.1.2 Major Components

Submit detail drawings for each major component including manufacturer's
descriptive and technical literature, catalog cuts, and installation
instructions.

1.4.2 Component UL Listed and Labeled

Submit proof of compliance that components are UL Listed and Labeled.
Listing alone in UL Electrical Constructn, which is the UL Electrical
Construction Directory, is not acceptable evidence. In lieu of Listed and
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Labeled, submit written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that items have been tested and conform to requirements and testing methods of Underwriters Laboratories.

1.4.3 **Lightning Protection and Grounding System Test Plan**

Provide a lightning protection and grounding system test plan. Detail both the visual inspection and electrical testing of the system and components in the test plan. Identify (number) the system test points/locations along with a listing or description of the item to be tested and the type of test to be conducted. As a minimum, include a sketch of the facility and surrounding lightning protection system as part of the specific test plan for each structure. Include the requirements specified in paragraph, "Testing of Integral Lightning Protection System" in the test plan.

1.4.4 **Lightning Protection System Inspection Certificate**

Provide certification from a commercial third-party inspection company whose sole work is lightning protection, stating that the lightning protection system complies with NFPA 780. Third party inspection company cannot be the system installer or the system designer. Alternatively, provide a UL Lightning Protection Inspection Master Label Certificate for each facility indicating compliance to NFPA 780.

Inspection must cover every connection, air terminal, conductor, fastener, accessible grounding point and other components of the lightning protection system to ensure 100% system compliance. This includes witnessing the tests for the resistance measurements for ground rods with test wells, and for continuity measurements for bonds. It also includes verification of proper surge protective devices for power, data and telecommunication systems. Random sampling or partial inspection of a facility is not acceptable.

1.5 **SITE CONDITIONS**

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer before changing the design.

**PART 2  PRODUCTS**

2.1 **MATERIALS**

Do not use a combination of materials that forms an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, provide conductors with protective coatings, such as tin or lead, or oversize conductors. Where a mechanical hazard is involved, increase conductor size to compensate for the hazard or protect conductors. When metallic conduit or tubing is provided, electrically bond conductor to conduit or tubing at the upper and lower ends by clamp type connectors or welds (including exothermic). All lightning protection components, such as bonding plates, air terminals, air terminal supports and braces, chimney bands, clips, connector fittings, and fasteners are to comply with the requirements of UL 96 classes as applicable.
2.1.1 Main and Bonding Conductors

NFPA 780 and UL 96 Class I, Class II, or Class II modified materials as applicable.

2.1.2 Copper Only

Provide copper conductors, except where aluminum conductors are required for connection to aluminum equipment.

2.2 COMPONENTS

2.2.1 Air Terminals

Provide solid air terminals with a blunt tip. Tubular air terminals are not permitted. Support air terminals more than 24 inches in length by suitable brace, supported at not less than one-half the height of the terminal.

2.2.2 Ground Rods

Provide ground rods made of copper-clad steel conforming to UL 467. Provide ground rods that are not less than 3/4 inch in diameter and 10 feet in length. Do not mix ground rods of copper-clad steel or solid copper on the job.

2.2.3 Connections and Terminations

Provide connectors for splicing conductors that conform to UL 96, class as applicable. Conductor connections can be made by clamps or welds (including exothermic). Provide style and size connectors required for the installation.

2.2.4 Connector Fittings

Provide connector fittings for "end-to-end", "Tee", or "Y" splices that conform to NFPA 780 and UL 96.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

Provide a lightning protection system that meets the requirements of NFPA 780. Lightning protection system consists of air terminals, roof conductors, down conductors, ground connections, and grounding electrodes. Bond secondary conductors with grounded metallic parts within the building. Make interconnections within side-flash distances at or below the level of the grounded metallic parts.

3.1.1 Roof-Mounted Components

Coordinate with the roofing manufacturer and provide certification that the roof manufacturer's warranty is not violated by the installation methods for air terminals and roof conductors.

3.1.1.1 Air Terminals

In areas of snow or constant wind, ensure that a section of roofing material (minimum dimensional area of 1 square foot) is first glued to the roof and then the air terminal is glued to it unless the roof manufacturer
recommends another solution.

3.1.1.2 Roof Conductors

Roof conductors are to be concealed within the ceiling cavities as much as practicable.

3.1.2 Down Conductors

Protect exposed down conductors from physical damage as required by NFPA 780. Use Schedule 80 PVC to protect down conductors. Paint the Schedule 80 PVC to match the surrounding surface with paint that is approved for use on PVC.

3.1.3 Ground Connections

Attach each down conductor to ground rods by welding (including exothermic), brazing, or compression. All connections to ground rods below ground level must be by exothermic weld connection or with a high compression connection using a hydraulic or electric compression tool to provide the correct circumferential pressure. Accessible connections above ground level and in test wells can be accomplished by mechanical clamping.

3.1.4 Grounding Electrodes

Extend driven ground rods vertically into the existing undisturbed earth for a distance of not less 10 feet. Set ground rods not less than 3 feet nor more than 8 feet, from the structure foundation, and at least beyond the drip line for the facility. After the completed installation, measure the total resistance to ground using the fall-of-potential method described in IEEE 81. Maximum allowed resistance of a driven ground rod is 25 ohms, under normally dry conditions. Contact the Contracting Officer for direction on how to proceed when two of any three ground rods, driven not less than 10 feet into the ground, a minimum of 10 feet apart, and equally spaced around the perimeter, give a combined value exceeding 50 ohms immediately after having driven.

3.2 RESTORATION

Where sod has been removed, place sod as soon as possible after completing the backfilling. Restore, to original condition, the areas disturbed by trenching, storing of dirt, cable laying, and other work. Overfill to accommodate for settling. Include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging or mulching in any restoration. Maintain disturbed surfaces and replacements until final acceptance.

3.3 FIELD QUALITY CONTROL

3.3.1 Lightning Protection and Grounding System Test

Test the lightning protection and grounding system to ensure continuity is not in excess of 1 ohm and that resistance to ground is not in excess of 25 ohms. Provide documentation for the measured values at each test point. Test the ground rod for resistance to ground before making connections to the rod. Tie the grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48
hours after rainfall. Include in the written report: locations of test points, measured values for continuity and ground resistances, and soil conditions at the time that measurements were made. Submit results of each test to the Contracting Officer.

-- End of Section --
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)


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


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 RP-16 (2010; Addendum A 2008; Addenda B 2009; Addendum C 2016) Nomenclature and Definitions for Illuminating Engineering

IES TM-21 (2011; Addendum B 2015) Projecting Long Term Lumen Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)


NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

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 ICS 2 (2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2011) Industrial Control and Systems: Enclosures

NEMA SSL 1 (2010) Electronic Drivers for Led Devices, Arrays, or Systems

NEMA SSL 3 (2011) High-Power White LED Binning for General Illumination

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NEMA WD 1 (1999; R 2015) Standard for General Color Requirements for Wiring Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)


NFPA 70 (2017) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8500.01 (2014) Cybersecurity

DOD 8510.01 (2014; Change 1-2016) Risk Management Framework (RMF) for DoD Information Technology (IT)

UNDERWRITERS LABORATORIES (UL)


UL 1598 (2008; Reprint Oct 2012) Luminaires

UL 20 (2010; Reprint Feb 2012) General-Use Snap Switches


UL 508 (1999; Reprint Oct 2013) Industrial Control Equipment


UL 917 (2006; Reprint Aug 2013) UL Standard for Safety Clock-Operated Switches

UL 924 (2016) UL Standard for Safety Emergency Lighting and Power Equipment


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
17-0016, Interior and Exterior Repairs, Bldg. 523

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 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.

c. 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.

d. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

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

SD-02 Shop Drawings
   Luminaire Drawings
   Occupancy/Vacancy Sensor Coverage Layout

SD-03 Product Data
   Luminaires
   Light Sources
   Drivers
   LED Luminaire Warranty
   Luminaire Design Data
   Vacancy Sensors
   Dimming Controllers (Dimmers)
   Lighting Contactor
   Timeswitch
   Exit Signs
   Emergency Lighting Unit (EBU)
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LED Emergency Drivers
Occupancy Sensors
Ambient Light Level Sensor
SD-06 Test Reports
LED Luminaire - IES LM-79 Test Report
LED Light Source - IES LM-80 Test Report
LED Light Source - IES TM-21 Test Report
Occupancy/Vacancy Sensor Verification Tests
Energy Efficiency
SD-07 Certificates
Luminaire Useful Life Certificate
LED Driver and Dimming Switch Compatibility Certificate

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 that must be listed, labeled, or identified per the 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 must 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 for both LM-79 and LM-80 testing.

b. One of the qualified labs listed on the Department of Energy - LED Lighting Facts Approved Testing Laboratories List at for LM-79 testing.

c. One of the EPA-Recognized Laboratories listed at for LM-80 testing.

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 two years prior to bid opening. The two-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 two-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 six months prior to date of delivery to site must not be used, unless specified otherwise.

1.5.11.3 Energy Efficiency

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 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  LUMINAIRE

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, ballast or generator 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:

<table>
<thead>
<tr>
<th>LUMINAIRE TYPE</th>
<th>MINIMUM LUMINAIRE EFFICACY (LPW)</th>
<th>MINIMUM COLOR RENDERING INDEX (CRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED TROFFER -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 x 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 2</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>2 x 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED Downlight</td>
<td>50</td>
<td>90</td>
</tr>
<tr>
<td>LED Track or Accent</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>LED Low Bay/High Bay</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>LED Linear Ambient</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

LED luminaires must also meet the following minimum requirements:

a. Luminaires must have a minimum 5 year manufacturer's warranty.

b. 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.

c. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

d. 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.

e. 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 SECTION 26 51 00 Page 8

f. Provide Department of Energy 'Lighting Facts' label for each luminaire.

2.3 DRIVERS

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 over the full dimming range when provided.

c. Current draw Total Harmonic Distortion (THD) of less than 20 percent.

d. Class A sound rating.

e. Operable at input voltage of 120-277 volts at 60 hertz.

f. Minimum 5 year manufacturer's warranty.

g. RoHS compliant.

h. Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.

i. UL listed for dry or damp locations typical of interior installations.

j. Fully-dimmable using 0-10V control as indicated in luminaire schedule.

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. Correlated 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.

2.5 LIGHTING CONTROLS

**ASHRAE 90.1 - IP ASHRAE 189.1.** Provide network certification for all networked lighting control systems and devices per requirements of
2.5.1 Toggle Switches

Provide line-voltage toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.5.2 Dimming Controllers (Dimmers)

UL 1472, UL 20, IEEE C62.41, NEMA SSL 7A. 120/277 V 0-10 V dimmers must provide flicker-free, continuously variable light output throughout the dimming range. 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. Dimmers must be capable of controlling 0-10 volt LED drivers. Ensure compatibility of dimmer with separate power packs when utilized for lighting control. Dimmers and the drivers they control, must be provided from the same manufacturer, or tested and certified as compatible for use together. Provide NEMA SSL 7A-compliant devices.

2.5.3 Sensors for Lighting Control

IEEE C62.41, NEMA WD 1, UL 94, UL 916, UL 508, ASTM D4674 REV A.

2.5.3.1 Occupancy Sensors

Provide occupancy sensors with coverage patterns as indicated on project plans. Provide no less quantity of sensors as shown on plans, but add additional sensors when required to fulfill coverage requirement for the specific model sensor provided. 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 sensors designed for ceiling, wall or wall-box installation as indicated. Operating voltage must be 120 volts. Operating voltage must be 24V in conjunction with a control system or separate power pack which interacts with luminare being controlled. Provide housing of high-impact, injection-molded thermoplastic with a multi-segmented lens for PIR and dual technology sensors. Sensor operation requires movement to activate luminaires controlled, and turns luminaires off after a set time of inactivity. Provide integral photocell mounted in occupancy sensor housing when indicated.

2.5.3.1.1 Passive Infrared (PIR) Sensors

Provide ceiling or wall-mounted PIR sensors meeting the following requirements:

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.

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. Time delay of five to 30 minutes in increments of five minutes with a walk through and test mode set by DIP switch.
e. LED indicator that remains active during occupancy.
f. Built-in light level sensor that is operational from 8 to 180 foot-candles.
g. Coverage pattern tested to NEMA WD 7 standards.
h. Standard five year warranty and be UL listed

i. 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. Operate at an ultrasonic frequency of 25 kHz.
b. LED on exterior of device to indicate occupant detection.
c. Adjustable time delay period of 15 seconds to 30 minutes.
d. UL listed with minimum five year warranty.

2.5.3.1.3 Dual Technology Sensors

Provide dual technology sensors that meet the requirements for PIR sensors and ultrasonic sensors indicated above. If either the passive infrared or ultrasonic sensing registers occupancy, the luminaires must remain on.

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 interchangable 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.

2.5.3.2 Vacancy Sensors

Provide vacancy sensors as indicated above under paragraph OCCUPANCY SENSORS, but with requirement of a manual operation to activate luminaires controlled. Provide automatic operation to turn luminaires off after a set period of inactivity.

2.5.4 Lighting Contactor

NEMA ICS 2. Provide a mechanically-held lighting contactor housed in a NEMA 12 enclosure conforming to NEMA ICS 6. Provide contactor with quantity as indicated normally-open (NO), single pole contacts, rated 600 volts, 30 amps. Provide coil operating voltage of 120 volts.

2.5.5 Timeswitch

UL 917. Provide electromechanical type timeswitch with a 24 hour 7 day astronomic dial that changes on/off settings according to seasonal variations of sunset and sunrise. Provide power to switch from integral synchronous motor with a maximum three watt rating. Rate contacts at 40 amps at 120-277 volts for general purpose loads. Provide contacts in a SPST, normally-open (NO) configuration. Provide switch with an automatic spring mechanism to maintain accurate time for up to 16 hours. Provide switch with function that allows automatic control to be skipped on certain selected days of the week. Provide switch with manual bypass control function.

House timeswitch in a surface-mounted, lockable, NEMA 1 enclosure constructed of painted steel or plastic polymer conforming to NEMA ICS 6.

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 universal 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 face as chevrons. 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, 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 lead-calcium 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, 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.

2.7 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 must 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, generators or drivers. Note the following light source characteristics in the format "Use Only _____":

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, generators 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. To encourage consistancy and uniformity, install luminaires of the same manufacture and model number when residing in the same facility or building.
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 must 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. Luminaires installed in suspended ceilings must also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

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 Power Supplies

Typically, provide 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.

3.1.6 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.7 Occupancy/Vacancy Sensors

Provide testing of sensor coverage in all spaces where sensors are placed. This should be done only after all furnishings (carpet, furniture, workstations, etc.) have been installed. 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.

-- End of Section --
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)


ASTM INTERNATIONAL (ASTM)


ILLUMINATING ENGINEERING SOCIETY (IES)

IES HB-10 (2011; Errata 2015) IES Lighting Handbook
IES RP-16 (2010; Addendum A 2008; Addenda B 2009; Addendum C 2016) Nomenclature and Definitions for Illuminating Engineering
IES TM-15 (2011) Luminaire Classification System for Outdoor Luminaires
IES TM-21 (2011; Addendum B 2015) Projecting Long Term Lumen Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

1.2 RELATED REQUIREMENTS

Luminaires and accessories installed in interior of buildings are specified in Section 26 51 00 INTERIOR LIGHTING.
17-0016, Interior and Exterior Repairs, Bldg. 523

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.

b. 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

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

SD-01 Preconstruction Submittals
   LED Luminaire Warranty

SD-02 Shop Drawings
   Luminaire drawings

SD-03 Product Data
   LED Luminaires
   Luminaire Light Sources
   Luminaire Power Supply Units (Drivers)
   Lighting contactor
   Time switch
   Photocell

SD-05 Design Data
   Design Data for luminaires

SD-06 Test Reports
   LED Luminaire - IES LM-79 Test Report
   LED Light Source - IES LM-80 Test Report
   Operating test

SD-07 Certificates
   Luminaire Useful Life Certificate

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 Drawing Requirements

##### 1.5.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data shall accompany shop drawings.

##### 1.5.2 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.

#### 1.5.3 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.

#### 1.5.4 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.

1.5.4.1 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.


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.

1.5.5 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.

1.5.6 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.

1.5.6.1 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.
1.5.6.2 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 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.

1.6.1 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

Luminaires and associated equipment and accessories for interior applications are specified in Section 26 51 00 INTERIOR LIGHTING.

2.2 LED LUMINAIRE

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 122 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.

<table>
<thead>
<tr>
<th>Application</th>
<th>Luminaire Efficacy in Lumens per Watt</th>
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<tr>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Exterior Wall-Mounted Area Luminaires</td>
<td>60</td>
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</tbody>
</table>


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.

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.

1. 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 ANSI C78.377:

Nominal CCT: 3500 degrees K: 3985 plus or minus 275 degrees K

b. Color Rendering Index (CRI) shall be:

Greater than or equal to 70 for 3500 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: 50 or 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.
1. 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

Controls shall comply with Section 9 of ASHRAE 90.1 - IP.

2.3.1 Photocell

UL 773 or UL 773A. Photocells shall be hermetically sealed, cadmium sulfide light sensor type, rated at 1500 watts, 120 volts, 50/60 Hz with single-pole, single-throw contacts. Photocell shall be designed to fail to the ON position. Housing shall be constructed of die cast aluminum, 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 fixed 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 24 hour 7 day 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 SPST 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 quantity of poles as indicated, 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 selector switch.

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 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations. Mount switch on or beside each luminaire when switch is provided in cast weatherproof aluminum housing with swivel arm. Set adjustable window slide for 1 footcandles photocell turn-on.

3.1.2 GROUNDING

Ground noncurrent-carrying parts of equipment including luminaires. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.1.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to meet the indicated or specified
safety criteria.

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 --
PART 1   GENERAL

1.1 RELATED REQUIREMENTS

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 ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)


NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017) National Electrical Code

NATIONAL SECURITY TELECOMMUNICATIONS AND INFORMATION SYSTEMS SECURITY (NSTISS)

NSTISSAM TEMPEST/2-95 (1995; Am A 2000) RED/BLACK Installation Guidance


TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-569 (2015d) Commercial Building Standard for Telecommunications Pathways and Spaces

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Conditions

Notify the Contracting Officer if it is impossible to install SIPRNET PDS that complies with this section and references.

1.3.2 Construction Methods

Methods of construction that are not specifically described or indicated in the Contract will be subject to the control and approval of the Contracting Officer.

1.3.3 PDS Design

Include separate plans, elevations, sections, details, and attachments to other work. Indicate PDS carrier route, PDS carrier mounting height above finished floor, user drop box mounting height, and user drop box locations. Submit the PDS design to the cognizant Central TEMPEST
Technical Authority (CTTA), for a technical review prior to the acquisition of material, through the installation Network Enterprise Center (NEC) or Directorate of Information Management (DOIM).

1.3.4 PDS Design Technical Review

Coordinate with the installation NEC/DOIM and submit PDS design for technical review to CTTA. Provide PDS carrier shop drawings, List of Material (LOM), and any other documentation required 90-days prior to PDS carrier installation (see NSTISSI-7003, Appendix C).

1.3.5 PDS Design Approval Request

PDS design approving authority is the installation NEC/DOIM Designated Approving Authority (DAA). Submit PDS design and CTTA technical review to the installation NEC/DOIM to obtained PDS design approval from the DAA prior to installation.

1.4 SUBMITTALS

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

SD-02 Shop Drawings
  PDS Design
  PDS Design Technical Review
  PDS Design Approval

SD-03 Product Data
  PDS Hardened Carrier

SD-04 Samples
  Pull Boxes
  Fittings

SD-11 Closeout Submittals
  User Drop Box
  Other Enclosures

1.5 QUALITY ASSURANCE

1.5.1 Manufacturer's Qualifications

Use firms regularly engaged in manufacture of secure raceway systems, boxes, and fittings of the types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.5.2 Installer's Qualifications

Installer is required to obtain certification from the manufacturer of secure raceway system and install secure raceway system in accordance with manufacturer's instructions.
17-0016, Interior and Exterior Repairs, Bldg. 523

1.5.3 Equipment

**PDS Hardened Carrier** shall meet or exceed guidelines as defined by NSTISSI-7003 and shall be approved for use by DHS, U.S. Army, U.S. Marine Corps, U.S. Navy, and U.S. Air Force. Submit manufacturer's descriptive data.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver secure raceways, conduit, fittings and components in factory labeled packages. Store and handle in strict compliance with manufacturer's written instructions and recommendations. Protect from damage due to weather, excessive temperature, and construction operations.

PART 2 PRODUCTS

2.1 PDS CARRIER CONFIGURATION

Use secure raceway carrier system in office environments. Use conduit carrier in Non-office environments, such as hangars, maintenance facilities, warehouse, training areas, industrial areas.

2.1.1 Conduit Carrier

Provide electrical metallic tubing (EMT) manufactured from ferrous material that meets ANSI C80.3. Use fittings, couplers, and connectors manufactured from ferrous material. Use of EMT, fittings, couplers, and connectors construction from non-ferrous material is not acceptable. TIA-569 cable fill standards do not apply. Do not exceed 60 percent cable fills capacity in horizontal or vertical runs.

2.1.1.1 Conduit

Use 4-inch EMT conduit for horizontal backbone or vertical riser runs; 1-inch EMT conduit for vertical runs from horizontal runs to secure user drop box. Use components (e.g. couplers, connectors, condulette, fittings, pull boxes, enclosures) constructed from ferrous metallic material. Use of components constructed from non-ferrous metallic material is not acceptable.

2.1.1.2 Mounting Brackets

Surface mount PDS conduit carrier on interior walls using 1-inch stand-off mounting brackets. Use of non-metallic pipe hangers is acceptable to mount PDS conduit carrier to wall partitions.

2.1.1.3 Fittings

PDS conduit carrier fittings include; flat internal and external elbows; tees; condulette; pulling elbows; couplings for joining conduit sections; wire clips; blank end fittings; device mounting brackets; trim plates as applicable.

a. Provide full capacity corner elbows and fittings to maintain a controlled 2-inch cable bend radius that meets the TIA-569 specification for Fiber Optic and UTP/STP cabling for communications pathways.

b. Use EMT conduit compression fittings and couplers to connect EMT conduit carrier sections, fittings and components together. Use of set
screw connectors or set screw couplers to connect EMT conduit sections together is prohibited.

2.1.1.4 Through Wall Penetrating

a. Provide dielectric breaks when penetrating secure room wall partitions.

b. Seal space between wall partition and PDS conduit using appropriate fill material or fire-stop material.

c. Fire-stop vertical risers and through wall penetrations of fire rated wall partitions after pulling cabling. Annotate firewall penetrations on PDS design.

2.1.1.5 Pull Points

Provide a pull point with a pull string between every pair of adjacent access/pull locations; for every 180 degree bends in EMT conduit carrier; and every 100 feet of continuous conduit run.

a. Size pull boxes according to the size of the conduit, not the number of cables or conduits that enter/exit the pull box. NFPA 70 conduit fill standards do not apply.

b. Leave pull string in place throughout the conduit carrier, even after cable is pulled, in each horizontal and vertical run.

2.2 USER DROP BOX

Provide User Drop Box (UDB) (aka Secure User Workstation Enclosure, Drop Box, or Lockbox) that is at least 7-inch high by 6-inch wide by 4-inch deep, tamper-resistant design constructed from 16 gauge steel with welded internal hinges, without pre-punched knockouts; and has a single door that has a built-in steel hasp that accepts a GSA approved changeable combination padlock. UDB shall accommodate a complete line of open connectivity outlets; modular inserts for Category 6 UTP cable with matching faceplates. UDB with exterior hinges, pre-punched knockouts, and built-in locks are not acceptable.

2.3 ENCLOSURES

Provide equipment and pull-box enclosures constructed from 16 gauge steel; have a single door with a built-in steel hasp or multi-point security hasp that accepts a GSA approved changeable combination padlock; without pre-punched knockouts; and a tamper-resistant design with welded internal hinges.

PART 3 EXECUTION

3.1 EXAMINATION

Examine the route and mounting locations of the raceways, boxes, distribution systems, supporting structure and accessories, to determine if conditions exist that will inhibit or prevent proper PDS installation. Notify the Contracting Officer in writing of conditions detrimental to proper completion of the work (i.e. that would render the distribution system non-compliant with governing security regulations). Do not proceed with work until unsatisfactory conditions are corrected.
3.2 PDS CARRIER ROUTING

3.2.1 General

Route the PDS carrier in a tree type fashion.

a. Start the PDS horizontal backbone at the TR (SIPRNET TR or at IPS container location) with a single raceway or conduit sized accordingly (70 percent cable fill for secure raceway with removable top cover, 60 percent cable fill for EMT conduit and solid construction secure raceway) to contain CAT6 UTP, cable runs.

b. Extend the PDS carrier from the PDS horizontal backbone throughout the facility to areas where SIPRNET access is required. Branch off the PDS horizontal backbone with a horizontal run to an area where the UDB is located.

c. Use vertical carrier runs from the horizontal run to the UDB. TIA-569 change in direction standard does not apply.

d. Maintain RED/BLACK cable separation in accordance with NSTISSAM TEMPEST/2-95.

e. Remove all burrs from carrier segments prior to installation.

3.2.2 Distribution Topology

Use a distributed topology when designing the PDS carrier. Locating a small secondary network switch in an equipment enclosure mounted in an Uncontrolled Access Area (UAA) space or in a relay or equipment rack within a Controlled Access Area (CAA) space (i.e. SCIF, NOC/BOC, etc.) that has a high concentration of users is acceptable. Interconnect network switches using single-mode fiber optic cable. Increase the capacity of the network switch to provide service to adjacent spaces as required.

3.2.3 Mounting Location Considerations

a. Route the PDS carrier so that it does not cross windows or doorway openings; does not cross ceiling or wall mounted lighting fixtures; does not obscure EXIT signs or fire alarms; and maintains a minimum 3-foot separation from fire sprinkler heads.

b. Bend (saddle or offset) conduit to follow wall contours and avoid wall obstacles (columns, pipes, etc.).

c. Use offset raceway to route secure raceway systems around columns and other wall partition obstacles.

d. Route PDS carrier so that it is surface mounted on interior walls wherever possible. Obtain exceptions from NEC/DOIM prior to installation to mount PDS carrier on exterior wall partitions.

e. Route PDS carrier to maximized cable fills in horizontal runs and reduce the number of horizontal runs within the same space.

f. Use all-thread rod to mount the PDS carrier to true ceiling structure when routing across open areas (e.g. large hallways, open office areas, large rooms) that exceed 8 feet. Mounting the PDS carrier directly from suspended ceiling framework is not acceptable.
3.2.4 Adjacent Infrastructure Considerations

Keep conduit a minimum of 6 inches from parallel runs of flues and steam or hot water pipes. A minimum separation of 6-inches is required between the PDS carrier and water pipes, electrical wires, electrical pipes, plumbing, air conditioning, etc.

3.3 INSTALLATION

Strictly comply with manufacturer's installation instructions and recommendations and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and compliance with project site manager and NEC/DOIM.

3.3.1 Mounting PDS Carrier

Surface mount PDS Conduit on the wall using conduit clamps, brackets, or mounts with 0.5 to 1-inch offset spacer from the wall surface. Mount PDS carrier to a wall partition every 5 feet and/or within 18 inches of a section or component connection. Do not mount the PDS Carrier directly to the wall surface.

a. Where wall mounting is unavailable, use appropriately sized all thread rods to mount PDS carrier to ceiling structure.

b. Do not mount PDS carrier to acoustical tile ceiling (ATC) framework.

c. Fasten PDS carrier and component items to building wall partitions using appropriate anchor and fastener for wall partition type.

d. Mount PDS carrier so that is is level and plumb along its route. The top edge of the carrier is horizontally level. Whenever possible maintain a minimum of 2-inches below the suspended ceiling line or the true ceiling line, whichever is lower.

e. Use appropriate hanger type to mount PDS Conduit carrier from ceiling structure.

f. Struts are not allowed to be used to mount secure raceway or conduit to wall partitions.

g. No more than 1/4 inch play is allowed on TOP CAP (top cover) and span cut per segment span.

h. Install the PDS carrier to permit visual inspections of its entire run.

i. Do not block doorways or access to emergency exits and do not inhibit the operation of windows.

j. Do not paint or cover the PDS carrier with wallpaper or other covering unless the paint is applied by the carrier manufacturer.

k. Bond PDS carrier to TGB or TMGB at point of origin.

3.3.2 Enclosures

Use of enclosures with pre-punched knockouts or external hinges is not acceptable. Fasten UDB, pull boxes, and enclosures to the wall partition
using fasteners appropriate for the wall partition type.

3.3.2.1 **User Drop Box** (UDB)

a. Indicate UDB locations in the PDS Plan and on as-built drawings.

b. Size the UDB to terminate up to 6 cables.

c. Coordinate drop box location with furniture, fixtures and equipment that will be used in the vicinity (provided by others). Surface mount drop boxes on the wall partition approximately 4 to 5 feet above final floor line depending on room furniture height and layout.

3.3.2.2 **Other Enclosures**

Indicate enclosure type (user drop box, equipment, or pull-box) on shop and as-built drawings.

3.3.3 **Mechanical Security**

Comply with site specific epoxy standards obtained from the installation NEC/DOIM. Apply a continuous bead of epoxy at all component, coupling, and fitting connection joints of an EMT conduit PDS carrier system. Seal pull box covers to the pull boxes around the mating surfaces after installation if they cannot be secured with GSA approved changeable combination padlock.

3.3.4 **Carrier Support**

Support carrier with mounting brackets at intervals not to exceed 5 feet.

3.4 **FIELD QUALITY ASSURANCE**

3.4.1 **Physical Inspection**

Physically inspect all interfaces to ensure that they are tight and cannot turn. Also, physically inspect lock covers to ensure that the lock cap is properly sealed inside the locking mechanism.

3.4.2 **Magnetic Test**

Perform magnet test on all components (e.g. carrier conduit, carrier raceway, pull boxes, enclosures, conduit bodies, cover plates, etc) and fittings used to construct the carrier. Place a magnet on the carrier component or fitting to verify that construction is from ferrous material. Some alloys will fail the magnet test (e.g. 309 stainless steel) but meet the ferrous material requirements. Provide alloy material property list for components that fail the magnet test to the Contracting Officer for approval. Use of components and fittings that fail the magnet test and are not made from ferrous material is not acceptable.

3.5 **CLEANING AND PROTECTION**

Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer. Protect raceways and boxes until acceptance.

-- End of Section --
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)

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)
ECA EIA/ECA 310  (2005) Cabinets, Racks, Panels, and Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

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)

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) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
TIA-1152  (2009) Requirements for Field Test
### Instruments and Measurements for Balanced Twisted-Pair Cabling

<table>
<thead>
<tr>
<th>Standard</th>
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<tr>
<td>TIA-526-14</td>
<td>(2010b) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant</td>
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<tr>
<td>TIA-568-C.0</td>
<td>(2009; Add 1 2010; Add 2 2012) Generic Telecommunications Cabling for Customer Premises</td>
</tr>
<tr>
<td>TIA-568-C.1</td>
<td>(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard</td>
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<tr>
<td>TIA-568-C.2</td>
<td>(2009; Errata 2010) Balanced Twisted-Pair Telecommunications Cabling and Components Standards</td>
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<td>TIA-568-C.3</td>
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<td>(2015d) Commercial Building Standard for Telecommunications Pathways and Spaces</td>
</tr>
<tr>
<td>TIA-569-C</td>
<td>(2012c; Addendum 1 2013; Errata 2013) Commercial Building Standard for Telecommunications Pathways and Spaces</td>
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<tr>
<td>TIA-570</td>
<td>(2012c) Residential Telecommunications Infrastructure Standard</td>
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<td>(2012b) Administration Standard for the Telecommunications Infrastructure</td>
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<td>TIA-607</td>
<td>(2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises</td>
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<tr>
<td>TIA/EIA-604-2</td>
<td>(2004b; R 2014) FOCIS 2 Fiber Optic Connector Intermateability Standard</td>
</tr>
</tbody>
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### 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 Sep 2013) Office Furnishings
- **UL 1863**: (2004; Reprint Nov 2012) Communication Circuit Accessories
- **UL 444**: (2008; Reprint Apr 2010) Communications
17-0016, Interior and Exterior Repairs, Bldg. 523

Cables

UL 467 (2013) Grounding and Bonding Equipment
UL 50 (2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 514C (2014; Reprint Dec 2014) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

1.2 RELATED REQUIREMENTS

Section 01 33 00 SUBMITTAL PROCEDURES; Section QUALITY CONTROL; Section 26 00 00.00 20, BASIC ELECTRICAL MATERIALS AND METHODS; Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM; apply to this section with additions and modifications specified herein.

Contact Camp Lejeune Base Telephone (aka Telecommunications Support Division or TSD) for special requirements on classified service, unofficial service, under slab cabling, using water block, and any item not covered in this document.

Buildings with Special Network Requirements such as Secured Internet Protocol, Classified networks, Commercial Network, Charter cable, MCCS.org, Boingo, and Naval Blue Network may require additional guidance outside this specification. Secured areas or secured networks in non-secured areas may require Protected Distribution System which is also outside this specification. Classified networks may require shielded twisted pair and has separation requirements outside this specification. In these cases contact Telecommunications Support Division G-6 MCIBAST-MCB CAMLEJ for guidance at (910) 451-9439 or (910) 451-4760.

Contact AHJ for special requirements on classified service, unofficial service, under slab cabling, using water block, and any item not covered in this document.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA-606 and IEEE 100 and herein.

1.3.1 Main Distribution Frame (MDF)

A physical structure at a central location for terminating permanent backbone cables to interconnect with service provider (SP) equipment at the activity minimum point of presence. The MDF generally includes vendor specific components to support voice and data circuits, building surge protector assemblies, main cross connect blocks, equipment support frames, and fire rated plywood backboard. Depending upon local site conditions, the MDF and BDF may be the same space.
1.3.2 Building Distribution Frame (BDF)

A structure with terminations for connecting backbone, campus, and horizontal cabling. The BDF generally includes a cross connect, equipment support frame or lockable terminal cabinet, cable supports, and fire rated plywood backboard. The BDF shall include building protector assemblies when used for campus backbone or SP cabling.

1.3.3 Intermediate Distribution Frame (IDF)

An intermediate termination point for horizontal wiring and cross connections within telecommunications rooms. Shall be connected to MDF with both fiber and copper. Secure Internet Protocol (SIPR) vault or cabinet is considered an IDF.

1.3.4 Communications Room (CR) (telephone room TR or Distribution Room (DR)

An enclosed space for communications equipment, terminations, and cross connect wiring for horizontal cabling.

1.3.5 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC) also known as central office or Area Distribution Node.)

1.3.6 Building Distributor (BD)

A distributor in which the building backbone (customer owned outside plant) cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.7 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.8 Entrance Facility (EF) (can be same as communications room)

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 communications room.

1.3.9 Equipment Room (ER) (can be same as communications room)

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.

1.3.10 Open Cable

Cabling that is not run enclosed 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, such as wire basket tray, cable tray, J-hooks, D-rings, or bridal rings. D rings should only be used in the communications room for cable management and J-hooks/bridal rings shall not be used.
1.3.11 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls, normally over 100 square feet.

1.3.12 Pathway

A physical infrastructure utilized for the placement and routing of communications cabling.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed horizontal cabling, horizontal pathways, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone data, and other communications systems (including LAN A/V, intercom, PA, CATV, CCTV, and WiFi) between equipment items in a building. The horizontal system shall be wired in a star topology from the communications work area to the floor distributor/IDF or building distributor/MDF or campus distributor or communications room at the center or hub of the star. The backbone system shall be wired in a star topology with the campus distributor (Area Distribution Node) 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 MCB CL Base Telephone (TSD) concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort with electrical sub and general contractor, ROICC and MCB CL Base Telephone (TSD).

1.5 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings

Telecommunications Space Drawings

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Communications cabling (backbone and horizontal)

Patch panels

Telecommunications outlet/connector assemblies

Equipment support frame

Connector blocks

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
Communications cabling testing

SD-07 Certificates
Communications Contractor Qualifications
Key Personnel Qualifications
Manufacturer Qualifications
Test plan

SD-09 Manufacturer's Field Reports
Factory reel tests

SD-10 Operation and Maintenance Data
Communications cabling and pathway system Data Package 5

SD-11 Closeout Submittals
Record Documentation

1.5.1 ADDITIONAL SUBMITTAL REQUIREMENTS

All submittals of material, equipment and design must be approved by the Telecommunications Support Division (TSD) prior to installing any telecommunications wiring, equipment, or power to support communications.

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. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, power, 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 communications 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 communications and ER communications, CD's, BD's, and FD's to the communications work area outlets. Provide a plastic laminated schematic of the as-installed communications cable system showing cabling, CD's, BD's, FD's, and the EF and ER for communications keyed to floor plans by room number. Mount the laminated schematic in the EF communications space as directed by the Contracting Officer. 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, communications 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, communications rooms, dedicated electrical, access points and detail call outs for common equipment rooms and other congested areas.

c. T4 - Typical Detail Drawings - Faceplate Labeling, Fire stopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typical such as faceplate labeling, faceplate types, faceplate population installation procedures, detail raking, 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 cabinet, 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, mechanical/electrical, 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 Communications Contractor Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved communications contractor and key personnel. Qualifications shall be provided for: the communications system contractor, the communications 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 communications contractor and of the key personnel.
1.6.2.1 **Communications Contractor**

The communications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified communications systems and equipment. The communications contractor shall demonstrate experience in providing successful communications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful communication system installations for the communications contractor. Also IAW Section on QC Specialists; a Telecommunications Systems QC Specialists may be required on site, full time with 10 years minimum experience in telecom installation and experience, specialist shall be very familiar with UFGS Division 27, 28, 33 concerning communications systems work and installation.

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 communications 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 communications 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 communication 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 communications system proposed for this solicitation. Include specific experience in installing and testing communications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper communications cabling systems. All of the existing communications 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 communications contractor, or have a commitment to the communications contractor to work on this project. All key persons shall be employed by the communications contractor.
contractor at the date of issuance of this solicitation, or if not, have a commitment to the communications 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 communications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the communications 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.0, 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 communications 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, sample report, 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, manufacture recommendations / installation manual, best known industry practices, and industry standards, 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. Modification of manufacturer's standard products such as painting face plates is not authorized.

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
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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 communications 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. All communications spaces shall follow TIA-569-C design.

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 communications cabling and pathway system, Data Package 5. 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 DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration. Copies of all telecommunications manuals should also be provided to TSD.

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 in hard copy and soft copy (PDF) and AutoCAD 2012 format on CD/CDRW. 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 the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility 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 COMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569-C and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide system furniture pathways in accordance with UL 1286.

2.2.1 Pathways Aboard Camp Lejeune Greater Area, Including MCAS New River

Pathway shall be conduit, cable tray, or modular access flooring that provides protection for cabling. Under floor duct, free laying and wire way shall not be used. Cantilever-type center hung tray or Poke-Thru devices shall not be used. J-hooks/ D-rings / bridal rings and other open face type cable pathways are not authorized except in minor renovations or to continue like existing system. Provide grounding and bonding as required by TIA J-STD-607-A. Cable tray wiring shall comply with NFPA 70. All conduits entering the communications room should be grouped and consolidated, conduits can be “Home Run” or stubbed to cable tray using approved pull boxes after every 180 degrees of bends, all shall have bonding bushing / plastic insert, and shall extend down from the ceiling 3 to 4 inches to ladder rack or onto the backboard, and will be bonded to the TMGB or TGB by a minimum number 6 green sheathed stranded conductors. All penetrations will be sealed in accordance with code (fire-stopping). A minimum of two 3 inch conduits overhead will be installed between the main communications room and other communication rooms (IDFs). Distribution Enclosures shall not be used as a pull box and will only be approved for their intended use.

2.2.2 Work area Pathways

Comply with TIA-569-C, except minimum 1 1/4 inch diameter conduit will be used. System furniture pathways shall comply with UL 1286. Horizontal cabling for open offices shall comply with TIA TSB-75. In system furniture
that blocks access to or is distant from the communications wall outlets:
each system furniture desk/cubical shall be equipped with system furniture
communications outlets that are plugged into the communications wall
outlets. All ports should be extended into the furniture.

2.2.3 Pull Boxes

Construct of galvanized sheet steel with screw-fastened covers. Minimum
size of boxes shall be not less than 5 inches wide by 5 inches in length by
2 7/8 inches deep for individual 1 1/4 inch diameter conduit; minimum size
of boxes shall be not less than 12"W x 48"L x 5"D for 3" conduit, 15"W x
60"L x 8"D for 4" conduit per TIA-569-C. Provide pull boxes where length of
conduit exceeds 100 feet or where there are more than two 90 degree bends,
or equivalent. Align conduit ends on opposite sides of pull boxes as in a
pull through, do not turn or change direction in pull boxes. Provide pull
boxes in straight lengths of conduit. Electrical pull points, LC, LB, condo
lets, Distribution Enclosures, and splice boxes, are not pull boxes and are
not authorized.

2.3 COMMUNICATIONS OUTLET BOXES

Communications outlet boxes shall be placed in all work areas and any areas
that can be converted to work areas; so any furniture package configuration
will have a connection with a 6’ base cord. Recommended practice is 6” to
the left or right of (the outside edge of) electrical outlet box in
workable office areas or any area that could be converted into workable
office area such as a large storage closet; also any conference room should
have one floor and one box just above the ceiling. Boxes shall be standard
type 5 inches square by 2- 7/8 inches deep for CAT6 with 1- 1/4 inch
diameter side knock-outs, with a single gang plaster ring. Mount flush in
finished walls or just above ceiling tile at height indicated by drawings.
Outlet boxes for wall-mounted telephones shall be 2 by 4 by 2- 1/8 inches
depth with 1 CAT6 cable terminated in a standard CAT6 studded wall phone
plate; mounted at ADA required height. Outlet boxes for work counter area
shall be mounted at a height 48 inches above finished floor. Outlet boxes
installed for CCTV, Wireless access points, and CATV shall contain 2 CAT 6
cables. Outlet boxes installed in floor shall be communications floor boxes
large enough to support a surge of users with proper cable protection and
ports that are in multiples of 4 and not parallel to the floor. Floor boxes
and under slab cabling should not be used on the first floor or in wet
areas. Tele electric poles or furniture managed pathways fed from above the
wet area should be used. Multi-user Telecommunications Outlet Assembly i.e.
Multimedia Outlet Assemblies (MUTOA) should be placed where best suited for
the furniture used in open office spaces and maintain clearance more than
6" from electrical or 2nd MUTOA for proper operation.

2.4 COMMUNICATIONS CABLELING

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 in accordance with the manufacture and local AHJ guidance
for cabling as required by TIA-606 and UL 969. Confirm labeling is
compatible with Base Telephone requirements. Ship cable on reels or in
boxes bearing manufacture date for unshielded/shielded twisted pair
(UTP/STP) 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.
2.4.1 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.0, TIA-568-C.1.

2.4.1.1 Horizontal Copper

Provide a minimum of four horizontal copper cables to each work area outlet (faceplate), 100 ohm in accordance with TIA-568-C.0, 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 green thermoplastic jacket for odd ports and a green thermoplastic jacket for even ports (unclassified service as color and cable type will be different for classified services). 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 are not recommended but can be used if approved by local AHJ and shall be UL listed and labeled for wet locations in accordance with NFPA 70. Contact AHJ for special requirements on classified service, unofficial service, under slab cabling, using water block, and any item not covered in this document.

2.4.2 Work Area Cabling

2.4.2.1 Work Area Copper

Provide work area copper cable in accordance with TIA-568-C.0, TIA-568-C.2, with a green on odd numbered and green on even numbered thermoplastic jacket.

Communications CAT6 twisted pair shall have a minimum of 6 inch slack cable loosely coiled into the communications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded. All communications work area outlet boxes should have 4 cables to a double gang box (no rough in or empty conduit for future use allowed).

2.5 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the communications entrance facility and communication equipment rooms to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Space shall be a minimum 8' x 10' unless a local waiver is provided by the AHJ (authority having jurisdiction) which is the Telecommunications Support Division (TSD) aboard Camp Lejeune. Communications room could be much larger depending on building size, usable square footage served, and customer requirements. Communications rooms shall be centrally located unless there are multiple Communication rooms, and then each room should be centrally located within the area served. Communications Rooms shall not share or be on a wet wall. Generally, the space should be sized to approximately 1.1 percent of the area it serves. For example, a 10,000 sq feet (929 sq m) area should be served by a minimum of one 10 ft x 11 feet (3 m x 3.4 m) Communications room. Access to Rooms shall be from a common area such as a hallway and door shall swing out. Additional/ Multiple communications rooms are required if the usable floor space to be served exceeds 10,000 square feet,
or the cable length between the horizontal cross-connect and the communications outlet, including slack and vertical distance, exceeds **295 feet**. Multiple communications rooms and IDFs shall be stacked and connected by a minimum of two 3 inch conduits overhead. The minimum clear height in the room shall be 2.4 m (8 ft) without obstructions. The height between the finished floor and the lowest point of the ceiling should be a minimum of 3 m (10 ft) to accommodate overhead pathways. The flooring shall be sealed concrete to reduce dust and static electricity; no carpet or VCT tile. Two separate dedicated 20 amp electrical outlet will be installed above or behind but not attached to each communications equipment rack. Dedicated outlets and conduits shall be installed on the longest farthest wall from the door, same wall as the communications backboard. OSP conduits shall be to the far left of the communications backboard while facing it. There should not be an electrical panel within the communications room unless it serves only the room. The room requires a lockable door keyed or key padded to restrict access to MCIEAST-MCB G-6 personnel only. Room shall not have any windows or skylights. At least one wall, where the point of presence is, and two adjacent walls should be covered with fire rated plywood backboard for mounting equipment; additional boards may be needed for mounting additional equipment. Light, as measured within the communications room, should be a minimum of 500 lx (50 foot-candles). Lighting design should seek to minimize shadows within the telecommunications room (minimum two light fixtures). Equipment not related to the support of the communications room (e.g., piping, ductwork, pneumatic tubing) shall not be installed in, pass through, or enter the telecommunications room. Equipment related to the support of the communications room (e.g., piping, ductwork, HVAC drains, dedicated power) shall be installed in support of the communications equipment and not pose a drip /moisture /trip hazard and be usable as intended. Provide telecommunications interconnecting hardware color coding in accordance with TIA-606.

2.5.1 Backboards

Provide void-free, interior grade A-C plywood 3/4 inch thick 4 feet wide by 8 feet high as indicated. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible. Backboards shall be provided on a minimum of one telecomm wall, two adjacent walls, and anywhere mounting is needed in the telecommunication spaces.

2.5.2 Equipment Support Frame

Provide in accordance with ECA EIA/ECA 310 and UL 50. Steel construction shall be treated to resist corrosion.

a. Bracket, wall mounted, (for buildings with very low jack/pair count and no secured electronic equipment requirement), 8 gauge aluminum. Provide hinged bracket compatible with 19 inches panel mounting and must be in a secured communications room.

b. Racks, wall or floor mounted modular type, 16 gauge steel construction, minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and a surge protected power strip with 6 duplex 20 amp receptacles. Racks shall be enough to support all telephone / data equipment required plus 25 percent spare and shall have a maximum of 7’ height. Rack shall be compatible with 19 inches panel mounting and must be in a secured communications room. Recommend SIEMON’s RS3-07-S or equivalent approved by AHJ.
2.5.3 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 with dual modular 8P8C jacks for Category 6 and higher systems, classified service may require shielded jack sets as approved by AHJ. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare. For Camp Lejeune greater area; Recommend Krone blocks' 6652-1-880-10 or equivalent approved by AHJ, for Category 3 voice and backbone risers and higher systems. Provide blocks for the number of backbone cables terminated on the block plus 25 percent spare. Also provide sufficient blocks for cross connects for all IDFs. Blocks shall be mounted on an 89D style bracket on rack or in cabinet.

2.5.4 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, cabinets, and telecommunications backboards. Cable guides of ring or bracket type devices mounted on rack, cabinet, panels, and backboard for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws and/or nuts and lock washers, cable guides are not to be used outside of the communications room.

2.5.5 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide pre-connectorized SC type optical fiber and CAT 6 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.0, TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3 for cables, cable length and hardware specified. Classified service may require shielded jack sets and panels as approved by AHJ.

2.5.5.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.0, TIA-568-C.1 and TIA-568-C.2. Panels shall be third party verified and shall comply with EIA/TIA Category 6/6A requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be cabinet/ rack mounted and compatible with an ECA EIA/ECA 310 19 inches equipment rack. Panel shall provide 48 non-keyed, 8-pin dual modular (8P8C) ports, wired to T568A. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. Recommend Siemon's CT Couplers, CT-F-C6-XX or equivalent approved by AHJ. The rear of each panel shall have incoming cable strain-relief and routing guides; DO NOT USE ZIP TIES. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

2.5.5.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 16 or 18 gauge steel or 11 gauge aluminum minimum and shall be cabinet/ rack mounted and compatible with a ECA EIA/ECA 310 19 inches equipment rack. Each panel shall provide multimode / single-mode adapters as required in SC format in accordance
with TIA/EIA-604-2 with 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. When populating the panel working left to right start with OSP feed, SM ISO to IDF, MM ISO to IDF, lastly row to row within same comm room.

2.5.6 Optical Fiber Distribution Panel

Cabinet/ Rack mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with ECA EIA/ECA 310 utilizing 16 or 18 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 multimode and single-mode adapters as required. Provide adapters as SC with alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS. When populating the panel working left to right start with OSP feed, SM ISO to IDF, MM ISO to IDF, lastly row to row within same communications room.

2.6 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.6.1 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, dual molded 8P8C, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568-C.2 Category 6 requirements. Recommend SIEMON's CT couplers, CT-F-C6-C6-xx or equivalent approved by AHJ, of indicated color (normally ivory or white at work area and black in communications room) should match electrical face plate color and type. 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 750 mating cycles. UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound. Shielded STP cable outlet connectors differ and are used in secured areas, coordinate with AHJ.

2.6.2 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3; flush or oversized design constructed of high impact thermoplastic material ivory, white in color to match color of receptacle switch cover plates specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, color may be different for classified networks Red and Grey. Provide labeling in accordance with the paragraph LABELING in this section. Additionally, it shall be labeled as to its function with a green computer icon on all even ports and a green phone icon on all the odd ports.

2.7 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

Provide MUTOA(s) in accordance with TIA-568-C.1. Ensure proper separation from other networks and power.
2.8 TERMINAL CABINETS

Construct of zinc-coated sheet steel, 36 by 24 by 6 inches deep, as indicated. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 5/8 inch backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with panel boards. Provide label and identification systems for telecommunications wiring and components consistent with TIA-606.

2.9 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 bus bars as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. The preferred ground for the Telephone Main Grounding Bus (TMGB) bar will be to the Main electrical Distribution Panel (MDP) bus bar and building steel. In most cases, but not all; a #6 AWG bonding conductor is recommended for telecommunications. All grounding and bonding conductors within the Telecommunications room will be green sheathed copper conductor, stranded, and labeled as suitable for use as such and tagged "DO NOT REMOVE". All grounding and bonding conductors running out of the Telecommunications room should be protected in conduit or attached to the outside of the cable tray and sized according to references. The minimum size of the TMGB shall be no smaller than 4" by 10" by 1/4 inch thick; bus bar should be factory made and factory drilled, not fabricated or drilled onsite. All bonding and grounding terminations shall be irreversible and secured with a double hole crimp termination. Do not exceed minimum bend radius on bonding and grounding conductors. Mount Bus Bar to far left of telecomm backboard at approximately 70" AFF.

2.10 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.11 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.12 FIELD FABRICATED NAMEPLATES

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.

2.13 TESTS, INSPECTIONS, AND VERIFICATIONS

2.13.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by
manufacturer to confirm compliance with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-526-7 for single mode optical fiber, and TIA-526-14 for multimode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install communications cabling and pathway systems, including the horizontal cable, pathway systems, communications outlet/connector assemblies, and associated hardware in accordance with NEC/BICSI 568, TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, NFPA 70, manufacture instructions, current industry best practices, and UL standards as applicable. Provide cabling in a star topology network. Provide residential cabling in a star wiring architecture from the distribution device as required by TIA-570. Pathways and outlet boxes shall be installed as specified in this document and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Standard type 5” x 5” x 2 7/8” square box with a single gang plaster ring shall be used except in concrete or concrete masonry units where a standard 4” and 11/16” square or a floor box will be used. Mount flush in finished walls at height indicated by drawings and with proper clearances from other networks and power systems. Depth of boxes shall be large enough to allow manufacturer's recommended conductor bend radii normally 2 7/8”. Install communications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and communications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the communications cabling (normal minimum clearance distances of 4 feet from motors, generators, frequency converters, transformers, x-ray equipment or uninterrupted power system, 300 mm (12 in) from power conduits and cable systems, 125 mm (5 inches) from fluorescent or high frequency lighting system fixtures. Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the communications cabling (normal minimum clearance distances of 4 feet from motors, generators, frequency converters, transformers, x-ray equipment or uninterrupted power system, 300 mm (12 in) from power conduits and cable systems, 125 mm (5 inches) from fluorescent or high frequency lighting system fixtures. Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

3.1.1 Cabling

Install UTP/STP, and optical fiber telecommunications cabling system as detailed in TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, and TIA-570 for residential cabling. 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 untwist Category 6 UTP cables more than ½” (12 mm) from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, minimum 10’ (3 meters) in the telecommunications room, 6” (150mm) in or close to the work area outlet for UTP. 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. Only hook and loop fasteners are allowed on Category 6 cable and optical fiber cable. DO NOT USE ZIP TIES. 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 (See NEC abandoned cabling). Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.
3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors in approved pathway (cable free laid on floor is not authorized). Install in accordance with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, and TIA-568-C.3. Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wire way or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

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. Cable 6 feet long shall be neatly coiled not less than 12 inches in diameter below each feed point in raised floor areas.

3.1.1.2 Horizontal Cabling

Install horizontal cabling as indicated in the spec and 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 or large service loop on each end of the cable (prevent inductance caused by small coils), 10 feet in the telecommunications room, and 6 inches in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70, except that 1 1/4 inch diameter conduit from cable tray or telecommunication room backboard to each work area outlet is required. Provide building pathway as specified in the spec and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

Conceal conduit within finished walls, ceilings, and floors (not in wet areas). Keep conduit minimum 12 inches away from parallel runs of electrical power equipment, flues, steam, light ballast, and 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 is visible after completion of project. Run conduits in crawl spaces as if exposed. Install no more than two 90 degree bends for a single horizontal cable run. All bends/turns in conduits will be in straight runs of conduit; a pull box shall be installed after every 180 degrees of bends or 100'; in no case will a turn be made within a pull box. The minimum size for a pull box for a single 1¼" conduit will be 5" long by 5" wide by 2 7/8" deep, and for a 3" conduit 30"W x 54"L x 9"D. All conduits should contain a bushing at the end to protect the cable from damage and required bonding. Pull points, LC, LB, condo lets, and consolidation points are not authorized.

Under floor cabling, under floor duct, and conduit under floor slabs should be avoided in the Camp Lejeune Greater area due to wet area close to coastal waters.
3.1.3  Cable Tray Installation

Install cable tray as specified in this spec and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP and OFNP type cable shall be installed in a plenum.

A continuous stranded bonding conductor shall be run on the outside along the tray tapped to each section to ensure bonding. Remove all sharps from cable tray and pathways. Ensure bonding is on the pathway so as not to obstruct horizontal cabling. Maintain proper clearance and work space per TIA-569 and Tempest.

3.1.4  Work Area Outlets

3.1.4.1  Terminations

Terminate UTP cable in accordance with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2 and wiring configuration as specified. Terminate fiber optic cables in accordance with TIA-568-C.3

All work areas will contain a minimum of two communications face plates. Any work area larger than 80 sq feet will require additional face plates to service any work location in the room within 6 feet of a faceplate. This also applies to any area that could be converted to work space in the future. Recommend a communications outlet box be placed 6" to the left or right of every electrical outlet box in workable office areas or any area that could be converted into workable office area such as a storage closet; All work area face plates will contain four category 6 jacks terminated with T568A configuration unless otherwise approved by AHJ. MUTOAs contain 12 cables and may require additional clearance and power.

3.1.4.2  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. (For secured networks contact AHJ as shielded twisted pair and color coded face plates may be necessary).

3.1.4.3  Cables

Unshielded/shielded twisted pair and fiber optic cables shall have a minimum of 6 inches of slack cable loosely coiled into the communications outlet boxes or in cable tray as close as possible to outlet box. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.4.4  Pull Cords

Pull cords shall be installed in conduit serving communications outlets that do not have cable installed (this is not normal as all outlets should be cabled).

3.1.4.5  Multi-User Telecommunications Outlet Assembly (MUTOA)

Run horizontal cable in the ceiling and terminate each cable on a MUTOA in each individual zone. MUTOAs shall not be located in ceiling spaces, or any obstructed area. MUTOAs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure. MUTOAs shall be located in an open work area so that each furniture cluster is served by at least one MUTOA. The MUTOA shall be limited to serving a
maximum of six work areas with 12 cables / 12 ports. Maximum work area
cable length requirements shall also be taken into account. MUTOAs must be
labeled to include the maximum length of work area cables. MUTOA labeling
is in addition to the labeling described in TIA-606, or other applicable
cabling administration standards. Work area cables extending from the
MUTOA to the work area device must also be uniquely identified and labeled.

3.1.5 Communications Space Termination

Install termination hardware required for Category 6 and optical fiber
system. A single punch manufacture approved insulation displacement tool
shall be used for terminating copper cable to insulation displacement
connectors.

3.1.5.1 Connector Blocks

Connector blocks shall be cabinet/rack mounted, as approved by the AHJ, 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.

3.1.5.2 Patch Panels

Patch panels shall be mounted in equipment cabinets/racks with sufficient
ports to accommodate the installed cable plant plus 25 percent spares.

a. Copper cable entering a patch panel shall be secured to a rear cable
manager with hook and loop ties and as recommended by the manufacturer
to prevent movement of the cable.

b. Fiber Optic Patch Panel. Fiber optic cable loop shall be 3 feet in
length 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.

3.1.5.3 Equipment Support Frames

Install in accordance with TIA-569:

a. Bracket, wall mounted. Mount bracket to right on plywood backboard in
accordance with manufacturer's recommendations. Mount so height of
highest panel does not exceed 78 inches above floor. Mount so there is
sufficient space remaining on backboard to mount lightning protection,
bonding, and cable managers or install additional backboards.

b. Racks, floor mounted modular type. Permanently anchor rack to the
floor in accordance with manufacturer's recommendations. Install
sections of ladder rack anchored to telephone rack/ cabinet and at
least two walls.

3.1.6 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated
wall, partitions, floors, or ceilings as specified in Section 07 84 00
FIRESTOPPING.
3.1.7 Grounding and Bonding

Provide in accordance with TIA-607, NFPA 70 and as specified in this spec and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM except only two hole irreversible compression lugs will be accepted.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA-606 except jacks will be numbered in a logical, sequential, clockwise numbering system from 1 to X with a closet designator. Example would be 145 C 146, would be the 145th & 146th jacks from the C comm. room. All labels shall be numbered with manufacture's labeling system (not fabricated) and be equipped with laminated plastic cover. All terminations that are not to work area outlets should be in the last patch panel locations and labeled accordingly i.e. DDC, FACP, Elevator, Wall phones, or Wireless access points.

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 manufacturing labeling system, color coded labels with identifiers in accordance with this spec and TIA-606. Coordinate with Base Telephone.

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

Camp Lejeune no longer paints backboards as fire rated plywood is available, manufactured fire retardant backboard shall be used, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be visible.

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 Communications Cabling Testing

Perform communications cabling inspection, verification, and performance tests on both Backbone and Horizontal cabling in accordance with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and AHJ local guidance. 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 all communications cabling jacket materials for UL or third party certification markings. Inspect cabling terminations in communications rooms and at workstations to confirm color code for T568A pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, and TIA-570 for residential cabling. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, cable physical damage, and patch panels.

### 3.5.1.2 Verification Tests

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 all terminations are complete but prior to being cross-connected.

For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.3 and TIA-526-14 using Tier 1 Option with power meter and light source for optical fiber validate / troubleshoot failures with Tier 2 Option. For single-mode optical fiber of sufficient distance (normally OSP), perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.0 and TIA-526-7 using Tier 2 Option, OTDR for single-mode optical fiber. Perform verification acceptance tests.

### 3.5.1.3 Performance Tests

Provide summary in .pdf (hard and soft copy) detailed tester results in test format .flw (soft copy only), and fiber power meter/OTDR reports (summary hard copy and detailed soft copy). All Test reports should have a building or project number on it. The final QC and certification of installation will be performed by TSD after the contractor has provided passing and acceptable results on all test and as-built drawings showing all communications outlets telecommunications outlets and their numbers to include any empty conduit or ports coiled in overhead for future use and all building automated system ports such as DDC, Elevator, FACP, or WAPs. Test results that are a marginal may not be accepted. Also fiber tests that pass the link budget but exceed tolerance on any connector or splice are considered a failure. All discrepancies need to be repaired and retested.

Perform testing for each outlet and MUTOA as follows:

a. Perform Category 6 link tests in accordance with TIA-568-C.0, TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with TIA-568-C.0.

### 3.5.1.4 Final Verification Tests

Perform verification tests for all copper and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
a. Voice Tests. These tests assume that dial tone service has been installed (normally only done for FACP, Elevator, or emergency phones). 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 (normally this is only done for VTC, CCTV). Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --
PART 1  GENERAL

1.1  RELATED SECTIONS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein. In addition, refer to the following sections for related work and coordination:

Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
Section 07 84 00 FIRESTOPPING for additional work related to firestopping.

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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)


FM GLOBAL (FM)


INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)


INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16  (2003; ED 4.0) Sound System Equipment - Part 16: Objective Rating Of Speech Intelligibility By Speech Transmission Index

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

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<tr>
<th>Code</th>
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<td>UL 228</td>
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<tr>
<td>UL 268</td>
<td>(2009) Smoke Detectors for Fire Alarm Systems</td>
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<td>UL 464</td>
<td>(2009; Reprint Apr 2012) Standard for Audible Signal Appliances</td>
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1.3 DEFINITIONS

Wherever indicated in this specification or on the contract drawings, the equipment, devices, and functions shall be defined as follows:

a. COMBINATION EMERGENCY COMMUNICATIONS SYSTEM: NFPA 72 terminology describing a combination fire alarm and mass notification system where the building mass notification system is integrated with the building fire alarm control unit to form one combined system that performs both functions.

b. COMBINATION EMERGENCY COMMUNICATIONS SYSTEM PANELS (CECP): Combination Emergency Communications System Panel may consist of separate autonomous control unit and fire alarm control unit supplied from the same or different manufacturers, or a single panel supplied by one manufacturer. Where the term "COMBINATION EMERGENCY COMMUNICATIONS SYSTEM PANEL" or "CECP" is utilized the intent is NOT to limit the designer to one manufacturer or a single enclosure. HOWEVER; whether installed as combined or separate panels or provided by one or separate manufacturers, the panels shall be integrated in their controls and performance to meet the requirements of this section and NFPA 72.

c. AUTONOMOUS CONTROL UNIT (ACU): The primary control unit for the building mass notification system portion of the CECP. ACU may be physically separate from, or a integral part, of the FACU.

d. FIRE ALARM CONTROL UNIT (FACU): Fire alarm system component portion of the CECP, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). FACU may be separate from or a portion of the ACU. Where more than one fire alarm control unit is installed in the building, one panel shall be designated as the Master Fire Alarm Control Unit.

e. SUPPLEMENTARY FIRE ALARM CONTROL PANELS: When necessary multiple interconnected fire alarm control units may be utilized to create a networked system consisting of a master fire alarm control unit and one or more supplementary fire alarm control panels capable of peer to peer communications. Networked panels shall be UL Listed as compatible. Interconnecting separate manufacturers' fire alarm panels or fire alarms panels not capable of peer-to-peer communications is prohibited. The term "supplementary fire alarm control panel" does not refer to releasing service fire alarm panels.

f. LOCAL OPERATING CONSOLE (LOC): Equipment used by authorized personnel and emergency responders to make live voice building-wide mass notification system messages.

g. SUPPLEMENTARY NOTIFICATION APPLIANCE CIRCUIT (SNAC) and AUXILIARY POWER SUPPLY PANELS: A panel separate from the "combination emergency communications system panel"(s), usually located remote from the main panel(s). SNAC's are utilized to power visual notification appliance circuits and auxiliary power supplies provide supplementary power to devices or functions requiring power in addition to that available from the SLC.

h. MONITOR MODULE: Term utilized to describe a Signaling Line Circuit Interface as defined by NFPA 72.
1.4 SYSTEM DESCRIPTION

1.4.1 Scope

This work includes completion of design and providing a new, complete, combination emergency communications system as described herein and on the contract drawings for Building 523.

Fire Alarm Control Unit portion shall be an analog/addressable system. Include in the system all necessary wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, supervising station fire alarm system transmitter, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically indicated or described. Provide system complete and ready for operation.

Equipment and devices shall be compatible and operable with the existing fire alarm reporting system and shall not impair reliability or operational functions of the existing system. Existing fire alarm reporting system is a "DACT dedicated copper phone pair.

Equipment and devices shall be compatible and operable with existing installation-wide mass notification system and shall not impair reliability or operational functions of the existing system. The installation-wide mass notification system utilizes Cooper/Madahcom Waves tranceivers.

a. Provide equipment, materials, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72, ISO 7240-16, and IEC 60268-16 except as modified herein. The system layouts on the contract drawings show the intent of coverage and are shown in suggested locations. Final quantity, system layout, and coordination are the responsibility of the Contractor.

1.4.2 Technical Data and Computer Software

Computer software and technical data relating to computer software that are specifically identified in this project, and may be defined/required in other specifications, shall be delivered in accordance with the CONTRACT CLAUSES. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of the contract. The data package shall also include the following listed. Failure to fully comply with the following stipulations shall result in the removal and replacement of the combination emergency communications system at no cost to the Government. Requests for extension of time for any delay to the completion of the project due to the removal, redesign, resubmittal
process, and replacement of the original system will not be considered. Liquidated damages shall apply and will be accessed in accordance with the contract clauses.

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable portions of the combination emergency communications system.

d. Description of Fire Alarm Control Unit equipment operation.

e. Description of auxiliary and remote equipment operations.

f. Library of application software.

g. Operation and maintenance manuals.

1.4.3 Keys

Keys and locks for equipment, panels and devices shall be identical. Provide the Contracting Officer with no less than six (6) keys of each type required. Direct requests for keys from all Government personnel to the Contracting Officer. Under no circumstances shall the contractor provide any keys to the building occupants. If any portion of building is occupied during construction or occupants begin moving into the building prior to project completion, the fire alarm contractor shall remove and secure all keys to the combination emergency communications system. All keys and locks shall be mastered to a single key as required by the AHJ. Keys shall be 17021.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for the Prime Contractor Quality Control approval. The NAVFAC MIDLANT Fire Protection Engineer shall review and approve all submittals requiring Government approval.

Provide electronic submittals. File format of electronic submittal materials shall be portable document format. No other electronic formats shall be accepted. Catalog data shall be first generation scans or manufacturer's originals. Shop drawings shall be plotted to scale. Scale all line weights. Submittals consisting of illegible pdf's shall be returned disapproved without review. One hard copy review set of the entire package, including full scale shop drawings, shall accompany each submittal for use by the NAVFAC MIDLANT Fire Protection Engineer. The single hard copy review set shall be retained by the Government reviewer. The Government reviewer shall digitally stamp, sign and lock the electronic submittal package prior to returning the electronic copy to the Contracting Officer.

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

SD-01 Preconstruction Submittals
Within 36 days of contract award but no less than 14 days prior to commencing any work on site, the Prime Contractor shall submit the following for review and approval:

Qualifications for Fire Alarm System Subcontractor

On Staff Fire Alarm System Designer(s)

Supervising Fire Alarm Technician

Installing Technicians

Testing Personnel

Contractor SD-02, SD-03 & SD-05 submittals received prior to the review and approval of the Qualifications of the Fire Alarm Subcontractor shall be returned Disapproved Without Review. All resultant delays shall be the sole responsibility of the Prime Contractor.

Contract requirements for the Fire Alarm Contractor to have NICET Certified Fire Alarm Technicians on staff are NOT negotiable. The Prime Contractor's Quality Control Manager shall not endorse nor submit the qualifications for the fire alarm system subcontractor if fire alarm contractor does not have the required NICET Technicians on staff. All resultant delays shall be the sole responsibility of the Prime Contractor.

SD-02 Shop Drawings

Include Annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ANSI D (22 in x 34 in).

Wiring Diagrams

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 that are supervised or controlled by the system. Diagrams shall show connections from field devices to the CECP and remote fire alarm control units, initiating circuits, switches, relays and terminals. Point-to-point wiring diagrams shall be job specific. Point-to-point wiring diagrams shall not indicate connections or circuits not being utilized.

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, appliances, and equipment.

System Layout

Plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, conduit sizes, wire counts, wire color-coding, circuit identification in each conduit, and circuit layouts for all
floors. Drawings shall comply with the requirements of NFPA 170, and NFPA 72. Indicate candela rating of each visual notification appliance. Indicate the wattage of each speaker. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, etc.

System Operation

A complete list of device addresses, corresponding messages.

Provide a complete description of the system operation in matrix format.

Notification Appliances

Provide data on each circuit to indicate that there is at least 25 percent spare capacity on each notification appliance circuit, a 25 percent spare capacity for each supplementary notification appliance circuit panel and auxiliary power supply panel, and 25 percent spare capacity for each signaling line circuit. Annotate data for each circuit on the drawings.

Amplifiers

Provide data to indicate the amplifiers have sufficient capacity to simultaneously drive all notification speakers at the wattage setting required to meet intelligibility requirements while maintaining a minimum 25 percent spare capacity. Annotate data for each circuit on the drawings. Contractor shall be responsible for additional and/or larger amplifiers if adjustments during testing to meet intelligibility requirements reduces the spare capacities to less than 25 percent.

As-Built Drawings

Provide four sets of detailed as-built drawings. Furnish four sets of CD or DVD discs containing software backup with CAD-based drawings in latest version of AutoCAD *.dwg format of as-built drawings and schematics. Discs shall also include as-built drawings plotted to scale in *.pdf format along with *.pdf copies of the manufacturer's data, and calculations. The drawings shall include complete wiring diagrams showing point-to-point 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 contract drawings and the approved shop drawings. These drawings shall be submitted within 14 days after the final acceptance test of the system. At least one copy of the as-built (red-lined) drawings shall be provided at the time of, or prior to, the final acceptance test.

SD-03 Product Data

Provide UL or FM listing cards for equipment provided. Include annotated catalog data, in table format, showing manufacturer's name, model, voltage and catalog numbers for all equipment and components.
Technical Data And Computer Software

Fire alarm control unit (FACU)
Autonomous control unit (ACU)
Combination emergency communications system panel (CECP)
Local operating consoles (LOC)
Amplifiers
Digitalized voice generators
Supplementary notification appliance circuit panel
Auxiliary power supply panel
Remote annunciator
Digital alarm communicator transmitter (DACT)
Batteries
Battery chargers
Wiring and cable
Surge protection
Ceiling bridges for ceiling mounted appliances
Back boxes and conduit
Terminal cabinets/assemblies
Notification appliances
Addressable monitor module
Addressable control/relay module
Isolation module
Manual stations
Smoke detectors
Duct mounted smoke detectors
Heat detector
Electromagnetic door holders

Manufacturer's installation and maintenance manuals; G
Provide one copy of the most recent Manufacturer's installation and maintenance manuals for each piece of equipment being installed. This data is necessary for use by NAVFAC MIDLANT Fire Protection Engineering when reviewing the contractor's submittal. Manual may be submitted in *.pdf format and submitted directly to NAVFAC MIDLANT Fire Protection Engineering.

SD-05 Design Data

System Operation

Provide a complete description of the system operation, in matrix format, on the shop drawings.

a. Verify battery capacity exceeds supervisory and alarm power requirements.

1). Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component and each panel component, and the battery-recharging period, shall be included.

2). Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.

b. For battery calculations, use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the
batteries. Calculate the required Ampere-hour for the specified standby time, and then calculate the required Ampere-hour for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period.

Voltage Drop Calculations

Provide voltage drop calculations to indicate sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

Utilize the lump sum method for voltage drop calculations. Assume the entire appliance load is at the end of the circuit (lump sum). Utilize 16 VDC as the operating voltage of the appliances and 21.6 VDC as the voltage at the circuit terminals.

Spare Capacity Calculations

Provide calculations verifying the contract stipulated 25 spare capacity is provided for each notification appliance circuit, FACU/ACU, SNAC panel, and auxiliary power supply panel. Also provide a calculation indicating a 25 percent spare capacity is maintained for each SLC.

SD-06 Test Reports

Field Quality Control
Testing Procedures
Smoke detector testing procedures
Heat detector testing procedures

SD-07 Certificates

Installer

SD-09 Manufacturer's Field Reports

Combination emergency communications system panel (CECP)

Provide reports on preliminary tests, include printer information. Include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports. Printer generated data shall consist of a unique identifier for each device, combination emergency communications system panel, initiating device and notification appliance, with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer.

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions

Provide one copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training.
Original and backup copies of all software delivered for this contract on each type of CD/DVD media utilized.

Provide Operation and Maintenance (O&M) Instructions in electronic format. File format of electronic submittal materials shall be portable document format. No other electronic formats shall be accepted.

**Instruction of Government Employees**

The installers training history for the employees involved with this contract.

### 1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing installation-wide fire alarm reporting and mass notification systems and shall not impair reliability or operational functions of existing system. The installation-wide fire reporting system utilizes DACT dedicated copper phone pair. The installation-wide mass notification system utilizes Cooper/Madahcom.

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" and/or AHJ to mean the Naval Facilities Engineering Command, MIDLANT, Fire Protection Engineer.

b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.

c. Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM APP GUIDE.

#### 1.6.1 Qualifications

**1.6.1.1 Qualifications for Fire Alarm System Subcontractor**

The Prime Contractor shall be responsible for obtaining the services of a qualified fire alarm system subcontractor for the design and installation of the combination emergency communications system. The firm designated by the Prime Contractor as their qualified fire alarm system subcontractor:

a. Shall have been in existence a minimum of four years prior to contract award.

b. Shall provide proof of previous experience installing a system of equal or greater complexity, utilizing the same equipment to be provided under this contract.

c. Shall provide proof of adequate qualified staffing to meet all of the following requirements:

**1.6.1.1.1 On-Staff Fire Alarm System Designer(s)**

A qualified fire alarm contractor shall have at least one on staff NICET Level IV SET, (Senior Engineering Technician) fire alarm technician. This technician shall also have proof of factory certified training for the design of the systems utilizing the equipment being installed. The NICET
Level IV technician(s) shall be the lead technician responsible for the contractor's design of the combination emergency communications system, including, but not limited to, the selection and design of necessary equipment, battery, power and circuit calculations, provision of the required manufacturers data and the creation and completion of the shop drawings. The submittal materials (drawings, calculations & manufacturer's data) shall bear the stamp and signature of the NICET Level IV technician. RFIs pertaining to the combination emergency communications system shall be reviewed and signed by the NICET Level IV technician prior to submission to the Contracting Officer.

A NICET Level III, ET (Engineering Technician) fire alarm technician may be utilized to create the shop drawings, calculations and submittal material provided the Level III technician is directly supervised by the NICET Level IV technician. The NICET Level IV technician remains responsible for the system design and submittal materials. Both technicians' signatures and stamps shall be included on the submittal material.

1.6.1.1.2 Supervising Fire Alarm Technician

A NICET Level II, AET (Associate Engineering Technician) fire alarm technician with a minimum of 8 years experience shall supervise the installation of the combination emergency communications system. The fire alarm technicians supervising the installation of equipment shall also be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Supervising technician shall be a direct employee of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

1.6.1.1.3 Installing Technicians

The installing Contractor shall provide fire alarm technicians with a minimum of four years of experience utilized to assist in the installation and termination devices, appliances, cabinets and panels. The fire alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Technicians with minimum NICET Level I or II Certification are preferred. Installing technicians shall be direct employees of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

1.6.1.1.4 Testing Personnel

The installing Contractor shall provide Fire Alarm Technicians with a minimum of eight years of experience utilized to test and certify the installation of the combination emergency communications system devices, appliances, cabinets and panels. The fire alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Testing personnel shall be direct employees of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

1.6.2 Regulatory Requirements

1.6.2.1 Requirements for Fire Protection Service

Equipment and material shall be Listed by UL and listed in UL Fire Prot Dir, UL Electrical Constructn 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 interpreted as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

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 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The combination emergency communications system Operation and Maintenance Instructions shall include:

a. "Manufacturer Data Package 5" as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide an electronic copy of the OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

b. Manufacturer's installation and maintenance manuals outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features.

c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.

d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.

e. Software delivered for this project shall be provided, on CD or DVD discs.

f. Printouts of configuration settings for all devices.

g. Routine maintenance checklist. The routine maintenance checklist shall be arranged in columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

1.9 WARRANTY PERIOD REPAIR SERVICE, MAINTENANCE AND ADJUSTMENTS

During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site. During the guarantee period, the installing fire alarm contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72 and the system manufacturer. Installing fire alarm contractor is NOT responsible for any damage resulting from abuse, misuse or neglect of equipment by the end user.
1.10 EXTRA MATERIALS

1.10.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of ten years after the date of final acceptance of this work by the Contracting Officer.

1.10.2 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.

1.10.3 Spare Parts

Furnish the following spare parts and accessories:

a. Four fuses for each fused circuit
b. Two smoke detectors
c. Two thermal detectors
d. Two addressable control modules
e. Two addressable interface modules

1.10.4 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Manufacturer

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 combination emergency communications system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

2.1.2 Standard Products

Provide materials, equipment, and devices that are UL Listed or FM 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. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least two years prior to bid opening.
2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

a. CECP (includes component panels)

b. Automatic transmitters (for both the installation-wide fire alarm reporting system and installation-wide mass notification systems)

Furnish nameplates to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.2 GENERAL PRODUCT REQUIREMENT

All combination emergency communications system equipment shall be listed for use under the applicable reference standards.

2.3 FIRE ALARM CONTROL UNIT (FACU) AND AUTONOMOUS CONTROL UNIT (ACU)

Provide a complete control panel fully enclosed in a lockable steel enclosure as specified herein. At the designer's discretion, the FACU and ACU may be housed in separate panels that contain independent power supplies and batteries or the ACU may be housed in the same panel with the FACU as a combination emergency communications system panel (CECP). Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the FACU enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly.

a. Each control unit shall provide power, supervision, control, and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120 Volt, 60 Hertz, normal building power supply. Provide each panel with supervisory functions for power failure, internal component placement, and operation.

b. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control unit shall be by liquid crystal display or similar means with a minimum of 80 characters, that at least 32 are field changeable. The ACU shall have the capability of temporarily deactivating the fire alarm messages while delivering voice messages. Provide conductor integrity monitoring for strobe, display, temporary deactivation of fire alarm audible notification appliances and speaker wiring.

c. Provide secure operator console with a microphone for delivering live voice messages. Provide adequate discrete outputs to temporarily deactivate fire alarm audible notification, and initiate/synchronize strobes. Provide a complete set of self-diagnostics for controller and appliance network. Provide local diagnostic information display and local diagnostic information and system event log file.
2.3.1 Cabinet

Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "Fire Alarm and Mass Notification Control Panel" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.3.2 Control Modules

Provide power and control modules to perform all functions of the FACU. Provide audible signals to indicate any alarm, supervisory, or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and relays, if any, on screw terminals in the FACU. 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.

2.3.3 Silencing Switches

a. Alarm Silencing Switch: Provide an alarm silencing switch at the FACU that shall silence the audible signal but not affect the visual alarm indicator. This switch shall be overridden upon activation of a subsequent alarm.

b. Supervisory/Trouble Silencing Switch: Provide supervisory and trouble silencing switch that shall silence the audible trouble and supervisory signal, but not affect the visual indicator. This switch shall be overridden upon activation of a subsequent alarm, supervision, or trouble condition. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated.

2.3.4 Non-Interfering

Power and supervise each circuit such that a signal from one device does not prevent the receipt of signals from any other device. Circuits shall be manually reset by switch from the FACU after the initiating device or devices have been restored to normal.

2.3.5 Voice Notification System

The Voice Notification System shall comply with the requirements of NFPA 72 for Emergency Voice/Alarm Communications System requirements ISO 7240-16, IEC 60268-16, except as specified herein.

Tones and voice messages shall repeat until the control panel is reset or silenced. A live voice message shall override the automatic audible output through use of a microphone input at the control panel.

a. The system shall be a single channel voice notification system incorporating user selectability of a minimum 8 distinct sounds for tone signaling, and the incorporation of a voice module for delivery of
prerecorded messages.

b. The digitalized voice message shall consist of a non-volatile (EPROM) microprocessor based input to the amplifiers. The microprocessor shall actively interrogate circuitry, field wiring, and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power, or any other malfunction that could render the digitalized voice module inoperative shall automatically cause the three tone temporal signal to take over all functions assigned to the failed unit.

c. When using the microphone, live messages shall be broadcast through all speakers. The system shall be capable of operating all speakers at the same time.

d. The Mass Notification functions shall override the manual or automatic fire alarm notification functions. The system shall have the capability of utilizing a remote microphone station with redundant controls of the notification system control panel. A hand held microphone shall be provided and, upon activation, shall take priority over any tone signal, recorded message or PA microphone operation in progress, while maintaining the strobe Notification Appliance Circuits activation.

Where the Combined Emergency Communications System consists of separate autonomous control and fire alarm control units, a Class X pathway shall be provided as the means for activating the strobe appliances.

The activation of the strobe circuits shall follow the operation of the speaker notification appliance circuits.

Audio output shall be selectable for line level (600 ohms), 25 or 70.7 volt output.

The audio amplifier outputs shall be not greater than 100 watts RMS output.

The strobe notification appliance circuits shall provide at least 2 amps of 24 VDC power to operate strobes and have the ability to synchronize all strobes.

All outputs and operational modules shall be fully supervised with on-board diagnostics and trouble reporting circuits.

Form "C" contacts shall be provided for system alarm and trouble conditions.

Circuits shall be provided for operation of auxiliary appliances during trouble conditions.

During a Mass Notification event the panel shall not generate nor cause any trouble alarms to be generated with the fire alarm portion of the combination emergency communications system.

Mass Notification functions shall take precedence over all other function performed by the Voice Notification System.

Messages shall be recorded professionally utilizing standard industry methods and be recorded utilizing a professional female voice. Message and
tone volumes shall both be at the same decibel level. Messages recorded from the system microphone shall not be accepted. Messages shall be the following:

1) FIRE ALARM/FIRE DRILL: 1000 Hz tones (1 sec on, 1/2 second off, 1 second, on, 1/2 second off, 1 second on)

"May I have your attention please. May I have your attention please. A fire emergency has been reported in the building. Please leave the building by the nearest exit or exit stairway. Do not use the elevators." (Provide a 2 second pause.) "May I have your attention please," (repeat the message).

2) BOMB THREAT: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"Attention, Attention. A bomb threat alert has been issued for this building. All personnel are to evacuate immediately using the nearest exit and report to your designated rally point. Further instructions will be issued outside the building by emergency response teams." (Provide a 2 second pause and repeat message.)

3) INTRUDER: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"Attention, Attention. An intruder has been observed in the building. Effective immediately initiate secure and lockdown procedures. All personnel should remain calm and stay where you are. Please wait for further instructions." (Provide a 2 second pause and repeat message.)

4) SHELTER IN PLACE: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"Attention, Attention. An emergency is taking place. All personnel remain in the building until further instructions are given." (Provide a 2 second pause and repeat message.)

5) ALL CLEAR: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"The building emergency has now ended and the status is all clear. Please resume your normal duties and thank you for your cooperation." (Provide a 2 second pause and repeat message.)

6) TEST FOR MNS: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"May I have your attention please. This is a test of the mass notification system. Repeat, this is only a test." (Provide a 2 second pause and repeat message.)

7) TEST FOR FIRE: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"May I have your attention please. This is a test of the fire alarm system. Repeat, this is only a test." (Provide a 2 second pause and repeat message.)
8) TEST COMPLETE: 1000 Hz tones (1 sec on, 1/2 second off, 1 second on, 1/2 second off, 1 second on)

"Testing of the system is complete. Thank you for your cooperation."

2.3.6 Memory

Provide each control unit with non-volatile memory and logic for all functions. The use of long-life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMs, or EPROMs.

2.3.7 Field Programmability

Provide control units and control panels that are fully field-programmable for control, initiation, notification, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer-based equipment. Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the combination emergency communications system shall be provided as part of this contract. Passwords for all levels of access shall be the manufacturer's default password and be provided to the Contracting Officer.

2.3.8 Input/Output Modifications

The FACU shall contain features allowing the bypass of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad. Any bypass or modification to the system shall indicate a trouble condition on the FACU.

2.3.9 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition exists on the system.

2.3.10 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACU. The card shall show those steps to be taken by an operator when a signal is received, as well as the functional operation of the system under all conditions; normal, alarm, supervisory, and trouble. The instructions shall be approved by the Contracting Officer before being posted.

2.3.11 Walk Test

The FACU shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated on the system printer, but no other outputs occur.
2.3.12 History Logging

In addition to the required printer output, the control panel shall have the ability to store a minimum of 400 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the control panel shall not clear the memory.

2.3.13 RS-232-C Output

Each local control panel shall be capable of operating remote service type printers, and/or modems. The output shall be paralleled ASCII from an EIA RS-232-C connection with a baud rate of 1200 or 2400 to allow use of any commonly available CRT, printer, or modem.

2.4 LOCAL OPERATING CONSOLES (LOC)

Provide a LOC at the location indicated on the contract drawings. The LOC shall consist of a Remote Microphone station incorporating a Push-To-Talk (PTT) hand held microphone and system status indicators of/for the system. Using the console, personnel in the building can provide live voice messages and instructions. The LOC shall NOT have the capability of being utilized to activate any pre-recorded messages. The unit shall incorporate microphone override of any tone generation or prerecorded messages. The unit shall be fully supervised from the FACU. The housing for the LOC shall not be lockable.

2.5 AMPLIFIERS PREAMPLIFIERS, DIGITALIZED VOICE GENERATORS

Any amplifiers, preamplifiers, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed within panels. The system shall automatically operate and control all building fire alarm speakers. Each amplifier shall be single output channel. The provision of backup amplifiers is not a contract requirement.

2.5.1 Construction

Amplifiers shall utilize computer-grade, solid-state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient voltage up to ten times the highest rated voltage in the system.

2.5.2 Inputs

Each system shall be equipped with separate inputs from the tone generator, digitalized voice driver and panel mounted microphone. Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

2.5.3 Message Tones

Message tones shall be stored digitally. Tones shall be either attached to the recorded message or be able to be programmed via the system software or by selector programming switches within the main control unit.
2.5.4 Protection Circuits

Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause illumination of a visual "amplifier trouble" indicator on the CECP.

2.6 SUPPLEMENTARY NOTIFICATION APPLIANCE CIRCUIT PANEL (SNAC)

Provide SNAC panels as necessary to power and control visual notification appliance circuits in addition to those connected to the main FACU. Trouble contacts of SNAC panel shall be individually monitored for trouble conditions on the panel.

2.7 AUXILIARY POWER SUPPLY PANEL

Provide auxiliary power supply panels as necessary to power combination emergency communications system devices, relays and control modules where power requirements exceed the capacity of the FACU. Trouble contacts of auxiliary power supply panels shall be individually monitored for trouble conditions.

2.8 Remote Annunciator

Provide a semi-recessed mounted remote annunciator as indicated on the contract drawings. The remote annunciator shall duplicate functions of the FACU for message display, fire alarm, supervisory alarm and trouble condition visual and audible notification and system reset functions. Remote annunciator shall require the use of a key for accessing the reset, control and other functions.

2.9 Installation-Wide Control

If an installation-wide control system for mass notification exists, the autonomous control unit shall communicate with the central control unit of the installation-wide system. The autonomous control unit shall receive commands/messages from the central control unit and provide status information.

2.10 INTERFACE TO THE INSTALLATION-WIDE MASS NOTIFICATION NETWORK

2.10.1 Wide Area Mass Notification Network/Local-Area Network (WAN/LAN)

The Wide Area Network/Local Area Network (WAN/LAN) Interface shall be a 10BASE-T/100BASE-TX Category 6. The ANSI/TIA/EIA 568 wiring method of the RJ-45 outlet shall be as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM. The WAN/LAN Interface shall support sensitive data at rated data transmission speeds with DES/3DES encryption, MD5 and SHA-1 hashing, RFC 2402 authentication and meet security features of FIPS 140-2 criteria. The WAN/LAN Interface shall have the following characteristics:

a. 10BASE-T/100BASE-TX, autonegotiation

b. WAN/LAN Connection: RJ-45

c. Cabling: as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM
d. Security Protocols: 168-bit 3DES, 56-bit DES, SHA-1, MD5, RFC 2402; up to 75 security associations

2.10.2 Telephone Connections to Installation-Wide Mass Notification System

A modem shall provide for communication with the Central Control/Monitoring System. The modem shall be 56k, compatible with data mode V.90, utilizing Hayes compatible command codes. The modem shall be capable of Auto dialing a preset number based on preprogrammed events. The modem shall auto answer and provide a secure password protection system.

Cabling: as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.10.3 RS-232/RS-485

The panel shall support a direct connect via RS-232 or RS-485 connections.

2.11 AUTOMATIC FIRE TRANSMITTERS

2.11.1 Digital Alarm Communicator Transmitter (DACT)

Provide DACT that is compatible with the existing Sur-Guard System III multi-platform digital telephone receiver and is programmed to report by points via contact ID protocol. Transmitter shall have a means to transmit alarm, supervisory, and trouble conditions via a single transmitter. Transmitter shall have a source of power for operation that conforms to NFPA 72. Transmitter shall be capable of initiating a test signal daily at any selected time. Transmitter shall be arranged to seize telephone circuits in accordance with NFPA 72.

2.12 EMERGENCY POWER SUPPLY

Provide emergency power 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.

2.12.1 Batteries

Provide sealed, maintenance-free, lead-calcium batteries as the source for emergency power to the CECPs. 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.

2.12.1.1 Capacity

Provide the batteries with sufficient capacity to operate the system under the most demanding of the following conditions.

a. Under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal appliances under alarm conditions for an additional 15 minutes.
2.12.2 Battery Chargers

Provide a solid-state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (18 Volts DC), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

2.12.3 Battery Cabinets

Locate battery cabinets below the FACU. Battery cabinets shall be installed at an accessible location when standing at floor level. Battery cabinets shall not be installed lower than 12 inches above finished floor. Installing batteries above drop ceilings or in inaccessible locations is prohibited. Battery cabinets shall be large enough to accommodate batteries and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall indicate the panel(s) the batteries power and shall not be less than one inch high. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.13 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.13.1 Alarm Wiring

The SLC wiring shall be solid copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 14 AWG size conductors at a minimum. Notification appliance circuit conductors, other than speakers, shall be solid copper No. 14 AWG size conductors at a minimum. Speaker circuits shall be copper No. 16 AWG size conductors at a minimum. Wire size shall be sufficient to prevent excessive voltage drop. 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 a minimum No. 12 AWG solid copper having similar insulation.

2.14 OVERVOLTAGE AND SURGE PROTECTION

2.14.1 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, that serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform(s):

a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

2.14.2 Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveform:

a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

2.15 CEILING BRIDGES

Provide ceiling bridges for ceiling-mounted appliances. Ceiling bridges shall be as recommended/required by the manufacturer of the ceiling-mounted notification appliance.

2.16 BACK BOXES AND CONDUIT

In addition to the requirements of SPECIFICATION SECTION 26 20 00 INTERIOR DISTRIBUTION SYSTEM; provide all wiring in rigid metal conduit or intermediate metal conduit unless specifically indicated otherwise. Minimum conduit size shall be 3/4 inch in diameter except for 1/2 inch drops to individual devices. Do not use electrical non-metallic tubing (ENT) or flexible non-metallic tubing and associated fittings.

Provide rigid metal back boxes of adequate size and depth as recommended by the manufacturer of the appliance or device installed.

2.17 NOTIFICATION APPLIANCES

2.17.1 Audio Notification Appliance Network

The notification appliance network consists of textual audible appliances (speakers) located to provide intelligible instructions at all locations in the building and areas as indicated on the contract drawings.

2.17.2 Fire Alarm/Mass Notification Speakers

Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Surface mounted audible appliances shall be painted white. Recessed audible appliances shall be installed with a grill that is painted white.

a. Textual audible appliances (speakers) shall conform to the applicable requirements of UL 1480. Speakers shall have six different sound output levels and operate with audio line input levels of 70 Volts AC, and 25 Volts AC, by means of selectable tap settings.
Speaker tap settings shall include taps of 1/4, 1/2, 1, and 2. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 400Hz to 4000Hz. Speakers shall have a sealed back construction.

Where speakers and strobes are provided in the same location, they may be combined into a single unit. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring via the Fire Alarm Control Unit.

b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.

Speakers mounted on the exterior of the building, within unconditioned spaces or in the vicinity of showers shall be Listed weather-proof appliances.

2.17.3 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Americans With Disabilities Act (ADA). Fire Alarm/Mass Notification Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light and be marked "ALERT" in red letters. Appliances with decals or adhesive labels, whether factory or field applied, are prohibited. 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. Strobe flash rate shall be one flash per second and a minimum of 15 candela based on the UL 1971 test. Strobes shall be surface mounted. Provide synchronized operation.

2.17.4 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

2.18 ADDRESSABLE MONITOR MODULE

The initiating device being monitored shall be configured as a Class B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm, trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterfall switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, and other similar functions. The module shall be UL or FM listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED. LED shall be visible without needing to remove the backbox cover plate.
2.19 ADDRESSABLE CONTROL/RELAY MODULE

The control module shall be capable of operating as a relay (form C contacts) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class B Pathway. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. Circuit between the module and the equipment/feature controls is permitted be configured as Class B pathways. The pathway is unsupervised but has a fail-safe operation that performs the intended function when the connection is lost. The control model shall provide address setting means compatible with the control panel’s SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed. LED shall be visible without needing to remove the backbox cover plate.

2.20 ISOLATION MODULE

Provide isolation modules to subdivide each Class B signaling line circuit pathway into groups of a maximum of 20 devices but no more than recommended by the equipment manufacturer between adjacent isolation modules. Isolation modules may be modules or combination detector base/isolation module. LED shall be visible without needing to remove the backbox cover plate.

2.21 MANUAL STATIONS

Provide addressable manual pull stations. Manual pull stations shall be metal or plastic, semi-flush mounted, double action, addressable manual stations, that are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations that 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. Manual stations shall be mounted at 48 inches. Stations shall have a separate screw terminal for each conductor.

2.22 SMOKE DETECTORS

2.22.1 Photoelectric Smoke Detectors

Provide addressable photoelectric smoke detectors as follows:

a. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors shall be listed for use with the fire alarm control unit.

b. Provide self-restoring type detectors that do not require any readjustment after actuation at the FACU to restore them to normal operation. Detectors shall be UL Listed or FM Approved as smoke-automatic fire detectors.
c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

d. Provide twist lock bases for the detectors. The detectors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The detector shall have a visual indicator to show actuation.

e. The detector address shall identify the particular unit, its location within the system, and its sensitivity setting. Detectors shall be of the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

   (1) Primary status
   (2) Device type
   (3) Present average value
   (4) Present sensitivity selected
   (5) Detector range (normal, dirty, etc.)

2.22.2 Duct mounted smoke detectors

Provide addressable duct smoke detectors as follows:

Duct-mounted photoelectric smoke detectors shall be furnished and installed where indicated on the contract drawings and in accordance with NFPA 90A. Units shall consist of smoke detectors, as specified in the paragraph titled Photoelectric Smoke Detectors, mounted in a housing fitted with duct sampling tubes. Detectors shall be powered from the fire alarm control unit.

   a. Sampling tubes shall run the full width of the duct. The duct smoke detector package shall conform to the requirements of NFPA 90A, UL 268A, and shall be UL listed or FM Approved for use in air-handling systems. The control functions, operation, reset, and bypass shall be controlled from the FACU.

   b. Lights to indicate the operation and alarm condition; shall be visible and accessible with the unit installed and the cover in place. Detectors mounted above 6 feet and those mounted below 6 feet that cannot be easily accessed while standing on the floor, shall be provided with a remote detector indicator panel containing test switches.

   c. Remote lamps and switches, as well as the affected fan units, shall be properly identified in etched plastic placards. Detectors shall provide for control of auxiliary contacts that provide control, interlock, and shutdown functions specified in Section 28 31 76.00 22.
INTERIOR COMBINATION EMERGENCY COMMUNICATIONS SYSTEMS. Auxiliary contacts provided for this function shall be located within 3 feet of the controlled circuit or appliance. The detectors shall be supplied by the fire alarm system manufacturer to ensure complete system compatibility.

2.22.3 Air Sampling Smoke Detectors

*The project Fire Protection Engineer shall provide custom verbiage addressing requirements for air sampling smoke detectors*

2.22.3.1 Air Sampling Smoke Detector Testing

Air Sampling Smoke Detectors shall be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

2.22.4 Smoke Detector Testing

Smoke detectors shall be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

2.23 Heat detector

2.23.1 Spot Type Heat Detectors

Heat detectors shall be combination fixed temperature and rate-of-rise (ROR-FT). The alarm condition shall be determined by comparing detector valve with the stored values. Heat detector spacing shall be rated in accordance with UL 521. Spot type heat detectors shall be listed for 50 by 50 feet spacing. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70 and as shown on the contract drawings, shall be types approved for such locations.

2.23.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication that is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be 135 degrees F and as shown on the contract drawings.

2.23.2 Heat Sensing

A moving average of the detectors heat sensing value to automatically compensate for conditions that could affect detection operations. System shall automatically maintain a constant heat sensing sensitivity from each detectors by compensating for environmental factors.

2.23.3 Self-Test Routines

Automatic self-test routines shall be performed on each detectors that will functionally check detectors sensitivity electronics and ensure the accuracy of the value being transmitted. Any detectors that fails this test shall indicate a trouble condition with the detectors location at the fire alarm control unit.
2.23.4 Operator Access

An operator at the CECP, having the proper access level, shall have the capability to manually access the following information for each heat detector:

a. Primary status
b. Device type
c. Present average value

2.23.5 Operator Control

An operator at the CECP with proper access, shall have the capability to manually control the following information for each heat detector:

a. Alarm detection sensitivity values
b. Enable or disable the point/device
c. Control detector relay driver output

2.23.6 Heat detector testing

Heat detectors shall be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

2.24 ELECTROMAGNETIC DOOR HOLDERS

Where indicated on the contract drawings, provide magnetic fire door hold open devices. The electromagnetic holding devices shall be designed to operate on 24 VDC, and require not more than 3 watts of power to develop 25 psi of holding force. Under normal conditions, the magnets shall attract and hold the doors open. The initiation of any fire alarm shall cause the release of the electromagnetic door holding device permitting the door to be closed by the door closer. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure. The device shall be UL listed based on UL 228 tests.

2.25 SYSTEM OPERATION

The combination emergency communications system shall be a complete, supervised, noncoded, analog/addressable fire alarm and mass notification system conforming to NFPA 72, UL 864, and UL 2017. The system shall be activated into the alarm mode by actuation of any fire alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. The system may be placed in the alert mode by local microphones or remotely from authorized locations/users.

2.25.1 Fire Alarm and Supervisory Initiating Devices

Connect alarm initiating devices to Class B signal line circuit (SLC) pathways, and install in accordance with NFPA 72.

The contract required 25 percent spare capacity per SLC limits the design
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to 38 addresses per Class B SLC.
In accordance with NFPA 72 the number of addresses between isolation modules on a Class B SLC pathway is limited to 50 addresses OR the maximum number of addresses per the manufacturer (most manufacturers limit the number of addresses between isolation modules to 20 addresses.)

a. Contractor shall utilize Class B signal line circuit pathways

2.25.2 Functions and Operating Features

The system shall provide the following functions and operating features:

a. The Combination Emergency Communications System Panels (CECP) whether separate or combined Fire Alarm Control Units (FACU) and Autonomous Control Units (ACU), shall provide power, annunciation, supervision, and control for the system. Systems shall be microcomputer (microprocessor or microcontroller) based addressable systems with a minimum word size of eight bits with sufficient memory to perform as specified.

b. Provide Class B initiating device circuit pathways for conductor lengths of 10 feet or less.

c. Provide Class B signaling line circuit pathways

d. Provide Class B control circuits. Class D control circuits are permissible when the intended operation has fail-safe operation. Fail-safe operation is when the intended operation is performed in the event of a pathway failure.

e. Provide Class B notification appliance circuit pathways. Visual alarm notification appliances shall have the flash rates synchronized.

f. Provide alarm verification capability for smoke detectors. Alarm verification shall initially be set for 20 seconds.

g. Provide program capability via switches in a locked portion of the FACU to bypass the automatic notification appliance circuits, fire reporting system, air handler shutdown, door release, door unlocking features. Operation of this programming shall indicate this action on the FACU display and system printer output.

h. Alarm, supervisory, and trouble signals shall be automatically transmitted to the fire department.

i. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

j. Programmed information shall be stored in non-volatile memory.

k. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

l. There shall be no limit, other than maximum system capacity, as to the number of addressable devices, that may be in alarm simultaneously.

m. 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.

n. 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 FACU, and on the remote annunciator. Indication on the annunciator shall be by floor & room number, device address, and device type.

(3) Continuous actuation of all alarm notification appliances.

(4) Recording of the event electronically in the history log of the FACU.

(5) Release of doors held open by electromagnetic devices.

(6) Release of power to electric locks on doors that are part of the means of egress.

o. A supervisory signal shall automatically initiate the following functions:

(1) Visual indication of the device operated on the FACU, and on the remote annunciator. Indication on the annunciator shall be by floor & room number, device address, and device type.

(2) Sound the audible alarm at the respective panels.

(3) Transmission of a supervisory signal to the fire department.

(4) Recording of the event electronically in the history log of the FACU.

(5) Supervisory signals shall be non-latching.

(6) Operation of a duct smoke detectors shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.

p. A trouble condition shall automatically initiate the following functions:

(1) Visual indication of the system trouble on the FACU, and on the remote annunciator and sound the audible alarm at the respective panels.

(2) Transmission of a trouble signal to the fire department.

(3) Recording of the event electronically in the history log of the fire control system unit.

(4) Trouble conditions shall be non-latching.
2.26 SYSTEM MONITORING

2.26.1 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, isolating valves for pressure type waterflow or supervision switches, 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.

2.26.2 Independent Fire Detection System

Each existing independent smoke detection subsystem, and kitchen fire extinguishing system shall be monitored both for the presence of an alarm condition and for a trouble condition. Each monitored condition shall be provided with a separate address.

2.27 ELECTRIC POWER

Primary power to combination emergency communications system panels and equipment

Primary power shall be 120 VAC service for the CECPs and equipment. Primary power shall be supplied from the AC service to the building. Provide dedicated branch circuit(s) supplying all CECPs & equipment including but not limited to FACU's, ACU's, supplementary power supplies, SNAC panels, LED message control/interface panels, LED Text signs, etc. Branch circuits shall supply no loads other than those associated with the combination emergency communications system. The circuit disconnecting means and all branch-circuit overcurrent protective devices shall be located within a single panel located in the building's main electrical room. The location of the branch-circuit overcurrent protective device shall be permanently identified at the combination emergency communications system panels/enclosures. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Combination emergency communications system panels and equipment(s) includes, but is not limited to; fire alarm control units (FACU), autonomous control units (ACU), local operating consoles (LOC), supplementary fire alarm control units, supplementary notification appliance circuit panels, auxiliary power supply panels, fire alarm system printers, mass notification system transceivers, fire alarm reporting system transmitters, LED text displays, LED text display control panels, circuits powering the elevator power shunt trip feature, circuits powering computer room power shunt trip feature and circuits powering 120VAC door holders.

PART 3 EXECUTION

3.1 INSTALLATION OF COMBINATION EMERGENCY COMMUNICATIONS SYSTEM EQUIPMENT DEVICES AND APPLIANCES

a. Locate the panels associated with the COMBINATION EMERGENCY
COMMUNICATIONS SYSTEM (FACU, ACU, LOC, Amplifiers, SNAC & Auxiliary power supply panels, MNS transmitter and Fire alarm transmitter) where indicated on the contract drawings. Semi-recessed panels with the top of the cabinet 6 feet above the finished floor or center the panels at 5 feet, whichever is lower. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted inside the panels.

b. Manual Stations: Locate manual stations as required by NFPA 101 IEC 60268, Part 16, and ASA S3.2 and NFPA 72 and where shown on the contract drawings. Mount stations so the operating handles are 4 feet above the finished floor. Mount stations so they are located no more than 5 feet from the exit door they serve, measured horizontally.

c. Notification Appliances: Locate notification appliances as required by NFPA 72 and where shown on the contract drawings. Mount assemblies on walls 90 inches above the finished floor or 6 inches below the ceiling whichever is lower. Ceiling mounted speakers shall conform to NFPA 72. Provide additional speakers as necessary to meet the intelligibility requirements indicated on the contract drawings.

d. Smoke and Heat detectors: Locate detectors as required by NFPA 72 and their listings and as shown on the contract drawings on a 4 inch mounting box. Detectors located on the ceiling shall be installed not less than 4 inches from a side wall to the near edge. Those located on the wall shall have the top of the detector at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. In raised floor spaces, the smoke detectors shall be installed to protect 225 square feet per detector. Install smoke detectors no closer than 5 feet from air handling supply outlets.

e. Remote Annunciator: Locate the remote annunciator as shown on the contract drawings. Surface mount the panel, with the top of the panel 6 feet above the finished floor or center the panel at 5 feet, whichever is lower.

f. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.

3.2 SYSTEM FIELD WIRING

3.2.1 Wiring within Cabinets, Enclosures, and Boxes

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 that 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, that are securely mounted. The use of wire nuts or similar devices shall be prohibited. Wiring shall conform to NFPA 70.

3.2.2 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 by 8 inches. Terminal strips shall be securely mounted inside. Utilizing tape or glue is not an acceptable means of mounting terminal strips.

3.2.3 Conduit

Minimum conduit size shall be 3/4 inch in diameter except for 1/2 inch drops to individual devices. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Provide an insulated green grounding conductor for all circuit(s) installed in conduit.

a. Galvanized rigid steel (GRS) conduit shall be utilized where exposed to weather, where subject to physical damage, and where exposed on exterior of buildings. Intermediate Metal Conduit (IMC). IMC may be used in lieu of GRS as allowed by NFPA 70.

b. Electrical Metallic Tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. EMT shall have a factory applied red exterior coating. Do not use EMT underground, encased in concrete, mortar or grout, in hazardous locations, where exposed to physical damage, outdoors or in fire pump rooms. Use die-cast compression connectors.

c. Flexible metal conduit is permitted for initiating device circuits 6 ft length in length or less. Flexible metal conduit is prohibited for notification appliance circuits and signaling line circuits. Use liquidtight flexible metal conduit in damp and wet locations.

3.2.4 Wire

Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FACU. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Pull all conductors splice free. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

3.2.5 Conductor Terminations

Label all conductor terminations in panels and equipment associated with the combination emergency communications system (FACU, ACU, LOC, Amplifiers, SNAC & Auxiliary power supply panels, MNS transmitter and Fire alarm transmitter) Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each combination emergency communications system cabinet and panel shall contain a laminated drawing that 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.
3.3 DISCONNECTION AND REMOVAL OF EXISTING SYSTEM

Existing fire alarm equipment shall be maintained fully operational until the new equipment has been 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 new system is completed, tested, and accepted by the Government, it shall be placed in service and connected to the installation-wide fire reporting system. New equipment shall have tags removed and the existing equipment shall be tagged "NOT IN SERVICE" until removed from the building.

a. After acceptance of the new system by the Contracting Officer, existing equipment not connected to the new system shall be removed, unused exposed conduit shall be removed, and damaged surfaces shall be restored. The material shall be removed from the site and disposed of by the Contractor.

b. Disconnect and remove the existing fire alarm and smoke detection systems where indicated and elsewhere in the specification.

c. Fire alarm control panels and fire alarm devices disconnected and removed shall be turned over to the Contracting Officer.

d. Properly dispose of fire alarm outlet and junction boxes, wiring, conduit, supports, and other such items. Existing wiring shall not be abandoned in place.

3.4 CONNECTION OF NEW SYSTEM

The following new system connections shall be made during the last phase of construction, at the beginning of the preliminary tests. New system connections shall include:

a. Connection of new control modules to existing magnetically held door (hold-open) devices.

b. Connection of new system transmitter to existing installation-wide fire reporting system.

Once these connections are made, system shall be left energized and new audio/visual appliances deactivated. Report immediately to the Contracting Officer any coordination and field problems resulting from the connection of the above components.

3.5 FIRESTOPPING

Provide firestopping for conduit penetrations through fire rated floor slabs, walls, partitions, and shaft enclosures.

3.6 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish. Paint junction boxes, conduit and surface metal raceways red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

In unfinished areas, paint all fire alarm conduit, junction boxes and covers red. In lieu of painting conduit, the contractor may utilize red
conduit with a factory applied finish.

In finished areas, paint exposed fire alarm conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Fire Alarm" and the conduit must have painted red bands 3/4 inch wide at 10 foot centers and at each side of a floor, wall, or ceiling penetration.

3.7 FIELD QUALITY CONTROL

3.7.1 Testing Procedures

Submit detailed test procedures prepared and signed by 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). Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

a. Identify the NFPA Class of pathways for all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).

b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.

c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.

d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).

e. Provide space to identify the date and time of each test.

f. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.7.2 Tests Stages

a. Preliminary Testing: Conduct preliminary tests to ensure 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 the installation is complete and fully operable. The letter shall state
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.

b. Request for Formal Inspection and Tests: Requests for Formal Inspection and Tests shall not be submitted until after the connections to the installation-wide fire reporting system and the installation-wide mass notification system have been completed and fully functional. When preliminary tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Naval Facilities Engineering Command, MIDLANT, Fire Protection Engineer.

c. 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. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Furnish instruments and personnel required for the tests. 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 project site:

1. The systems manufacturer's technical representative
2. As-built (red-lined) 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 NAVFAC MIDLANT 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.

3.7.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, ISO 7240-16, IEC 60268-16. The required tests are as follows:

Demonstrate communications with the supervising station as specified by the Contracting Officer. As a minimum, verify all points are correctly received at the supervising station receiver and automated software system.

Demonstrate communications with the installation-wide mass notification system as specified by the Contracting Officer.

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. 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.

d. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.

e. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke detectors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

f. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.

g. 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.

h. Determine that the system is operable under trouble conditions as specified.

i. Visually inspect wiring.

j. Test the battery charger and batteries.

k. Verify that software control and data files have been entered or programmed into the FACU. Hard copy records of the software shall be provided to the Contracting Officer.

l. Verify that red-line drawings are accurate.

m. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

o. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the detector. Testing of smoke detectors shall be conducted using real smoke. The use of canned smoke is prohibited.

p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

q. Audibility Intelligibility testing of the Voice Evacuation
Notification System shall be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, IEC 60268-16, and ASA S3.2.

r. Opening the circuit at not less than 50% of alarm initiating devices and notification appliances to test the wiring supervisory feature.

s. Demonstrate modem communications with remote sites as specified by the Contracting Officer. Dial in capability shall also, be demonstrated, using specified security.

t. Demonstrate fiber optic communications with remote sites as specified by the Contracting Officer. Dial in capability shall also, be demonstrated, using specified security.

3.8 INSTRUCTION OF GOVERNMENT EMPLOYEES

Provide 1 days (8 hours) of onsite 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.

3.8.1 Instructor

Include in the project the services of an instructor, who has 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. 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.

3.8.2 Required Instruction Time

Provide 1 days (8 hours) of onsite 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.

3.8.3 Technical Data and Computer Software

Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize designated government personnel with proper operation of the installed system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract. Maintenance software required and provided as part of this contract shall not require any type of annual license agreement or annual cost to continue use of the software. The
software that is provided will continue to operate during the entire lifetime of the installed equipment without any additional cost to the Government.

-- End of Section --
PART 1   GENERAL

1.1  SUBMITTALS

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

SD-03 Product Data

Nonsaleable Materials

SD-04 Samples

Tree Wound Paint

Herbicide

1.2  DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2   PRODUCTS

2.1  MATERIALS

2.1.1  Tree Wound Paint

Submit samples in cans with manufacturer's label of bituminous based paint of standard manufacture specially formulated for tree wounds.

2.1.2  Herbicide

Provide herbicides currently registered by the EPA or approved for such use by the appropriate agency of the host county and approved by the Contracting Officer. Select a herbicide that is suitable for the climatic conditions at the project site. Submit manufacturer's label and SDS for herbicides proposed for use.

PART 3   EXECUTION

3.1  PREPARATION

3.1.1  Protection

3.1.1.1  Roads and Walks

Keep roads and walks free of dirt and debris at all times.
3.1.1.2 Trees, Shrubs, and Existing Facilities

Provide protection in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS. Protect trees and vegetation to be left standing from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 30 00 ADMINISTRATIVE REQUIREMENTS and Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

3.2 CLEARING

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Apply herbicide in accordance with the manufacturer's label to the top surface of stumps designated not to be removed.

3.2.1 Tree Removal

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.2.2 Pruning

Trim trees designated to be left standing within the cleared areas of dead branches 1-1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1-1/4 inches in diameter with an approved tree wound paint.

3.2.3 Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than...
3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material and compact to make the surface conform with the original adjacent surface of the ground.

3.3 DISPOSAL OF MATERIALS

3.3.1 Saleable Timber

1. The Government will, by separate contract, harvest all saleable timber from the project site. All remaining timber, limbs, tops, stumps, and debris shall be cleared and disposed of by the Contractor as specified.

3.3.2 Nonsaleable Materials

Written permission to dispose of such products on private property shall be filed with the Contracting Officer. Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise directed in writing. Such directive will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --
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 D1140  (2014) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve


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 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 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.))

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)


1.2  DEFINITIONS

1.2.1  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
1.2.2 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.

1.2.3 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

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

SD-06 Test Reports

Select material test

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 on Government property.

e. Blasting will not be permitted. Remove material in an approved manner.
1.6 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics (including toxicity, ignitability, corrosivity, and reactivity). Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Contracting Officer.

1.7 QUALITY ASSURANCE

1.7.1 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. 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 Select Material

Provide materials classified as GW, GP, SW, SP by ASTM D2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D1140.

2.2 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property.
2.3 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.

<table>
<thead>
<tr>
<th>Warning Tape Color Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red: Electric</td>
</tr>
<tr>
<td>Yellow: Gas, Oil; Dangerous Materials</td>
</tr>
<tr>
<td>Orange: Telephone and Other Communications</td>
</tr>
<tr>
<td>Blue: Potable Water Systems</td>
</tr>
<tr>
<td>Green: Sewer Systems</td>
</tr>
<tr>
<td>White: Steam Systems</td>
</tr>
<tr>
<td>Gray: Compressed Air</td>
</tr>
<tr>
<td>Purple: Non-Potable, Reclaimed Water, Irrigation and Slurry Lines</td>
</tr>
</tbody>
</table>

2.3.1 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.

2.3.2 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.

2.4 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

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

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, at least two feet below the working level.

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 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 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the clearing limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.3 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 select material and compact to 95 percent of ASTM D698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with select material and compact to 95 percent of ASTM D698 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 Hard Material Excavation

Remove hard material to elevations indicated in a manner that will leave foundation material in an unshattered and solid condition. Roughen level surfaces and cut sloped surfaces into benches for bond with concrete. Protect shale from conditions causing decomposition along joints or cleavage planes and other types of erosion. Removal of hard material
beyond lines and grades indicated will not be grounds for a claim for additional payment unless previously authorized by the Contracting Officer. Excavation of the material claimed as rock shall not be performed until the material has been cross sectioned by the Contractor and approved by the Contracting Officer. Common excavation shall consist of all excavation not classified as rock excavation.

3.3.3 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."

3.3.4 Final Grade of Surfaces to Support Concrete

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

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 sheepfoot 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 with six passes of a dump truck loaded with 6 cubic meters of soil. 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 Select Material Placement

Provide under porous fill of structures not pile supported. Place in 6 inch lifts. Do not place over wet or frozen areas. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structure.

3.6 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.

3.7 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.

3.8 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required. Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.

3.8.1 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 D698.

3.8.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D698. Compact common fill, fill and backfill material, select material to 95 percent of ASTM D698.

3.8.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D698.
3.8.4 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D698. Compact fill and backfill materials to 95 percent of ASTM D698.

3.9 FINISH OPERATIONS

3.9.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.9.2 Topsoil and Seed

Provide as specified in Section 02 82 30 RE-ESTABLISHING VEGETATION.

3.9.3 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

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 Select Material Testing

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

3.11.2.2 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.
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 C151/A21.51 (2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C500 (2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C502 (2014) Dry-Barrel Fire Hydrants
AWWA C503 (2014) Wet-Barrel Fire Hydrants
AWWA C515 (2015) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C600 (2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605 (2013) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and
Fittings for Water

AWWA C651 (2014) Standard for Disinfecting Water Mains

AWWA C800 (2014) Underground Service Line Valves and Fittings

ASME INTERNATIONAL (ASME)


ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)


ASTM D2774  (2012) Underground Installation of Thermoplastic Pressure Piping


ASTM F2164  (2013) Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure

ASTM F402  (2005; R 2012) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List  (continuously updated) List of Approved Backflow Prevention Assemblies

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)


NSF INTERNATIONAL (NSF)

NSF 372  (2011) Drinking Water System Components - Lead Content

NSF/ANSI 14  (2016a) Plastics Piping System Components and Related Materials

NSF/ANSI 61  (2016) Drinking Water System Components - Health Effects
1.2 SUBMITTALS

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

SD-03 Product Data

Piping Materials
Water Distribution Main Piping, Fittings, Joints, Valves and Couplings
Valves
Indicator Posts
Valve Boxes
Hydrants
Tapping Sleeves

Submit manufacturer's standard drawings or catalog cuts. Include information concerning gaskets with submittal for joints and couplings.

Backflow Preventers

SD-06 Test Reports

Backflow Preventer Tests
Bacteriological Samples
Test results from commercial laboratory verifying disinfection.

SD-07 Certificates

Water Distribution Main Piping, Fittings, Joints, Valves and Couplings
Shop-Applied Lining and Coating
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.

1.3.2 Backflow Preventers

1.3.2.1 Backflow Preventers Certificate

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.3.2.1.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

1.3.2.1.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.
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 ductile iron pipe, fittings, and accessories in accordance with AWWA C600. Handle PVC pipe, fittings, and accessories in accordance with AWWA C605.

1.4.3 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC), pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

Storage facilities shall be classified and marked in accordance with NFPA 704.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Water Distribution Mains

Provide water distribution mains indicated as 4 through 12 inch lines of ductile iron, pipe. Provide water main accessories and valves 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


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; PVC 2120/PVC II; PVC 2116/PVC II.

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.
2.3 VALVES

2.3.1 Gate Valves 3 Inch Size and Larger on Buried Piping

AWWA C500, AWWA C509, AWWA C515, or UL 262. Unless otherwise specified, valves matching requirements of: (1) AWWA C500: nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends compatible for the adjoining pipe, (2) AWWA C509 or AWWA C515: nonrising stem type with mechanical-joint ends or resilient-seated gate valves 3 to 12 inches in size, and (3) UL 262: inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 350 psi, and have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Match materials for UL 262 valves to the reference standards specified in AWWA C500. Valves open by counterclockwise rotation of the valve stem. Stuffing boxes have O-ring stem seals. Stuffing boxes are bolted and constructed so as to permit easy removal of parts for repair. Where an indicator post is shown, provide an indicator post flange; indicator post flange for AWWA C500, AWWA C509, or AWWA C515 valve is to conform to the requirements of UL 262.

2.3.2 Reduced Pressure Double Check Valve Assembly

The reduced pressure backflow preventer shall consist of two independently operating, spring loaded cam-check valves with a hydraulically operated differential pressure relief valve located between and below the cam-checks, required test cocks and inlet and outlet resilient seat shut off valves. When normal flow exists, both check valves are open and the pressure in the area between the checks, called the zone, is a least 2 psi lower than the inlet pressure. The differential pressure relief valve is closed during normal flow.

If cessation of normal flow occurs, the differential pressure relief valve will automatically open and discharge to maintain the zone at least 2 psi lower than the inlet pressure. This action will prevent a backflow or backsiphonage condition. After the required differential is established, the differential pressure relief valve again closes.

The cam-checks include a stainless steel spring and cam-arm, rubber faced disc and a replaceable seat. The body shall be manufactured from 300 series stainless steel, lead free, with a single two-bolt grooved style access cover. No special tools shall be required for servicing. The relief valve shall be compact with a rolling diaphragm and no sliding seals. The relief valve shall discharge in a 360 degree radius.

The assembly shall have a rated working pressure of 175 psi and a rated hydrostatic pressure of 350 psi.

The assembly shall meet the American Society of Sanitary Engineering (ASSE) Standard and carry the ASSE seal or appear on the University of California approval list.

2.3.3 Water Service Valves

2.3.4 Indicator Posts

Provide upright gate valve with indicator post in accordance with UL 789 and NFPA 24, where indicated. Construct indicator post body of cast iron, ductile iron or a combination of both, bronze operating nut, cast iron...
locking wrench meeting the requirements of ASTM A126 Class B, with open and shut target window.

2.3.5 Valve Boxes

Provide a valve box for each gate valve on buried piping, except where indicator post is shown. 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 FIRE HYDRANTS AND HOSE HOUSES

2.4.1 Fire Hydrants

Provide hydrants where indicated. Paint hydrants with at least one coat of primer and two coats of enamel paint. Paint barrel and bonnet colors in accordance with UFC 3-600-01. Stencil hydrant number and main size on the hydrant barrel using black stencil paint.

2.4.1.1 Dry-Barrel Type Fire Hydrants

Provide Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, with 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Provide mechanical-joint end only inlet; with end matching requirements as specified for the joint as specified in AWWA C502 or AWWA C503 or UL 246 for size and shape of operating nut, cap nuts, and threads on hose and pumper connections. Provide hydrants with frangible sections as mentioned in AWWA C502. Design the hydrant with special couplings joining upper and lower sections of hydrant barrel that break from a force imposed by a moving vehicle. Hydrant is to be fully operational under normal conditions.

2.5 ACCESSORIES

2.5.1 Tapping Sleeves

Body: 304 Stainless Steel.

Bolts and Nuts: 304 Stainless Steel.

Gaskets: Gaskets are made of virgin Styrene Butadiene Rubber (SBR) compounded for water and sewer service in accordance with ASTM D2000 3 BA715.

Pressure: Saddle shall be suitable for a maximum working pressure of 150 psi and a maximum hydrostatic pressure of 200 psi.

Standards: The service saddle shall meet the requirements of ANSI/AWWA C800.

2.5.2 Sleeve-Type Mechanical Couplings

Design couplings to join plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling consists of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to
draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings are to be true circular sections free from irregularities, flat spots, and surface defects; provide for confinement and compression of the gaskets. For ductile iron pipe, the middle ring is cast-iron or steel; and the follower rings are malleable or ductile iron. Cast iron, ASTM A48/A48M not less than Class 25. Malleable and ductile iron are to meet the requirements of ASTM A47/A47M and ASTM A536, respectively. Steel is to have a strength not less than that of the pipe. Design gaskets for resistance to set after installation and to meet the requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Provide track-head type bolts ASTM A307, Grade A, with nuts, ASTM A563, Grade A; or round-head square-neck type bolts, ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Provide 5/8 inch in diameter bolts. Shape bolt holes in follower rings to hold fast to the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Provide a tight flexible joint with mechanical couplings under reasonable conditions, such as pipe movements caused by expansion, contraction, slight settling or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Match coupling strength to that of the adjoining pipeline.

2.5.3 Insulating Joints

Provide a rubber-gasketed insulating joint or dielectric coupling between pipe of dissimilar metals which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.5.4 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.

2.6 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.

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. Provide at least 18 inches above the top (crown) of the sewer piping and the bottom (invert) of the water piping. The sewer piping is to be constructed of AWWA-compliant water pipe and pressure tested in place without leakage prior to backfilling where this vertical separation can not be obtained. Shop drawings for the waste water disposal method are required. Test the sewer manhole in place to ensure watertight construction.

3.2.1.1.1.2 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

a. 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.

b. Unusual Conditions: When local conditions prevent a routing or vertical separation as described above, use the following construction:
(1) 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.

(2) Water piping passing under sewer piping shall 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 crossings so that joints shall be equidistant and as far as possible from the sewer piping.

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 2 1/2 feet depth of cover over top of
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 Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a flanged joint as specified, replace it. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the setscrewed flange manufacturer. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer.

b. Allowable Deflection: Follow AWWA C600 for the maximum allowable deflection. If the alignment requires deflection in excess of the above limitations, provide special bends or a sufficient number of shorter lengths of pipe to achieve angular deflections within the limit set forth.

c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.

3.2.2.2 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 D2774 and ASTM D2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.

3.2.2.2.1 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.

3.2.2.2.2 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 Valves

3.2.3.1 Installation of Gate Valves

Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.3.2 Installation of Check Valves

Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated. Make and assemble joints to check valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.4 Installation of Fire Hydrants

Install hydrants, except for metal harness, in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, install hydrants with the 4 1/2 inch connection facing the paved surface where the connecting main is located.
3.2.5 Disinfection

Disinfection of systems supplying nonpotable water is not required.

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

3.3.2.1 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:

\[ L = \frac{(S \times D \times (P)^{\frac{1}{2}})}{133,200} \]

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.

3.3.2.1.1 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.

3.3.2.2 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.

For PE perform leak testing in accordance with ASTM F2164.

3.3.3 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.

3.3.4 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 --
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</table>
I certify that I have read, understood, and accept this document and all attachments, and that all those within my party working on a job site within Marine Corps Base Camp Lejeune and/or Marine Corps Air Station New River will comply with the environmental policies and regulations herein. I am aware that there are penalties for not complying with this Guide.

________________________________________
Signature

________________________________________
Date
# LIST OF ACRONYMS AND ABBREVIATIONS

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<td>Asbestos-Containing Material</td>
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<td>Coastal Area Management Act</td>
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<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation, and Liability</td>
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<td>Comprehensive Environmental Training and Education Program</td>
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<td>CFR</td>
<td>Code of Federal Regulations</td>
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<td>CG</td>
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<tr>
<td>HCFC</td>
<td>Hydrochlorofluorocarbon</td>
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<td>USMC</td>
<td>United States Marine Corps</td>
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<tr>
<td>UW</td>
<td>Universal Waste</td>
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UXO  Unexploded Ordnance

XRF  X-Ray Fluorescence
# CONTRACTOR’S PHONE DIRECTORY

In the event of an emergency, refer to the emergency numbers below. All non-emergency contractor inquiries regarding the operations at Marine Corps Base (MCB) Camp Lejeune and Marine Corps Air Station New River should be directed to the Resident Officer in Charge of Construction (ROICC) or Contract Representative. The ROICC or Contract Representative will either directly contact or refer contractors to the appropriate Division or Organization.

## Emergency and Important Non-Emergency Numbers

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<tr>
<td>Hearing Impaired</td>
<td>(910) 451-4444</td>
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<tr>
<td>CHEMTREC (Emergency 24-hour/Outside MCB Camp Lejeune)</td>
<td>(800) 424-9300</td>
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<td>Hazardous Chemical Spill</td>
<td>911</td>
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<tr>
<td>Military Police</td>
<td>911</td>
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<tr>
<td>National Response Center (Outside MCB Camp Lejeune)</td>
<td>(202) 372-2428</td>
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<tr>
<td>Toll Free</td>
<td>(800) 424-8802</td>
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<td>Provost Marshall Office</td>
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## Marine Corps Base Camp Lejeune

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<td>(910) 451-5725</td>
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<td>Environmental Management Division</td>
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Asbestos Management
Resource Conservation and Recovery Section
(910) 451-1482

Hazardous Material Consolidation Site/Free Issue
(910) 451-1482

Recycling Center, Building 982........(910) 451-4214

-Environmental Conservation Branch...........(910) 451-5063

Fish & Wildlife
Forestry Management
NEPA
Conservation Law Enforcement
(910) 451-2196/5226

-Environmental Quality Branch.............(910) 451-5068

Air Quality
Underground Storage Tanks
Water Quality

Explosives and Ordnance Disposal............(910) 451-0558

Public Works Division..........................(910) 451-5307

-Construction Project Managers..............(910) 451-2583

-Contracts Branch................................(910) 451-2582

-Officer In Charge of Construction (Main)....(910) 451-2581

-Public Works Base Utility Director.........(910) 451-5024

Water Line Break/Wastewater Line Break......(910) 451-7190 (x225)

-Public Works Solid Waste Division/Landfill

....................................................(910) 451-2946

Range Control....................................(910) 451-3064

Regional Geospatial Information & Services (Installation Manager)..................(910) 451-8915

Safety Department................................(910) 451-5725
Marine Corps Air Station New River

Confined Space Program ........................................ (910) 449-4964
Consolidated Hazardous Material Reutilization and
Inventory Management Program ........ (910) 449-4531/4533

Environmental Affairs Department
(Director) ................................................................. (910) 449-5441
-Environmental Affairs Department (Environmental
  Manager) ................................................................. (910) 449-5442
-Environmental Affairs Department (GIS
  Manager) ................................................................. (910) 449-6144
-Environmental Affairs Department (Hazardous
  Waste) ............................................................... (910) 449-5997
-Conservation Law Enforcement ........ (910) 449-0108

Explosives Safety Officer ......................... (910) 449-5443

Military Police (Non-Emergency) ........ (910) 449-4248/4249

Public Works Division ................................. (910) 449-6506
-Officer In Charge of Construction .... (910) 449-5587

Safety Department ........................................... (910) 449-4527
1.0 CONTRACTOR ENVIRONMENTAL GUIDE OVERVIEW

Environmental protection is an integral part of the Marine Corps mission in order to protect public health, preserve environmental quality, comply with regulatory requirements, and develop and strengthen relationships between the Marine Corps community and external stakeholders. The purpose of the MCB Camp Lejeune Contractor Environmental Guide is to assist contractors working aboard Marine Corps Installations East’s (MCIEAST’s) Marine Corps Base (MCB) Camp Lejeune and Marine Corps Air Station (MCAS) New River in maintaining the mission by complying with Federal and State environmental laws and regulations, as well as the United States Marine Corps (USMC) and installation environmental policies. This guide is written in accordance with Marine Corps Order (MCO) P5090.2A and designed to answer many of the environmental questions that arise, as well as to provide pertinent information on environmental topics and training requirements.

NOTE: This document should be used only as a guide to the environmental issues contractors may face while working aboard MCB Camp Lejeune and MCAS New River.
aboard MCB Camp Lejeune and MCAS New River. It is expected that contractors will work closely with the Environmental Management Division (EMD) at MCB Camp Lejeune, the Environmental Affairs Department (EAD) at MCAS New River, and Contract Representatives regarding environmental management issues, concerns, and/or questions. Should the need arise, this guide provides contractors with EMD, EAD, and emergency response points of contact (POCs). All initial inquiries should be directed to the Resident Officer in Charge of Construction (ROICC) or Contract Representative, who will either direct the contractor or contact the appropriate environmental office if additional clarification regarding an environmental issue is necessary.

**NOTE:** It is very important to note that this guide is designed to provide requirements specific to MCB Camp Lejeune-issued contracts. It is the contractor’s responsibility to know and comply with all Federal, State, and local regulations. MCB Camp Lejeune environmental personnel will assist contractors with compliance issues; however, the primary burden of regulatory identification, familiarity, and compliance lies with the contractor. This training does not replace any required regulatory environmental training or certification as per contract requirements. All required environmental training should be completed prior to working at MCIEAST installations.

Contact the ROICC or Contract Representative with any questions.
**NOTE:** It is the contractor’s responsibility to review the project-specific contract and specifications. Additional environmental requirements, submissions, and/or meetings not documented in this guide may be required.

### 1.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are used throughout this guide. If you have any questions about these definitions or concepts, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 1.1.1. Key Definitions

- **Environment.** Surroundings, to include all surface water, groundwater, drinking water supply, land surface or subsurface area, or ambient air within the United States or under the jurisdiction of the United States, including manmade structures, indoor air environments, natural resources, and archeological and cultural resources.

- **Environmental Management Division.** MCB Camp Lejeune’s division responsible for environmental issues and compliance at MCB Camp Lejeune.

- **Environmental Affairs Department.** MCAS New River’s department responsible for environmental issues and compliance at MCAS New River.

- **Environmental Management System (EMS).** A systematic approach for integrating environmental
considerations and accountability into day-to-day decisionmaking and long-term planning processes across all missions, practices, and functions. The EMS institutionalizes processes for continual environmental improvement and reducing risks to mission through ongoing planning, review, and preventive or corrective action.

1.1.2. Key Concepts

- **Environmental Requirement.** A defined standard pertaining to environmental compliance, pollution prevention (P2), or natural/cultural resources, subject to uniform application. Environmental requirements may be in the form of a law, regulation, Executive Order (EO), policy, ordinance, permit, Base Order (BO), or other form that prescribes a standard.

- **Executive Order.** Legally binding orders given by the President, as head of the Executive Branch, to direct Federal agencies and officials in their execution of congressionally established laws or policies.

- **MCB Camp Lejeune.** Throughout this document, MCB Camp Lejeune includes all MCB Camp Lejeune real property and contracts for work performed at MCAS New River and all outlying fields associated with MCB Camp Lejeune.

- **Marine Corps Order.** A directive of continuing authority or information, meant to be a permanent reference and requiring continuing action, issued by Headquarters Marine Corps (HQMC). In accordance
with MCO 5215.1K (10 May 2007), all MCOs shall, where applicable: establish, describe, or change existing policy, programs and major activities, and organizations; define missions; assign responsibilities; issue procedural guidance; and be written in standardized format.

- **Resident Officer In Charge of Construction.** The ROICC administers construction contracts and is the contractor’s first line of contact with the government.

- **Regulatory Requirements.** Government (including Federal, State, and local) environmental regulations implemented by environmental statutes. Federal regulations often establish minimum standards for State and local governments’ implementing programs.

- **Statutory Requirements.** Federal environmental statutes are laws that generally require compliance by U.S. Department of Defense (DoD) installations.

### 1.2. INSTALLATION BACKGROUND

MCB Camp Lejeune was established in 1941 in Onslow County, along the southern coast of North Carolina (NC). MCB Camp Lejeune is just south of MCAS New River. MCB Camp Lejeune takes advantage of 156,000 acres and 11 miles of beach capable of supporting amphibious operations, 32 gun positions, 48 tactical landing zones, three state-of-the-art training facilities, and 80 live fire ranges for its training mission.
The primary function of MCB Camp Lejeune is national defense, providing a home installation for the II Marine Expeditionary Force (MEF), 2nd Marine Division, 2nd Force Service Support Group, and other combat units and support commands. MCB Camp Lejeune’s mission is to maintain combat-ready units for expeditionary deployment. MCB Camp Lejeune maintains and utilizes supply warehouses, maintenance shops, hazardous material storage, nonhazardous and hazardous waste storage, bulk fuel storage and transfer facilities, fleet parking, housing areas, recreational areas, two golf courses, and a marina.

MCAS New River is the principal USMC helicopter operating location on the East Coast and supports aircrew training in the H-53 helicopter. It is also the evaluation and prospective bed-down site for the V-22 Osprey. The mission of MCAS New River is to provide the necessary support for its Marine Aircraft Group (MAG) tenant units, MAG-26 and MAG-29.

1.2.1. Environmental Management Division and Environmental Affairs Department

MCB Camp Lejeune’s EMD, within the Installation and Environment Department, is responsible for all natural resource and environmental matters aboard the installation. EMD works closely with MCB Camp Lejeune personnel, educating and training them to comply with environmental laws while accomplishing the military mission.

The EAD at MCAS New River works closely with the EMD on environmental compliance and protection matters. Due to
various joint operations, MCB Camp Lejeune and MCAS New River participate together in one EMS. See Figure 1-1 and Figure 1-2 for organization charts of EMD and EAD.

**Figure 1-1. Environmental Management Division (MCB Camp Lejeune) Organization Chart**

**Figure 1-2. Environmental Affairs Department (MCAS New River) Organization Chart**

### 1.2.2. Expectations

Contractors aboard the installation, which are committed to strict compliance with environmental laws and regulations,
assist MCB Camp Lejeune in providing the best possible training facilities for today’s Marines and Sailors, while honoring our environmental responsibilities and objectives. Violation of environmental laws may result in severe civil or criminal penalties and fines.

1.3. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable environmental regulations and requirements, which include but may not be limited to the following:

- **EO 12088, Federal Compliance with Pollution Control Standards (October 13, 1978).** Requires all facilities owned by or leased to or by the military to be designed, operated, and maintained in compliance with all applicable environmental standards. Military and civilian personnel must cooperate with Federal, State, and local environmental protection agencies and comply with applicable standards and criteria issued by these agencies to the extent permitted by law.

- **EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management.** Requires Federal agencies to comply with applicable Federal, State, local, and host nation environmental laws and regulations. Additionally, requirements include more widespread use of EMSs as the framework for sustainability management.
• **EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance.** Requires Federal agencies to meet various sustainability goals, to include the reduction of greenhouse gas emissions. Applicable provisions for meeting these goals are to be included in acquisition and service contracts.

• **MCO P5090.2A, Environmental Compliance and Protection Manual (26 August 2013).** USMC policies and responsibilities for compliance with environmental statutes and regulations, as well as the management of USMC environmental programs.

1.3.1. **Contractor Environmental Guide**

This guide consists of the following information:

- MCB Camp Lejeune Contractor Environmental Guide
  - EMS overview and requirements
  - Environmental program-specific requirements
- MCB Camp Lejeune General EMS and Environmental Awareness Training for Contractors and Vendors
- Signature Page
Prior to beginning work onsite, or within 30 days of beginning work onsite, all contractors and their employees performing work aboard MCB Camp Lejeune must review these materials and complete EMS and General Environmental Awareness training. This guide summarizes the EMS and environmental programs at MCB Camp Lejeune, as well as key requirements associated with the various environmental issues contractors may encounter while performing work aboard the installation. Contractors are expected to work with their ROICC or Contract Representatives and EMD/EAD when environmental concerns or issues arise.

1.3.2. Environmental and EMS Training

In accordance with Department of Defense (DoD) instructions and MCOs, EMD has implemented a Comprehensive Environmental Training and Education Program (CETEP). The goal of the CETEP is to ensure that appropriate environmental instruction and related information are provided to all levels of the Marine Corps in the most effective and efficient manner to achieve full compliance with all applicable environmental training
requirements. A major component of the CETEP is to provide general environmental awareness training to all individuals associated with the installation, including contractors.

In addition to CETEP requirements, MCB Camp Lejeune has implemented an installation-wide EMS. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors) whose activities have the potential to impact the environment.

All contractors are required to receive both EMS and general environmental awareness training at the level necessary for their job function. This guide satisfies these training requirements (See the Appendix).

As such, contractors working aboard MCB Camp Lejeune will do the following:

- Conduct job responsibilities in compliance with environmental regulations and in conformance with EMS requirements.
- Complete all applicable environmental training and maintain associated records as per contract requirements.
• Complete EMS and general environmental awareness training, and be aware of and understand the MCB Camp Lejeune Environmental Policy.

• Contact their ROICC or Contract Representative immediately regarding environmental and/or EMS issues.

Prior to beginning work onsite or within 30 days, all contractors must sign and date the signature page and return it to the installation Contract Representative. Anyone who works on a contract at any point during the contract period must receive this information and training.

1.4. POINTS OF CONTACT

EMD Branches and phone numbers are found in the Contractor’s Phone Directory on pages xv and xvi of this Guide. All initial inquiries regarding an environmental issue should be directed to the ROICC or Contract Representative, who will either directly contact or refer the contractor to the appropriate environmental office if additional clarification is necessary. In the case of a spill or environmental emergency, immediately dial 911. Additional emergency response procedures are provided in Section 5.0 of this Guide.
Table 1-1. Contacts in Case of a Spill

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<tr>
<th>For spills of:</th>
<th>Call:</th>
<th>Follow-up:</th>
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</thead>
<tbody>
<tr>
<td>Hazardous waste</td>
<td>911</td>
<td>Spill Report</td>
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<tr>
<td>Unknown materials</td>
<td>911</td>
<td>Spill Report</td>
</tr>
<tr>
<td>Material on a permeable surface</td>
<td>911</td>
<td>Spill Report</td>
</tr>
<tr>
<td>Any amount of a POL or Hazardous Material</td>
<td>911</td>
<td>Spill Report</td>
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<td>Material that reaches stormwater inlets or waterways</td>
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<tr>
<td>Nonhazardous waste</td>
<td>(910) 451-1482</td>
<td>911</td>
</tr>
</tbody>
</table>

1.5. OVERVIEW MAP

Figure 1-3 provides an overview map that displays the locations of installation facilities discussed throughout this Guide.
Figure 1-3. Overview Map
MCB Camp Lejeune and MCAS New River jointly operate an EMS, which provides a systematic way of continually implementing environmental requirements and evaluating performance. The EMS is founded on the principles of MCB Camp Lejeune’s Environmental Policy, which is endorsed by the Commanding General (CG). Three key principles of the Environmental Policy are to:

- Comply with relevant environmental laws and regulations;
- Prevent pollution; and
- Continually improve the EMS.

The EMS promotes sustained mission readiness through actively identifying and implementing opportunities for efficient resource use. The USMC implements EMS at all levels to continually improve environmental compliance programs and meet evolving EOs and DoD requirements for mission sustainability. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units,
offices, and personnel (including contractors and vendors) whose activities have the potential to impact the environment.

2.1. KEY DEFINITION AND CONCEPTS

The following key definitions and concepts are associated with an EMS. Please consult the ROICC or Contract Representative with any questions about these definitions or concepts.

2.1.1. Key Definitions

- **Environment.** Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.

- **Environmental Aspect.** A characteristic of an organization’s activities, products, or services that may cause, in normal operation or upset mode, an impact to an environmental or other resource. Each practice may have several aspects.

- **Environmental Impact.** An effect, beneficial or adverse, of a practice’s aspect on an environmental or other resource. Each practice may have several impacts.

- **Environmental Resources.** Sensitive environmental receptors (e.g., air, water, natural
resources) or cultural or historic assets at MCB Camp Lejeune or MCAS New River, in the surrounding community, within the ecosystem, or beyond, that may be impacted by the operation of practices.

- **Practice.** A unit process that supports a military mission and may impact environmental resources. (It is the ability to impact an environmental resource that is key to defining a practice. However, practices may also impact other resources.)

- **Practice Owner.** Person(s) responsible for control of practices. EMS procedures use the term practice owner when the assignment of more specific responsibilities is left to the owning organizations.

- **Requirement.** Legislation, regulation, or policy issued by any Executive, Federal, State, local, DoD, Department of Navy (DoN), or USMC authority that addresses environmental considerations and requires action.

### 2.1.2. Key Concepts

- **Environmental Management System.** A systematic approach for integrating environmental considerations and accountability into day-to-day decisionmaking and long-term planning processes across all missions, activities, and functions. The EMS institutionalizes processes for continual environmental improvement and for reducing risks to mission through ongoing planning, review, and preventive or corrective action.
• **Environmental Policy.** Public commitment by senior leaders to the management of the installation’s environmental affairs, including environmental compliance, pollution prevention, natural/cultural resource management, cleanup, risk to mission, and continual improvement of the EMS.

• **Plan, Do, Check, Act.** Four-step model by which the EMS carries out change – **Plan:** establish objectives and processes; **Do:** implement and execute the plan; **Check:** study and analyze the results; **Act:** take action based on what you learned.

*Figure 2-1. Plan, Do, Check, Act Cycle*
2.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Camp Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements concerning EMS, which include but may not be limited to the following:

- **EO 13148, Greening the Government Through Leadership in Environmental Management.** Mandates that environmental management considerations must be an integral component of Federal Government policies, operations, planning, and management, with the primary goal for each agency to promote the sustainable management of Federal facility lands through the implementation of cost-effective, environmentally sound practices, and programs to reduce adverse impacts to the natural environment.

- **EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management.** Establishes the EMS as the primary management approach for addressing environmental aspects, including energy and transportation aspects, and as the reporting mechanism for communicating progress on meeting performance goals.

- **EO 13514, Leadership in Environmental, Energy, and Economic Performance.** Requires continuing implementation of formal EMSs at all appropriate organizational levels to support the sustainability performance requirements of the Order.
2.3. ENVIRONMENTAL MANAGEMENT SYSTEM

An EMS is a systematic way to identify and eliminate or minimize the installation’s environmental risk-to-mission. MCB Camp Lejeune’s EMS identifies practices and their aspects as a starting point for prioritizing environmental management initiatives. Each installation practice, such as construction/renovation/demolition, equipment operation/maintenance/disposal, landscaping, or pesticide/herbicide management and application, has one or more environmental aspects. Figure 2-2 illustrates the simplified potential interactions of one practice, construction/renovation/demolition, with the environment.
Figure 2-2. Potential Interactions of Construction and Demolition Activities with the Environment
2.4. EMS RESPONSIBILITIES

Contractors are expected to understand that the practices they support on the installation may interact with and have the potential to impact the environment. Therefore, it is expected that contractors will do the following:

- Review the Contractor Environmental Guide.

- Be aware of the Environmental Policy (Attachment 2-1).

- Conduct practices in a way that avoids and/or minimizes impacts to the environment by complying with all applicable Federal, State, and local environmental regulations and BOs.

- Be familiar with spill response procedures.

- Report all environmental emergencies and spills.

- Report any environmental problems or concerns promptly, and notify the ROICC or Contract Representative.

- Respond to data collection efforts upon request.
The sections of this Contractor Environmental Guide are categorized based on the type of environmental requirements routinely encountered by contractors at MCB Camp Lejeune. The following matrix is derived from MCB Camp Lejeune’s EMS Working Group sessions and relates the contents of this guide to the practices aboard MCB Camp Lejeune. It is provided to assist contractors in narrowing down specific requirements that may apply to onsite activities.
### Table 2-1. Practices Identified Under MCB Camp Lejeune’s EMS

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<thead>
<tr>
<th>MCB Camp Lejeune 2015 Practices</th>
<th>Env. Emergency Response/ Spill Response, Section 5.0</th>
<th>Potential Discovery of Undocumented Contaminated Sites, Section 13.0</th>
<th>Asbestos, Section 8.0</th>
<th>Lead-Based Paint, Section 9.0</th>
<th>Stormwater, Section 11.0</th>
<th>Solid Waste, Recycling, and P2, Section 12.0</th>
<th>Cultural Resources, Section 3.0</th>
<th>Permitting, Section 14.0</th>
<th>Air Quality, Section 4.0</th>
<th>Natural Resources, Section 10.0</th>
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<td>MCB Camp Lejeune 2015 Practices</td>
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<td>Potential Discovery of Undocumented Contaminated Sites, Section 13.0</td>
<td>Asbestos, Section 8.0</td>
<td>Lead-Based Paint, Section 9.0</td>
<td>Stormwater, Section 11.0</td>
<td>Solid Waste, Recycling, and P2, Section 12.0</td>
<td>Training, Section 3.0</td>
<td>Cultural Resources, Section 6.0</td>
<td>Air Quality, Section 14.0</td>
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Attachment 2-1

MCB Camp Lejeune’s Environmental Policy Statement
COMMANDING GENERAL’S ENVIRONMENTAL POLICY STATEMENT

The protection and enhancement of our natural environment is a valuable tool in sustaining the training and support mission of Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ). As MCIEAST-MCB CAMLEJ prepares for the increasing demands on facilities, training areas, ranges, and quality-of-life services that support the readiness of our forces, we are committed to protecting human health, conserving natural and cultural resources, and complying with regulatory requirements.

The MCIEAST-MCB CAMLEJ Environmental Management System (EMS) promotes sustained mission readiness through actively identifying and implementing solutions and opportunities for efficient resource use. Through the EMS, MCIEAST-MCB CAMLEJ will continually assess daily operations in order to identify and implement improvements to its practices that will ensure compliance with governing regulations and meet the sustainability objectives of Executive Orders 13514 and 13423. In this endeavor, MCIEAST-MCB CAMLEJ will:

- Continue proactive compliance with all environmental laws, regulations, and U. S. Marine Corps policies.
- Integrate natural and cultural resource management with the military mission whenever practical.
- Incorporate sound environmental practices into all of our operations and business decisions.
- Implement pollution prevention initiatives, waste diversion, recycling, and waste minimization programs.
- Assess and remediate contaminated sites aboard the Base that are the result of past disposal practices or spills and leaks of hazardous materials.
- Implement energy efficiency and water conservation management projects.
- Procure sustainable products, including biobased, environmentally preferable, energy efficient, water efficient, and recycled-content products.
- Collaborate with local communities and regulatory agencies to enhance stewardship of the environment, create goodwill and build trust.
- Educate our Marines, Sailors, and Civilian Marines about their responsibility to protect our natural environment, stressing the important role each individual plays in an effective EMS.

Join me in applying these environmental management principles to protect and enhance our natural environment, while strengthening the combat readiness of our forces and the quality-of-life services to our warriors and their families.

R. F. CASTELLVI
Brigadier General, U.S. Marine Corps
Commanding General
Marine Corps Installations East-Marine Corps Base Camp Lejeune
3.0 TRAINING

The contractor is responsible for ensuring that every employee completes a program of classroom instruction or on-the-job training that teaches the employee to perform his or her duties in compliance with Federal, State, and local regulatory requirements.

To minimize the environmental impact of MCB Camp Lejeune operations, all civilian and military personnel, including contractors, are required to receive both EMS and general environmental awareness training at the level necessary for their job function. Use of the Contractor Environmental Guide satisfies these training requirements. A training presentation is provided in the Appendix.

NOTE: The contractor is responsible for knowing and complying with Federal, State, and local regulations. MCB Camp Lejeune environmental personnel will assist contractors with compliance issues; however, the primary burden of regulatory identification, familiarity, and compliance lies with the contractor. This training does not
replace any required regulatory training as per contract requirements. Required training should be completed *prior* to working at MCB Camp Lejeune.

### 3.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with contractor training. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

#### 3.1.1. Key Definitions

- **Explicitly Required Training.** Training expressly required by specific laws, regulations, or policies that apply due to the nature of work assignments, job functions, and/or specific licensing or certification requirements mandated by environmental laws, regulations, or policies.

- **Implicitly Required Training.** Instruction/information that is not expressly required by laws, regulations, or policies, but that may be reasonably inferred as being required to maintain compliance or is determined through EMS to reduce overall environmental risk.
3.1.2. Key Concepts

- **Comprehensive Environmental Training and Education Program (CETEP).** The USMC training program designed to ensure that high-quality, efficient, and effective environmental training, education, and information are provided at all levels of the USMC.

- **Environmental Management System (EMS).** The part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the Environmental Policy.

- **EMS Training.** All contractors are required to receive EMS training at the level necessary for their job function.

- **General Environmental Awareness Training.** Instruction designed to ensure that MCB Camp Lejeune and MCAS New River personnel become familiar with the installation environmental policies and programs for regulatory compliance, natural resource conservation, P2, and environmental protection. General EMS and Environmental Awareness Training for contractors and vendors is required for all MCB Camp Lejeune contractors. The training presentation is included as an Appendix to this document.
3.1.3. Environmental Management System

Training is potentially applicable to all EMS practices conducted aboard MCB Camp Lejeune.

3.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements concerning training, which include but may not be limited to the following:

- **Executive Order 13423.** Strengthening Federal Environmental, Energy, and Transportation Management. Requires implementation of an EMS at all appropriate organizational levels.

3.3. TRAINING REQUIREMENTS

3.3.1. General Environmental Awareness

In accordance with DoD instructions and MCO, the EMD at MCB Camp Lejeune has implemented a CETEP. A major component of the CETEP is to provide general environmental awareness training to all individuals associated with the installation, including contractors and vendors. Prior to or within 30 days of beginning work onsite, all contractors and their employees performing work aboard...
MCB Camp Lejeune must receive general environmental awareness training.

3.3.2. Environmental Management System

In addition to CETEP requirements, MCB Camp Lejeune has implemented an installation-wide EMS per EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and DoD and USMC EMS policy. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors and vendors) whose activities have the potential to impact the environment.

Prior to or within 30 days of beginning work onsite, all contractors and their employees performing work aboard MCB Camp Lejeune must receive EMS training.

3.3.3. Recordkeeping

Upon completion of the training materials included in the Appendix of the Contractor Environmental Guide, each employee must sign the Training Roster. The Contracting Representative must maintain these records in the contract file.

All training records, including other applicable environmental training, must be maintained onsite for review.
4.0 AIR QUALITY

The Air Quality Program is responsible for ensuring that the installation complies with all applicable Federal, State, and local air quality regulations. The ROICC or Contract Representative will provide a copy of BO 5090.6A, Air Quality Management, which has additional information.

4.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with air quality. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

4.1.1. Key Definitions

- **Criteria Pollutants.** Pollutants that the U.S. Environmental Protection Agency (EPA) Administrator has determined will cause or contribute to air pollution, that may reasonably be anticipated to endanger public health and welfare, and for which air quality criteria have been established (i.e., sulfur dioxide, nitrogen oxides,
ground-level ozone, carbon monoxide, lead, and particulate matter).

- **Dust-Causing Activity.** Any activity that has the potential to generate an excess level of dust, including but not limited to construction and demolition (C&D), blasting and sanding, construction of haul roads, land clearing, or fallow fields.

- **Hazardous Air Pollutants.** Air pollutants, as identified within 42 United States Code (USC) 7412, that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects.

- **Ozone-Depleting Substance.** Chemicals, such as certain refrigerants, that cause depletion of the stratospheric ozone layer—primarily chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) and their blends.

- **Particulate Matter.** A criteria air pollutant that includes dust, soot, and other small materials that are released into and transported by air.

- **Title V Operating Permit.** Permit issued under the Clean Air Act (CAA) Amendments of 1990 for all major sources of air pollution. All emission sources at the installation must be listed on the permit.

### 4.1.2. Key Concepts

- **Emission Sources.** Before beginning any emitting activity, please have the ROICC or Contract
Representative contact EMD to determine whether any permitting, monitoring, reporting, testing, and/or recordkeeping requirements apply.

- **Permitted Sources.** Ensure that construction/authorization permits are in place prior to beginning construction and/or prior to the arrival onsite of new or additional emission sources (emergency generators, paint booths, etc.).

### 4.1.3. Environmental Management System

Contractor activities associated with air quality include the following:

- Boat operation/maintenance
- Boiler operation
- Chlorination
- Degreasing
- Engine operation and maintenance
- Fueling and fuel management/storage
- Hazardous material (HM) storage/transportation
- Hazardous waste (HW) satellite accumulation area/HW transportation
- Live fire range operations
- Metal working
- Ozone-depleting substance (ODS)/halon management
- Paint booth operations/paint gun cleaning/paint removal
- Polishing
- Road construction and maintenance
- Rock-crushing operations
- Solid waste collection/transportation
- Storage tank management
- Unexploded ordnance (UXO)/explosives and ordnance disposal (EOD) operations
- Vehicle maintenance

The potential impacts of these activities on the environment include degradation of air quality, degradation of quality of life, and depletion of nonrenewable resources.

### 4.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding air quality, which include but may not be limited to:

- **Clean Air Act Amendments of 1990.** Protect human health and clean air resources by establishing standards and regulations for the control of air pollutants.
- **Title V Operating Permit.** Operating permit required for any major stationary source that emits or
has the potential to emit 100 tons per year or more of any criteria air pollutant and outlines the requirements to address and ensure air quality compliance.

- **BO 5090.6A, Air Quality Management.** Implements policies and procedures at the installation level that all personnel must follow in order to demonstrate compliance with the Title V permit and USMC requirements.

- **Base Bulletin 5090, Open Burning of Vegetative Debris.** Outlines procedures for conducting open burning in accordance with State regulations and installation procedures.

- **North Carolina Department of Air Quality (NCDAQ) Rules.** Outlines all State-specific air quality rules, control requirements, procedures for permits, and approvals contained in 15A North Carolina Administrative Code (NCAC) 02D, 02H, and 02Q applicable to North Carolina entities.

### 4.3. PERMIT REQUIREMENTS

The installation has a single permit, the CAA Title V Construction and Operating Permit, which includes all stationary air emission sources at the facility; therefore, all permit application submittals to the NCDAQ must be coordinated through the EMD. The NCDAQ will review and process the application and then issue a permit to construct and operate or to modify the emission source(s). A permit is required prior to the construction of any emission source. Timely submittal of the permit application is required to
obtain the final permit prior to commencing construction. The most common types of emission sources at the installation are as follows:

- Boilers
- Generators
- Engine test stands
- Surface coating/painting operations
- Paint removal (chemical and mechanical), abrasive blasting, or other surface preparation activities
- Fuel storage and fuel dispensing
- Grinding
- Woodworking
- Welding
- ODS/refrigerant recovery and recycling operations (industrial chillers, refrigerators, air conditioning compressors, cleaning agents, etc.)
- Bulk chemical and flammable materials storage

4.4. ADDITIONAL ACTIVITIES OF CONCERN

Contact the ROICC or Contract Representative for additional information regarding activities that do not
necessarily require modification to the Title V permit, but that must be coordinated with or tracked by EMD or the NCDAQ. Examples of these activities include, but are not limited to, the following:

- **Use, Maintenance, and Management of Refrigerants and other ODS.** Includes installation, recovery, replacement, conversion, or service of refrigerant-containing equipment (chillers, refrigerators, air conditioning condensers, etc.). All contractors will use Best Management Practices (BMPs) during refrigerant management activities. All Heating, Ventilation, and Air Conditioning (HVAC) technicians will maintain their appropriate State-specific licenses and present them to the ROICC or Contract Representative upon request.

- **Emergency Generators.** Includes the installation and temporary use of emergency generators during electrical failures and construction activities. All contractors will coordinate with the ROICC or Contract Representative to determine if the intended generator may be exempted or must be temporarily permitted for the intended use.

- **Open Burning (e.g., right-of-way clearing, storm debris burning).** Open burning activities aboard MCB Camp Lejeune and MCAS New River must coordinated through EMD and the Fire Department. Open burning activities are only permissible for land clearing and right-of-way maintenance when the following conditions are met:
The wind direction at the time the burning is initiated is away from any public transport roads within 250 feet so they are not affected by smoke, ash, or other air pollutants from the burning.

The location of the burning is at least 500 feet from any dwelling, group of dwellings, commercial or institutional establishment, or other occupied structure not located on the property on which the burning is conducted, unless an air curtain burner is used. If an air curtain burner is used, the regional office supervisor may grant exceptions to the setback requirements.

Heavy oils, asphaltic materials (e.g., shingles and other roofing materials), items containing natural or synthetic rubber, or any materials other than vegetative plant growth are not burned.

Initial burning must begin between 0800 and 1800. After 1800, no material may be added to the fire until 0800 the following day.

No fires may be started, and no vegetation may be added to existing fires, when the North Carolina Division of Forest Resources has banned burning for that area.

Burners that have the potential to burn more than 8,100 tons per year may be subject to Title V air quality permitting requirements.

Situations that require a regulatory exemption evaluation by the NCDAQ Regional Office
Supervisor are coordinated through EMD’s Environmental Quality Branch Air Quality Program Manager. The ROICC or Contract Representative will address any additional questions or provide a copy of Base Bulletin 5090, which contains a summary of the installation’s open burning requirements.

The four designated sites at MCB Camp Lejeune that are permitted for storing and/or burning storm debris are in the following areas: Mainside at the borrow pit near the Piney Green landfill, Courthouse Bay, Camp Johnson, and Camp Geiger. Only storm debris may be accumulated at these sites. EMD must notify the NCDAQ if the installation intends to burn the storm debris at one of these sites. Contact the ROICC or Contract Representative for more information.

- **Fire training outside of designated fire training pits.** State approval is required to conduct fire training outside of the designated fire training pits. First, complete the Notification of Open Burning for the Training of Firefighting Personnel form. The form is available at the following site: http://daq.state.nc.us/enf/openburn/ob_firetrain.pdf.

Before the training exercise, an accredited North Carolina Asbestos Inspector must inspect any structure to be burned to ensure that it is free from asbestos. Turn in the completed form to EMD for submittal to NCDAQ and the Division of Public Health, Health Hazards Control Unit. Contact the
ROICC or Contract Representative for additional information.

- **Dust-causing activities (e.g., concrete and rock crushing).** Wet suppression is required during the entire dust-causing operation. Ensure that an adequate water supply is available, and coordinate with the Fire and Emergency Services Division if access to a fire hydrant is necessary. Applicable wet suppression may be required during temporary concrete-crushing operations during C&D activities.

- **Noise Management.** USMC commands engaged in any activity resulting in noise emissions must comply with Federal, State, interstate, and local requirements for the control and management of environmental noise to minimize disruption to the local community. To the maximum extent practicable, personnel should limit the use of power tools, machinery, construction equipment, and other noisy devices to normal working hour
5.0 ENVIRONMENTAL EMERGENCY PLANNING AND RESPONSE

Environmental emergency planning and response can reduce injuries, protect employees, reduce asset losses, minimize downtime, and minimize environmental impacts of uncontrolled releases of pollutants to air, land, and water. The purpose of emergency planning is to prepare for, mitigate, respond to, and recover from environmental emergencies while minimizing any potential impacts to human health and the environment. Contractors operating aboard MCB Camp Lejeune must be aware of and adhere to all environmental emergency response procedures and notification requirements to minimize detrimental effects from inadvertent releases.

Procedures relating to emergencies caused by unforeseen site conditions are addressed in Section 5.0 of this guide. If an environmental emergency is identified, contact 911 immediately. Additional inquiries should be directed to the ROICC or Contract Representative.

5.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with environmental emergency response and spill response requirements. If you have any questions or concerns about the information in this section.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.
questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

5.1.1. Key Definitions

- **Berm.** A mound used to prevent the spread of a contaminant.
- **Discharge.** Any spilling, leaking, pumping, pouring, emitting, emptying, or dumping not explicitly permitted.
- **Navigable waters.** The waters of the United States and territorial seas, including waters that have been or may be used for commerce, waters subject to tidal flow, interstate waters and wetlands, and all other waters (intrastate lakes, rivers, streams, intermittent streams, flats, wetlands, sloughs, prairies, wet meadows, natural ponds, tributaries, etc.).
- **Petroleum, Oil, and Lubricant (POL).** A broad term that includes all petroleum and associated products or oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, vegetable oil, animal oil, sludge, oil refuse, and oil mixed with wastes.
- **Release.** Pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles) of any hazardous
chemical, hazardous substance, or extremely hazardous substance (EHS). Releases may be aboveground, belowground, or to water.

- **Spill Event.** The reportable discharge of oil into or upon the navigable waters of the United States or adjoining shorelines in harmful quantities, as defined by the Code of Federal Regulations (CFR) in 40 CFR 110.

### 5.1.2. Key Concepts

- **Environmental Emergency Response Contacts.** The following table identifies the emergency contact information for various spill scenarios. In addition to these emergency response contacts, the ROICC or Contract Representative should be notified immediately after an incident.

**Table 5-1. Environmental Emergency Response Contacts**

<table>
<thead>
<tr>
<th>For spills of:</th>
<th>Call:</th>
<th>Follow-up:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste</td>
<td>911</td>
<td>Spill Report</td>
</tr>
<tr>
<td>Unknown materials</td>
<td>911</td>
<td>Spill Report</td>
</tr>
<tr>
<td>Material on a permeable surface</td>
<td>911</td>
<td>Spill Report</td>
</tr>
</tbody>
</table>
Contractors have containment and cleanup responsibilities following a spill, and there may be additional follow-up reporting or requirements. Contact the ROICC or Contract Representative for additional guidance.

### 5.1.3. Environmental Management System

Environmental planning and response are potentially applicable to all EMS practices conducted aboard MCB Camp Lejeune.

### 5.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements regarding emergency response.

<table>
<thead>
<tr>
<th>For spills of:</th>
<th>Call:</th>
<th>Follow-up:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any amount of a POL or Hazardous Material</td>
<td><strong>911</strong></td>
<td>Spill Report</td>
</tr>
<tr>
<td>Material that reaches stormwater inlets or waterways</td>
<td><strong>911</strong></td>
<td></td>
</tr>
<tr>
<td>Nonhazardous waste</td>
<td>(910) 451-1482</td>
<td><strong>911</strong></td>
</tr>
</tbody>
</table>
and spill response procedures, which include but may not be limited to the following:

- **Clean Air Act of 1970, Section 112r** Mandates the prevention and control of air emissions and specifies emergency planning where the potential exists for accidental release of hazardous air pollutants.

- **Clean Water Act (CWA) of 1972**. Establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The CWA establishes that there should be no discharges of oil or hazardous substances into or upon the navigable waters of the United States or adjoining shorelines, which may affect natural resources under the management of the United States.

- **Comprehensive Environmental Response, Compensation, and Liability (CERCLA) Act of 1980**. Authorizes a Federal response to any release or threatened release of a hazardous substance into the environment. This act defines hazardous substances by reference to substances that are listed or designated under other environmental statutes.

- **Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, Section 304**. Establishes requirements for reporting a release to ensure a quick response by local emergency responders. Notification requirements apply to two chemical lists: the CERCLA Hazardous Substance list and the EHS list. The “List of Lists” provides a comprehensive identification of hazardous
substances and EHSs. In addition, facilities may be required to submit a list of their hazardous materials inventory maintained onsite or Safety Data Sheets (SDS) to response personnel.

- **Oil Pollution Act (OPA) of 1990.** Addresses oil storage at facilities and emphasizes preparedness and response activities. This act prohibits the harmful discharge of oil and hazardous substances into waters of the United States. The OPA requires contingency planning for “worst case” discharges and demonstrated response capabilities through planning, equipment, training, and exercises.

- **Resource Conservation and Recovery Act (RCRA) of 1976.** Protects human health and the environment from the hazards associated with hazardous waste handling, generation, transportation, treatment, storage, and disposal. Subtitle C of the RCRA requires owners and operators of hazardous waste facilities to develop comprehensive management plans that address spill prevention and cleanup.

### 5.3. SPILL NOTIFICATION

#### 5.3.1. POL/Hazardous Materials Spill Notification Procedures

In accordance with MCB Camp Lejeune notification requirements, any discharge of oil or hazardous materials must be immediately reported to the MCB Camp Lejeune Fire Department at 911.
MCB Camp Lejeune maintains a Spill Prevention, Control, and Countermeasures (SPCC) Plan that establishes procedures to prevent oil spills and documents existing oil spill prevention structures, procedures, and equipment. The Installation SPCC Plan provides general information for any type of response actions needed for spills aboard MCB Camp Lejeune. Contractors engaged in the handling and transfer of POL or hazardous materials must develop a Unit-Level Contingency Plan (ULCP) that addresses the spill response for their specific sites and potential spill types. This ULCP must be maintained onsite, and all personnel working within that site must be made aware of its location and use.

In the event of a spill, contact the ROICC or Contract Representative (after contacting emergency responders) to obtain a spill report form. Return the completed spill report form to EMD (fax to (910) 451-3471) and to the ROICC or Contract Representative. A copy of the spill report form is included as Attachment 5-1. The following information must be provided when reporting a spill:

- Name and phone number
- Location of spill (building, number, street)
- Number and type of injuries, if any
- Type and amount of spilled material
5.3.2. **Wastewater Spill and Water Line Break Notification**

Contractors operating aboard MCB Camp Lejeune and MCAS New River must be aware of water and wastewater utilities in their specific work/project area.

**Wastewater Spills**

In the event of a wastewater spill, report the incident to the Public Works Base Utilities at (910) 451-7190 (x225). In addition, report the incident immediately to the ROICC or Contract Representative. The following information must be provided:

- Name and phone number
- Location of spill (building number, street address)
- Type and amount of spilled material
- Source of the spill
- Action being taken, if any, to control the spill
- Estimated time of spill

Do not wait to report a spill, even if all of the required information is not immediately available.
Water Line Breaks

In the event of a water line break, report the incident to the Public Works Base Utilities at (910) 451-7190 (x225). In addition, report the incident immediately to the ROICC or Contract Representative. The following information must be provided:

- Name and phone number
- Location of spill (building number, street address)
- Reason for the break
- Estimated time of the break

5.4. FOLLOW-UP

If surface run-off is contaminated, the contractor will, under the advisement of the Fire Department or EMD, construct a temporary berm or containment area. Contaminated surface water will be removed in accordance with all safety and environmental requirements for the installation. Notify the Resource Conservation and Recovery Section (RCRS) at (910) 451-1482); the RCRS will provide concurrence for temporary containment areas and removal of contaminated runoff.

If solid or hazardous waste was generated as the result of a spill, refer to Sections 12.0 and 7.0 of this guide for disposal requirements.
Attachment 5-1

Spill Reporting Form
6.0 CULTURAL RESOURCES

MCB Camp Lejeune enjoys a rich history, and remnants of our past may be found throughout the real properties that make up the installation. All personnel at MCB Camp Lejeune are responsible for ensuring the cultural resources entrusted to the USMC care remain intact and available for future generations. Contractors are responsible for notifying the ROICC or Contract Representative immediately if they encounter suspected archaeological sites, artifacts, or human remains.

6.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with cultural resource management. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

6.1.1. Key Definitions

- Archaeological Resource. Defined by the Archaeological Resources Protection Act (ARPA) as any material remains of past human life or activities
that are at least 100 years old and are capable of providing scientific or human understanding of past human behavior and cultural adaptation, including the site on which the remains are located. Examples include pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials/remains, or any portion or piece of any of the foregoing items or structures. Non-fossilized and fossilized paleontological specimens, or any portion or piece thereof, are not considered archaeological resources unless found in an archaeological context. (According to the National Historic Preservation Act (NHPA) of 1966, some historic properties built within the past 50 years can achieve significance if they are of exceptional importance [National Register Criteria Consideration G].)

- **Cultural Resource.** A generic term for the collective evidence of the past activities and accomplishments of people, including buildings, structures, districts, sites, features, and objects of significance in history, architecture, archaeology, engineering, or culture, per MCO P5090.2A.

- **Effect.** Any condition of a project that may cause a change in the quality of the historic, architectural, archaeological, or cultural character of a property that qualifies it for listing in the National Register of Historic Places (NRHP). A project is considered to have an effect on a historic or cultural property when any aspect of the project changes the integrity of the
location, design, setting, materials, workmanship, feeling, or association of the property that contributes to its significance.

- **Historic Property.** Any prehistoric or historic district, site, building, structure, or object significant in U.S. history, architecture, archaeology, engineering, or culture and included, or eligible for listing in, the NRHP, per the NHPA and MCO P5090.2A.

- **State Historic Preservation Officer.** The person designated to administer the State Historic Preservation Program, including identifying and nominating eligible properties to the NRHP and administering applications for listing historic properties in the NRHP.

### 6.1.2. Key Concepts

- **Notification.** Contractors must notify the ROICC or Contract Representative if they encounter any cultural resources.

- **Policy.** DoD policy is to preserve significant historic and archaeological resources.

### 6.1.3. Environmental Management System

Contractor practices associated with cultural resources include the following:

- Construction/demolition/renovation
- Land clearing
• Road construction and maintenance
• Soil excavation/grading

The potential impacts of these activities on the environment include damage, destruction, alteration, theft, or demolition of historic properties.

6.2. OVERVIEW OF REQUIREMENTS

It is DoD policy to integrate the archeological and historic preservation requirements of applicable laws with the planning and management of activities under DoD control; to minimize expenditures through judicious application of options available in complying with applicable laws; and to encourage practical, economically feasible rehabilitation and adaptive use of significant historical resources.

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements regarding cultural resources, which include but may not be limited to the following:

• **BO 5090.8A.** Sets forth regulations and establishes responsibilities associated with management of archaeological and historic resources aboard MCB Camp Lejeune.

• **Archaeological and Historic Preservation Act (AHPA) of 1974 (16 USC 469 et seq.)** Amends the Reservoir Salvage Act to extend its provisions beyond the construction of dams to any terrain alteration resulting from any Federal construction
project or federally licensed project, activity, or program.

- **Archeological Resources Protection Act of 1979 (16 USC 470 et seq.)** Requires Federal land managers to issue permits for the excavation or removal of artifacts from lands under their jurisdiction. The ARPA requires that relevant Native American tribes be notified of permit issuance if significant religious or cultural sites will be affected. It prohibits the excavation, damage, alteration, theft, or defacement of an archaeological site or artifacts unless permitted by the Federal land manager.

- **DoD Directive 4710.1, Archaeological and Historic Resources Management.** Provides policy for the management of archaeological and historic resources on land and in water under DoD control.

- **EO 11593, May 13, 1971.** Requires all Federal agencies to administer cultural properties under their control. Agencies are required to direct their policies, plans, and programs so that significant sites and structures are preserved.

- **Historic Sites, Buildings, and Antiquities Act of 1935 (Public Law 74-292, 16 USC 461 et seq.).** States that it is Federal policy to preserve historic and prehistoric properties of national significance.

- **National Environmental Policy Act (NEPA) of 1969 (42 USC 4321 et seq.).** States that it is Federal government policy to preserve important historic, cultural, and natural aspects of our national heritage
and requires the consideration of environmental concerns during project planning and execution.

- **National Historic Preservation Act of 1966 (16 USC 470 et seq.).** Establishes historic preservation as a national policy and requires Federal agencies undertaking actions that may affect NRHP-eligible historic properties to consult State historic preservation offices and the Advisory Council on Historic Preservation. Section 110 of NHPA requires Federal agencies to inventory, evaluate, identify, and protect cultural resources that are determined eligible for listing in the NRHP.

- **Public Buildings Cooperative Use Act of 1976 (Public Law 94-541).** Encourages adaptive reuse of historic buildings as administrative facilities for Federal agencies.

- **Title 36 CFR Part 65, National Historic Landmarks Program.** Identifies and designates National Historic Landmarks, and encourages the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.
6.3. PROCEDURES

All contractors are expected to follow these procedures:

- Notify the ROICC or Contract Representative immediately concerning any encounter with suspected archaeological sites, artifacts, human remains, or any other suspected cultural resources during contractor activities.

- Stop work in the immediate area of the discovery until directed by the Contract Representative to resume work.

Be particularly aware of surroundings when working in a designated historic area. The Camp Lejeune Installation Geospatial Information & Services Office of the Geospatial Services Division can provide resource mapping of known cultural resource areas for all planners, project managers, contractors, and others, through formal request. The ROICC or Contract Representative will assist with making arrangements to request access for Geographic Information System mapping.
Figure 6-1. Possible Cultural Resource Discovery Flow Chart
7.0 HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT

All persons on a USMC installation are subject to compliance with Federal, State, and local regulations and permit conditions addressing the proper management of hazardous materials and waste. Mishandling these wastes and materials may result in violation notices, fines, and/or penalties. The EPA regulates hazardous wastes through the RCRA, which provides specific regulatory definitions for hazardous waste and its management. The RCRA governs all hazardous waste from the point of generation to ultimate disposal, including hazardous waste generated by contractors aboard MCB Camp Lejeune and MCAS New River. Hazardous materials, including those used by contractors aboard the installation, are also regulated by the EPCRA. Additionally, the North Carolina Department of Environmental Quality (NCDEQ) has issued more stringent rules and regulations governing hazardous materials and hazardous waste management that also apply to contractors.

7.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with hazardous materials (HM), hazardous wastes (HW), and their management. If you have any questions or concerns about the information in this section, Direct questions or concerns about the information in this section to the ROICC or Contract Representative.
please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

7.1.1. Key Definitions

- **90-day Accumulation Area.** These areas are used to store HW temporarily until it is either manifested and shipped off site for disposal or transferred to a permitted storage facility. HW may be accumulated for up to 90 days in these areas. MCB Camp Lejeune’s 90-day accumulation facility is located on Michael Road.

- **Generator.** Any person whose activity or process produces HW or whose activity or process subjects HW to regulation.

- **Hazardous Material.** A chemical compound, or a combination of compounds, posing or capable of posing a significant risk to public health, safety, or the environment as a result of its quantity, concentration, or physical/chemical/infectious properties.

- **Hazardous Waste.** Any discarded material (including solid, liquid, or gas) or combination of discarded materials which, due to quantity, concentration, or physical, chemical, or infectious characteristics may:
  - Cause or significantly contribute to an increase in mortality or cause a serious irreversible or incapacitating reversible illness; or
Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

- **Manifest.** A document that allows all parties involved in HW management (e.g., generators, transporters, disposal facilities, EPA, State agencies) to track the movement of HW from the point of generation to the point of ultimate treatment, storage, or disposal. All HW manifests for waste generated aboard MCB Camp Lejeune must be reviewed and released by personnel from the Resource Conservation and Recovery Section, EMD, who can be contacted at (910) 451-1482.

- **Non–RCRA-Regulated Waste.** Waste that is not regulated or is exempt from regulation under RCRA HW requirements but has other regulatory requirements for proper management.

- **Satellite Accumulation Area (SAA).** Designated areas at or near the point of generation, where HW is accumulated. Generators may accumulate up to 55 gallons of HW or one quart of acute HW at a satellite area for an indefinite amount of time. When 55 gallons of HW (or 1 quart of acute HW) are exceeded, the generator must date the container and transfer it to an approved 90-day site or long-term HW storage facility within 72 hours. EMD authorization for an SAA must be obtained and posted at the site. EMD authorization will establish individual limits for each SAA. No SAA
authorizations will exceed 55 gallons of HW or 1 quart of acute HW. In accordance with installation policy, HW in an SAA should not be stored longer than 365 days, even if the container is not full.

- **Safety Data Sheet (SDS).** A document that provides information about (1) chemical properties, environmental hazards, and health hazards; and (2) protective measures, along with safety precautions, for handling, storing, and transporting hazardous chemical products. The Hazard Communication Standard (HCS), 29 CFR 1910.1200(g), was revised in 2012 to mandate the use of a single Globally Harmonized System of Classification and Labelling of Chemicals (GHS) by manufacturers, distributors and importers to communicate information on chemical-related hazards. The information contained in the SDS is standardized in a 16-section format. Employers must ensure that the SDSs for all hazardous chemicals in the workplace are readily accessible to employees.

- **Treatment.** Any method, technique, or process designed to change the physical, chemical, or biological character or composition of any HW to neutralize the waste; or to recover energy or material resources from the waste; or to render such waste nonhazardous or less hazardous, safer to transport, store, or dispose of, or amenable for recovery or storage, or reduction in volume.

- **Treatment, Storage, and Disposal (TSD) Facilities.** TSD facilities conduct HW treatment,
storage, or disposal operations and require an RCRA part B permit for final approval to operate. The part B permit is maintained to accurately identify the most current operations at the TSD facility. MCB Camp Lejeune does not have a TSD facility.

- **Universal Waste (UW).** UW regulations streamline HW management standards for batteries, pesticides, mercury-containing equipment, and fluorescent lamps. The regulations govern the collection and management of these widely generated wastes, thus facilitating environmentally sound collection and proper recycling or treatment. In North Carolina, batteries, thermostats, obsolete agricultural pesticides, and fluorescent lamps may be managed under the UW Rule. UW must be transferred off site within 1 year of the date when the material was first identified as waste.

- **Used Oil.** Any oil that has been refined from crude oil or synthetic oil and, as a result of use, storage, or handling, has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. Used oil may be suitable for further use and is economically recyclable; therefore, it is managed as a separate category of material.

### 7.1.2 Key Concepts

- **HW Management.** The systematic control of the collection, source separation, storage, transportation, processing, treatment, recovery, and disposal of HW. In addition, HW Management includes processes to
reduce the HW’s effect on the environment and to recover resources from it.

- **HW Minimization.** The USMC policy is to reduce the quantity of HW disposed of by source reduction, recycling, treatment, and disposal. The highest priorities are reducing HW generation, and recycling. The goal of the USMC is to achieve continuous reduction of HW generation through P2 initiatives, BMPs, and use of the best available demonstrated technology.

- **National Fire Protection Association.** The U.S. trade association that creates and maintains private, copyrighted standards and codes, including the diamond hazard label in Figure 7-1, which is used by emergency personnel to quickly and easily identify the risks posed by hazardous materials.
### Diamond Hazard Label

**Health Hazard**

- **4 Extreme**: Highly toxic - May be fatal on short-term exposure.
- **3 Serious**: Toxic - Full protective suit and breathing apparatus should be worn.
- **2 Moderate**: Breathing apparatus and face mask must be worn.
- **1 Slight**: Breathing apparatus may be worn.
- **0 Minimal**: No precautions necessary.

**Flammability Hazard**

- **4 Extreme**: Extremely flammable gas or liquid. Flash Point below 73°F.
- **3 Serious**: Flammable. Flash Point 73°F to 100°F.
- **2 Moderate**: Combustible. Requires moderate heating to ignite. Flash Point below 200°F.
- **1 Slight**: Slightly combustible. Requires strong heating to ignite.
- **0 Minimal**: Will not burn under normal conditions.

**Specific Hazard**

- **Oxidizer**: OXY
- **Acid**: ACID
- **Alkali**: ALK
- **Corrosive**: COR
- **Use NO WATER**: W
- **Radiation**: ⚡

**Instability Hazard**

- **4 Extreme**: Explosive at room temperature.
- **3 Serious**: May detonate if shocked or heated under confinement or mixed with water.
- **2 Moderate**: Unstable. May react with water.
- **1 Slight**: May react if heated or mixed with water.
- **0 Minimal**: Normally stable. Does not react with water.

*Figure 7-1. Diamond Hazard Label*
7.1.3 Environmental Management System

Contractor practices associated with HM and HW management include, but are not limited to, the following:

- Battery management
- Boat operation/ maintenance
- Boiler operation
- Building operation/ maintenance/repair
- Chlorination
- Cooling tower operation and maintenance
- Construction/renovation/ demolition
- Degreasing
- Drinking water management
- Engine operation and maintenance
- Equipment operation/ maintenance/disposal
- Fueling and fuel management/storage
- Habitat management
- HCP operation
- HM storage
- HM transportation
- HW disposal offsite transport
- HW satellite accumulation area
HW storage (<90 days)
HW transportation
Laboratory
Landscaping
Laundry
Live fire range operations
Metal working
Non-destructive inspection
ODS/halon management
Paint gun cleaning
Paint removal
Painting
Parts replacement
Pesticide/herbicide management and application
Polishing
Pumping station/force main
Range residue clearance
Recreational facilities operation
Roofing kettle
Sidewalk and road deicing
Storage tank management
Swimming pool operation and maintenance
Universal waste storage/collection

UXO/EOD operations

Vehicle maintenance

The potential impacts of these activities on the environment include depletion of the HW landfill, depletion of non-renewable resources, and degradation of soil quality.
7.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements regarding HM and HW, which include but may not be limited to the following:

- **BO 5090.9, Hazardous Material/Waste Management/Air Station Order (ASO) 5090.2, Environmental Compliance and Protection Program for MCAS New River.** Establishes procedures and general responsibilities for the disposal of HM and HW under environmental permits and authorizations.

- **Emergency Planning and Community Right-to-Know Act.** Establishes requirements regarding emergency planning and the reporting of hazardous chemical storage and use.

- **Hazardous Material Transportation Act (HMTA) of 1975.** The principal Federal law regulating the transportation of HM. Established to mitigate the risks to health, property, and the environment inherent in the transportation of HM in intrastate, interstate, and foreign commerce. The HMTA is administered by the U.S. Department of Transportation (DOT) and regulates the shipping, marking, labeling, placarding, and recordkeeping requirements for HM, including HW and military munitions.
• **Resource Conservation and Recovery Act of 1976.** Establishes standards for HW generators as necessary to protect human health and the environment by instituting statutory standards for generators and transporters of HW that will ensure the following: proper recordkeeping and reporting; use of a manifest system; use of appropriate labels and containers; containerization and accumulation time; and proper management of TSD facilities. In addition, it gives the EPA and State agencies authority to access facility premises and all records regarding HW management.

• **40 CFR Subchapter I (Parts 260–299), Solid Wastes.** Federal regulations promulgated under the 1976 RCRA that regulate HW management, generators, transporters, and owners or operators of TSD facilities. North Carolina has adopted the Federal HW rules by reference.

Because the installation is designated as a Large Quantity Generator (LQG) of HW, all HW generated aboard MCB Camp Lejeune must meet the regulatory requirements of this generator designation. An LQG may maintain three types of HW accumulation/storage areas: satellite, 90-day, and permitted. Typically, HW is accumulated at an SAA and later transferred to a 90-day or permitted storage area.

Both MCB Camp Lejeune and MCAS New River maintain Hazardous Waste Management Plans (HWMPs) that outline the specific requirements for managing HM and HW. The HWMP identifies and provides guidance to implement all regulatory HW management activities and is available to all
personnel who accumulate, generate, transport (including on-installation transportation), treat, store, or dispose of HW.

Contractors are responsible for the management of all HM and the ultimate disposition of any HW generated aboard MCB Camp Lejeune during a contract performance period. The ROICC or Contract Representative will contact Environmental personnel, who will provide additional guidance and oversight to verify compliance with applicable Federal, State, and local laws governing the generation, handling, and disposal of HM, HW, UW, used oil, petroleum-contaminated materials, RCRA-regulated HW, and non-RCRA-regulated waste.

Depending on the type of project, contractors may be required to submit a site-specific HWMP to the ROICC or the Contract Representative prior to beginning work. Additionally, the Contracting Officer may require a Contractor Hazardous Material Inventory Log and corresponding SDSs for all materials to be used during the execution of the contract. EMD/EAD will use the SDSs to help contractors establish their Hazardous Material Storage and SAAs.
7.3. HAZARDOUS MATERIALS REQUIREMENTS

If a project uses HM:

- Reduce/reuse/recycle when possible; meet contract requirements for recycling.

- Segregate incompatible materials. Consult the SDS or material manufacturers with questions about a material’s compatibility. Some examples of incompatible materials likely to be used by contractors are:
  
  o **Corrosives** (e.g., batteries, stripping and cleaning compounds containing acids or bases) and **Flammables** (e.g., fuels, oils, paints, and adhesives)

  o **Corrosives and Oxidizers** (e.g., peroxide, perchlorates, sodium hypochlorite/bleach, or calcium hypochlorite)

  o **Oxidizers and Flammables**

- All compatible materials should be segregated and stored within designated storage lockers or cabinets (i.e., flammable materials should be stored in designated flammable storage lockers or cabinets, and corrosives should be stored in designated corrosives storage lockers or cabinets).
- Do not store large quantities of materials. Keep on hand only what can be used.

- Maintain an inventory of all HM maintained onsite, with adequate controls in place to prevent unauthorized access.

- Do not dump any HM into floor drains, sinks, oil-water separators (OWSs), or storm drains, or onto the ground.

- Store containers that hold 55 gallons or more (including in-use electrical generators and portable equipment) in proper secondary containment. Permanent secondary containment must be inspected weekly, temporary secondary containment must be inspected daily; all inspections and drainage of stormwater from secondary containment must be documented.

- Maintain SDSs and appropriate spill control/cleanup materials onsite at all times.

- Provide HM storage and usage information for regulatory reporting to the appropriate environmental office upon request.

- Stop work immediately if a project unearths any unknown HM (e.g., munitions and explosives of
concern [MEC], discarded military munitions [DMM], or unexploded ordnance [UXO]), and immediately report the situation to the ROICC or Contract Representative.

- Do not leave HM (or HW) onsite once the contract is completed. Remove it from the installation or make arrangements through the ROICC or Contract Representative to contact RCRS or EAD for turn-in procedures upon completion of the contract.

### 7.4. UNIVERSAL WASTE REQUIREMENTS

The NCDEQ allows thermostats, obsolete agricultural pesticides, lamps, and certain types of batteries to be managed as UW. UW has less stringent requirements for storage, transport, and collection, but it must still comply with full HW requirements for final recycling, treatment, or disposal. Federal UW requirements are outlined in 40 CFR 273. Contact the ROICC or Contract Representative regarding any additional direction or questions on the handling of UW.

All UW must be properly containerized, stored, and labeled when the waste is first generated. Containers/areas for accumulating UW must be labeled as follows:

- **Words:** UNIVERSAL WASTE.
- **Content:** Noun name found on the specific Hazardous Waste Profile Sheet (DRMS Form 1930), which is available from EMD (e.g., batteries,
fluorescent lamps, pesticides, mercury-containing equipment).

- Accumulation Start Date (ASD): The ASD must be marked on the subject container as soon as the UW item is placed in the container. Storage of UW cannot exceed 365 days.

- Number of Containers: The number of containers marked reflects the total number of containers disposed of within the current document (i.e., 1 of 1, etc.).

Contractors who need UW accumulation areas should contact the ROICC or Contract Representative, who will contact RCRS or EAD personnel to help contractors establish an accumulation area for UW. Key points for this process:

- The containers must be under the control of the contractor generating the waste and must be closed at all times except when waste is being adding.

- Per installation policy, UW containers/areas must be inspected weekly using the Weekly Hazardous Waste (HW) Site Inspection Form, included as Attachment 7-1 and Attachment 7-2. Written records noting discrepancies and corrective actions must be maintained onsite for 3 years. Copies of inspection reports should be provided to the ROICC or Contract Representative.

- When the ASD reaches 1 year, or when the container is full, the waste generator has 72 hours (3 days) to arrange for the transportation of the UW to an RCRA
Part B permitted storage area. Contact the ROICC or Contract Representative to coordinate the removal of the UW when the container is full or the contract is finished.

7.5. HAZARDOUS WASTE REQUIREMENTS

The appropriate environmental office must be notified before any HW is generated on projects managed by the ROICC or the Facilities Support Contracts (FSC). Have the ROICC or Contract Representative contact RCRS or EAD with questions regarding whether or not a waste meets the definition of HW. Installation personnel must approve all regulated waste and HW storage locations.

If a project generates HW:

- Minimize generation through waste minimization and P2 techniques.
- Have the ROICC or Contract Representative contact RCRS or EAD with questions regarding how to manage the waste. Do not mix waste types (e.g., used oil rags and solvent rags).
- Have the ROICC or Contract Representative contact RCRS or EAD for turn-in procedures as wastes are
generated, to determine if waste can be disposed of on the installation.

- Do not dump any HW into floor drains, sinks, OWSs, or storm drains, or onto the ground. Do not place HW into general/municipal trash dumpsters.
- Ensure that HW drums are properly labeled and lids are secured (wrench tight).
- Ensure that SAAs are managed properly and storage limits are not exceeded; have the ROICC or Contract Representative consult RCRS or EAD prior to creating a new SAA.

### 7.5.1. Storage

All HW must be properly containerized, stored, and labeled at the time the waste is first generated. HW must be stored in containers that meet applicable DOT specifications. HW labels, as required by the EPA and the NCDEQ, must contain the following information:

- **Words:** HAZARDOUS WASTE.
- **Content:** Noun name found on the specific Hazardous Waste Profile Sheet (DRMS Form 1930) provided by RCRS or EAD.
- **ASD:** For HW accumulated in an SAA, the ASD will be affixed once the container is filled or at the 1-year anniversary, whichever comes first.
- **Number of Containers:** Reflects the total number of containers (e. g., 1 of 1, etc.).
Any HW generated by contractors must be stored in an SAA. Contractors who need an SAA should contact the ROICC or Contract Representative, who will contact RCRS or EAD personnel to help the contractor establish each SAA. A summary of procedures follows:

- The HW generator may accumulate as much as 55 gallons of a specific HW stream (or up to one quart of acute HW) in a container at or near the point of generation.

- The containers must be under the control of the contractor generating the waste and must be kept closed (wrench tight) at all times except when waste is being added.

- HW containers must be inspected weekly using the *Weekly Hazardous Waste (HW) Site Inspection Form*, included as Attachment 7-1 and Attachment 7-2. Written records noting discrepancies and corrective actions must be maintained for a period of 3 years. Copies of inspection reports should be provided to the ROICC or Contract Representative.

- The generating contractor must monitor the level of waste in the SAA container and contact the ROICC or Contract Representative to coordinate disposal or determine if the contractor can turn in the HW to RCRS or EAD before the container is full. If the SAA container becomes full, the generating contractor has 72 hours (3 days) to arrange for the transport of the HW to an RCRA Part B permitted...
storage area. Storage of HW in an SAA should not exceed 365 days, even if the container is not full.

7.5.2. Manifesting and Disposal

All disposal of HW generated by contractors must be coordinated with the installation. HW and UW generated aboard MCB Camp Lejeune and MCAS New River must be transported off the installation by a permitted HW transporter and must include a Uniform Hazardous Waste Manifest form (EPA Form 8700-22) or an equivalent approved manifest. The following procedures must be followed for disposal of HW:

- Use the MCB Camp Lejeune or MCAS New River EPA identification number for disposal of all contractor-generated HW.

- HW may only be transported by authorized personnel or permitted companies. Prior to transportation offsite, the HW generator must ensure that all DOT requirements for labeling, marking, placarding, and containerizing are met. The HW generator must also ensure that the transporter has obtained the installation’s EPA identification number for the transportation of HW and that an appropriate waste manifest accompanies each shipment.

Only personnel from EMD who have been designated in writing by the MCB Camp Lejeune Commanding General can sign the hazardous waste manifest.
The HW manifest can only be signed by personnel from the installation who have been designated in writing by the CG. The ROICC or Contract Representative should contact RCRS or EAD about manifesting regulated and non-regulated wastes offsite. Under NO circumstances can a contractor, ROICC, or Contract Representative sign a HW manifest or use another EPA identification number for wastes generated at the installation.

All HW must be submitted to a permitted TSD facility. HW generators must certify that the facility receiving the waste employs the most practical and current treatment, storage, or disposal methods for minimizing present and future threats to human health and the environment.

7.6. NON–RCRA-REGULATED WASTE REQUIREMENTS

Non-RCRA-regulated wastes include used oil (when recycled), non-terne (tin and lead alloy) plated oil filters (not mixed with listed waste), CFC refrigerants (from totally enclosed equipment), certain wastes containing Polychlorinated Biphenyl (PCB), asbestos, and batteries not managed as UW.

7.6.1. Used Oil and Oil Filters

Used motor oil itself is not regulated as HW in North Carolina if it is recycled or burned for energy recovery. If used oil is not recycled, the generator must determine prior to disposal whether it is HW. Used oil must be collected in
drums or another approved container marked “Used Oil.” If the used oil storage container has a volume of 55 gallons or more, it must be stored in secondary containment.

- Do not dump used oil into drains, sinks, or trash containers, or onto the ground.
- Do not store used oil in open buckets or drip pans, damaged or rusted containers, or containers that cannot be fully closed.
- Do not mix used oil with other waste materials.

Terne plated oil filters contain an alloy of tin and lead. They are considered a hazardous waste due to their lead content and are typically located on industrial and heavy duty vehicles and equipment. All other used oil filters are not regulated as HW in North Carolina, as long as they are not mixed with listed HW. To qualify for this exclusion, the following conditions must be met:

- Used oil filters must be gravity hot-drained by puncturing the filter anti-drain back valve or filter dome and hot draining into a “Used Oil” storage drum. “Hot-drained” means that the oil filter is drained at a temperature that approximates the temperature at which the engine operates.
- Any incidental spillage that occurs must be cleaned up with a dry sweep, rags, or “absorbent matting.”
- Drained used oil filters must be collected in a container that is in good condition and is labeled with the words “Drained Used Oil Filters.”
• No other waste streams should be deposited in containers collecting used oil filters for disposal.

• Coordinate with the ROICC or Contract Representative to determine if the drained used oil filters can be given to RCRS or EAD.

7.6.2. Used Antifreeze

Antifreeze is composed of regulated chemicals, including ethylene glycol and propylene glycol, and during typical use may become contaminated with traces of fuel or metal particles (i.e., lead, cadmium, or chromium). It may also become HW if it has been mixed with other wastes, such as gasoline or solvents. Additional characterization may be required to determine whether or not used antifreeze is HW. Used antifreeze that is not recycled may be regulated as HW if the results from the Toxic Characteristics Leaching Procedure (TCLP) indicate metal contents that meet or exceed RCRA thresholds.

The State of North Carolina does not regulate used antifreeze as HW, as long as it is recycled by reuse, distillation, filtration, or ion exchange. Used antifreeze must be stored in closed containers on an impermeable concrete surface with adequate spill controls (secondary containment, appropriate stocked spill kits, etc.). Contact the ROICC or Contract Representative to determine if used antifreeze can be given to RCRS or EAD.
7.6.3. Petroleum-Contaminated Wipes and Oily Rags

Petroleum-contaminated wipes and oily rags are to be managed as non-regulated waste. Follow these procedures:

- Store oil-contaminated wipes and oily rags in metal containers because of their flammability/combustibility and to protect them from the weather.
- Do not throw these non-regulated waste items into solid waste dumpsters or garbage cans.
- Contact the ROICC or Contract Representative to determine if petroleum-contaminated wipes and oily rags can be given to RCRS or EAD.

7.6.4. Used Electronic Equipment

Used electronic equipment may contain lead solder or PCB oils (e.g., light ballast). Turn in these items as they are generated. Have the ROICC or Contract Representative contact RCRS or EAD for proper handling and/or turn-in procedures.

7.6.5. New and Used Batteries (Not Regulated as Universal Waste)

- Store compatible batteries together (i.e., lithium batteries should be stored with other lithium batteries).
• Store batteries off the ground to prevent them from coming into contact with water.
• Store lead-acid batteries away from an open flame.
• Place rechargeable batteries in plastic bags before storing them with other rechargeable batteries.
• Do not dispose of batteries unless authorized.
• Have the ROICC or Contract Representative contact RCRS or EAD for proper handling and/or turn-in procedures.
Attachment 7-1

Weekly Hazardous Waste (HW) Site Inspection Form

MCB Camp Lejeune
MCB Camp Lejeune Weekly Hazardous Waste (HW) Site Inspection
Universal Waste (UW)/Satellite Accumulation Area (SAA)

Building Number/location of HW Site: _________________
Unit Evaluated: ________________________________
Evaluation Date: _____/_____/_____
Evaluation By (Site Manager): ________________
Evaluation Time: __________________

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>YES</th>
<th>NO</th>
<th>Location of Discrepancy and Proposed Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is housekeeping maintained in acceptable manner?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Is any HW present at the site?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Are HW containers properly marked?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4. Are HW containers in serviceable condition?</td>
<td></td>
<td></td>
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<tr>
<td>5. Are container bungs, caps, and openings properly secured?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6. Is a unit spill plan/activation prominently posted?</td>
<td></td>
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</tr>
<tr>
<td>7. Is 911 spill response sign posted?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Are &quot;Danger-Unauthorized Personnel Keep Out&quot; signs posted so they may be seen from any approach?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Are &quot;No Smoking&quot; signs posted?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QUESTION</td>
<td>YES</td>
<td>NO</td>
<td>Location of Discrepancy and Proposed Corrective Action</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>10. Does the site have emergency communication system or two-man rule in effect? If the two-man rule is implemented, is a sign posted with the legend &quot;Two-Man Rule in Effect&quot;?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Are properly charged fire extinguishers, as well as eye wash stations, present and inspected at least monthly?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Is the post indicator valve in good operating condition and secured in the closed position, and are there any structural defects such as cracked concrete?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Is the proper spill response equipment readily available?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Is the site designated and recognizable, and is the EMD Authorization posted within the site as to be visible to personnel placing waste into the container? (SAA site only)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Are all HWs properly segregated and stored in the designated site?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Are any hazardous materials being stored in the Satellite Accumulation Area or &lt; 90-day storage site?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Attachment 7-2

Weekly Hazardous Waste (HW) Site Inspection Form
MCAS New River
# Weekly Hazardous Waste Storage Area Inspection Form

**Squadron:** ____________  **Inspector:** ________________

**Date:** ____________  **Signature:** ________________

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Corrective Actions or N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the HW container located at or near the point of generation?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Is the HW container DOT approved?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Is the HW container marked correctly with the words “Hazardous Waste,” correct noun name of contents, NSN’S and unit designator?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Is the HW container closed and wrench tight when no one is adding to the container?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. If a funnel is left in place, does that funnel have a plug or ball valve to be considered closed or secured?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Is the HW container in good condition? (No excessive rust or dents in critical areas, seals are in place, no bulging or collapsing and no signs of spillage or leakage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Is the Spill Contingency Plan posted and in plain view?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Is the SAA Site approval letter from EAD posted at the SAA site?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Is the SAA Site limited to Authorized Personnel only?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
<td>Corrective Actions or N/A</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>--------------------------</td>
</tr>
<tr>
<td>10. Is the HW container below the proper ullage for a liquid to expand? (4 inches from the top)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Are SAA HW containers moved to the 90-Day Site within 72 hours when filled to the proper ullage or weight capacity of the container?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. (90-Day Site only) Are all palletized waste streams correctly marked with “Hazardous Waste” or “Universal Waste,” noun name of the waste, NSN and unit designator on the pallet or wall of the waste structure?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. (90-Day Site only) Are all HW containers turned in prior to the 90th day after the ASD?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Are adequate spill response supplies readily available for use in case of spill or leakage?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Is there a means of emergency communication between storage facilities and working spaces?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Is the SAA site or 90-Day Site in a good state of police?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### NAVOSHENVTRACEN COMPATIBILITY CHART

<table>
<thead>
<tr>
<th>HMG Group</th>
<th>Group Name</th>
<th>Examples</th>
<th>Incompatible Materials</th>
<th>Examples</th>
<th>Reaction if Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACIDS</td>
<td>Hydrofluoric Acid, Acetic Acid</td>
<td>FLAMMABLES/COMBUSTIBLES</td>
<td>Acetic Acid</td>
<td>Heat, Violent Reaction</td>
</tr>
<tr>
<td>2</td>
<td>ADSORPTION</td>
<td>Ammonia, Hydrochloric Acid</td>
<td>EXPLOSIVE</td>
<td>Hydrochloric Acid</td>
<td>Fire Hazard</td>
</tr>
<tr>
<td>3</td>
<td>ALKALOIDS</td>
<td>Calcium Hydroxide, Sodium Hydroxide</td>
<td>SENSITIZATION</td>
<td>Sodium Hydroxide</td>
<td>Heat</td>
</tr>
<tr>
<td>4</td>
<td>A.I.PLANTS</td>
<td>Osmium Tetroxide, Platinum Sulfide</td>
<td>CORROSIVE</td>
<td>Osmium Tetroxide</td>
<td>Heat</td>
</tr>
<tr>
<td>5</td>
<td>COMBUSTIBLES</td>
<td>Ethanol, Methanol</td>
<td>REACTS WITH WATER</td>
<td>Methanol</td>
<td>Heat</td>
</tr>
<tr>
<td>6</td>
<td>EXPLOSIVE</td>
<td>Ammonium Nitrate, Nitrocellulose</td>
<td>HEAT SENSITIVE</td>
<td>Nitrocellulose</td>
<td>Heat</td>
</tr>
<tr>
<td>7</td>
<td>DETERGENTS</td>
<td>Sodium Dodecyl Sulfate, Sodium Lauryl Ether Sulfate</td>
<td>HEAT SENSITIVE</td>
<td>Sodium Dodecyl Sulfate</td>
<td>Heat</td>
</tr>
<tr>
<td>8</td>
<td>LIQUID OXIDIZERS</td>
<td>Peroxide, Hydrogen Peroxide</td>
<td>HEAT SENSITIVE</td>
<td>Peroxide</td>
<td>Heat</td>
</tr>
<tr>
<td>9</td>
<td>EXPLOSIVE</td>
<td>Nitroglycerin, RDX</td>
<td>EXPLOSIVE</td>
<td>Nitroglycerin</td>
<td>Fire Hazard</td>
</tr>
<tr>
<td>10</td>
<td>FUZE/EXPLOSIONS</td>
<td>Pyrolytic Gel, Detonating Gel</td>
<td>EXPLOSIVE</td>
<td>Pyrolytic Gel</td>
<td>Fire Hazard</td>
</tr>
<tr>
<td>11</td>
<td>LUBRICATING OILS</td>
<td>Petroleum Solvent, Motor Oil</td>
<td>EXPLOSIVE</td>
<td>Petroleum Solvent</td>
<td>Fire Hazard</td>
</tr>
<tr>
<td>12</td>
<td>FIRE PROTECTION</td>
<td>Intumescent Paint, Foam</td>
<td>TOXIC</td>
<td>Intumescent Paint</td>
<td>Toxic</td>
</tr>
<tr>
<td>13</td>
<td>HEAVY METALS</td>
<td>Chrome, Copper</td>
<td>EXPLOSIVE</td>
<td>Chrome</td>
<td>Heat</td>
</tr>
<tr>
<td>14</td>
<td>POLISHING PADS</td>
<td>Sandpaper, Steel Wool</td>
<td>EXPLOSIVE</td>
<td>Sandpaper</td>
<td>Heat</td>
</tr>
<tr>
<td>15</td>
<td>SOLVENTS</td>
<td>Methylene Chloride, Toluene</td>
<td>VAPOR HAZARD</td>
<td>Toluene</td>
<td>Vapour</td>
</tr>
<tr>
<td>16</td>
<td>THERMAL INSULATION</td>
<td>Glasswool, Ceramic Fiber</td>
<td>VAPOR HAZARD</td>
<td>Glasswool</td>
<td>Vapour</td>
</tr>
<tr>
<td>17</td>
<td>WATER PESTICIDES</td>
<td>Pesticides, Herbicides</td>
<td>VAPOR HAZARD</td>
<td>Pesticides</td>
<td>Vapour</td>
</tr>
<tr>
<td>18</td>
<td>HEAVY METALS</td>
<td>Iron, Steel</td>
<td>VAPOR HAZARD</td>
<td>Iron</td>
<td>Vapour</td>
</tr>
<tr>
<td>19</td>
<td>RUST INHIBITORS</td>
<td>Chrome Plating, Zinc Plating</td>
<td>VAPOR HAZARD</td>
<td>Chrome Plating</td>
<td>Vapour</td>
</tr>
<tr>
<td>20</td>
<td>HEAVY METALS</td>
<td>Lead, Tin</td>
<td>VAPOR HAZARD</td>
<td>Lead</td>
<td>Vapour</td>
</tr>
<tr>
<td>21</td>
<td>BATTERIES</td>
<td>Lithium, Nickel, Zinc</td>
<td>VAPOR HAZARD</td>
<td>Lithium</td>
<td>Vapour</td>
</tr>
<tr>
<td>22</td>
<td>PESTICIDES</td>
<td>Insecticides, Herbicides</td>
<td>VAPOR HAZARD</td>
<td>Insecticides</td>
<td>Vapour</td>
</tr>
</tbody>
</table>

1. This chart is to be used as a GUIDE ONLY.
2. Compare the desired HMUG Group/HCC in the left column with the incompatible Material(s) of that Group in the center column on the same row. Mixing of the HMUG Group/HCC with the Incompatible Material(s) may result in the reaction(s) listed in the right column.
3. Not all applicable HCCs are listed; only the most frequently encountered HCCs (except N) are listed.

[www.safetycenter.navy.mil/training REV 09-03](http://www.safetycenter.navy.mil/training)
8.0 ASBESTOS

Asbestos was widely used in many products (especially building parts) prior to 1990 for its fire resistance, strength, and affordability. However, exposure to friable asbestos can lead to lung diseases including cancer. Contractors working aboard the installation must follow all Federal, State, and local regulations/specifications for the proper notification, removal, disposal, and management of all asbestos-containing materials (ACM) associated with demolition and renovation projects.

8.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with asbestos and its management. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate EMD program if additional clarification is necessary.

8.1.1. Key Definitions

- **Abatement.** Work performed to repair, maintain, remove, isolate, or encapsulate ACM.

- **Asbestos.** Asbestos is the generic term for a group of naturally occurring fibrous silicate minerals, including those that typically exhibit high tensile
strength, flexibility, and resistance to thermal, chemical, and electrical conditions. Asbestos was commonly used in installed products such as roofing shingles, floor tiles, cement pipe and sheeting, roofing felts, insulation, ceiling tiles, fire-resistant drywall, and acoustical products.

- **Asbestos-Containing Material.** Any material containing more than 1 percent asbestos, per 29 CFR 1926.1101.

- **Category I Non-friable ACM.** Asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos, per 40 CFR 61, Subpart M.

- **Category II Non-friable ACM.** Any material, excluding Category I non-friable ACM, containing more than 1 percent asbestos that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure, per 40 CFR 61, Subpart M.

- **Demolition.** The wrecking or removal of any load-bearing walls or structure with any related handling operations.

- **Friable.** Any ACM that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure (may include damaged ACM that was previously identified as non-friable), per 40 CFR 763.

- **Glove Bag.** A sealed compartment with attached inner gloves that is used for handling ACM. Glove bags provide a small work area enclosure typically used for small-scale asbestos stripping operations.
• **Presumed Asbestos-Containing Material (PACM).** Thermal system insulation (TSI) and surfacing material found in buildings constructed no later than 1980, per 29 CFR 1926.1101.

• **Regulated Asbestos-Containing Material (RACM).** Includes friable ACM, Category I non-friable ACM that has become friable, Category I non-friable ACM that has been sanded, ground, cut, etc., and Category II non-friable ACM that has a high probability of becoming crumbled, pulverized, or reduced to powder during demolition or renovation, per 40 CFR 61, Subpart M.

• **Removal.** Stripping, chipping, sanding, sawing, drilling, scraping, sucking, and other methods of separating material from its installed location in a building.

• **Renovation.** Altering a facility or its components in any way, including stripping or removal of RACM, per 40 CFR 61, Subpart M.

### 8.1.2. Key Concepts

• **Demolition Notification.** North Carolina law requires notification for all demolition, regardless of whether asbestos is present, 10 working days prior to starting demolition.

• **Disposal.** ACM waste can be accepted at the MCB Camp Lejeune Sanitary Landfill. Work with the ROICC or Contract Representative to coordinate the disposal through the MCB Camp Lejeune Sanitary
Landfill. Asbestos waste is only accepted on Mondays through Thursdays from 0700 to 1000.

- **Removal Requirements.** Permits for asbestos removal or demolition must be obtained when the ACM present exceeds 260 linear feet, 160 square feet, or 35 cubic feet. Additionally, proper work practice procedures must be followed during demolition or renovation operations.

- **Renovation Notification.** If ACM is present within a structure, North Carolina law requires notification of renovation 10 working days prior to starting renovation.

### 8.1.3. Environmental Management System

Contractor practices associated with asbestos management include the following:

- Building operation/maintenance/repair
- Construction/demolition/renovation
- Equipment operation/maintenance/disposal
- HW transportation
- Parts replacement

The potential impacts of these activities on the environment include soil contamination, degradation of water quality and air quality, and the potential exposure of installation occupants.
8.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding ACM, which include but may not be limited to the following:

- **Asbestos General Standard, 29 CFR 1910.1001 – Asbestos.** Applies to all occupational exposures to asbestos in all industries covered by the Occupational Safety and Health Administration (OSHA).

- **Asbestos Hazard and Emergency Response Act (AHERA), 1986.** AHERA was written primarily to provide officials in schools, grades K-12, with rules and guidance for the management of ACM.

- **Asbestos School Hazard Abatement Reauthorization Act, 1992.** This act extended AHERA regulations to cover public and commercial buildings.


- **Naval Facilities Engineering Service Center, Facilities Management Guide for Asbestos and Lead.** Summarizes asbestos and lead requirements.
that routinely affect facilities operations, to protect workers, building occupants, and the environment.

- **Naval Facilities Guide Specifications and Engineering Control of Asbestos Materials.**
  Covers the requirements for safety procedures and requirements for the demolition, removal, encapsulation, enclosure, repair, and disposal of ACM.

- **North Carolina Asbestos Hazard Management Program, NC General Statutes, Chapter 130A, Article 19; 10A NCAC 41C.0601–.0608 and .0611.**
  Incorporates 40 CFR 763 and 29 CFR 1926.1101 by reference and outlines criteria for asbestos exposures in public areas, accreditation of persons conducting asbestos management activities, and asbestos permitting and fee requirements.

- **Safety and Health Regulations for Construction, Asbestos, 29 CFR 1926.1101.**
  Regulates asbestos in the construction, demolition, alteration, repair, maintenance, or renovation of structures that contain asbestos.

### 8.3. RESPONSIBILITIES BEFORE A DEMOLITION OR RENOVATION PROJECT

Prior to starting a demolition or renovation project, contractors must:
• Determine whether ACM, PACM, and/or RACM are present in the buildings involved in the project.

• Complete the necessary notifications to the State of North Carolina and obtain any necessary permits for the removal of ACM, PACM, and/or RACM.

• Understand what actions to take if ACM, PACM, and/or RACM are unexpectedly encountered during project execution.

• Remove all non-friable and friable ACM in accordance with all Federal, State, and local regulations, prior to demolition activities.

• Know how to properly dispose of ACM, and provide any waste disposal manifests generated for disposal.

8.3.1. Identification of ACM and PACM

Contract documents will identify the presence of known ACM, PACM, and RACM. Contact the ROICC or Contract Representative with questions regarding the presence of these materials as identified in the contract documents. An inspection conducted by a Health Hazards

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Form DHHS 3768 must be posted onsite during all permitted projects.
Control Unit (HHCU)-licensed asbestos inspector may be necessary to confirm the location and quantities of any ACM, PACM, and/or RACM and determine if any previously unidentified materials are present.

8.3.2. Notification

To maintain accurate files and records, the ROICC or Contract Representative is required to notify the Asbestos Program Manager, who is part of the Installations and Environment Department, of all work involving asbestos removals, including glove bag projects.

The North Carolina Department of Health and Human Services (DHHS) Form 3768, Asbestos Permit Application and Notification for Demolition and Renovation, must be submitted to the North Carolina HHCU 10 working days in advance of demolition activities, regardless of whether asbestos is present. This form must be posted onsite during the entire duration of the project. Have the ROICC or Contract Representative contact the Asbestos Program Manager with questions or concerns about requirements for notification of demolition or renovation.

8.3.3. Removal

Any ACM, PACM, and/or RACM present must be removed before the area is disturbed during renovation or demolition.
activities (except in certain rare instances). Certification and handling requirements for asbestos removal are provided in 10A NCAC 41C and the Asbestos NESHAP. Refer to these regulations for detailed requirements.

8.3.4. Training

North Carolina regulations require that all persons who perform asbestos management activities in the State of North Carolina must be accredited by the North Carolina HHCU under the appropriate accreditation category (i.e., Building Inspector, Project Supervisor, and/or Abatement Worker). Training documentation should be available upon request.

8.4. RESPONSIBILITIES DURING A DEMOLITION OR RENOVATION PROJECT

North Carolina regulations require that DHHS Form 3768, Asbestos Permit Application and Notification for Demolition and Renovation, be acquired by the contractor and posted onsite during all permitted projects. Contractors must post this form when the project will remove the following: at least 260 linear feet, 160 square feet, or 35 cubic feet of RACM or asbestos that might become regulated as a result of handling. The form must also be posted for nonscheduled asbestos removal that will exceed these numbers in a calendar year.

During a renovation or demolition project, if the contractor suspects the presence of additional ACM (other than the materials identified in contract documents), the contractor
must immediately report the suspected area to the ROICC or Contract Representative. Before proceeding, the facility must be inspected by an asbestos inspector licensed by the North Carolina HHCU. The individual performing the asbestos survey will coordinate with the ROICC or Contract Representative throughout the process. A legible copy of the building inspection report must be provided to the North Carolina HHCU prior to each demolition and upon request for renovations; a building inspection report will be acceptable only if the inspection was performed during the 3 years prior to the demolition. A copy of the report should also be forwarded to the Asbestos Program Manager.

During a renovation or demolition project, a contractor who suspects additional ACM is present must immediately report the suspected area to the ROICC or Contract Representative.

For specific work procedures and requirements for glove bag projects, refer to 29 CFR 1926.1101.

8.5. DISPOSAL OF ACM WASTE

Contractors can dispose of ACM waste at the MCB Camp Lejeune Sanitary Landfill after first coordinating with the MCB Camp Lejeune Landfill office through the ROICC or Contract Representative. The contractor must provide the MCB Camp Lejeune Landfill with Form DHHS 3787, North Carolina Health Hazards Control Unit’s Asbestos
Waste Shipment Record. The contractor must submit this form to the North Carolina HHCU for all permitted asbestos removal projects.
9.0 LEAD-BASED PAINT

Lead was used in paint for its color and water-resistant properties until it was banned in 1978 for its highly toxic properties that may cause a range of health problems, especially in young children. Improper removal of lead-based paint (LBP) may result in paint chips and dust, which may contaminate a structure inside and out. The North Carolina DHHS regulations require any person who performs an inspection, risk assessment, or abatement to be certified. North Carolina DHHS also requires a person to obtain a permit for conducting an abatement of a child-occupied facility or target housing.

9.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with LBP activities. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate Environmental Department or Safety Representative if additional clarification is necessary.

9.1.1. Key Definitions

- **Abatement.** The permanent removal or elimination of all LBP hazards.

- **Demolition.** The removal of any load-bearing walls or structure.
- **Inspection.** A surface-by-surface investigation to determine the presence of LBP, and a report explaining the results of the investigation.

- **Lead-Based Paint.** Surface coatings that contain lead in amounts equal to or in excess of 1.0 milligram per square centimeter, as measured by X-ray fluorescence (XRF) or laboratory analysis, or more than 0.5 percent by weight, per 40 CFR 745.

- **Lead-Containing Paint.** Surface coatings that contain lead in any amount greater than the laboratory reporting limit but less than 1.0 milligram per square centimeter, or less than 0.5 percent by weight, per 29 CFR 1926.62 and 29 CFR 1910.1025 (also contained in 40 CFR 745 Subpart L, and adopted by the State of North Carolina under North Carolina General Statute Chapter 130A, Article 19A).

- **Renovation.** Alteration of a facility or its components in any way.

- **Target Housing.** Any housing constructed before 1978, with the exception of housing for the elderly and persons with disabilities (unless a child under the age of 6 lives there) and residential dwellings where the living areas are not separated from the sleeping areas (efficiencies, studio apartments, dormitories, etc.).
9.1.2. **Key Concepts**

- **Disposal.** Analysis is required to determine proper disposal of waste (non-hazardous or hazardous). A Toxic Characteristic Leaching Procedure (TCLP) analysis must be conducted to determine whether lead levels have exceeded 5 parts per million (ppm), which is the RCRA threshold for HW determination.

- **LBP Survey.** A LBP survey is required prior to disturbing painted surfaces, to determine whether the paint meets the criteria of lead containing over 1.0 milligram per square centimeter or over 0.5 percent by weight.

- **Training.** LBP training requirements set forth by the OSHA must be followed by all personnel involved in all LBP removal activities. MCB Camp Lejeune Base Safety tracks this training for contract staff, as the Safety Office houses the Lead Program Manager.

9.1.3. **Environmental Management System**

Contractor practices associated with LBP include the following:

- Construction/demolition/renovation
- HW transportation
- Paint removal

The potential impacts of these activities on the environment include the potential degradation of soil, water, and air
environments, and the potential exposure of installation occupants.

9.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable Federal, State, and local regulations and requirements regarding LBP activities, which include but may not be limited to the following:

- **Naval Facilities Engineering Service Center, Facilities Management Guide for Asbestos and Lead.** Summarizes asbestos and lead requirements that routinely impact facilities operations, in order to protect workers, building occupants, and the environment.

- **Lead-Based Paint Hazard Management Program, NC General Statutes, Chapter 130A, Article 19A, Section 130A-453.01 through 453.11.** Requires a person who performs an inspection, risk assessment, abatement, or abatement design work in a child-occupied facility (daycare center, pre-school, etc.) or housing built before 1978 to be certified and establishes the requirements for certification, including the oversight of required training. It also requires a person who conducts an abatement of a child-occupied facility or target housing to obtain a permit for the abatement; establishes work practice standards for LBP abatement activities; and has adopted requirements included in 40 CFR Part 745, Subpart L and 40 CFR Part 745, Subpart D.
• **Lead-Based Paint Hazard Management Program for Renovation, Repair, and Painting (RRP), 10A NCAC 41C.0900.** Common renovation activities may create hazardous lead dust and chips by disturbing LBP, which may be harmful to adults and children. This article requires that dust sampling technicians, firms, and individuals performing renovation, repair, and painting projects for compensation that disturb LBP in housing and child-occupied facilities built before 1978 be certified and follow specific work practices to prevent lead contamination. Child-occupied facilities include, but are not limited to, child care facilities and schools (with children under the age of 6) that were built before 1978.

• **10A NCAC 41C.0800, Lead-Based Paint Hazard Management Program.** Requires (1) all individuals and firms involved in LBP activities to be certified and (2) all LBP activities to be carried out in accordance with 40 CFR 745.

• **29 CFR 1926, Safety and Health Regulations for Construction.** Contains the OSHA requirements for construction activities where workers may come into contact with lead.

• **40 CFR Part 745, Lead-Based Paint Poisoning Prevention in Certain Residential Structures.** Ensures that (1) LBP abatement professionals, including workers, supervisors, inspectors, risk assessors, and project designers, are well trained in conducting LBP activities; and (2) inspections for the
identification of LBP, risk assessments for the evaluation of LBP hazards, and abatements for the permanent elimination of LBP hazards are conducted safely, effectively, and reliably by requiring certification of professionals.

### 9.3. RESPONSIBILITIES BEFORE RENOVATION OR DEMOLITION

Buildings constructed prior to 1978 are assumed to contain LBP. Ordinary renovation and maintenance activities may create dust that contains lead, but following lead-safe work practices may help mitigate or prevent lead hazards. The North Carolina RRP Program (10A NCAC 41C.0900) mandates that contractors, property managers, and others working for compensation in homes and child-occupied facilities built before 1978 be trained in and use lead-safe work practices. In addition, it mandates that contractors provide the owner and occupants with *The Lead-Safe Certified Guide to Renovate Right* information pamphlet, which is found at the following website: [http://epi.publichealth.nc.gov/lead/pdf/RenovateRight.pdf](http://epi.publichealth.nc.gov/lead/pdf/RenovateRight.pdf)

Individuals must be certified by the State of North Carolina to perform RRP activities for compensation in housing and child-occupied facilities built before 1978. A firm engaged in regulated renovation activities (such as RRP that disturbs more than 6 square feet of interior painted surfaces or 20 square feet of exterior painted surfaces, or dust sampling after renovation) must be a certified renovation firm.
To address the hazards associated with the improper abatement or removal of LBP, any person who performs an inspection, risk assessment, abatement, or abatement design work in a child-occupied facility (child development centers, preschools, etc.) or housing built before 1978 must be certified by the State of North Carolina. Any person who conducts an abatement of a child-occupied facility or target housing must also obtain a permit for the abatement. Individuals conducting LBP abatement activities in North Carolina, such as inspections, risk assessments, LBP hazards abatement, clearance testing, or abatement project design in housing and child-occupied facilities built before 1978, must be certified by the State of North Carolina. A firm engaged in abatement activities must be a certified lead abatement firm.

Prior to any renovation or demolition aboard the installation that involves the disturbance of painted surfaces, a LBP survey must be completed by an inspector certified in North Carolina, retained through the ROICC or Public Works Division (PWD). Certain projects will use PWD staff to conduct the sampling, and other projects will use contracted personnel. Buildings constructed prior to 1978 are assumed to contain LBP; therefore, no LBP survey is necessary. The LBP survey (through sampling and analysis) will determine whether painted surfaces meet the criteria of LBP (lead content equal to or greater than 1.0 milligram per square centimeter as measured by XRF or lab analysis, or 0.5 percent by weight). Naval Facilities Guide Specifications and contract documents must be implemented for contracts where LBP is to be abated/removed prior to demolition or renovation.
If the area is to be reoccupied, final clearance must be conducted, including a visual inspection and sample collection, prior to reoccupation. Clearance on all projects involving abatement must be provided by a certified risk assessor or a certified LBP inspector. Clearance for RRP projects may be conducted by a certified risk assessor, certified LBP inspector, or certified dust sampling technician.

### 9.4. PERMITS

Contractors must obtain a North Carolina LBP Abatement Permit from North Carolina DHHS when lead paint is removed from targeted structures (child-occupied facilities or housing built prior to 1978).

### 9.5. DISPOSAL

If the LBP survey determines that LBP will be abated as part of a renovation or demolition project, the contractor must take analytical samples to determine whether the waste material is hazardous. Usually, a TCLP sample is collected from a “representative” sample of the material removed. The laboratory conducting the sample analysis must be accredited by the Environmental Lead Laboratory Accreditation Program. A list of these accredited labs is available by contacting (703) 849-8888 or visiting
If the LBP is removed from the underlying building material, then the paint is the waste stream. If the LBP is removed with the building material, then both materials are considered the waste stream.

If the lead content is below HW regulatory disposal levels, consult the ROICC or Contract Representative to determine whether the contract allows for the disposal of the material in the MCB Camp Lejeune Sanitary Landfill. Lead waste is only accepted on Mondays through Thursdays from 0700 to 1000.

If the abated LBP is above HW regulatory levels, refer to Section 7.0 of this guide for information on HW management and disposal requirements.

### 9.6. TRAINING

Before the project begins, workers who are subject to lead exposure during abatement or removal activities must be trained according to the OSHA regulations in 29 CFR 1926.62 concerning lead exposure in construction, and they must receive all training and certification specified by 10A NCAC 41C.0800 and 10A NCAC 41C.0900. The contractor is responsible for providing this training before initiating any work aboard MCB Camp Lejeune.
10.0 NATURAL RESOURCES

The installation has stewardship and recovery responsibilities over the natural resources on the installation. These responsibilities are regulated under numerous laws described in this section. The installation ensures compliance with these laws through an interdisciplinary process of review and coordination of all activities occurring on the installation.

Contractors working on the installation are responsible for complying with conditions and measures imposed on their work as a result of this process; these responsibilities include preserving the natural resources within the project boundaries and outside the limits of permanent work, restoring work sites to an equivalent or improved condition after the work is complete, and confining construction activities to the limits of the work indicated or specified. The contractor is advised that the installation is subject to strict compliance with Federal, State, and local wildlife laws and regulations. The contractor must not disturb wildlife (birds, nesting birds, mammals, reptiles, amphibians, and fish) or the native habitat adjacent to the project area except when indicated or specified.

10.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with natural resources management. If you have any questions or concerns...
about the information in this section or require assistance regarding any wildlife matters (snakes, nesting birds, nuisance wildlife, etc.) on the site or within the project area, please consult the ROICC or Contract Representative, who will contact the Environmental Conservation Branch.

10.1.1. Key Definitions

- **Conservation.** The planned management, use, and protection of natural resources to provide their sustained use and continued benefit to present and future generations.

- **Ecosystem.** A dynamic, natural complex of living organisms interacting with each other and with their associated nonliving environment.

- **Habitat.** An area where a plant or animal species lives, grows, and reproduces, and the environment that satisfies its life requirements.

- **Natural Resource.** Soil, water, air, plants, and animals, according to the Natural Resources Conservation Service.

- **Endangered or Threatened Species.** Federally listed taxon that is “in danger of extinction throughout all or a significant portion of its range” or “likely to become endangered within the foreseeable future throughout all or a significant portion of its range.”

- **Riparian Buffer.** Vegetated area bordering a body of water, such as a stream, lake, or pond.
• **Wetland.** Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas, per the EPA.

### 10.1.2. Key Concepts

• **Coastal Zone Management Act (CZMA) of 1972.** Requires each installation to ensure that its operations, activities, projects, and programs affecting the coastal zone in or on coastal lands or waters are consistent with the federally approved Coastal Zone Management Plan of the State.

• **Ecosystem Management.** A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of natural processes’ time scales; recognizes social and economic viability within functioning ecosystems; is adaptable to complex, changing requirements; and is realized through effective partnerships among private, local, State, tribal, and Federal interests. Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.
- **Integrated Natural Resources Management Plan (INRMP).** A planning document using ecosystem management principles to direct the management and conservation of installation natural resources, which includes all elements of natural resources management applicable to the installation.

- **National Environmental Policy Act.** Requires Federal agencies, including the USMC, to consider the environmental impacts of projects prior to implementation. All projects that support military training, minor and major military construction, maintenance, and natural resources management actions are reviewed for potential environmental impacts. Contractors must obtain and review any NEPA documentation associated with their projects. All NEPA documentation can be obtained from the ROICC or Contract Representative.

- **Threatened and Endangered Species.** Specific requirements regarding protected areas on the installation apply to contractor activities. Eight federally threatened and endangered species are currently managed at MCB Camp Lejeune – red-cockaded woodpecker, green sea turtle, loggerhead sea turtle, rough-leaved loosestrife, seabeach amaranth, piping plover, red knot, and American alligator. In addition, as of March 25, 2015, the U.S. Fish and Wildlife Service lists six species as threatened and nine as endangered for Onslow County, NC. Consult the ROICC or Contract Representative to determine if there are any project...
requirements regarding threatened or endangered species.

- **Timber.** Contractors must ensure that the ROICC or Contract Representative notify the EMD’s Forest Management Program prior to conducting site work. Timber will not be released to contractors without the approval of the Forest Management Program.

- **Waters of the United States.** All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce; interstate waters; the territorial seas; impoundments; tributaries; adjacent waters including wetlands, ponds, lakes, oxbows, and impoundments; waters determined to have a significant nexus; Carolina bays; Pocosins; and waters within the 100-year floodplain or within 4,000 feet of the high tide line or ordinary high water mark; per 33 U.S.C. 1251 et seq. Section 328.3.

- **Wetlands.** Any work in installation waters or wetlands requires a permit prior to the start of an activity.

### 10.1.3. Environmental Management System

Contractor practices associated with natural resources include the following:

- Erosion/runoff control
- Fish stocking
- Habitat management
• Land clearing
• Live fire range operations
• Road construction and maintenance
• Soil excavation/grading
• Timber management
• Urban wildlife management

The potential impacts of these activities on the environment include air emissions, sedimentation, eutrophication of surface waters (addition of nutrients that stimulate aquatic plant growth and depletes oxygen), degradation of habitat, impacts to marine mammals, damage to commercial and noncommercial timber, impacts to endangered species and natural resources, and degradation of soil quality.

10.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding natural resources, which include but may not be limited to the following:

• **Bald and Golden Eagle Protection Act of 1940, as Amended (16 USC 688 et seq.).** Prohibits taking, possessing, and transporting bald eagles and golden eagles and importing and exporting their parts, nests, or eggs. The definition of “take” includes pursue, shoot, shoot at, poison, wound, capture, trap, collect, molest, or disturb.
- **BO 5090.11A, Protected Species Program.** Sets forth regulations and establishes responsibilities to ensure the conservation of threatened and endangered species and species at risk aboard MCB Camp Lejeune.

- **BO 5090.12, Environmental Impact Review Procedures.** Implements NEPA 1969 and NEPA policy and guidance in Chapter 12 of MCO P5090.2A.

- **Clean Water Act of 1972.** Establishes the basic structure for regulating wastewater discharges and placing fill materials into the waters of the United States.

- **CZMA of 1972 (16 USC 1451 et seq.).** Requires that Federal actions affecting any land/water use or coastal zone natural resource be implemented consistent with the enforceable policies of an approved State coastal management program. Requires concurrence from the State before taking an action affecting the use of land, water, or natural resources of the coastal zone.

- **Endangered Species Act of 1973 (16 USC 1531 et seq.).** Requires all Federal agencies to carry out programs to conserve federally listed endangered and threatened species of plants and wildlife.

- **EO 11990, Protection of Wetlands, 24 May 1977.** Addresses Federal agency actions required to identify and protect wetlands, minimize the risk of wetlands destruction or modification, and preserve
and enhance the natural and beneficial values of wetlands.

- **EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, 10 January 2001.** Requires each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a plan to promote the conservation of migratory bird populations.

- **Marine Mammal Protection Act of 1972 (MMPA), as Amended (16 USC 1361 et seq.).** Mandates a moratorium on the killing, capturing, harming, and importing of marine mammals and marine mammal products. The MMPA also prohibits the taking of any marine mammal, including to harass, hunt, capture, collect, or kill any marine mammal, including any of the following: collection of dead animals or their parts, restraint or detention of a marine mammal, tagging a marine mammal, the negligent or intentional operation of an aircraft or vessel, or any other negligent or intentional act that results in disturbing or molesting a marine mammal.

- **Migratory Bird Treaty Act of 1918, as Amended (16 USC 703 et seq.).** Protects migratory birds (listed in 50 CFR 10.13) and their nests and eggs and establishes a permitting process for the taking of migratory birds by establishing a Federal prohibition to “pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause
to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.”

- **MCO P5090.2A, Environmental Compliance and Protection Manual.** Provides guidance and instruction to installations to ensure the protection, conservation, and management of watersheds, wetlands, natural landscapes, soils, forests, fish and wildlife, and other natural resources as vital USMC assets.

- **NEPA 1969 (42 U.S.C. 4321 et seq.).** Requires Federal agencies, including the USMC, to consider the environmental impacts of projects before the decisionmaker proceeds with the implementation. All projects that support military training, major and minor military construction, maintenance, and natural resources management actions are reviewed for potential environmental impacts.

- **Rivers and Harbors Act of 1899.** Prohibits the excavation, filling, or alteration of the course, condition, or capacity of any port, harbor, or channel without prior approval from the Chief of Engineers.

- **Sikes Act of 1960, as Amended (16 USC 670 et seq.).** Requires military installations to manage natural resources for multipurpose uses and public access appropriate for those uses, as well as ensuring no net loss to training, testing or other defined
missions of the installation through the development and implementation of an INRMP.

- **Neuse River Basin Riparian Buffer Rules (15A NCAC 02B.0233).** Require a 50-foot riparian buffer that is divided into two zones. The 30 feet closest to the water (Zone 1) must remain undisturbed. The outer 20 feet (Zone 2) may include managed vegetation, such as lawns or shrubbery. The riparian buffer rules also require diffuse flow of stormwater runoff. The buffers apply to intermittent streams, perennial streams, lakes, ponds, estuaries, and modified natural streams that are depicted on the most recent printed version of the soil survey map prepared by the Natural Resources Conservation Service or the 1:24,000 scale quadrangle topographic map prepared by the U.S. Geologic Survey.

### 10.3. NATIONAL ENVIRONMENTAL POLICY ACT

Staff specialists from various installation departments participate in the NEPA process, which coordinates the review of projects and documents environmental impacts (or lack thereof) for projects before implementation.

The documentation of this review process occasionally includes mandatory conditions affecting the design and construction/implementation of the project. The documentation, when completed, is provided to the action proponent, who is expected to provide it to the ROICC or Contract Representative.
Consult the ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project. The documentation marks the end of the NEPA review process; it does not constitute approval for the proponent of the action to implement the action. Some contracts may include stipulations from the NEPA document that must be implemented prior to the onset of work to prevent environmental impacts and violations of Federal or State rules and regulations. Stipulations could include replacing monitoring wells if damages occur from contractor operations, stopping work if contamination is encountered, notification that a wetlands permit is required, seasonal restrictions, etc.

10.4. TIMBER

Potential timber resources are identified during the NEPA process. The contractor is responsible for advising the ROICC or Contract Representative to notify EMD’s Forest Management Program prior to beginning site work. Additionally, the ROICC or Contract Representative and/or contractor is required to notify the Forest Management Program if the contract has been amended with modifications to the site location.

MCB Camp Lejeune manages its forest in accordance with the installation INRMP. The Forest Management Program
maintains first right of refusal for all timber products on construction projects and will determine whether the Government will harvest the timber or release it to the contractor. The Government retains exclusive rights to all forest products on construction projects. If the Government elects to harvest the timber, only merchantable timber will be removed.

Contractors must adhere to the following requirements when performing site work that may impact timber resources:

- Do not remove, cut, deface, injure, or destroy trees or shrubs without authorization from the ROICC or Contract Representative.

- Do not fasten or attach ropes, cables, or guy wires to nearby trees for anchorages without authorization from the ROICC or Contract Representative. (If these actions are authorized, the contractor is responsible for any resultant damage.)

- Protect trees that are to remain in place and that may be injured, bruised, defaced, or otherwise damaged by construction operations.

- With the ROICC or Contract Representative’s approval, use approved methods of excavation to protect existing trees that are to remain in place and that may be injured, bruised, defaced, or otherwise damaged by construction operations.
remove trees with 30 percent or more of their root systems destroyed.

- With the ROICC or Contract Representative’s approval, remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features.

Please refer to Section 12.0 for disposal information for land-clearing debris.

10.5. THREATENED AND ENDANGERED SPECIES

Entry into a threatened or endangered species site or shorebird nesting area marked with signs and/or white paint is prohibited without written permission from installation personnel. With the exception of improved roadways, entry into a threatened or endangered species site or shorebird nesting area marked with signs and/or white paint is prohibited without written permission from installation personnel. BO 5090.11A lists threatened and endangered species that may be encountered at the installation. The following restrictions apply on the installation unless written permission is explicitly provided:

- Work on Onslow Beach or Brown’s Island is not permitted between April 1 and October 31. Traffic
on the beaches should be limited to below the high tide line.

- Vehicles and lighting are prohibited on the beaches overnight between May 1 and October 31.
- Construction activities are prohibited within 1,500 feet of a bald eagle’s nest (JD, MC, and IF Training area).
- Cutting or damaging pine trees is not permitted.
- Altering hydrology through excavation, ditching, etc., is prohibited.
- Fish and wildlife must not be disturbed.
- Water flows may not be altered; the native habitat adjacent to the project and critical to the survival of fish and wildlife may not be significantly disturbed, except as indicated or specified.

10.6. WETLANDS

10.6.1. Avoidance

In accordance with MCO P5090.2A, all facilities and operational actions must avoid, to the maximum degree feasible, wetlands destruction or degradation, regardless of the wetlands size or legal necessity for a permit. Prior to the onset of

Contractors must incorporate avoidance and minimization measures to comply with the national policy to permit no overall net loss of wetlands.
construction, coordination with the Environmental Conservation Branch of EMD should have taken place during project design to ensure CWA permitting issues are addressed by the contractor at the earliest opportunity. Contractors must incorporate avoidance and minimization measures to comply with the national policy to permit no overall net loss of wetlands, as well as meeting concept design criteria while incorporating avoidance and minimization measures to protect wetlands, streams, and waters of the United States. Any proposed action that would significantly affect wetlands must be coordinated with the CG of MCB Camp Lejeune.

The contractor must ensure that construction of all buildings, facilities, and related amenities, including earthwork, grading, landscaping, drainage, stormwater management, parking lot and paved roadway, sidewalks, site excavation, sanitary sewer system extensions, and domestic water extensions, avoids, to the maximum degree feasible, wetlands destruction or degradation.

Identified and mapped boundaries of the legally defined wetlands on all USMC lands within the project area will be distributed to the ROICC or Contract Representative for use (if available) and included in all design products, including drawings, plans, and figures.

10.6.2. Permits

All unavoidable potential impacts to wetlands or waters of the United States require prior coordination as described in this section. Failure to acquire written authorization for
If work in wetlands is required, know who is responsible for obtaining permits, and what the terms and conditions of the permits require.

impacts to wetlands and/or waters of the United States may result in significant project delays or design modifications.

No discharge of fill material, mechanized land clearing, or any other activity is allowed in jurisdictional wetlands or waters of the United States without the proper approvals. The contractor may be responsible for obtaining the following permits (including pre-permit coordination, preparation, and submission of all permit applications after review and concurrence by the installation) and complying with all regulations and requirements stipulated by the State of North Carolina as conditions upon issuance of the permits:

- U. S. Army Corps of Engineers (USACE), Section 404 Permit (individual or applicable nationwide permit); CWA of 1977, as Amended (Public Law 95-217, 33 U. S. C. 1251 et seq.)

- North Carolina Division of Water Resources (NCDWR), Section 401 Water Quality Certification – (15A NCAC 02H) NCDEQ; CWA of 1977, as Amended (Public Law 95-217, 33 U. S. C. 1251 et seq.)

- North Carolina Division of Coastal Management (NCDCM), Federal Consistency Determination (15A NCAC 07) NCDEQ; CZMA of 1972 (16 USC 1451 et seq.)
Two types of activities generally require a permit from the USACE:

- **Activities within navigable waters.** Activities such as dredging, constructing docks and bulkheads, and placing navigation aids require review under Section 10 of the Rivers and Harbors Act of 1899 to ensure that they will not cause an obstruction to navigation.

- **Activities in wetlands and waters of the United States** (regulated by Section 404 of the CWA of 1972). A major aspect of the regulatory program under Section 404 of the CWA is determining which areas qualify for protection as wetlands. Contractors should contact the USACE, the NCDWR, or the NCDCM if there is any question about whether activities could impact wetlands, streams, or protected buffers.

Contractors working on the installation will not perform any work in waters of the United States or wetlands without an approved permit (even if the work is temporary). Examples of temporary discharges include dewatering of dredged material prior to final disposal and temporary fills for access roadways, cofferdams, storage, and work areas.
10.6.3. Impacts

Any disturbance to the soil or substrate (bottom material) of a wetland or water body, including a stream bed or protected buffer, is an impact and may adversely affect the hydrology of an area. Discharges of fill material generally include the following, without limitation:

- Placement of fill material that is necessary for the construction of any structure or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; and causeways or road fills
- Dams and dikes
- Artificial islands
- Property protection or reclamation devices such as riprap, groins, seawalls, breakwaters, revetments, and beach nourishment
- Levees
- Fill for intake and outfall pipes and subaqueous utility lines
- Fill associated with the creation of ponds
- Any other work involving the discharge of fill or dredged material
10.6.4. Mitigation

Any facility requirement that cannot be sited to avoid wetlands must be designed to minimize wetlands degradation and must include compensatory mitigation as required by wetland regulatory agencies (USACE and NCDWR) in all phases of project planning, programming, and budgeting.

The contractor may be required to develop onsite mitigation, if appropriate, consisting of wetland/stream/buffer restoration or creation, for all unavoidable wetland, stream, and buffer impacts, whenever possible and feasible. Use of USMC lands and lands of other entities may be permissible for mitigation purposes for USMC projects when consistent with EPA and USACE guidelines or permit provisions. Land within the project area suitable for establishment of mitigation may be evaluated by the contractor and used for mitigation where compatible with mission requirements and approved by the CG. Proposals for permanent resource areas must be approved by the Assistant Secretary of the Navy (Installations and Environment) or his/her designee.
Offsite mitigation is preferred and should be coordinated through the North Carolina Division of Mitigation Services or an approved private mitigation bank.

10.7. TEMPORARY CONSTRUCTION

Traces of temporary construction facilities, such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction, should be removed upon completion of a contract or project. Temporary roads, parking areas, and similar temporarily used areas should be graded to conform to surrounding contours and the area restored, to the degree practical, to its state prior to any disturbing activities.
MCB Camp Lejeune is responsible for stormwater permits associated with construction, industrial, or municipal activities that discharge to outfalls leading to receiving waters. The most applicable permit for contractors is the construction permit, since the majority of the contractor activities are affiliated with construction/renovation. However, the contractor is also responsible for adhering to the requirements of the industrial and municipal permits held by MCB Camp Lejeune for all of the contractor activities on the installation. In essence, all contractors for the installation need to know and implement the necessary measures to prevent stormwater runoff and pollution runoff from land-disturbing activities (LDAs) and associated construction permit requirements, as well as industrial and municipal activities. The general requirements for each area, as they apply to contractors, are discussed in the following subsections.

### 11.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with stormwater. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the
appropriate environmental office if additional clarification is necessary.

11.1.1. Key Definitions

- **Best Management Practices.** Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs include structural and nonstructural stormwater controls, operation and maintenance procedures, treatment requirements, and practices to control site runoff (e.g., sediment, spillage or leaks, sludge or waste disposal, or drainage from material storage). See the following website for more information: http://deq.nc.gov/about/divisions/energy-mineral-land-resources/stormwater

- **Certificate of Stormwater Compliance.** A document providing approval for development activities that meet the requirements for coverage under a stormwater general permit.

- **Discharge (Pollutant).** The addition of any pollutant or combination of pollutants to waters of the United States from any point source, including, but not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of any pollutant; this excludes discharges in compliance with a National Pollution Discharge Elimination System (NPDES) permit.
• **Erosion and Sedimentation Control Plan.** Any plan, amended plan, or revision to an approved plan submitted to the North Carolina Division of Land Resources or its delegated authority in accordance with North Carolina General Statute 113A-57. Erosion and Sedimentation Control Plans show the devices and practices that are required to retain sediment generated by the land-disturbing activity within the boundaries of the tract during construction and upon development of the tract. *Note that in North Carolina, the Erosion and Sedimentation Control Plan and the NCG010000 Construction General Permit are considered the Stormwater Pollution Prevention Plan (SWPPP, or SPPP) for a construction site.* See the following website for more information: http://deq.nc.gov/about/divisions/energy-mineral-land-resources/stormwater

• **Land Disturbance.** Areas that are subject to clearing, excavating, grading, stockpiling, and placement/removal of earth material.

• **Nonpoint Source Discharge.** All discharges from stormwater runoff that cannot be attributed to a discernible, confined, and discrete conveyance. *(See also point source discharge, below.)*

• **Point Source Discharge.** Any discernible, confined, and discrete conveyance, including but specifically not limited to, any pipe, ditch, channel, tunnel conduit, well, discrete fissure, container, rolling stock, or concentrated animal feeding operation from
which pollutants are or may be discharged to waters of the State. *(See also nonpoint source discharge, above.)*

- **Stormwater (Runoff).** The portion of precipitation (rain and/or snowmelt) that does not naturally infiltrate into the ground or evaporate but flows via overland flows, channels, or pipes into a defined surface-water channel or stormwater system during and immediately following a storm event. As the runoff flows over the land or impervious surfaces (such as streets, parking lots, and building rooftops), it accumulates sediment and/or other pollutants that could pollute receiving streams.

- **Stormwater Associated with Construction Activities.** The discharge of stormwater from construction activities, including clearing, grading, and excavating, that result in a land disturbance of equal to or greater than 1 acre, per 40 CFR 122.

- **Stormwater Associated with Industrial Activities.** The discharge from any conveyance that is used for collecting and conveying stormwater and which is directly related to manufacturing, processing, or raw materials storage areas from an applicable industrial plant or activity, per 40 CFR 122.

- **Stormwater Associated with Municipal Activities.** The discharge of stormwater from municipal activities, including public works shops, vehicle maintenance shops, and other municipal activities, with the potential to cause stormwater pollution.
11.1.2. Key Concepts

- **Energy Independence and Security Act (EISA).** In December 2007, Section 438 of EISA was issued. This section requires that Federal facility projects over 5,000 square feet must “maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to temperature, rate, volume, and duration of flow.” In January 2010, the DoD Policy of Implementing Section 438 of the EISA was issued; this document includes a flowchart with implementation steps.

- **Good Housekeeping.** Good housekeeping practices refer to the maintenance of a clean and orderly facility to prevent potential pollution sources from coming into contact with stormwater. The practices include procedures to reduce the possibility of mishandling materials or equipment. Good housekeeping practices benefit stormwater quality and also provide for a clean, safe place for employees and clients. *Note that good housekeeping is one of the six minimum control measures (MCMs) of the MS4 permit requirements.*

- **Low Impact Development (LID).** LID is a holistic approach that incorporates site-specific ecosystem and watershed-based considerations for planning and design. The goal of LID is to mimic a site’s predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to the source. LID seeks to control
non-point source pollutants “nature’s way,” through the application of plant-soil-water mechanisms that maintain and protect the ecological and biological integrity of receiving waters and wetlands.

- **National Pollution Discharge Elimination System.** The national program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits. The NPDES stormwater program regulates stormwater discharges from three potential stormwater sources, as follows:
  
  - **Construction Activities.** LDAs that disturb 1 or more acres need an NPDES permit. At a minimum, these permits require the development of a site-specific Erosion and Sedimentation Control Plan to address sediment controls during construction and upon development of the tract. As previously noted, the Erosion and Sedimentation Control Plan and the NCG010000 Construction General Permit are considered the SWPPP for a construction site in North Carolina. In the applicable areas of the installation, a State Stormwater Management Permit and coverage under the Construction General Permit may be required. *Note that construction site runoff control is also one of the six MCMs of the Municipal Separate Storm Sewer Systems (MS4) permit requirements.*

  - **Industrial Activities.** Owners and operators of industrial facilities that fall into any of the 30 industrial sectors identified by EPA stormwater...
regulations need an NPDES Phase I permit if stormwater is discharged directly into surface water (or MS4). The permit regulations specify steps that facility operators must take prior to becoming eligible for permit coverage and actions that must be taken to continue coverage under an existing permit. These steps and actions include, but are not limited to, effluent limits, monitoring, inspection, sampling, reporting, and corrective action requirements.

- **Municipal Separate Storm Sewer Systems.** Owners and operators of MS4s need an NPDES Phase II permit. An MS4 is a system of pipes and drainage ditches within an urbanized area used to collect storm runoff and convey it to receiving waters. Polluted runoff is commonly transported through MS4s, from which it is often discharged untreated into local waterbodies.

- **Operational Requirements.** Equipment, discharge, and material use requirements that apply to all construction and industrial activities.

- **Post-Construction Requirements.** The management of stormwater generated on a stable, established site after the construction process is complete. The State Stormwater Management Program sets forth requirements for post-construction stormwater runoff control. *Note that post construction is one of the six MCMs of the MS4 permit requirements.*
• **Stormwater Pollution Prevention Plan.** A plan required by permits provided under NPDES that provides guidance to prevent stormwater pollution from construction, industrial, or municipal activities. *Note that the terminology for this plan (and associated acronym) varies somewhat from State to State.*

### 11.1.3. Environmental Management System

Contractor practices associated with stormwater include the following:

- Boat, ramp, dock cleaning
- Channel dredging
- Composting
- Construction/demolition/renovation
- Erosion/runoff control
- Fueling and fuel management/storage
- HM storage
- Land clearing
- Laundry
- Landscaping
- Livestock operations
- Pesticide/herbicide management and application
- Range residue clearance
- Road construction and maintenance
- Sewers
- Sidewalk and road deicing
- Soil excavation/grading
- Stormwater collection/conveyance
- Surface washing
- Vehicle parking
- Wash rack

Other activities that contractors could be involved in that may cause stormwater pollution include:

- Grounds maintenance (herbicide, pesticides, fertilizer, etc.)
- Outdoor material storage
- Building/roof repairs
- Industrial activities

The potential impacts of these activities on the environment include degradation of water quality and damage to public and private property due to flooding.

11.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding potential stormwater contamination, which include but may not be limited to:
• **Clean Water Act of 1972.** Establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The CWA establishes that no oil or hazardous substances should be discharged into or upon the navigable waters of the United States or adjoining shorelines, which may affect natural resources under the management of the United States through the following goals: (1) eliminate the introduction of pollutants into waters of the United States, and (2) develop water quality, which protects and propagates fish, shellfish, and wildlife and provides for recreation in and on the water.

• **40 CFR 122, National Pollutant Discharge Elimination System.** Requires industrial, construction, and municipal stormwater permits for the discharge of pollutants from any point source into waters of the United States.

• **15A NCAC Chapter 4.** Requires all persons conducting a land-disturbing activity to take all reasonable measures to protect all public and private property from damage caused by the release of sediments from the activity. The primary tool used to accomplish the objective is the development of an Erosion and Sedimentation Control Plan.
  
  o Identify critical areas
  
  o Limit exposure areas
  
  o Limit time of exposure
  
  o Control surface water
- Control sedimentation
- Manage stormwater runoff

More information can be found at:

http://reports.oah.state.nc.us/ncac.asp?folderName=Title%2015A%20-%20Environmental%20Quality\Chapter%2004-%20-%20Sedimentation%20Control

- **15A NCAC 02H.1000 Stormwater Management.**
  The State Stormwater Management Program requires all persons conducting LDAs that (1) require a Coastal Area Management Act (CAMA) Major Development Permit or an Erosion and Sedimentation Control Plan, and (2) are located within coastal counties or drain to specific classifications of water bodies, to protect surface waters and highly productive aquatic resources from the adverse impacts of uncontrolled high-density development or the potential failure of stormwater control measures. To receive permit approval, projects must limit the density of development, reduce the use of conventional collection systems in favor of vegetative systems, and incorporate post-construction, structural BMPs.

### 11.3. PRIOR TO SITE WORK

Contractors are required to address the following in the below section prior to beginning site work.
11.3.1. Construction Notifications

Any project involving LDAs aboard the installation must be reviewed by the installation’s NEPA Review Board prior to the onset of work so that potential impacts of the project and associated mitigation measures (if necessary) can be determined. Documentation of this review should have been provided to the ROICC or Contract Representative and may include mandatory conditions affecting the construction/implementation of the project. Consult the ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project in the contract.

11.3.2. Familiarity with the Stormwater Phase I Industrial Permit

Discharges of industrial stormwater have the potential to contain contaminants from industrial activity. Because of this, MCB Camp Lejeune holds a Stormwater Phase I industrial permit. This type of discharge is defined and regulated in 40 CFR 122, the EPA final rule regarding NPDES stormwater permitting. Contractors are responsible for preparing project-specific permit applications and related plans and for coordinating the permit review schedule with the ROICC or Contract Representative.
Daily industrial operations discharging stormwater aboard MCB Camp Lejeune and MCAS New River are covered under an individual NPDES permit. In accordance with the permit, the installation maintains an industrial SWPPP that identifies potential sources of pollution that may affect the water quality of stormwater discharges associated with an industrial activity. Refer to Section 11.4 for more information on contractor responsibilities associated with this permit.

11.3.3. **Familiarity with the Stormwater Phase II Municipal Permit**

Discharges of municipal stormwater have the potential to contain contaminants from municipal activity. Because of this, MCB Camp Lejeune holds a Stormwater Phase II municipal permit. This type of discharge is defined and regulated in 40 CFR 122, the EPA final rule regarding NPDES stormwater permitting.

Daily municipal operations discharging stormwater aboard MCB Camp Lejeune and MCAS New River are covered under an NPDES permit. In accordance with the permit, the installation maintains a municipal Stormwater Plan to address the six MCMs of the permit, as well as other requirements. Refer to Section 11.4 for more information on contractor responsibilities associated with this permit.

11.3.4. **Project-Specific Construction Permits**

Contractors are responsible for preparing all project-specific stormwater permit applications and related plans and for coordinating the permit review schedule with the ROICC or
Contract Representative. MCB Camp Lejeune is the responsible party for all project-specific stormwater permits located outside of Public-Private Venture (PPV) housing. All permit-required plans and applications must be submitted to the appropriate MCB Camp Lejeune organization to go through internal approval prior to submission to the appropriate State agency. The permit review schedule should allow adequate time for internal review prior to State submission deadlines. Adequate review time fluctuates and is based on the type of permit application. Stormwater compliance should be coordinated with the appropriate PPV partner for housing-related projects outside the jurisdiction of MCB Camp Lejeune.

Permit coverage is required under the North Carolina General Permit No. NCG010000 (General Permit) for construction activities that disturb 1 acre or more of land. Three copies of a proposed Erosion and Sedimentation Control Plan must be prepared and submitted to the NCDEQ Sedimentation Control Commission (or to an approved local program) at least 30 days prior to beginning construction activity to obtain coverage under the General Permit. A copy of the plan will be kept on file at the job site at all times while the site is active. Coverage under the permit becomes effective when a plan approval is issued. No LDAs may take place prior to receiving the plan approval. The
approved plan is considered a requirement or condition of the General Permit; deviation from the approved plan will constitute a violation of the terms and conditions of the permit unless prior approval for the deviations has been obtained.

A State Stormwater Management Permit, issued in accordance with 15A NCAC 02H.1000, is required for all development activities that require a CAMA Major Development Permit or an Erosion and Sedimentation Control Plan and that meet any of the following criteria:

- Development within the 20 coastal counties
- Development within 1 mile of and draining to any waters classified as High Quality Water (HQW) and rated “excellent” based on biological and physical/chemical characteristics through the NCDWR monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission
- Development that drains to an Outstanding Resource Water, which is a subset of HQW that is intended to protect unique and special waters having excellent water quality and being of exceptional ecological or recreational significance to the State or Nation

A State Stormwater Management Permit is required for all activities that will disturb 1 acre or more of land.
Because the installation is in a coastal county, any project that disturbs greater than 1 acre of land (requiring coverage under the General Permit for construction activity) will also require a State Stormwater Management Permit. A State Stormwater Management Permit application must be submitted and filed with the NCDEQ, Division of Water Quality, after the construction plans and specifications are complete and before construction activities begin. Additional information is available on the NCDEQ website:

http://deq.nc.gov/about/divisions/energy-mineral-land-resources/stormwater

State Stormwater Management Permits typically specify design standards for conveyance systems and structural BMPs, a schedule of compliance, and general conditions to which the permittee must adhere.

11.4. RESPONSIBILITIES DURING SITE WORK

The contractor is responsible for maintaining the quality of the stormwater runoff and preventing pollution of stormwater at the construction/job site. The job site may be inspected by installation environmental personnel to ensure compliance with the contractor’s construction and/or the installation’s industrial SWPPP, municipal stormwater plan, and applicable permits. The following requirements apply to all projects at the installation that have the potential to impact water quality:
• Any changes to the project area that do not comply with the approved Erosion and Sedimentation Control Plan, alter the approved post-construction stormwater conveyance system, or could otherwise significantly change the nature or increase the quantity of pollutants discharged should be immediately communicated to the ROICC or Contract Representative.

• All permitted erosion and sedimentation control projects will be inspected by the contractor at least once every 7 calendar days (unless discharges to a 303(d)-listed water body are occurring) and within 24 hours after any storm event greater than 0.5 inch of rain per 24-hour period, as required by the North Carolina General Permit No. NCG010000. Inspection results shall be maintained by the designated contractor throughout the duration of an active construction project.

• Equipment used during the project activities must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters of the State.

• No POL products (e.g. fuels, lubricants, hydraulic fluids), coolants (e.g., antifreeze), or any other substance shall be discharged onto the ground, into surface waters, or down storm drains (to include leaking vehicles, heavy equipment, pumps, and/or structurally deficient containers of hazardous materials).
• Spent fluids shall be disposed of in a manner so as not to enter surface or ground waters of the State, or storm drains. Disposal of spent fluids is outlined in Section 7.0.

• Implement spill prevention measures, clean up all spills immediately, and follow the spill reporting requirements presented in Section 5.0. Any spilled fluids shall be cleaned up to the extent practicable and disposed of in a manner so as not to allow their entry into the water (surface or ground) of the State. Refer to Section 5.0 for emergency and spill response procedures.

• Herbicide, pesticide, and fertilizer use shall be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act and shall be used in accordance with label restrictions. Refer to Section 7.0 for additional information on Hazardous Material/Hazardous Waste Management.

• Particular care must be used when storing materials outside. Materials and equipment stored outside that could potentially affect the quality of stormwater runoff include, but are not limited to, garbage dumpsters, vehicles, miscellaneous metals, chemical storage, fuels storage, wood products, and empty storage drums. These materials should be stored under cover whenever practicable. Contact the ROICC or Contract Representative with any questions about whether an outdoor storage practice is acceptable.
• Use good housekeeping practices to maintain clean and orderly work areas, paying particular attention to those areas that may contribute pollutants to stormwater. For industrial activities, refer to the link below for more information on best management practices to prevent stormwater pollution. EPA Industrial Fact Sheet Series for Activities Covered by EPA’s multi-sector general stormwater permit: http://www.epa.gov/npdes
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12.0 SOLID WASTE, RECYCLING, AND POLLUTION PREVENTION (P2)

The installation has a proactive P2 and recycling program, and contractors should minimize the amount of solid waste requiring disposal in a landfill. This section addresses solid waste, including both municipal solid waste (MSW) and construction and demolition (C&D) waste. HM and HW are discussed in Section 7.0 of this guide. Contractors are required to comply with all Federal, State, and local laws and regulations for proper disposal and recycling of all solid wastes.

12.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with solid waste, recycling, and pollution prevention. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.
12.1.1. Key Definitions

- **Construction and Demolition Debris.** Inert materials generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D waste often contains bulky, heavy materials such as concrete, lumber (from buildings), asphalt (from roads and roofing shingles), gypsum (the main component of drywall), and glass (from windows).

- **Green Procurement (GP).** The purchase of products and services that are environmentally preferable, when compared with competing products that serve the same purpose, in accordance with federally mandated “green” procurement preference programs. GP is intended to have a lesser or reduced negative effect on human health and the environment, and to permit fulfilling the social, economic, and other requirements of present and future generations.

- **Pollution Prevention.** Reducing the amount of pollution entering waste streams or otherwise released to the environment through source reduction and process efficiencies.

- **Recycling.** Activities that may include collection, separation, and processing, by which products or other materials are recovered from the solid waste stream for use as raw materials in the manufacturing of new products. Recycling also includes using, reusing, or reclaiming materials, as well as processes
that regenerate a material or recover a usable product from it.

- **Municipal Solid Waste.** Any solid materials discarded, including garbage, construction debris, commercial refuse, non-hazardous materials, non-recyclable wood, or other non-recyclable material per BO 11350.1, Refuse Disposal Procedures.

### 12.1.2. Key Concepts

- **Pollution Prevention/Green Procurement.** Installation contractors are strongly encouraged to use P2 and GP practices.

- **Qualified Recycling Program (QRP).** An organized operation that diverts or recovers scrap or waste streams and that identifies, segregates, and maintains the integrity of the recyclable materials in order to maintain or enhance the marketability of the materials.

- **Recycling.** Recycling is required on the installation. The MCB Camp Lejeune Landfill (Base Landfill) Recycling Center accepts specified recyclables according to the schedule in Table 12-1. Call (910) 451-4214 prior to a bulk turn-in.

- **Solid Waste.** Solid waste is disposed of in accordance with contract specifications (off the installation or at the Base Landfill). Data related to disposal off the installation (to include C&D waste) must be provided to the ROICC or Contract Representative on a monthly basis.
Source Reduction. Any practice that reduces the amount of any HM, pollutant, or contaminant entering any waste stream or released into the environment prior to recycling, treatment, and disposal that could reduce the hazard to public health and the environment. Source reduction may include equipment or technology modification; process or procedure modification; reformulation or redesign of products; substitution of raw materials; and improvements in housekeeping, maintenance, training, or inventory control.

12.1.3. Environmental Management System

Contractor practices associated with solid waste, recycling, and P2 include the following:

- Battery management
- Building operation/maintenance/repair
- Composting
- Construction/demolition/renovation
- Equipment operation/maintenance/disposal
- Grease traps
- HW disposal offsite transport
- Land clearing
- Livestock operations
- Metal working
- Packaging/unpackaging
• Paint removal
• Painting
• Parts replacement
• Polishing
• Range residue clearance
• Recreational facilities operation
• Road construction maintenance
• Rock crushing operations
• Solid waste collection/transportation
• Storage tank management
• Urban wildlife management
• Vehicle maintenance

The potential impacts of these activities on the environment include soil degradation, surface water quality degradation, depletion of landfill space, and depletion of nonrenewable resources.

12.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding solid waste disposal, recycling, and P2, which include but may not be limited to the following:

• **BO 5090.17, Solid Waste Reduction – Qualified Recycling Program.** Provides guidance for solid
waste reduction, P2, and management of recyclable materials.

- **BO 11350.2D, Refuse Disposal Procedures.** Establishes procedures for the separation, collection, and disposal of refuse and the disposal of waste wood products.

- **DoD Instruction 4715.4, Pollution Prevention.** Establishes the DoD requirement for installation QRPs and calls for GP.

- **EO 13423, Strengthening Federal Environmental, Energy and Transportation Management.** Integrates prior practices, strategies, and requirements to further enhance the environmental and energy performance and compliance requirements. The EO sets goals in several environmental areas, including recycling.

- **EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance.** Expands on the environmental performance requirements for Federal agencies, to include setting goals for solid waste diversion.

- **Pollution Prevention Act of 1990 (42 USC 13101 et seq.).** Establishes the national policy that “pollution should be prevented or reduced at the source whenever feasible,” and establishes the following hierarchy: source reduction, recycling, treatment, and disposal.

- **Resource Conservation and Recovery Act of 1976.** Governs the disposal of solid waste and establishes
Federal waste disposal standards and requirements for State and regional authorities. The objectives of Subtitle D are to assist in developing and encouraging methods for the disposal of solid waste that are environmentally sound and that maximize the utilization of valuable resources recoverable from solid waste.

- **Solid Waste Disposal Act (SWDA) of 1965.** Requires Federal facilities to comply with all Federal, State, interstate, and local requirements concerning the disposal and management of solid wastes, including permitting, licensing, and reporting requirements. The SWDA encourages the reuse of waste through recycling and requires the procurement of products that contain recycled materials.

### 12.3. SOLID WASTE REQUIREMENTS

Contractors must follow all Federal, State, and local requirements regarding the collection, storage, and disposal of solid waste. Contact the ROICC or Contract Representative for additional information regarding solid waste requirements.

At a minimum, the following actions are required for all contractors:

1. Prior to performing work that will or may generate solid waste at the installation, all contractors must provide their ROICC or Contract Representative with a copy of their Solid Waste Disposal Permit.
unless the use of the Base Landfill is authorized for disposal. If the Base Landfill is authorized, the contractor must contact the Base Landfill Operations Clerk to ensure the contract is registered in the Landfill Tracking System. Recycling should be coordinated with the ROICC or Contract Representative and the Landfill Manager.

2. Provide the weight of **ALL** waste, both MSW and C&D, that is either disposed of or recycled, to the ROICC or Contract Representative, with a copy to the Landfill Manager. This requirement does not apply if the landfill/recycling facility picks up or accepts materials directly from the contractor. If contractors transport waste offsite for disposal, it is mandatory that they track the material weight and provide that information to their ROICC or Contract Representative for input into the annual Pollution Prevention Annual Data Summary.

In addition, contractors producing solid waste on the installation are required to take these steps:

- Pick up solid waste, separate it according to material type, and place it in covered containers of the correct type that are regularly emptied for recycling or landfilling.
- Verify that the solid waste contains no HM or HW.
- Prevent contamination of the site and the surrounding areas when handling and disposing of waste.
• Leave the project site clean upon completion of a project.

12.3.1. MCB Camp Lejeune Landfill Acceptable Waste Streams

To dispose of waste at the Base Landfill, contractors must be authorized with a valid construction pass and placard representing the related contract. Contractors must also contact the Landfill Operator prior to unloading refuse. Contact the ROICC or Contract Representative with any questions regarding use of the landfill or to coordinate disposal.

The Base Landfill accepts certain types of solid waste under the conditions specified in Table 12-1. Base Landfill hours of operation are 0730 to 1530, Monday through Friday, but ACM waste must be delivered between 0700 and 1000, Monday through Thursday. Each material must be separated into different loads.
### Table 12-1. Base Landfill Requirements

#### No Personal Property/Off-Base Trash Accepted

<table>
<thead>
<tr>
<th>Landfill Operating Hours</th>
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<tbody>
<tr>
<td>0700-1500 Monday – Thursday</td>
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<tr>
<td>0700-1400 Friday</td>
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**Wood Products**

The following products may be mixed together and delivered to the landfill:
- Scrap lumber (unpainted)
- Embark boxes (broken down)
- Pallets (broken/untreated)

The following products must be separated and delivered to the landfill:
- Trees (cut to 10 feet or less and free of soil)
- Leaves and scrubs
- Serviceable pallets

**Lead Based Painted Wood Products**

- Delivered before 1400 Monday – Thursday
- Not accepted on Friday
- Cut in less than 8-foot lengths
  - Wrapped in 6-millimeter plastic bags/sealed

**Asbestos (all types)**

- Appointment needed (910-451-5011 / 2946)
- Delivered by 1000 (Mon – Thurs.)
- Not accepted on Friday
- Double wrapped in 6-millimeter plastic bags
- Sealed with duct tape
  Labeled and manifested prior to delivery

**Organic Products**
- Leaves, pine straw, grass, and shrub clippings
- No bags or containers allowed
- No twigs or limbs over 2 inches in diameter
- Less than 6-foot lengths

**Concrete**
- Delivered separately from other items
- Wire and rebar must be cut off flush with exposed surfaces
- Concrete and culverts
- Bricks and blocks
- Mortar products

**Soil**
Non-contaminated soil accepted

**Recyclable Products**
(Must be separated and dropped off at a designated recycling drop-off point or at a Recycling Center)
- Wood pallets (delivered separately)
- White paper (mixed flat or shredded)
- Newspaper
- Magazines
- Military publications (binders removed)
- Phone books
- Plastic and glass (containers or bottles)
- Toner cartridges
- Cardboard (delivered separately if in bulk)
- Vinyl siding (delivered separately, in less than 6-foot lengths)
- Asphalt shingles (delivered separately)

Scrap metals

**Other Related Information**

**Asphalt may** be accepted in small quantities, as needed, at the discretion of the Landfill Manager (large quantities of asphalt must be taken off the installation).

**All furniture** must be accompanied by a DD Form 1348, with a classification of rejected by the Base Property Office **AND** downgraded to scrap by Defense Logistics Agency Disposition Services (DLADS).

**All other Base or USMC property** must be accompanied by a DD Form 1348 and downgraded to scrap by DLADS.

Scrap materials related to **ordinance, ammunition or dangerous items**, including containers, tubes, and packing, must also be accompanied by Ammunition, Explosives, and Other Dangerous Articles (AEDA) certifications and copies of the certifier and verifier’s appointment letters.

**Phone Numbers:** (area code 910)
- Landfill Manager 451-4998
- Recycling Manager 451-4214
- Landfill Fax 451-9935
- Landfill Clerk 451-2946
- EMD 451-5837
- EOD 451-0558
### Unacceptable Items

- Hazardous Waste
- Liquid Waste
- Useable Appliances
- Paint and Paint Cans
- Appliances
- Electronics
- Computer Equipment
- Batteries
- Wire (Communication/Barbed/ Concertina)
- Oyster Shells
- Contaminated Soil
- Tires
- 55-Gallon Drums
- Oil Filters
- Petroleum Containers
- Regulated Medical Waste
- PCBs or PCB containers
- Demilitarized Waste
- Construction and Demolition Debris (unless specified in the contract)

### 12.4. RECYCLING REQUIREMENTS

The installation’s QRP is managed by the EMD in collaboration with the Public Works Division. Reducing solid waste saves money and helps protect the environment by conserving natural resources. Additionally, USMC facilities are mandated to recycle, and the installation must meet solid waste diversion goals specified in EO 13514, the
DoD Strategic Sustainability Performance Plan, and the EMS.

12.4.1. Recycling Center

The MCB Camp Lejeune Recycling Center, Building 982, is co-located with the Base Landfill on Piney Green Road. Normal working hours are Monday through Thursday, 0700–1500, and Friday, 0700-1400. All materials should be brought to the Recycling Center. Have the ROICC or Contract Representative contact the Recycling Center at (910) 451-4214 for additional details. Call Recycling Coordinator at (910) 451-4214 for specific types and categories of materials accepted.

The following types and categories of materials are accepted for recycling but must be delivered to the Recycling Center on Piney Green Road:

- Scrap metal
- Steel (high temperature, corrosion resistant)
- Brass (includes spent/fired munitions, but excludes brass casings above .50 caliber; please call the Recycling Coordinator at (901) 451-4214 for details and documentation requirements)
- Copper and copper wire
- Aluminum (plate, sheet, scrap) and aluminum cans
- Paper (white, news, magazine)
- Cardboard
Glass bottles (no window, windshields, or drinking glass)

- Plastic bottles
- Toner cartridges

Special arrangements may be made for other materials (C&D waste) or larger volumes of commonly recycled materials from events such as C&D. Regulations set forth in BO 11350.1 must be followed.

### 12.4.2. Other Recyclables

- **Asphalt Pavement.** Asphalt must be removed and delivered to an asphalt recycling facility. Contractors must provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling facility to their ROICC or Contract Representative, with a copy to the Landfill Manager.

- **Empty Metal Paint Cans.** Take empty metal paint cans to Building S-962 for recycling. Turn in all HM cans or HM containers that are generated from MCB Camp Lejeune or MEF contracts to Building S-962 on Michael Road on the scheduled contractor turn-in day. Have the ROICC or Contract Representative contact EMD for more information. Any waste generated from this process must be managed appropriately.

- **Other Metals.** Take other metals to the DLADS disposal area in Lot 201, following the guidelines of BO 5090.17.
• **Red Rag Recycling.** Contractors should seek a red rag program to supply and launder shop rags. This service supplies clean rags and picks them up after use. The rags are laundered offsite and returned.

• **Universal Waste.** See Section 7.0 of this guide for management procedures.

• **Unused Hazardous Materials.** Turn in these materials to the HM Free Issue Point, Building 977 on Michael Road. Have the ROICC or Contract Representative contact the Free Issue Point at (910) 451-1482.

• **White Rag Recycling.** White rags are used in painting (these have no dye and thus do not interfere with these types of operations) and may be laundered offsite in a program analogous to the red rag recycling service.

### 12.5. POLLUTION PREVENTION AND GREEN PROCURMENT

MCB Camp Lejeune is subject to GP requirements. GP implements environmentally protective principles in the procurement arena and includes preferential use of the following:

- Products made from recovered materials
- Biobased products
- Water- and energy-efficient products
- Alternatives to ozone-depleting substances
• Non-toxic and less-toxic products
• Electronics that meet Electronic Product Environmental Assessment Tool standards
• Products that do not contain toxic chemicals, hazardous substances, or other pollutants targeted for reduction and elimination by the DoD
• Products with alternative fuel use/increased fuel efficiency
• Environmentally preferable purchasing practices

Contractors are encouraged to employ GP practices whenever feasible.
13.0 POTENTIAL DISCOVERY OF UNDOCUMENTED CONTAMINATED SITES

MCB Camp Lejeune was placed on the EPA National Priorities List, effective November 4, 1989. To ensure the protection of human health and the environment, a proactive Installation Restoration Program has been established to assess and remediate various sites on the installation. Numerous investigations have been performed to ensure that all of the installation’s contaminated sites have been found, but additional contaminated areas may still exist. It is the contractor’s responsibility to notify the ROICC or Contract Representative of any unforeseen site conditions while on the installation. It is recommended that any contractors performing intrusive activities on the installation be properly trained in accordance with the OSHA standards in 29 CFR 1910.120(e). If intrusive activities are planned for known contaminated areas, all required environmental training should be completed prior to working at MCB Camp Lejeune. Copies of training records should be available upon request by Federal or State regulators.

Contact the ROICC or Contract Representative with questions or concerns about the information in this section.
13.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with unforeseen site conditions. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

13.1.1. Key Definitions

- **Free Product.** A discharged HM/HW, POL, or environmental pollutant that is present in the environment as a floating or sinking non-aqueous phase liquid that exists in its free state (i.e., exceeds the solubility limit of liquids or saturation limit of soil/solids).

- **National Priorities List.** List of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants.

- **Petroleum, Oil, and Lubricants.** A broad term that includes all petroleum and associated products or oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, vegetable oil, animal oil, sludge, oil refuse, and oil mixed with wastes.

- **Unforeseen Site Condition.** A potentially hazardous or unanticipated site condition encountered on a job site.
• **Munitions and Explosives of Concern.** Military munitions that may pose explosives safety risks, including MEC, UXO, DMM, and munitions constituents present in a high enough concentration to present an explosives hazard.

13.1.2. **Key Concepts**

• **Notification.** Contractors must notify the ROICC or Contract Representative, in writing, of any unforeseen site conditions prior to disturbing them.

• **Response.** Contractors must stop working and evacuate work areas if unforeseen site contaminants, HM, or MEC/DMM/UXO are suspected to be present.

13.1.3. **Environmental Management System**

Unforeseen site conditions are potentially applicable to all EMS practices conducted aboard MCB Camp Lejeune.

13.2. **OVERVIEW OF REQUIREMENTS**

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding unforeseen site conditions, which include but may not be limited to the following:

• **CERCLA of 1980 and Superfund Amendments & Reauthorization Act (SARA) of 1986.** Establishes the Nation’s HW site cleanup program.
• **Occupational Safety and Health Standards, 29 CFR 1910.** Federal standards that govern occupational health and safety to ensure the protection of employees from recognized hazards, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions. The standards include provisions for many facets of employee safety and health, including, but not limited to, employee training, personal protective equipment, HM communication, medical surveillance, and emergency planning.

13.3. **UNFORESEEN SITE CONDITION PROCEDURES**

Contractors must promptly, before the conditions are disturbed, give a written notice to the ROICC or Contract Representative of (1) any subsurface or latent physical conditions at the site that differ materially from those indicated in the contract, or (2) any unknown physical conditions at the site, of an unusual nature, that differ materially from those ordinarily encountered.

The ROICC or Contract Representative will investigate the site conditions promptly after receiving the notice.

The most common unforeseen conditions at MCB Camp Lejeune typically relate to POL contamination and MEC/DMM/UXO. Procedures for these scenarios are provided in the following sections.
13.3.1. Petroleum, Oil, and Lubricants

The most frequently encountered condition that requires EMD assistance is the presence of a POL odor while excavating. If an odor or any free product is encountered during construction or excavation activities, take the following actions:

- Stop work.
- Immediately clear the area of all personnel to a safe distance upwind of the suspected area.
- Call the Fire and Emergency Services Division (911) immediately if personnel are affected or injured by the suspected contaminant.
- Call the Fire and Emergency Services Division to properly secure the area.
- Notify the ROICC or Contract Representative so that the EMD Spill Response Team will be contacted to determine the appropriate course of action.

Please note that if contaminated soil is removed during excavation activities, the soil will have to be characterized prior to disposition. While it is staged and awaiting characterization sampling results, contaminated soil is to be placed within a bermed area on an impervious surface or barrier and securely covered with plastic or appropriate
material. Sample results and characterization will determine the ultimate disposition of the soil. In accordance with installation policy, contaminated soil is not permitted to be reintroduced into excavations.

13.3.2. Munitions and Ordnance

MCB Camp Lejeune has been in operation as a military training installation since the early 1940s. As such, munitions or an ordnance item may be encountered during site excavation or construction activities. MEC, DMM, or UXO at MCB Camp Lejeune and its outlying areas typically include flares, mines, grenades, rockets, artillery projectiles, bulk explosives, fuses, or blasting caps. These items may vary in condition from very good/easily recognizable to unrecognizable, fragmented, or corroded scrap metal. MEC, DMM, or UXO may be encountered on the ground surface, partially buried, or completely buried.

Contractors operating aboard the installation should follow the “3R” concept if a possible munitions or ordnance item is discovered: “Recognize, Retreat, and Report.”

- Recognize. Contractors with the potential to encounter any possible MEC, DMM, or UXO should have a basic knowledge of these items. The item does not have to
be specifically recognized or identified, but it is important for personnel to recognize the potential hazard.

- **Retreat.** If a suspected MEC, DMM, or UXO item is encountered, leave the immediate area and DO NOT DISTURB the item. If possible, note the general size and shape of the item, any markings, and the location.

- **Report.** Report all occurrences to the appropriate authority, including any observations (e.g., size, shape, markings, and location).

Stop work immediately if a project unearths a hazardous material, such as MEC/DMM/UXO, and report the situation to the ROICC or Contract Representative.

If a project unearths any potential MEC/DMM/UXO, recognize the potential hazard. Stop work immediately, and have all personnel clear the immediate area. Report the situation and any observations to the ROICC or Contract Representative, who will then report the item to Range Control and Explosive Ordnance Disposal (EOD). The following link is to a 6-minute “UXO Safety” awareness training video that provides additional guidance.


For other emergency response procedures, please refer to Section 5.0 of this guide.
14.0 PERMITTING

Contractors operating aboard the installation must ensure that all relevant environmental permits are obtained before work commences onsite. Contractors must work with their ROICC or Contract Representative to determine permitting responsibilities prior to beginning work. Contractors must adhere to all permit conditions. Examples of permits related to the environment are provided in Section 14.3.

14.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with contractor permitting requirements. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

14.1.1. Key Definitions

- **Major Source.** Any source that emits or has the potential to emit 100 tons per year or more of any criteria air pollutant in accordance with Title V of the CAA.
• **Permit.** A legally enforceable document required by statutory regulation for potential sources of pollution that is required for operations that may have an environmental impact. Permits may be administered at the Federal, State, or local level.

• **Target Housing.** Any housing constructed before 1978, with the exception of housing for the elderly and persons with disabilities (unless a child under the age of 6 lives or is expected to live there) and residential dwellings where the living areas are not separated from the sleeping areas (efficiencies, studio apartments, dormitories, etc.).

### 14.1.2. Key Concepts

• **Permits.** Prior to beginning work aboard the installation, consult applicable permit requirements and ensure that they are met before work begins. Copies of all applicable permits/authorizations should be retained onsite for the life of the project. Additional information on North Carolina permits is found on the following webpage: http://deq.nc.gov/about/divisions/environmental-assistance-customer-service/deacs-permit-guidance/environmental-permit-assistance

Consult the ROICC or Contract Representative for additional information concerning the contract’s permit requirements. The contractor is responsible for ensuring that all required permits are acquired prior to any work aboard MCB Camp Lejeune.
14.1.3. Environmental Management System

Currently, no practices are associated with permitting under the EMS.

14.2. OVERVIEW OF REQUIREMENTS

Please refer to the individual sections of this Guide for applicable permitting regulations and requirements for each environmental media. Many permits have specific timetables for submittal prior to project initiation. Contractors must consult the permit requirements and ensure that all pertaining permits are obtained in the required timeframe.

14.3. PROJECT PERMITS AND APPROVALS

Prior to work being awarded, EMD’s NEPA Section should have performed an environmental review of the installation-associated action proponent to comply with NEPA 1969. The outcome of this review would be either a Decision Memorandum or an Environmental Assessment. Contractors must refer to their contract and the requirements outlined in the NEPA documentation for specific permitting requirements. EMD Program Managers are available for

The NCDEQ website (http://deq.nc.gov/) is a useful reference for determining required permits and obtaining necessary forms.
guidance; however, if the contractor is tasked with preparing permit applications, the contractor is expected to have the capability and expertise required to complete the submittals in accordance with the guidance provided by the regulatory agency that issues the permit. In addition, EMD must be provided with copies of all permits submitted to the NCDEQ. In some cases, EMD must submit the permit application. Please direct questions to the ROICC or Contract Representative.

Some permits that may be required are discussed in applicable sections of this Guide. The following list of permits is not meant to be all-inclusive; please be aware that other permits may also be required. The NCDEQ website (http://deq.nc.gov/) is a useful reference for determining required permits and obtaining necessary forms. In addition, any inspection and/or data collection required by the permits must be retained onsite for review upon request.

14.3.1. Stormwater (Section 11.0)

- **NPDES Stormwater Discharge Permit for Construction Activities** (also referred to as General Permit No. NCG010000). Required for all LDAs that exceed 1 acre; also requires an accompanying Erosion and Sedimentation Control Plan.

- **General Permit SWG050000.** Required for residential development activities within the 20 coastal counties (including Onslow County) located within 1/2 mile and draining to class SA waters (waters classified as SA are tidal salt waters that are...
used for commercial shellfishing or marketing purposes) that disturb less than 1 acre if adding more than 10,000 square feet of built-upon area that will result in a built-upon area greater than 12 percent of the total project area.

- **High-Density Stormwater Permit.** Required when (1) the LDA exceeds 1 acre and impervious surfaces are greater than or equal to 25 percent of the total project area adjacent to non-SA waters or greater than or equal to 12 percent of the total project area adjacent to SA water; or (2) total development exceeds 10,000 square feet of impervious surface.

- **Low-Density Stormwater Permit.** Required when the LDA exceeds 1 acre and impervious surfaces are less than 25 percent of the total project area when adjacent to non-SA waters or less than 12 percent of the total project area when adjacent to SA waters.

14.3.2. **Asbestos (Section 8.0)**

- **Asbestos Permit Application and Notification for Demolition/Renovation.** DHHS Form 3768, available at the following website (under *Forms & Applications*):

  http://epi.publichealth.nc.gov/asbestos/ahmp.html

14.3.3. **Lead-Based Paint (Section 9.0)**

- **North Carolina Lead-Based Paint Abatement Permit Application.** Any person or firm conducting an abatement of a child-occupied facility or target
housing is required to obtain a Lead Hazard Management Plan Permit. The application is available at the following website: http://epi.publichealth.nc.gov/lead/pdf/LeadAbatePermit08-07.pdf

14.3.4. Air Quality (Section 4.0)

- **Construction Permits.** Construction permits are required for all new stationary sources and all existing stationary sources that are added to or are modified with new equipment that may emit air pollutants. Permits may be required for the construction or modification of the following types of emission sources:
  - Boilers
  - Generators
  - Engine test stands
  - Surface coating/painting operations
  - Refrigerant recovery and recycling operations for other ozone-depleting substances, such as industrial chillers, refrigerators, air conditioning compressors, or cleaning agents.
  - Chemical or mechanical paint removal, abrasive blasting, grinding, or other surface preparation activities
  - Fuel storage and fuel dispensing
  - Woodworking shops
- Welding shops
- Bulk chemical or flammables storage
- Open burning
- Fire training
- Rock crushing or other dust-causing activities

- **New Source Review Permit.** A New Source Review permit is a pre-construction permit that authorizes the construction of new major sources of air pollution or major modifications of existing sources.

### 14.3.5. Wetlands (Section 10.6)

- **Section 404 Clean Water Act Permit.** Contractors working aboard the installation will not perform any work in waters of the United States or wetlands (see definition below) without an approved permit (even if the work is temporary). Unavoidable impacts to wetlands or waters of the United States will require coordination and written approval from the USACE for a Section 404 CWA permit (individual or applicable nationwide permit), the NCDWR for a Section 401c Water Quality certification, and the NCDCM for a Federal Consistency Determination. Failure to acquire written authorization for making impacts to wetlands and/or waters of the United States may result in significant project delays or design modifications. See the following website for more information:

http://www.epa.gov/laws-regulations
14.3.6. Drinking Water/Wastewater

- **Approval of Engineering Plans and Specifications for Water Supply Systems.** Applicants must submit engineering plans and specifications at least 30 days prior to the date upon which the Authorization to Construct is desired. Authorization to Construct must be obtained prior to onset of work.

- **Wastewater Extension Permit.** NCDEQ Form FTA 02/03 – Rev. 3 04/05. Applicants submitting Form FTA 02/03 should plan to allow the State approximately 90 days to issue the permit. The Wastewater Extension Permit must be obtained prior to onset of work.